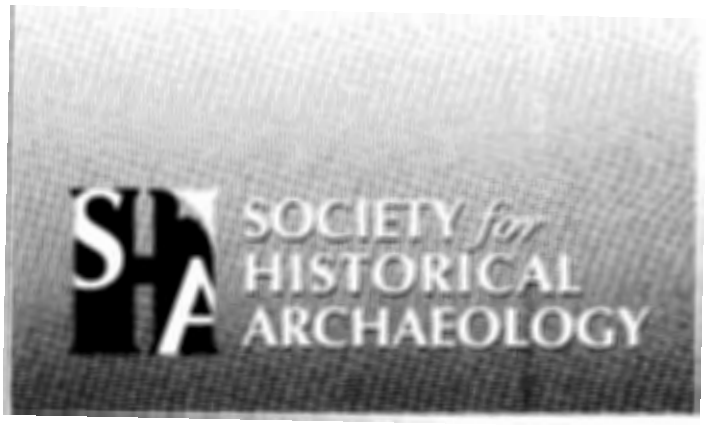

Underwater Archaeology

STEPHEN R. JAMES, JR.
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FOREWORD

STEPHEN R. JAMES, JR.

Introductory Remarks

Held in Cincinnati, Ohio, on January 3, 4, and 5, 1996, the 29th annual Society for Historical Archaeology Conference on Historical and Underwater Archaeology will be remembered by many for a variety of reasons. Both the weather and government politics were standouts, the former making attendance tentative for many, the latter making attendance impossible for others. With a conference date affixed firmly in the bowels of winter, the gods of January (as they often do) blessed and shaped the occasion with not one but three snow storms. Common were tales of strandings, late arrivals, and canceled flights, with the first storm affecting departure points as a blizzard, and the third storm, the major blizzard of the season, if not the century, crippling at the end of the conference not only the local airport and roads, but much of the eastern third of the nation. Compounding the concerns of conference organizers, "storms" were also raging in the federal government. A second government shutdown closed all "nonessential" federal agency offices over the holidays and precluded conference attendance and paper presentation by furloughed personnel with the Minerals Management Service, the National Oceanic and Atmospheric Administration, the Smithsonian Institution, the National Park Service, the U.S. Army Corps of Engineers, and others.

Due in part to planned festivities such as the reception and beer-tasting at the Cincinnati Museum Center, and unplanned and now infamous all-night hotel room "rages," even with the absence of approximately 100 registrants, by all accounts the conference was a huge success. Over 700 people attended, and 328 papers were presented. However, as a result of the weather and the furlough, three sessions involving 20 papers were canceled. To our dismay, of the nine scheduled sessions dealing with underwater archaeology and maritime history, the session entitled *Maritime Archaeology in a National Park: The Dry Tortugas Model* was all but canceled owing to the absence of personnel with the Submerged Cultural Resources Unit of the National Park Service. The two papers which were presented from this session were not only exemplary in their insightful interpretations of extant cultural material and archival information, but served also in suggesting what had been missed from the session's canceled papers.

Other papers were equally exciting, and as underwater chair I would like to thank all who presented papers, and especially thank the symposia organizers. I am constantly amazed at what subjects and areas are addressed in our field, and two symposia stand out in my mind as ones to not have missed. They include *Eighteenth- and Nineteenth-Century Waterborne Transportation in North Carolina* and *The Nautical Archaeology of Lake Champlain*. The latter symposium finally forced me to recognize the incredible nature and spectrum of the Lake Champlain finds and the work which is being conducted under the tutelage and auspices of the Institute of Nautical Archaeology and the Lake Champlain Maritime Museum.

Although the papers and presenters were the conference's *raison d'être*, we must not hesitate to give credit where credit is due by thanking Marcy Gray, the conference chair, and her conference committee composed of Kim McBride, Stephen McBride, Jeanne Harris, Robert Genheimer, and Jeannine Kreinbrink, as well as a host of volunteers. It was their fine-tuned organizational skills that allowed a successful conference. I would also like to thank all those who helped in the editing of this volume of Underwater Archaeology. My job as underwater chair actually began with bringing together this publication, and my life was made bearable during this endeavor by the perseverance and editorial know-how of Camille Stanley, my co-editor. But all these efforts would have in vain if not for the generous support of the financial contributors who are listed and thanked on the previous page.

In closing I must mention the sudden and unexpected death of Brina Agranat. A maritime historian by trade and graduate from East Carolina University, she knew her "stuff." As her colleagues and peers, we must acknowledge her passing from this ocean-covered planet.

DONNA J. SOUZA

Technology and Risk: The High Price of Profit

Introduction

In 1955 James Duffy published his book *Shipwreck and Empire* in which he examined a collection of narratives from the 16th and 17th centuries that describe the conduct of the Portuguese maritime mercantile enterprise in the East. A recurrent theme of these narratives is overloaded, undermanned, and poorly maintained ships. Duffy concluded that the financial losses incurred as the result of the vast numbers of merchant ships that were lost was a contributing factor to the demise of the Portuguese Empire (Duffy 1955). Much more recently, the Institute of London Underwriters (ILU) published statistics that indicate that the value of ships and cargoes lost worldwide during the years 1983 to 1993 exceeded 7.3 billion dollars (ILU 1993). Shipping is, and always has been, a risky business.

Today there is a new element of public anxiety about hazards in many industrialized societies. Due to the increasing number of industrial accidents each year and the vast number of liability claims that glut our court system, questions about the nature of risk have developed. Researchers have begun to dispense with the distinction between natural and man-made hazards and now consider "accidents" not as single events but as sets of related phenomena (Sjöberg 1987). From a broad spectrum of events from an individual injured on the job to large-scale disasters such as floods and droughts, oil-spills, and shipwrecks, such catastrophes are no longer dismissed as "Acts of God" but are now often considered to be the result of the misapplication of technology (Sjöberg 1987).

The potential for anthropology to study aspects of the processes of social evolution through changing cultural attitudes and concepts of risk in capitalistic industrialized societies and its relationship to technological innovation is rich indeed. However, a full investigation of this potential lies beyond the scope of this immediate discussion. In this paper, I will begin to explore the relationship between technological innovation, adaptation, and risk through the evaluation of materials from a series of shipwreck sites located in the Dry Tortugas and historical data from various documentary sources.

Sailing Ships and Steam Technology

The introduction of a new technology into an established industry can have a wide range of effects. While some improvements and specialized regional developments had been incorporated into the construction of ships, the basic form, function, and means of propulsion had remained unchanged for centuries. With the advent of the Industrial Revolution, new technologies were developed and new sources of power became available.

Periods of relatively rapid development can provide valuable insight into the processes that determine cultural change. Yet the transition from sail to steam remains under-represented in the literature when compared to studies of the "age of sail" or the naval history of World War II. The historians that have addressed the transition present a picture of a more efficient and profitable technology rapidly eclipsing another in economic competition or have focused on the development and use of steam technology in the military arena or the transition from wood to iron construction (Griffiths 1993; Ville 1993). While steam technology had been applied to boats as a means of propulsion as early as 1785 (Gilfillan 1935), it was not until the second decade of the 19th century that steam propulsion began to emerge as viable for merchant vessels.

Chart 1 (Figure 1) represents a comparison of the gross tonnage and number of merchant vessels built in the United States throughout the 19th century . By 1861, the tonnage of sailing vessels was on the decline, while steamship tonnage continued to increase. By the 1880s, steam vessel tonnage was greater then sail tonnage for the first time, and by the 1890s the ratio of steam to sail tonnage was almost 2 to 1 (U.S.

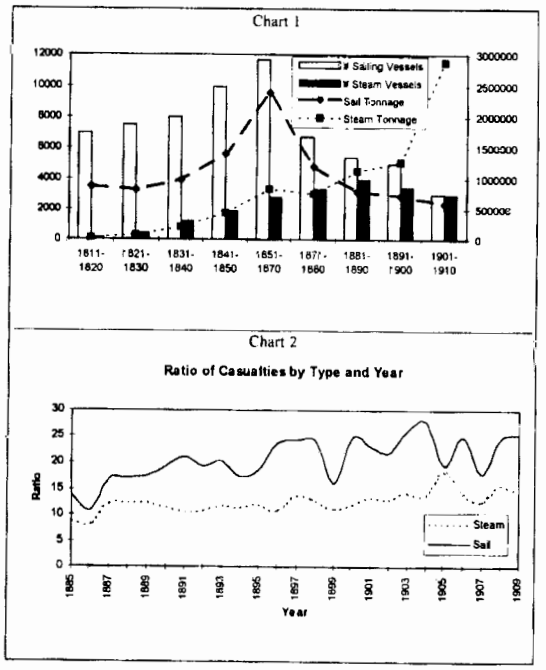

FIGURE 1. Chart 1. Note: Tonnage is in 1,000s of tons. 1851-1870 represents an average as data are not available for 1857-1859 or 1868-1870. Adapted from Historical Statistics of the United States, Colonial Times to 1957. Chart 2. Adapted from the *Annual Report of the Operations of the United States Life Saving Service 1885-1909.*

Bureau of Census 1960). When viewed as the number of ships built, however, the data present a somewhat different picture. The data illustrate that after 1865 there was a general decline in shipbuilding. This was due to a sluggish recovery of the merchant shipping industry after the Civil War and the continued development and expansion of the railroad industry. While the building of sailing vessels steadily declined, data indicate that as recently as the first decade of the 20th century the number of sailing vessels built was greater than the number of steam vessels built.

How can we account for the seemingly archaic technology of sail propulsion persisting in the latter half of the 19th century, and even into the 20th century, when steam propulsion had been firmly established as more profitable? It might be better to rephrase the question to ask "How did the merchant sailing industry react to the introduction of steam power?" One way in which it attempted to compete with merchant steam ships was to build larger vessels that could carry more cargo. As sailing vessels became larger, there was a corresponding transition from wood to iron hull construction. Also, larger ships required larger crews. These aspects of the changes in the merchant sailing industry are well documented and studied by archaeologists and historians. An archaeological evaluation of shipwreck sites in the Dry Tortugas, however, provides evidence of an additional corresponding transition.

The "Iron Ballast Wreck" (FOJE001) at the north end of Loggerhead Key has been identified as a late 19th- or early 20th-century sailing ship (Murphy 1993:201). Among the features, which include an iron anchor, a windlass chain and three sizes of iron ballast, is a well-preserved manually operated cargo winch. The barrel and spur wheel are still visible, as is the gypsy-type warping hub. This type of winch was in common use throughout much of the 19th century.

The wreck of the sailing ship *Avanti*, which was built in 1875 and originally named *Killean*, lies just to the south of Loggerhead Key and is known to have been lost in 1907. *Avanti* was iron hulled, ship rigged, and 1,862 gross tons. Several examples of steam-related machinery are located at this site and include a cargo winch, a capstan, and a closed feed-water heater that consists of a cylindrical wrought-iron or steel shell. The tube sheets and cast-iron heads are bolted to the shell, and tubes are expanded into the tube sheets to form steam-tight and water-tight joints. This water heater was most probably used to produce steam to operate the winch and the capstan. Even though it operated under steam power, the capstan of the *Avanti* had holes to accommodate capstan bars for manual operation.

The materials located at the site known as BO16-032 provide some of the best-preserved deck machinery in the Dry Tortugas National Park. The site is known to be that of a sailing vessel and is estimated to date from 1860-1880. A windlass that measures 13 ft. long with two gypsy-type warping hubs plus an additional

FIGURE 2. Capstan base. (NPS photo by Eugene Rowe.)

gypsy on one end dominates the site. The pawl rim in the center, the purchase rims, and the cogged spur wheel on the end are clearly visible. A view of the underside of a capstan (Figure 2) from the same site illustrates the gears used for its operation in conjunction with steam components. On this particular capstan there are no holes for capstan bars for manual operation, indicating that it relied solely on steam power.

Located at this same site is a Scotch-type donkey boiler (Figure 3). It is 7.5 ft. long and has a diameter of 3 ft. The tubes that extend from the front plate of the combustion chamber to the front head of the shell are visible. This type of boiler was in common use by 1870 and changed little throughout the remainder of the 19th century.

A site known only by its System-wide Archaeological Inventory Program designation of BO13-030 contains a steam-operated capstan which dates to late in the 19th century (Murphy 1996). A windlass in close association with this capstan measures 6 ft. 11 in. long. This particular windlass was fitted with the wildcat type of warping hubs which were designed specifically for use with stud-link chain. The wildcat was introduced in approximately 1870. The rod that connects the windlass and the capstan is still attached and consists of the worm shaft, the thrust collar, and the upright shaft.

This windlass and the capstan probably were originally configured in similar fashion to illustrations published in 1897 in the catalog of the American Ship Windlass Company (ASWC) of Providence, Rhode Island, and to similar designs by other windlass manufacturers at that time. The 1897 catalog of the ASWC illustrates an "old style" model with a horizontal steam engine suspended from the underside of the deck (ASWC 1897). Patents for innovations to the "old style" model were granted in 1881, 1883, 1888, and 1893. A "new style" Providence steam capstan windlass shares several of the patents as the "old style" model, but in 1889 the steam engine was brought down to sit on the base of the windlass and was redesigned to the vertical type. While the designation "new" of the 1889 model may imply that it was intended to replace the "old" style of steam capstan windlass, it should be kept in mind that both of these models and similar steam-operated designs continued to be offered by the ASWC, the Hyde Windlass company, and other windlass manufacturers up until at least 1913. By 1913, the ASWC offered models that operated electrically (ASWC 1913). It should be mentioned also that manually operated models continued to be offered, making capstans and windlasses a somewhat unreliable diagnostic.

It can be determined from the material observed at these sites and supported by the his-

FIGURE 3. Donkey boiler. (NPS photo by Eugene Rowe.)

torical statistics that commercial sailing vessels continued to develop and to operate in many capacities for several decades after the introduction of steam technology. The simple rig of a schooner made it economical to operate, especially in terms of manpower. But by the mid 19th century, larger ships were being built which made manual operation of the rigging expensive due to the greater number of crew members required. Steam-operated deck machinery, used to operate the windlass, hoist the sails, and work the pumps, was developed in response to this problem. Rather than "tolling the death knell" of the sailing vessel, steam technology allowed the industry to build and sail larger, more economically efficient ships that operated in the coasting trade.

The Factor of Risk

Are technological adaptation and economics in and of themselves sufficient to explain the persistence of sail in the age of steam? Even though owners and operators of sailing vessels learned to adapt the new technology to suit their purposes, steam propulsion had proven to be more profitable than sailing vessels as early as 1870. Why, then, in a profit-driven economy were merchant sailing vessels still being built up until W.W.I? Marvin Harris has argued that while human behavior and history are structured to a great extent by technological and economic factors, non-material aspects of social behavior have to be considered when material aspects alone cannot account for observed behavior (Harris 1979).

Ships that were not properly maintained often had difficulty in procuring adequate insurance. In many instances the loss of the ship and its cargo presented less of a financial burden to its owners than did a refit to bring the ship in question up to insurable standards. As a result, many ships, both sail and steam, that were determined to be unseaworthy simply continued to operate without insurance. According to statistics reported in the Annual Report of the Operations of the United States Life Saving Service for the fiscal year ending 30 June 1895, 38 percent of vessels reporting casualties were operating without insurance. Similar statistics are reported for other years (U.S. Life Saving Service 1885-1905).

Chart 2 (Figure 1) presents data that represent the ratio of casualties by type and year. These data are for casualties that occurred on and near the coasts and on the rivers of the United States and to American vessels at sea and on the coasts of foreign countries. "Casualties," as reported here, include founderings, strandings, collisions, and other causes, which include, but are not limited to, fire, loss of masts, damage to machinery, and explosion of boilers. In interpreting this chart, it must be kept in mind that more is better. For instance, in 1885, 1 out of 14 sailing vessels reported a casualty, while for steam vessels the ratio is 1 out of 9, indicating that steam vessels suffered casualties more frequently. In 1904, sailing vessels seem to have reached a high point in safety standards, as only 1 in 28 vessels resulted in a casualty, while steam casualties were 1 in 14. Over the span of the 25 years that these data were reported, sailing vessels consistently reported fewer casualties than did steam vessels. It is important to keep in mind that these statistics are for reported casualties only. It is impossible to determine how many events might have gone unreported. The actual number of casualties for both sail and steam could be higher.

Conclusions

The archaeological evidence provided from these sites in the Dry Tortugas indicates that steam technology was utilized for purposes other than propulsion. Owners and operators of sailing vessels did not reject steam technology but adapted it into the existing infrastructure of the merchant sail industry, allowing them to operate in specialized trades.

The historical data could be interpreted to indicate that sailing vessels were, overall, safer than steam vessels. To merchant ship owners, the innovation of steam propulsion offered the promise of higher profits but at increased risk of loss; to the merchants who consigned their car-

goes to these ships and to sailors with the appropriate skills, it offered a choice. While there are many more factors that determined the persistence of merchant sail into the early 20th century than this paper presumes to address, there are sufficient data to warrant the further investigation of technological innovation and its relationship to changing concepts of acceptable risk in seafaring activities. In an industrialized capitalistic society, the market is the clearing mechanism for the acceptance or rejection of technologies but does not determine directly the development of new ones. The acceptance or rejection of a new technology or innovation is not based solely on economics but also on the social and cultural perceptions of its advantages and disadvantages.

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ANN MERRIMAN

Nineteenth-Century North Carolina Schooners: Their Significance in the Development of North Carolina's Trade

Introduction

Throughout most of the 19th century, North Carolina merchants and mariners chose schooners most often for their maritime transportation. The coastal trading schooner's flat-bottom design and shallow draft allowed river and canal travel, while centerboard construction provided stability on the ocean. These traits and the schooner's cost-effective small crew requirements affirmed this vessel's place in 19th-century North Carolina seaborne commerce. The town of Washington, North Carolina, and the merchant shipping firm of Samuel Richardson Fowle typified 19th-century eastern North Carolina, trade and schooner use, transporting goods to the major United States East Coast and West Indian markets. This paper examines the Fowle merchant shipping company and the schooner's role in this business and in North Carolina maritime history. Furthermore, it presents the Cypress Landing Shipwreck (0017PMR), a scow schooner that was possibly Fowle owned (Figure 1).

S. R. Fowle Company and North Carolina Shipping

Since the 17th century, North Carolina's sounds and inlets have accommodated passenger and merchant vessels, and shipbuilding is documented on the Pamlico River by 1706. In the 1770s, Washington, North Carolina, was established where the Tar River enters the Pamlico River. Throughout the 1780s, Washington's port grew into an important commercial and export center, and in 1790, the federal government declared the city an official port (Still 1981:26-29). Coastal trading vessels supported the area's agrarian and commercial bases, and in the early 19th century, schooners emerged as the most often used vessel for these trades.

In 1818, Samuel Richardson Fowle joined his two older brothers, Josiah and James, in their Little Washington general mercantile business located on Castle Island (Litchfield 1976:235). Upon the deaths of Josiah and James in the 1820s, Samuel established the S. R. Fowle Company (later becoming the S. R. Fowle and Son Company), supplying commodities such as naval stores, agricultural products, and foodstuffs for Washington and the surrounding communities (*Washington Gazette* [*WG*] 28 February 1884).

By the 1830s, the S. R. Fowle Company regularly shipped freight to northeastern receiving companies in New York, Boston, Philadelphia, and Baltimore, and to the West Indies. Three surviving shipping ledgers chronicled 1,062 voyages made by 139 schooners, 5 brigs, 18 barges, 7 steamers, and other unnamed steamers from three steamboat companies carrying Fowle Company goods. The S. R. Fowle Company owned 16 schooners and 2 brigs listed in the ledgers, as well as another 7 schooners and 1 sloop found in other historical records. Fowle loaded 133 cargo types onto sailing vessels, barges, and steamers between 1834 and 1902. Documentation for the 1850s is missing, and records during the Civil War are scant. The most numerous cargoes are forestry products such as shingles, hogshead staves, barrel staves, lumber, and barrels of turpentine, tar, and rosin. The Fowle Company also transported many agricultural products, particularly corn and cotton (Table 1). Schooners accounted for the majority of trips documented in the ledgers, and throughout the 19th century schooners transported the majority of goods to every destination listed (S. R. Fowle and Son Collection:1834-1902).

The Fowle shipping ledgers reflect greater North Carolina shipping activity, and compared to ship enrollments compiled by the United States Government, they mirror the greater trade of eastern North Carolina for the 19th century. Sixteen years of coastal trade enrollments from the North Carolina ports of Washington, Beau-

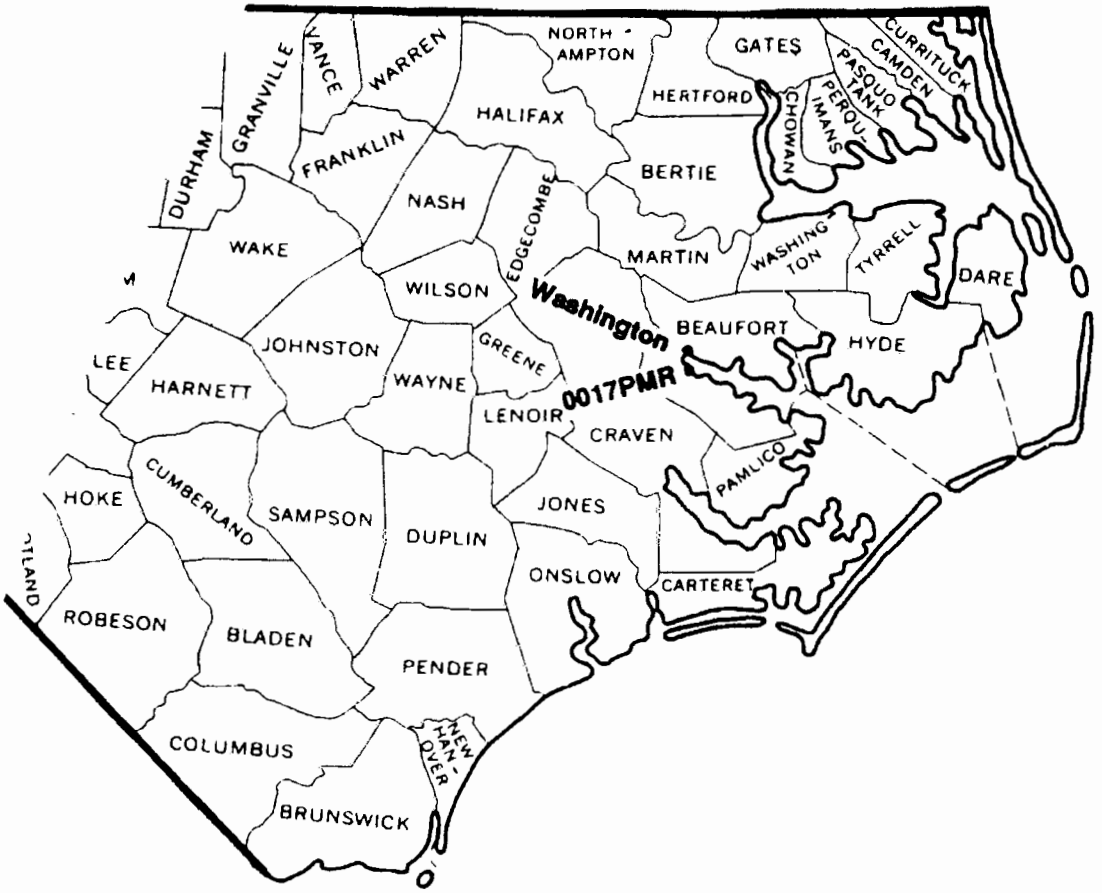

FIGURE 1. Map of eastern North Carolina showing the locations of Washington, the Cypress Landing Shipwreck (0017PMR), and the coastal counties (U.S. Department of Commerce, 1960).

fort, New Bern, Plymouth, Edenton, Ocracoke, and Elizabeth City spanning 1834-1850 were studied for comparison to the Fowle ledgers. Seven vessel types—schooners, brigs, sloops, brigantines, barques, boats, and steamers—were enrolled in these North Carolina ports between 1834-1850. A total of 1,950 vessels (108,925.3 dead weight tons) enrolled in these ports, and schooners accounted for 1,778 of these vessels (91%; 100,734.15 dead weight tons). Three hundred twenty-two vessels worked out of Washington during this period, and 294 vessels (91.3%; 20,510.29 dead weight tons) were schooners (National Archives:1834-1850).

The Cypress Landing Shipwreck (0017PMR)

Another document in the Fowle family papers possibly pertains to the Cypress Landing Shipwreck discovered near a brickyard site on the south shore of Chocowinity Bay in Beaufort County, North Carolina, in the spring of 1994 (Figure 1). During Weyerhaeuser Real Estate Company's Cypress Landing marina construction, the vessel's rudder was wrenched from the stern during removal of old pier pilings. A preliminary investigation by the North Carolina Underwater Archaeology Unit (UAU) in July 1994 determined the wreck to be a flat-bottomed centerboard sailing vessel with an extremely shallow draft and unusually narrow beam. The UAU rec-

ommended further research of the Cypress Landing Shipwreck (Wilde-Ramsing 1995).

The Fowle document is an original bill of sale dated 9 October 1878, and it contains the term "sail flat," which accurately describes the Cypress Landing Shipwreck:

> In consideration of one hundred dollars, the receipt of which is hereby acknowledged, we Joshua A. Cox and Wm. A. Cox have bargained and sold and do bargain and sell unto Jas. L. Fowle a certain sail flat now in our possession and running on Pamlico river which flat was built by Jos. Farrow in 1868. To Have and To Hold unto said Jas. L. Fowle, his executors, administrators and assigns forever (Cox 1878)

The sail flat's name and dimensions remain unknown.

The son of Samuel Richardson Fowle, James Luther Fowle, worked with his father's general mercantile firm and shipping enterprise until his son S. R. Fowle II took over the family business. At various times throughout the 19th and 20th centuries, the Fowle family owned land in Chocowinity near the Cypress Landing Shipwreck site. William Farrow, father of Joseph A. Farrow, established Little Washington's first shipyard. Joseph inherited his father's business in the early 1840s and continued to build ships until his death in 1906 (Litchfield 1976:230; Still 1981:33).

A Phase III investigation of the Cypress Landing Shipwreck took place in late May and early June of 1995 by East Carolina University's Program in Maritime History and Nautical Archaeology. Field school participants and staff members excavated the vessel's port side and uncovered a two-masted centerboard vessel with a transom bow and stern, classifying the Cypress Landing Shipwreck as a sailing scow or sailing flat (Figure 2). Most significantly, this vessel represents the only vessel of this type discovered in North Carolina waters.

The Cypress Landing Shipwreck is 73 ft. long, 14 ft. in the beam, and 27.25 in. in the hold; it has a flat bottom, hard chine, and is longitudinally planked. The vessel has a main keelson and one port and one starboard sister

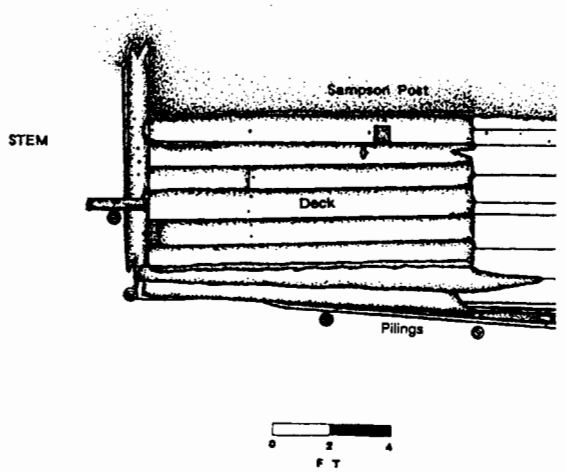

FIGURE 2. Stem portion of the Cypress Landing Shipwreck (0017PMR) showing the transom bow.

keelson that are discontinuous fore and aft of the centerboard trunk. The foredeck remains intact with the remains of a sampson post and a possible cathead located over the vessel's stem. The vessel has two mast partner deck beams mortised into the vessel's side, placed above and slightly aft of two mast steps indicating raked masts that were likely schooner-rigged. Two other deck beams were mortised into the wreck's side as well.

The centerboard trunk is 14.9 ft. long and is offset to starboard. Frames are visible along the vessel's side, with exposed stern area floors that resemble stretchers used in flatboat and barge construction (South Carolina Institute of Archaeology and Anthropology 1992). The keelsons are notched to receive the stretchers. A portion of movable decking was located slightly aft of the centerboard trunk. The stern post retained some iron gudgeon straps and the pintle hole after the rudders' extraction. Ten pilings wedged against the wreck's side and two pilings rammed under the bow indicate its purposeful disposition as a breakwater. Wood samples taken from the wreck, including the keelsons, mast partners, and ceiling planking, were southern yellow pine (Lee Newsom 1995, pers. comm.), a common wood found in eastern North Carolina's coastal region (Pinchot and Ashe 1897:130)

TABLE 1
S. R. FOWLE AND SON
SHIPPING LEDGERS

Destination	Voyages	Percent
New York	637	60.00%
West Indies	145	13.64%
Baltimore	104	9.80%
Boston	78	7.30%
Philadelphia	76	7.20%
Norfolk	13	1.22%
Unknown	6	.56%
Beaufort, NC	3	28%
TOTAL	1062	100.00%
United States	911	85.80%
West Indies	145	13.64%

Frequent Cargoes

Type	Quantity
Shingles	22,553,365
Feet of Lumber	19,950,118
Hogs Head Staves	2,209,490
Staves	1,338,850
BBL Turpentine	177,169
BBL Tar	100,245
BBL Rosin	91,997
Bales of Cotton	5,801

The vessel's lack of stable deck beam attachments and its extreme length-to-beam ratio (5.2:1) indicate the Cypress Landing Shipwreck likely could not contend with open, rough waters. Vessels such as scows and barges with raked ends and flat bottoms have increased buoyancy at their opposite corners, causing stresses leading to hogging or sagging. Further, an extremely long and narrow vessel will twist about its diagonal axis from end to end and cause tension, called racking stress (Michael B. Alford 1995, pers. comm.). During its working life, the Cypress Landing Shipwreck was most likely restricted to the tributary waters of creeks, rivers, canals, and sounds of North Carolina and possibly sailed to southern Virginia through the Dismal Swamp and Albemarle and Chesapeake canals.

A single leather shoe measuring 12 in. long, 6.25 in. at its widest point, with wooden peg and stitched construction is the only temporally diagnostic artifact recovered. A copper rivet fastened the upper's pieces together, and this rivet distinguishes the footwear, indicating the shoe is Union Army Civil War-era issue authorized only for African-American troops. As men of African descent enlisted in the Union Army and were issued uniforms, the high rate of shoe and boot replacement due to the "ripping out" of standard-issue army footwear prompted the manufacture of wider shoes with no laces and copper rivet construction. The Cypress Landing Shipwreck shoe's outer sole is not extremely worn, however, and likely remained "un-issued" during the Civil War, being sold as surplus after the war's end (D. A. Saguto to Larry Babits 1995, pers. comm.).

North Carolina Sailing Scows

An examination of vessels with similar dimensions and construction characteristics to the Cypress Landing Shipwreck is necessary to place the vessel into the greater context of North Carolina shipbuilding and maritime navigation. No sail flats were found in enrollments. However, 1 schooner flat, 1 scow schooner, 3 unrigged vessels with scow classifications, and 16 schooners with scow characteristics such as square, plain, and blunt stems were found in a search of North Carolina coasting trade enrollments for the 19th century (Table 2).

As a North Carolina sailing scow or sail flat, the Cypress Landing Shipwreck exhibits typical and atypical traits when compared to the historical record. The average dimensions of the 17 North Carolina schooners with scow characteristics are 70.77 ft. long, 15.87 ft. in the beam (4.5:1 length to beam ratio), and 4.41 ft. in the hold (Table 2). The Cypress Landing Shipwreck's 73-ft. length and 14-ft. beam closely align it with other scows. However, its 27.25-in. depth of hold clearly differentiates it from other 19th-century North Carolina sailing scows and aligns it more closely with flats.

Combining scow schooner and sail flat historical documentation wth the vessel's confinement to inland waters (excluding two schooners constructed in 1860 that had registered for foreign trade), the Cypress Landing Shipwreck's date of construction most likely falls between

1868 and 1890. Further, the Civil War-era shoe that probably remained un-issued and sold as surplus roughly places the Cypress Landing Shipwreck's disposition in Chocowinity Bay after 1865.

North American Sailing Scows

A brief examination of United States sailing scows further places the Cypress Landing Shipwreck into a historical context pertaining to its function and design. In Virginia's Chesapeake Bay, purpose-built scow schooners worked as lighters transporting heavy pig iron through shallow waters by 1743. Often towed by large schooners, small unrigged and decked scows served as temporary docks between large sailing schooners and a riverbank, "scowing grain" from the schooner to land (Snediker and Jensen 1992:7, 121-122, 125).

Sailing scow construction in the Great Lakes region and its extensive inland waterway system began in 1825 in Erie, Pennsylvania, with the building of the 60-ton schooner *Bolivar*. By the 1850s, Great Lakes sailing scow construction was booming, with 172 vessels constructed totaling 15,413 tons. In the northeastern United States, inland ship builders of New York's Finger Lakes, particularly Lake Champlain, also produced scows. The *Repulse*, a 30-ton unrigged scow built on Lake Champlain in 1827, was converted to a scow sloop with the addition of a mast upon its transfer to Lake Erie (Martin 1991:4).

On the Pacific Coast, scow schooners were documented in the San Francisco area by 1850. Often referred to as "the square-toed packet of San Francisco Bay," the sailing scow transported brick, lumber, coal, salt, hay, grain, and sand throughout the shallow waters of the Bay's tributaries in the late 19th century (Olmsted 1988:2).

The sailing scow in Texas and Mexico most often utilized the sloop rig for the fishing trade and were often referred to as "butt-headers." American scow sloops centered their activity around Port Isabel, Texas, and were between 26 and 32 ft. long and 10 to 12 ft. in the beam (Chappelle 1951:334).

TABLE 2
NORTH CAROLINA SCOW SCHOONERS AND SCOWS

Name	Length	Beam	Depth	Year/Place Built
Angelica	66.00'	15.30'	4.00'	1868/Pasquotank Co.
Barter[a]	65.00'	16.00'	3.00'	1885/New Hanover Co.
Camden Union	81.30'	15.70'	4.30'	1868/Camden Co.
Dezzie B. Onslow	51.20'	17.20'	4.80'	1877/Dare County
Flounder	64.95'	19.50'	4.75'	1865/Baltimore, MD
John James	76.00'	14.00'	4.40'	1870/Camden Co.
Julia Selden	60.00'	17.50'	4.00'	1872/Pasquotank Co.
Laura D.[b]	65.00'	16.00'	3.00'	1890/Brunswick Co.
Mariam	72.00'	16.00'	5.00'	1874/Camden Co.
Nellie Wodsworth	79.90'	17.30'	6.00'	1880/Pasquotank Co.
Sea Monster	85.00'	10.50'	4.00'	1850/Currituck Co.
Somerset	63.50'	24.30'	3.70'	1875/Washington Co.
Southerner	76.00'	15.80'	6.00'	1855/Pasquotank Co.
Viola	74.00'	11.60'	4.50'	1860/Camden Co.
Viola	69.00'	14.40'	4.40'	1869/Pasquotank Co.
Viola	75.00'	16.20'	4.00'	1882/New Hanover Co.
Widow's Son	75.00'	14.00'	4.70'	1871/Currituck Co.
William N.H. Smith	75.00'	14.30'	4.80'	1860/Camden Co.
Average	70.77'	15.87'	4.41'	
City of Stella[c]	44.00'	11.50'	3.00'	1890/Beaufort Co.
Eldridge[c]	62.80'	20.20'	3.80'	1892/Beaufort Co.
Maggie[c]	64.50'	20.50'	3.50'	1893/Beaufort Co.

[a]Scow Schooner, [b]Schooner Flat, [c]Unrigged Scows

Conclusion

Schooners played a vital role in the economic development of 19th-century eastern North Carolina, supporting riverine, coastal, and overseas trade. The detailed records of the S. R. Fowle and Son Company are evidence supporting this claim. North Carolina's 19th-century trade that utilized schooner-rigged vessels constructed with transom ends is seemingly centered on the northeastern North Carolina-to-Norfolk canal trade. However, the Fowle-owned sail flat constructed in Washington worked on the Pamlico River as a lighter or river vessel and, along with other sailing scows documented near Wilmington, plied the state's central and southern waters. Unrigged scows used in the latter 19th century around Beaufort likely worked in the harbor as lighters as well. With this information retrieved from the historical record, the Cypress Landing Shipwreck can be classified as a purpose-built vessel designed for shallow canal, sound, and riverine commerce. Its classification as a sailing scow, scow schooner, or sail flat places this wreck in a type all its own for North Carolina.

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A Historical Overview and Archaeological Assessment of the Cape Fear River's New Inlet

After a journey of 150 miles across the piedmont and coastal plain of North Carolina, the sediment-laden water of the Cape Fear River mixes with the black water of the Northeast Cape Fear River at present-day Wilmington. From Wilmington, it is still 30 miles to the sea. For the last five miles of the river's course, the waters widen to form a broad estuary. This lower reach is typified by a deep-water channel along the western shoreline, and a complex of marshes, creeks, and barrier islands that separate the river from the Atlantic Ocean. The southernmost, and largest, of those islands, Bald Head Island, is located at the river's mouth, and also forms the promontory for which the Cape Fear River was named. An extensive sandbank, known as Frying Pan Shoals, extends in a southerly direction from Cape Fear some 18 miles into the Atlantic. Like Cape Hatteras and Cape Lookout and their attendant shoals to the north, Cape Fear and Frying Pan Shoals have long been known to mariners as an area of treacherous waters.

Although the Cape Fear River was first explored by Europeans in the 16th century and briefly settled in the 1660s, permanent European settlement did not occur until the founding of Brunswick Town in 1725. The establishment of Brunswick, located on the west bank of the Cape Fear, 15 mi. from the river's mouth, was followed in 1733 by the founding of Wilmington. Situated at the confluence of the northwest and northeast branches of the Cape Fear River, 15 mi. farther upstream, Wilmington shortly developed as the prominent community on the river and the state's leading port. Relying on the province's vast pine forests, the Cape Fear region soon became Britain's major supplier of naval stores (Watson 1992:12).

Throughout the periods of exploration and colonization, the inlet at the mouth of the Cape Fear River, between Baldhead Island and Oak Island, provided the only direct access to the ocean. Eight miles north of the river's mouth, on the peninsula that separated the Cape Fear River from the Atlantic Ocean, was a narrow stretch of land known as the Haul Over. This name reportedly derived from the fact that at this location small boats could be "hauled over" from the river and launched in the ocean. The dreams of every mariner who had manhandled his boat across these sands must have been fulfilled when, in September 1761, a hurricane created an opening to the Atlantic at the Haul Over (Hartzer [1984]:12-13). This breach quickly grew and soon became known as New Inlet (Figure 1). Navigable at first only to small boats, New Inlet had two distinct advantages to the main inlet at the river's mouth. First, being farther upstream, New Inlet gave closer access to the ocean from both Wilmington and Brunswick Town. Second, and most important, when vessels traveling to and from northern ports passed through New Inlet, they shortened their voyage by 64 miles and avoided the treacherous waters around Cape Fear and Frying Pan Shoals (Hartzer [1984]:36-37).

During the late 18th and early 19th centuries, both the state and federal governments made efforts to encourage and improve navigation through New Inlet. Those efforts included marking the channel with buoys, assigning pilots to guide vessels through the inlet, and, in 1816, erecting a lighthouse. In 1804, army engineer Joseph Swift proposed that a fortification be built to guard New Inlet. The fort was never built, but gunboats were stationed at the inlet during the War of 1812 (Watson 1992:35, 42-43, 65).

The use of New Inlet by commercial vessels increased dramatically from the colonial to the ante-bellum period. This change was brought on by both the increased depth through New Inlet and a shift in trading patterns. Port records show that in 1768 three-fifths of the region's exports,

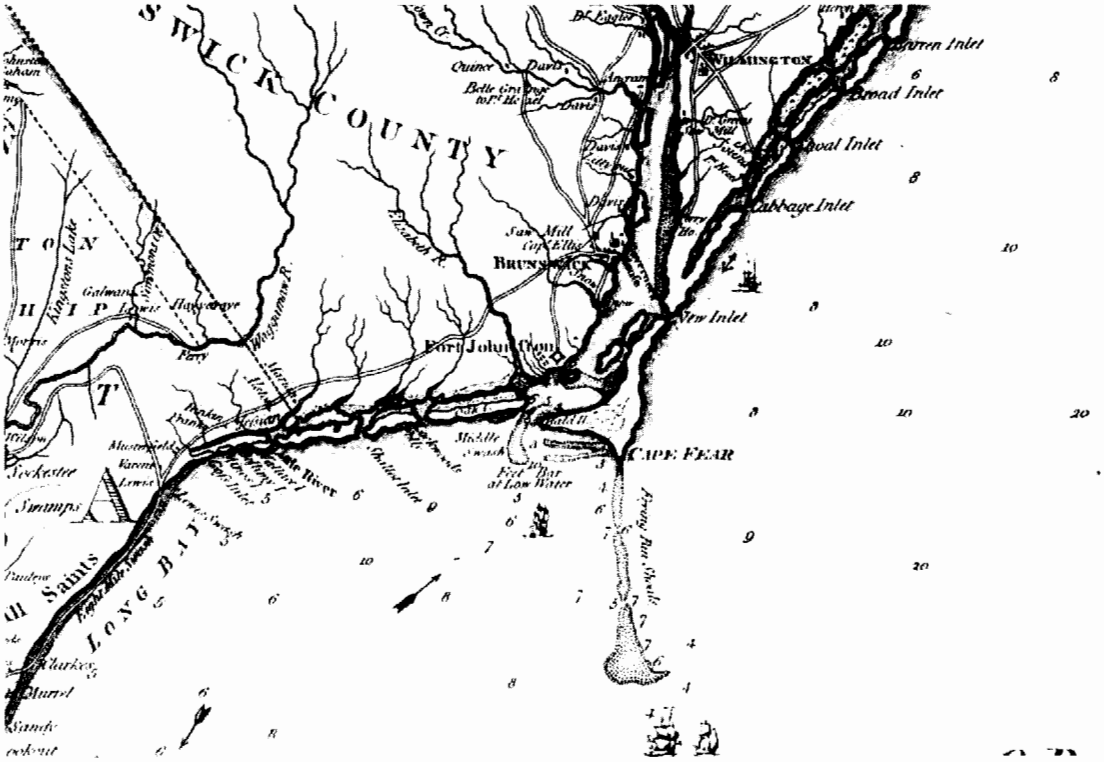

FIGURE 1. The 1775 Mouzon Map of the Cape Fear region was prepared 14 years after New Inlet was formed.

primarily naval stores, went directly to England, one-fourth went to the British West Indies, and less than one-tenth cleared to other colonies (Logan 1956:50). Most of the ocean-going vessels bound for Great Britain or the West Indies used the main entrance channel. By contrast, in the 1850s the majority of Wilmington trade was conducted with the northern states and entered and left the river by way of New Inlet (Watson 1992:64). In addition, numerous small schooners, known as "corn crackers," passed through New Inlet carrying corn, naval stores, and other produce from nearby Onslow County and the Pamlico and Albemarle regions of North Carolina. One observer offered this romantic depiction of the small fleet of corn-crackers: "It was most exhilarating on a fine day to see this tiny fleet, twenty or thirty white wings...led by the *We're Here*, *I'm Coming*, and *So Am I*, with every stitch of canvas spread to the favoring breezes on the last stretch to the Custom-house Wharf" (Sprunt 1992:197).

Although New Inlet offered distinct advantages to mariners traveling to and from northern ports, overall the inlet had a detrimental effect on river navigation. By the 1840s hydrographic surveys indicated that whereas New Inlet had gradually deepened over the preceding decades, the channel over the main bar at the mouth of the river was getting shallower, shoaling from 15 feet in 1797 to 9 feet in 1839. Engineers felt that the diversion of a portion of the river's waters through New Inlet had reduced the scouring effect of water flowing over the main bar. In addition, sand, brought through New Inlet during flood tides, was deposited in the river, creating a shoal in the main river channel. An 1853 study of the Cape Fear River concluded that permanent restoration of the main shipping channel could be accomplished only if New Inlet

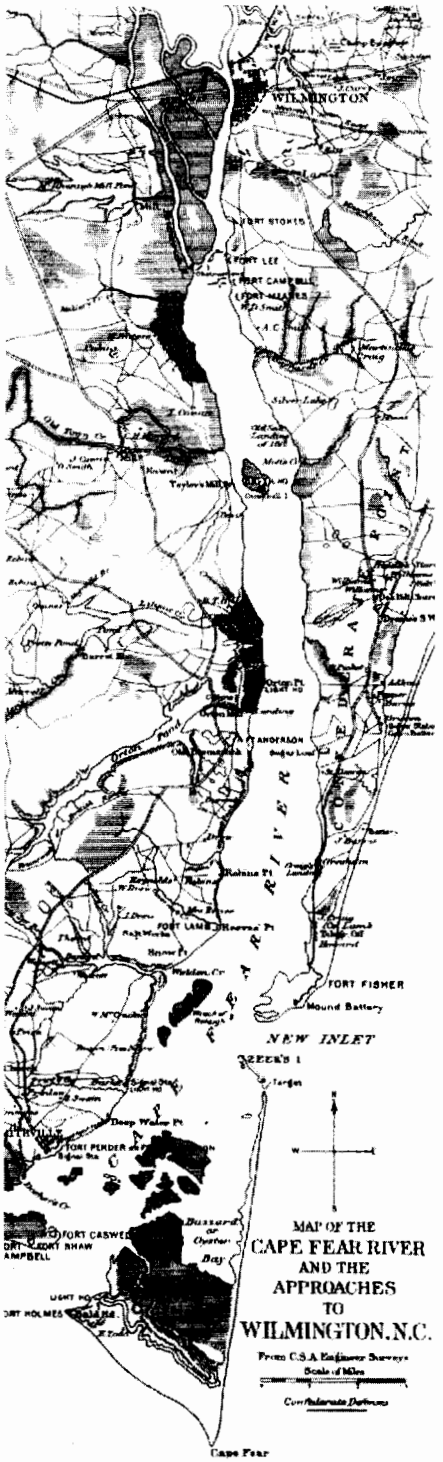

FIGURE 2. Civil War map of the lower Cape Fear River showing Confederate defenses. Note the wreck of the CSS *Raleigh* on the inside of New Inlet.

was closed. Over the next several years the Corps of Engineers made sporadic efforts to improve navigation on the Cape Fear River including work near New Inlet (Hartzer [1984]:13, 17-19). However, when the American Civil War broke out in 1861, the Corps had not yet started serious efforts to close New Inlet. As events unfolded, this was most fortuitous for the Confederate war effort.

During the Civil War, Wilmington became a center for the blockade-running trade. The region's unique geography, with two navigable inlets separated by Cape Fear and Frying Pan Shoals, made it extremely difficult for the Union vessels to effectively blockade the port. In addition, the Confederates constructed strong defenses to guard the inlets—Fort Caswell at the river's mouth and Fort Fisher at New Inlet (Figure 2). By the War's end, Fort Fisher, mounting 46 large guns and with a sea-face nearly a mile long, was the largest fortification in the South (Lee 1971:61, 65).

New Inlet was the preferred channel for blockade runners entering and leaving the Cape Fear River. These vessels, primarily British-built steamers, would arrive under the cover of darkness from ports in the West Indies and Bermuda, laden with war materials, manufactured goods, and luxury items. On their return, cotton was the main cargo, bound for British textile mills. Although it has been estimated that over 500 successful runs were made through the blockade of Wilmington, blockade running was not without its hazards. Throughout the South, some 136 blockade runners were captured and another 85 destroyed (Wise 1988:221; Watson 1992:89-101). In the New Inlet vicinity, historical records indicate that at least 13 vessels, including British, Confederate, and Union ships, were lost during the Civil War.

Realizing the strategic importance of Wilmington, Union forces attempted to capture Fort Fisher in December 1864. This attempt failed, but on 12 January 1865, over 50 federal ships returned to Fort Fisher to resume the attack. After a massive naval bombardment lasting three days, 10,000 Union soldiers and sailors landed on the beach north of New Inlet and

FIGURE 3. The blockade runner *Modern Greece* ran aground while attempting to enter New Inlet on 27 June 1862. The salvage of artifacts from the *Modern Greece* in the early 1960s led to the creation of North Carolina's underwater archaeology program.

stormed the fort. Following a pitched battle, the outnumbered Confederate garrison was forced to surrender. The capture of Fort Fisher ended blockade running through New Inlet, and by 22 February 1865, federal troops were in control of the entire Cape Fear region, including the city of Wilmington (Lee 1971:71-76).

With the resumption of normal commerce on the Cape Fear River following the War, Wilmington business interests again petitioned the federal government to improve the river's navigation, including closing New Inlet. They felt that only by closing the inlet and dredging the channel from the ocean bar to Wilmington would the city be able to successfully compete with Norfolk, Charleston, and Savannah. This effort was led by Henry Nutt, chairman of the Chamber of Commerce's Committee on River and Harbor Improvements. After several studies, the Corps of Engineers commenced work on the New Inlet Dam in 1873 (Hartzer [1984]:32-34). Not all residents of Wilmington were in favor of closing New Inlet. Those involved in local trade were angry, since closing the inlet would mean having to use the channel at the river's mouth and contending with the dangerous waters around Frying Pan Shoals. In 1876 a petition was sent to Congress asking that the project be stopped (*Wilmington Star* 1876). Henry Nutt, the main spokesman for the closing project, responded to the protest in a letter to the editor of the *Wilmington Weekly Star*. Nutt pointed out that there were several slues through Frying Pan Shoals that the small boats could use so they would not have to go completely around the shoals. He also appealed to the opponents' loyalty as North Carolinians, pointing out that:

> It is not for Wilmington alone we are now struggling for, but for *North Carolina* [emphasis in original]. Our great desire is to elevate *our* [emphasis in original] State to the standard of other States, by providing for her an importing and exporting port, which shall emancipate her from humiliating and slavish commercial vassalage to other States (*Wilmington Weekly Star* 1877).

The voice of progress won out in this battle of words, and work continued at the inlet. The

foundation for the dam consisted of 36-x-36-ft. mattresses constructed of wood and brush. The mattresses were floated to the site where they were anchored and loaded with rock to sink them in the proper place. A marine limestone, dug from nearby quarries on the Northeast Cape Fear River, was placed on top of the mattress to bring the height of the dam above the high-water mark. Fighting the currents and frequent storms, the work gradually progressed (Hartzer [1984]:35-36).

Throughout construction, workers left an opening in the wall so that small vessels could continue to use the inlet. But on 14 June 1879, this last gap was filled and New Inlet was officially closed. Appropriately, Henry Nutt was the first person to walk across the newly completed dam (Hartzer [1984]:36-37). The structure became known as "the Rocks," a name that it still retains today. The dam's final length was 4,800 ft., breadth at the base varied from 75 ft. to 120 ft., and the average height in the middle was 37 ft. (Watson 1992:125). After the construction of the Rocks, New Inlet gradually migrated south, creating an area know as the basin between the rocks and the ocean beach.

The ocean and river waters in the vicinity of former New Inlet are known to contain a high concentration of historic shipwrecks and other underwater archaeological sites. For 118 years the inlet served as a focal point for maritime activity. Coupled with this are the natural hazards of shallow water and swift currents related to navigating a coastal inlet and the added dangers associated with maintaining and running the naval blockade of New Inlet during the Civil War. The historical record confirms that numerous vessels were lost in the New Inlet vicinity. The Underwater Archaeology Unit's (UAU) historic shipwreck files contain references to 47 shipwrecks in the New Inlet vicinity. Seventeen of those shipwrecks occurred during the Civil War, including 12 blockade runners, 4 Union vessels, and 1 Confederate ironclad.

Efforts by the UAU and other groups to locate and study the shipwrecks at New Inlet have concentrated on three distinct zones: the ocean waters off Fort Fisher that incorporate the entrance channel and shoals of the former inlet, the ocean beach that made up a portion of the inlet's original shoreline, and the river waters on the inside of the inlet.

New Inlet can be considered the birthplace of underwater archaeology in North Carolina. In the early 1960s U.S. Navy divers, working in cooperation with the North Carolina Division of Archives and History, recovered over 10,000 artifacts from the sunken Civil War blockade runner *Modern Greece* (Figure 3). In 1963 the state established a preservation laboratory at the Fort Fisher State Historic Site to treat these artifacts. The state's underwater archaeology program grew out of these efforts, and the UAU's office and laboratory facilities are still located at Fort Fisher (Bright 1977).

Over the next two decades, the UAU conducted periodic investigations of the shipwrecks off Fort Fisher including field schools in the 1970s and magnetometer surveys in the early 1980s. Several more shipwreck sites were located through these efforts, including the blockade runners *Condor*, *Arabian*, and *Stormy Petrel*, the USS *Aster* and USS *Louisiana*, and an unidentified steamship called the Nearshore Wreck. In 1985, staff archaeologist Mark Wilde-Ramsing prepared a nomination to the National Register of Historic Places for the Cape Fear Civil War Shipwreck District. The nomination included 21 Civil War-era shipwrecks, including seven located on the former shoals of New Inlet.

During the summers of 1994 and 1995, the UAU combined forces with East Carolina University's Program in Maritime History and Nautical Archaeology (ECU) and the National Park Service's American Battlefield Protection Program to conduct an intensive investigation of the ocean waters off Fort Fisher. The project included a systematic magnetometer and side-scan sonar survey of an area measuring 4,200 feet by 9,000 feet which encompassed the entrance channel and ocean shoals of New Inlet. The survey confirmed the location of the seven known shipwreck sites and located additional vessel remains. A second major objective of the project was to prepare detailed maps of the shipwreck sites. Divers were limited by poor visibil-

FIGURE 4. The well-preserved bow section of the New Inlet Beach Wreck as it appeared in 1973.

ity and weather conditions, particularly during the unusually active 1995 hurricane season. Nevertheless, the ECU graduate students were able to prepare site maps for six of the seven Civil War-era shipwrecks off Fort Fisher. As a result of those investigations, the Nearshore Wreck has been identified as the troop transport *Flambeau*, and the site originally identified as the powdership USS *Louisiana* is now thought to be the steam packet *Twilight*. The site plans and information that resulted from this project will be used to produce interpretive displays on the shipwrecks at the Fort Fisher Historic Site. Ultimately it is hoped that some or all of these sites can be developed as a Civil War shipwreck park that will promote their recreational use, scientific study, and protection.

In addition to ocean sites, significant portions of shipwrecks have occasionally been uncovered on what was the inlet's former shoreline. In March 1962, a fierce storm uncovered the remains of a 44-ft. centerboard schooner on the beach at Fort Fisher. The wreck was removed from the beach and placed on display on the grounds of the historic site. Eventually the timbers, which are thought to be the remains of a mid-19th-century, locally built schooner, were taken to the North Carolina Maritime Museum in Beaufort and documented by shipwright Geoffrey Scofield.

A short distance down the beach, a second shipwreck was uncovered by spring storms in March 1973. This second wreck, called the New Inlet Beach Wreck, was in a remarkable state of preservation and included a bow section intact up to the main deck level (Figure 4). Over the next decade, winter and spring storms periodically exposed the wreck, which would then be reburied by the gentler summer waves. Finally, in April 1983, a series of storms completely uncovered and broke up the wreck, scattering pieces for miles down the beach. Staff from the UAU and the Fort Fisher Museum collected as much of the structure as possible, and portions of the wreck are now on display at the Museum of Coastal Carolina in nearby Ocean Isle Beach.

In the fall of 1993 the UAU, working in cooperation with the Corps of Engineers, conducted an archaeological survey and investigation of the Cape Fear River on the inside of the former New Inlet. During this project the survey crew examined the remains of the CSS *Raleigh*. The *Raleigh* was a Confederate ironclad built in Wilmington during the Civil War. In May 1864, the *Raleigh* passed through New Inlet and briefly engaged the Union blockading fleet off Fort Fisher. While returning to the Cape Fear River, the *Raleigh* grounded on a shoal on the inside of New Inlet, never to be refloated. The 1993 examination of the *Raleigh* revealed that significant portions of the shipwreck remained intact. During the summer of 1994 the staff from the UAU returned to the *Raleigh* with ECU graduate student Martin Peebles for further study of the site. Peebles, who reported on these investigations at last year's SHA/CUA conference in Washington, D.C., is currently completing his master's thesis on the history and archaeological condition of the *Raleigh*.

The shipwrecks of New Inlet offer a unique opportunity to study a wide variety of vessel types—ranging from small craft to iron-hull blockade runners—in three distinct environments. The Civil War shipwrecks off Fort Fisher originally grounded on the inlet's treacherous shoals, an area that would have been extremely difficult for archaeological investigations. However, because of changes brought about by the closing of the inlet, these sites are now in relatively deep water where diving investigations are possible. This collection of Civil War-period shipwrecks presents a variety of hull and steam engine types which are important both for their research value as well as recreational opportunities. On the Cape Fear River side of New Inlet, the CSS *Raleigh* site, which still contains significant portions of the vessel's casemate and steam machinery, offers an exceptional opportunity to study the first standard of Confederate ironclad design. Finally, as demonstrated by the two wrecks that have been uncovered on the ocean beach, the sandy shoreline and shallow waters of the basin may still contain well-preserved buried wooden hulls of the "corn crackers" and other small craft that once plied the waters of New Inlet. Future discovery and study of those wrecks may add considerable information to our understanding of local shipbuilding design and construction.

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A Working Definition of "Periauger"

Introduction

One of the most common vernacular watercraft in the Southeast during the 18th and 19th centuries was the periauger, or split dugout. Speculation that the periauger grew out of American Indian or West African dugout canoes has been presented along with an evolution from the Caribbean via the Spanish. Alford has presented rather convincing evidence that French ancestry must be considered as well (Alford 1992, 1993). Finally, split dugouts are not confined to the southeastern United States and France; similar techniques are seen in Albania as well (L. E. Babits, personal observation, March 1994). In an attempt to establish a meaningful relationship between three related early 18th-century terms—periauger, petiauger, and scout boat—a chronology is useful. This paper will concentrate on the early 18th century and will be limited to the Carolinas and Georgia.

In 1701, John Lawson traveled through the Carolinas and provided the initial description of a unique boat type. While describing trees, Lawson noted

> ...vast Ciprus-Trees, of which the *French* make Canoes, that will carry fifty or sixty Barrels. After the Tree is moulded and dug, they saw them in two Pieces, and so put a Plank between, and a small Keel, to preserve them from the Oyster-Banks, which are innumerable in the Creeks and Bays betwixt the *French* Settlement and *Charles*-Town. They carry two Masts, and Bermudas Sails, which makes them very handy and fit for their Purpose (Lawson 1967[1709]:16).

Lawson provided more details later:

> Of these great Trees the Pereaugers and Canoes are scoop'd and made; which sort of Vessels are chiefly to pass over the Rivers, Creeks, and Bays; and to transport Goods and Lumber from one River to another. Some are so large, as to cary thirty Barrels, tho' of one entire Piece of Timber. Others, that are split down the Bottom, and a piece added thereto, will carry eighty, or a hundred (Lawson 1967[1709]:103).

By using two names, Lawson indicates they are different, but capacity is not the key. Both types had a range of capacity and could be built either of one piece or split logs. Lawson made a distinction between canoe and periauger only after he learned more about Carolina watercraft. Lawson reinforced his interpretation by describing a canoe, comparing the longevity of canoes to that of boats: "...This Wood is very lasting, and free from the Rot. A Canoe of it will outlast four Boats, and seldom wants Repair" (Lawson 1967[1709]:103-104).

Lawson drew the baseline for terminology relating to this vernacular watercraft. According to Lawson, larger canoes and periaugers were dugouts expanded by being split and having another timber placed between the two halves. This change increased cargo-carrying capacity and stability. Lawson also points out that canoes might be decked, eliminating decking as an indicator for periaugers alone, as periaugers were usually partially decked.

Chronology

When territorial disputes between the English and Spanish erupted over colonial boundaries along the Atlantic coast, the struggle involved the use of different types of watercraft including canoes, periaugers, petiaugers, and scout boats. At different times, certain craft were called by different names. Terms such as "scout boat" and "petiauger" are not always exclusive; "canoe" and "boat," however, are exclusive. Whether or not "periauger" and "petiauger" are exclusive is still being debated, but these terms seem to refer to the same type of vessel.

Periaugers

Since Georgians were new to the area, they often made distinctions which were not made earlier; these distinctions help to clarify the terms "petiauger" and "periauger." In 1736, von Reck and Moore recorded observations including

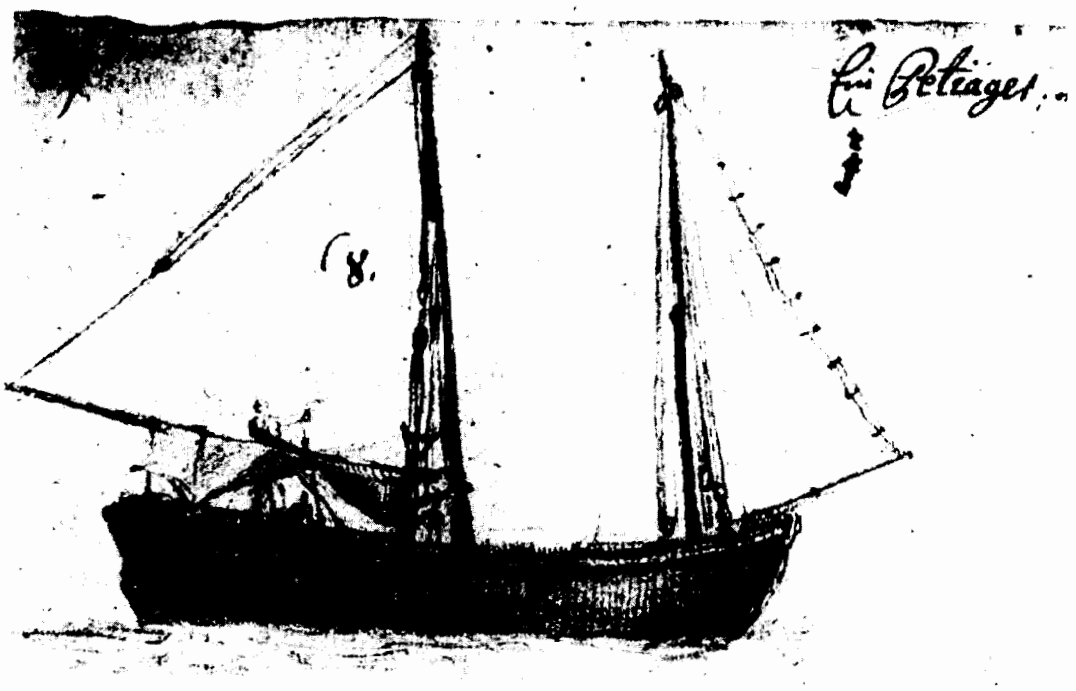

FIGURE 1. Von Reck's (1736) sketch of a "Petiauger" (Fleetwood 1995:40).

numerous words related to watercraft and, more importantly, provided drawings of three types. Von Reck used the words "scout boat," "river trade boat," "ship," "canoe," and finally, "petiauger." He did not use "periauger." Francis Moore was on the same vessel and described vessels that von Reck drew. Von Reck's petiauger "which one can control with sails and rudder" (Figure 1) is the only picture of a petiauger so designated by the artist (von Reck 1980:37, 39, 70). The picture matches a written description by Francis Moore:

> These petiaugers are long, flat-bottomed boats, carrying from 20 to 35 Tons. They have a kind of a Forecastle and a Cabin; but the rest open, and no Deck. They have two Masts, which they can strike, and Sails like Schooners. They row generally with two Oars only (Moore 1744:115).

Moore's use of a "kind of forecastle and a Cabin" and "no Deck" means that it is not completely decked from bow to stern in the normal fashion but that it had a half-deck arrangement, or that it was "partially decked." It is, however, significant that a petyauger has two masts, because canoes have only one. Moore later used the term "periague" repeatedly in contrast to "scout boat" (Moore 1744:131-134). John Wesley noted another Pettiawga was "a sort of flat-bttom'd Barge ... [and he] lay down on the Quarter Deck" (Wesley 1739:198).

These descriptions and the von Reck illustration show a vessel not unlike that described by Lawson in 1701. Two problems with von Reck's drawing are that the rigging appears to be standing, rather than quickly removable, and that the foresail seems almost as if it were fixed to a bowsprit. However, if one notes that the mainsail does not appear to be rigged and is actually supporting a canvas fly over the stern deck area, then the foresail might be in use to bring the boat about, which would make sense in terms of von Reck's accompanying description. The lack of a gaff or sprit on either sail is also important, given Lawson's reference to Bermuda sails, which have no gaff or sprit.

The term "petiauger" is first used in Georgia, interchangeably with "periauger." Only later does it appear in the Carolinas. It may well be that the new term "petiauger" was initially unique to Georgia's new settlers who "heard" a "T" not utilized by the South Carolinians. Something of this sort seems to be found in Peter Gordon's journal, as he refers to "periagaes" and "periagoes" in South Carolina but uses "petiagores" two weeks later in Georgia (Gordon 1735:11, 14). In other Georgia cases, the terms seem regularized in journals in which a person consistently used "periagua" (Causton 1737:262-63, 267) or "petiauger" (Stephens 1743:7, 8, 58, 135-36, 337). Thomas Causton, however, also used "pettiaguas" in a letter referring to vessels sent to Fort Frederica (Causton 1738:337).

To further complicate matters, in 1736 Benjamin Ingham used the word "perriagua," once in conjunction with a known scout boat commander; then, two days later, he used the word "pettiaugur," "a large Boat" for two days (Ingham 1736:146, 152, 176-77). It is intriguing to suggest that size may have been a defining characteristic between "periauger" and "petiauger," but the evidence is scant indeed.

Scout Boat

In 1702, the Commons House of Assembly of South Carolina recorded the following passage: "And allso ye manner and method of Carying on allarams from Each Watch And further to Consider what boats Cannoes and Periaugers ye watches, in Case of Allarams" (Salley 1932:66-67). The following day the House resolved "That there be Two Good Perriaugers to be Ready at ye most Convenient Place of Randezvous on James Island for the Transportation of the Company in Case of an Allaram" (Salley 1932:68). While these transports are not designated scout boats, they performed somewhat similar duties.

Foreseeing a need for a more extensive alarm system, the House also agreed to build six more periaugers with 13 pairs of oars per boat: "...that Six Perriaugers 40ft. long & 5f^{t}. wide with Seventy Eight pair of Oars, be provided with all Expedition at ye charge of ye Publick...for the Carrying of Men in Case of Invasion..." (Salley 1932:69).

This passage shows that periaugers served as defense vessels. At some point, the colonists' defensive posture changed using patrol vessels called scout boats instead of alarm vessels. The transition from periaugers performing military duties to scout boats appears to have taken place in the 1720s. The earliest reference to the term "scout boat" comes from a list of "provisions to be paid," 17 March 1724 (Salley 1945:47).

The shift is apparently not simply one of terminology. The shape of the vessel apparently changes from "guard (or alarm) boat" to "scout boat," and the number of men is decreased, possibly because they moved to staggered rowing positions, reflecting an emphasis on speed and mobility.

The South Carolina legislature authorized two alarm boats. These were periaugers, 40 ft. in length, 5 ft. in beam, with 20 oars. Four things stand out. First, the boats' role was passive and defensive to a Spanish threat. Second, their size was fairly large. Third, they had 20 oars. Fourth, they were probably log boats. Boat length, beam, and oars provide additional information. Length limited oarsmen's seating, so they may have been paired if all 20 oars were used at the same time. Pairing oars implies that neither oar nor oar stroke was very long. If oars were longer than 10 ft., rowers would get in each others' way and would not have sufficient mechanical advantage to effectively propel the boat. If oars were shorter, stroke length would not provide effective power.

The physical changes were major. Crew size was halved, reducing boat loading weight by 50 percent. If the men averaged 150 pounds, the 1702 boat crew weighed 3,000 pounds, while the 1728 boat crew's weight was only 1,500 pounds. This does not include approximately 40 pounds per man in food, equipment, and weapons for another 400 pounds of additional weight.

Conjecturing, then, reduction of oarsmen was accomplished by staggering the seating, concurrently lengthening oars and increasing stroke length. Lengthening the distance from the ful-

crum increased mechanical advantage. In comparison with earlier watch boats with (apparently) paired rowers, the newer scout boat used longer oars with mechanical advantage increased as much as four times.

By reducing scout boat manpower, boat length could be shorter by about 10 ft., reducing boat weight by 25 percent. The newer, shorter scout boat would carry half the weight of earlier watch boats. The lighter boat carried less with improved propulsion. It is no wonder observers remarked on their sailing and rowing speed.

In 1728, 1735, and 1736, scout boats on the South Carolina and Georgia coast were observed again. When scout boats were posted to guard the inland passage in 1728, the two boats were described as "periaguas one w[ith] ten oars & the other w[ith] eight, they sail and row very well" (Gascoign in Fleetwood 1995:32). In 1735, a scout boat was described as "a strong-built swift Boat, with three swivel Guns and ten Oars..." (Moore 1744:94).

Apparently, little was required to make an existing vessel into a scout boat, except arming it with swivels and adding men to pull the oars, as shown by the adaptation of a periauger in 1736.

> ...a Periagua that was a good Boat, to fit her out with Twenty Oars, and four Swivel Guns, and to send her to the River St. John's with a Scout-Boat Company, called the Marine Boat...the Periagua under the Shelter of those Guns might very easily hinder any Boats from coming through the Island-Passages, and send the Scout Boat to give the Alarm (Moore 1744:131-32).

The newly-armed vessel was not a scout boat but rather served to block an inlet with its swivel guns and to give advance warning by sending the scout boat, or Marine Boat, to give the word. The modified periauger may hearken back to the South Carolina watch boats.

A change occurred between 1701, when Lawson saw periaugers in the French settlements along the Santee River, and 1728, when the scout boat was first described. The change to scout boat came in a generation during which Carolinians fought Yamassee, Tuscarora, and Spanish in three wars. The stressful environment caused rapid change because ineffective vessels did not allow adequate defense. The skills and time involved in producing plank-built boats which lasted a few years could not compete with log boats requiring less skill, equipment, and effort, and which lasted four times longer.

Discussion

John Barnwell's journal is of some interest in learning about scout boats, periaugers, and petiaugers. Barnwell operated a South Carolina outpost on the Altamaha River at what is now Darien, Georgia. In his 1721 journal, he does not use the term "petiauger," although he refers to scouts, scoutmen, boats, scout boats, and perriaugoes (Barnwell 1926:191-202). Of 37 references to watercraft, Barnwell uses "periaugoe" 8 times; "sloop" 12 times; "whaleboat" twice; "pilot boat" once; and "scout boat" twice. The generic term "boat(s)" is used 11 times. Barnwell used some terms interchangeably but did not use "petiauger." In at least two entries, he uses "boat" for something previously described as a "perriaugoe"; in another entry a "scout boat" is called a "boat" (Barnwell 1926:194, 196, 201).

The first descriptive reference to a Georgia colony scout boat occurs on 2 July 1735, and reads as follows: "That One Canoe Boat with ten Oars One Other Canoe Boat with Eight Oars, and one other Boat of Six Oars, all of the same Nature with the Scout Boat be order'd to built in South Carolina for the use of Georgia...." While this does not mention specific construction techniques, it does show a difference between a "canoe boat" and a "scout boat." The passage also demonstrates that the term "scout boat" is used for a specific type of vessel. The "Nature" of this craft seems to imply a simply constructed, multi-oared vessel, characteristics common to the earlier periauger.

Linguistics

Linguistic approaches were explored to develop a periauger/petiauger definition by examining origins and development of terminology de-

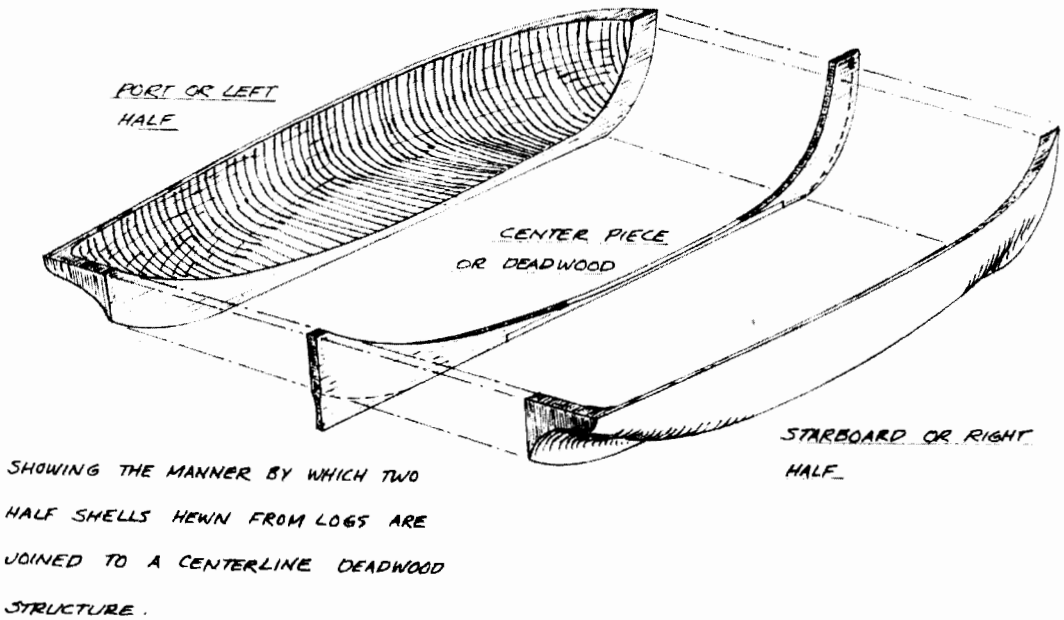

FIGURE 2. The French manner of building "Pereaugers and Canoes." (Drawing by M.B. Alford).

scribing scout boats and periaugers. The study suggested that scout boats were developed from periaugers and that, while periaugers continued to exist as cargo-carrying vessels later to be called pettiaugers, scout boats were for military purposes.

The term "periauger" is first mentioned in southeastern English America in 1625. Significantly, for supporting Alford's interpretation of a French origin, it reads:

> Monsieur de Nombe, that told us the Indians had slaine some French-men...and that there were six Periagers, which are huge great trees formed as your Canowes, but so laid out on the side with boards, they will seeme like a little Gally (Smith 1624:II:190-91).

The term "pettiauger" does not appear until 1725, and then only in Georgia. Although spelling is similar, the prefix "pet-" has a slightly different meaning than the prefix "per-." "Per-" is the base of prepositions and preverbs with a basic meaning of "forward" or "through." Its basic form **per*, and extended form **peri*, are related to Middle Dutch *vieren*, to let out or slacken. "Pet-" means to spread and is related to the Latin *pat êre*, to be open, and to spread out, from which the English "expand" derives. Significantly, in Greek, "pet-" relates to platter, as a thing spread out. Similarities between the two prefixes exist, but "pet-" means to spread or expand, while "per-" means to let out. These distinctions are not conclusive enough to establish that "periauger" and "petiauger" are meaningful differences (Morris 1970:1534).

Conclusions

Georgia settler William Stephens refers to petiaugers only when mentioning them without reference to ownership or use. Anytime he wrote of a vessel for which ownership, and sometimes use, were relevant, he called it, for example, "Noble Jones's boat" or "Peter Emery's boat" (Stephens 1742:19, 192). Most references to non-oceangoing vessels were described according to their use: trading boat, guard boat, express boat, etc. (Stephens 1742:86, 92, 96).

It appears that periauger/petiauger was a generic name for a particular class of vessel: a split-dugout cypress log with a plank keel in-

serted in the center (Figure 2), sometimes with one or more upper strakes added to increase freeboard, propelled by oars and sails, and with two masts which could be stepped when not rowing. They might well be partially decked over, and some carried large cargoes.

Once built, any vessel could be named for its use (i.e., scout boat, trade boat, plantation boat). Intended use obviously would determine adaptations made to the basic vessel's structure. Modifications for scout boats included an increase in the rowing stations and the addition of swivel guns. Cargo vessels might have four oars, but scout boats had as many as 10. The terms "petiauger" and "periauger" appear to have been interchangeable terms in the Southeast between 1725 and 1750, as shown by two 1740 quotations referring to the same vessels. The first refers to "fourteen Schooners and decked Petiaguas (of which three to carry one of the General's Companies from Port Royal)"; the second mentions "Perryaugers for carrying down Provisions &c. for the Indians and fifty Men of the Company at Port Royal" (Oglethorpe 1740:85, 106).

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The Role of Historic Preservation and Public Interpretation in Shipwreck Management: The Pensacola Partnership

Introduction

In 1992 the remains of the earliest colonial shipwreck in Florida were discovered on a shallow sandbar in Pensacola Bay. Exhibiting evidence of catastrophic damage, this ship is believed to be part of the ill-fated colonization fleet of Tristán de Luna which was all but destroyed in a hurricane in 1559, shortly after making landfall in Pensacola to begin one of the first European colonies in what was to become the United States (Smith et al. 1995). Subsequent excavations until early 1995 revealed a wealth of artifacts and cultural material, some unlike anything seen before in this context (Scott 1995).

The Emanuel Point Ship, as the wreck was named, represents a new chapter in the development of underwater archaeology programs in the State of Florida. The wreck was discovered by state archaeologists during a remote sensing survey of Pensacola Bay to locate and inventory aspects of Florida's maritime heritage—the first such survey in Florida organized by the state government through its Division of Historical Resources, Bureau of Archaeological Research (BAR) (Spirek et al. 1993; Franklin et al. 1994). After discovery and testing, the Pensacola Shipwreck Survey shifted gears to excavation rather than survey in order to learn more about this important shipwreck. The resulting project was the first full-scale underwater excavation performed by state archaeologists; previously, the state had focused on protecting submerged cultural resources and on creating underwater archaeological preserves (Miller 1989; BAR 1993). However, new directions were taken by the State of Florida in the excavation of the Emanuel Point Ship. Partnerships were developed with the Historic Pensacola Preservation Board (HPPB), the University of West Florida (UWF), citizens of Pensacola, and the media for the long-term investigation, exhibition, and public interpretation of the shipwreck.

Partnerships

After initial testing revealed the wooden ship buried under mud and ballast to be the remains of a 16th-century vessel, state archaeologists realized the importance of the ship and the possibilities for study by students of nautical archaeology. The University of West Florida, located in Pensacola, has had a superior archaeology program for nearly 20 years and a graduate program in historical archaeology for four years. Recognizing the potential of Pensacola Bay as a laboratory for underwater archaeology, and obtaining the expertise of the State Underwater Archaeologist as an adjunct professor, UWF began offering classes in maritime history and underwater archaeology as early as the spring of 1989. In the summer of 1989, UWF offered its first underwater archaeology field school; ten students excavated the wreck of a British warship known as the Deadman's Island wreck (Smith 1989). A permanent exhibit of the artifacts was placed in the local community center where it remains a popular attraction.

A second underwater archaeology field school was organized in the summer of 1993 to help state archaeologists in the excavation of the Emanuel Point Ship, as well as to involve students in the examination of this important resource. This represented the first step in forming a partnership between state agencies for the continuing investigation of the vessel. UWF provided publicity for the project and also offered credit to the class and permitted them to fulfill field work requirements for archaeology students.

The HPPB supported the Pensacola Shipwreck Survey during all stages by providing office equipment, facilities, and administrative assistance. The HPPB is a part of Florida's Department of State, Division of Historical Resources, as is the BAR; both are expected to work together for the protection of Florida's his-

torical and cultural resources. The Preservation Board is highly active in Pensacola's National Register and neighborhood preservation programs and has operated Historic Pensacola Village and related museums for over 25 years. Public interpretation of Pensacola's historical treasures centers around the Village, with museums dedicated to the history of commerce and industry, as well as the T. T. Wentworth, Jr. Florida State Museum and several historic homes. Programs in living history, colonial crafts demonstrations, and tours for school children complete the interpretive efforts of the Preservation Board (Brosnaham 1994).

The discovery of the Emanuel Point shipwreck prompted a closer working relationship between the BAR and Historic Pensacola. Since 1986, the HPPB has worked with UWF's archaeology program in helping to coordinate and provide work space for projects in Pensacola's historical district. A portion of UWF's excavations in the Historic Village has been designated the Colonial Archaeological Trail (Joy 1989). The open excavations, in situ features, signs, and brochures enable visitors to glimpse the city's underground history and are regularly used on school tours to educate children about the importance of archaeology and Pensacola's unique past. However, the Emanuel Point wreck provided a new challenge in historic preservation and public interpretation.

The involvement of the public through volunteer opportunities, lectures, and presentations helped foster the fourth link in the Pensacola partnership. Pensacolians are proud of their city's history, and many citizens are involved in the local archaeological and historical societies. The media added to this link with constant updates on the project. Newspapers, television, and radio offered coverage of each new discovery, as well as running commentary. Local businesses supported the project with donations and complementary services.

Partners in Excavation

As the unique nature and historical importance of the Emanuel Point shipwreck became apparent through continued excavations, state archaeologists became aware of the benefits of working with other agencies. The large scope of the project necessitated a joining of forces and pooling of resources.

After participating in the 1993 Emanuel Point field school, UWF began to push for a permanent maritime archaeology program. However, UWF is the smallest school with the lowest enrollment in the state university system and has had difficulty in funding even its major programs. To date, the Florida legislature has not provided funding or teaching positions for UWF to implement a full-fledged maritime archaeology program.

In 1994, the HPPB agreed to provide space in the basement of the Wentworth Museum to house an artifact laboratory and conservation facilities for the growing artifact collection. Plans were made for the permanent exhibit of shipwreck artifacts in one of the Board's museums and for the incorporation of shipwreck archaeology into public interpretive tours. The Board also supported the creation of the Pensacola Maritime Historical Society to spearhead fundraising efforts.

The Bureau of Archaeological Research team continued the excavation into the spring of 1995 using two survey boats and what equipment could be carried between the site and the headquarters each day. Fortunately, local businesses donated materials and services vital to the excavation. Chemicals for conservation, materials to repair equipment, air fills, and even a small pontoon hull which was converted into an excavation barge were donated to the project.

Media Blitz

Continual media coverage ensured that information about the shipwreck reached all areas of the community and piqued the interest of the citizens of Pensacola and the nation. Regular updates about the progress of the excavation and lectures by the project team to civic organizations and school classes allowed the Pensacola public to participate in this exciting investigation. Volunteers, a vital source of labor for any ar-

chaeology project, were easily recruited, and most contacted the state to offer their services. Associated Press stories were run in newspapers as far away as Arizona and Ohio. Magazines also carried the story; features and pictures were run in *Sea History, Florida Heritage,* and *Modern Maturity*. The cable television channel "fX" sent the roving host of its morning show "Breakfast Time" to interview project members and to dive with the principal investigator on the shipwreck. A diving free-lance journalist volunteered on the project and produced a series of articles for the *Pensacola News Journal*.

Lecture series were held during the summers of excavation. Consulting archaeologists, brought in to offer professional opinions and advice, also were asked to give public lectures. Held in various locations in the city, each served to offer additional information to the public.

Status of the Emanuel Point Ship Project

The summer of 1995 proved a convenient time to halt excavation. Significant research had been completed in the midship and stern sections, as well as testing in other areas of the site. These test excavations located features in the ship's galley and permitted estimation of the vessel's size, type, and construction methods (Smith et al. 1995). Over 3,000 artifacts were recovered, all requiring stabilization and conservation.

Diagnostic artifacts, such as an early variety of Middle Style olive jar and Melado, El Morro, and Seville Blue-on-Blue and Yayal Blue-on-White glazed wares, indicated a date range of the first half of the 16th century. A Spanish coin called a *blanca*, minted in Spain between 1471 and 1474, provided a definite, if early, *terminus post quem*. Made of an alloy of copper and silver, it was discovered in the bilge and may represent the keepsake or pocket-piece of a passenger or crew member, or it may have been present in ballast loaded onto the ship. Also diagnostic is the presence of over 7 pounds of mercury; used in the colonial mining industry, it was not carried to the New World in quantity until 1556 (Haring 1964:158). Sherds of Aztec IV ceramics molded in the shape of a human face were found in the stern excavations. This type of pottery ceased to be made after a 1576 plague killed the potters (Smith et al. 1995:100-103, 117, 119).

Historical research continues in the archives of Spain. Previously, the main body of information available pertaining to the Luna expedition was the two-volume translation of documents published by Herbert Ingram Priestley in 1928 containing correspondence between Luna and the Viceroy of New Spain. New research has uncovered additional information, including the names and types of vessels in the colonization fleet (Smith et al. 1995:12). Work is ongoing in the archives, including searches for additional information about this little-studied period in United States history and translation of newly discovered documents. Plans have been made for publication of the translated documents to augment those provided by Priestley over 60 years ago.

A series of educational tours for middle and high school students in Pensacola and surrounding counties has been developed by HPPB and has been most popular and successful. The tour integrates a slide and video program, a walk through the Colonial Archaeological Trail excavations, and a program in the conservation lab itself. The students learn the importance of terrestrial and underwater archaeology, detailed information about the Emanuel Point Ship, and the necessity for a conservation lab; a few are even permitted to clean concretions with an air scribe. These tours will continue into 1996, and ideas for the tailoring of material to younger ages are being developed.

Future Plans

Until funding details for continuation of field work can be determined, the Pensacola partnership remains intact, though operating at a reduced level. The shipwreck site is protected by the layers of mud and sand and ballast that safeguarded the fragile wooden timbers and the profusion of artifacts for over 400 years. The dark water inhibits divers who, even if they found the wreck, would see only a low mound of oyster-

encrusted rocks. The site is not marked, but its location is known to Marine Patrol officers who can view the area through their office windows and who patrol the site daily.

The shipwreck has been formally nominated to the National Register of Historic Places. The nomination passed the Florida state review board in November of 1995 and has been sent to Washington, D.C. for review and expected approval; National Historic Landmark status also is expected. A preliminary report of the project has been written, as well as two master's theses, one on conservation procedures (Smith 1995) and one on ceramics recovered from the wreck (Wells 1996). Several papers and lectures have been presented in professional conferences to disseminate information.

Among recommendations presented in the report is that the Emanuel Point shipwreck be designated a state archaeological preserve in order to protect and manage the wreck for future research and education (Smith et al. 1995:141). The State of Florida has a system of underwater archaeological preserves that has served to educate the diving public about the benefits of preserving their maritime heritage. Interpretation of preserve wrecks through lectures, brochures, and underwater guides demonstrates the knowledge gained by archaeology. Although the Emanuel Point wreck cannot boast the clear water and easy access of the five established preserves, the interpretation materials will serve to further educate the public, and the protected status will help to discourage unauthorized activities.

Artifacts from the Emanuel Point shipwreck continue to be treated in the Wentworth Museum basement lab. Most of the artifacts have completed conservation and are ready for exhibition. A few concretions and large metal objects such as gudgeons and pintles still await casting and cleaning. One of the shipwreck artifacts is already on display on the second floor of the Wentworth Museum. This copper pitcher has lost most of its original metal and is on display as it is being conserved (Scott 1995).

Currently, plans are made for the permanent exhibition of shipwreck artifacts in Pensacola. Construction and renovation are in progress on the first floor of the Bowden Building, which houses the administrative offices of the HPPB. Funded jointly through a matching grant from the Museum of Florida History and Fiesta of Five Flags, Inc., this exhibit area will be dedicated to an interpretive presentation of artifacts, maps, photos, drawings, and documents depicting the history of Pensacola as the City of Five Flags. Since the Emanuel Point shipwreck is the only discovered manifestation of Pensacola's first settlement, material from the wreck will compose the bulk of the First Spanish Period display. Grand opening date for the City of Five Flags' exhibit is September of 1996.

Historic Preservation and Public Interpretation in Shipwreck Management in Pensacola

Although excavation of the Emanuel Point shipwreck is suspended, the public interpretation of the wreck is just beginning. Many people still think of gold and silver when they think of shipwrecks. Often, the first question asked of the excavation team members at public presentations is, "Have you found any treasure?" Only through continued public education and interpretation can the importance of underwater archaeology and the preservation of our maritime heritage be realized.

As one link in the Pensacola partnership, the HPPB is striving to manage shipwreck materials in a manner conducive to this end. As historical tourism increases in popularity, the remains of the Emanuel Point wreck, in conjunction with museums and the Historic Village, can serve to increase public concern for those historical resources under the water as well as those above the ground. The Preservation Board will continue to provide conservation lab space and funding for a conservator as long as the artifacts need care. Historic Pensacola, with the support of Pensacola's City Council, also is funding the ongoing archival research in Spain, Mexico, and the United States. The incorporation of the conservation lab into school tours and the display of artifacts is helping to fulfill the obligation to the

public trust for the interpretation and preservation of the shipwreck.

The University of West Florida continues to offer various classes in nautical archaeology and ship construction, some of which are required for graduation from the archaeology program. Funding and positions for a maritime archaeology program have been approved by the Board of Regents and will go to the Florida Legislature in May of 1996 for approval and funding.

The Underwater Section of the BAR is focusing on the creation of underwater archaeological preserves and on managing salvage contracts. When funding is approved, the Emanuel Point excavation will be resumed in partnership with the Preservation Board, UWF, and Pensacola's public and media.

The local citizenry is proud of their one-of-a-kind shipwreck. Vandalism of the Deadman's Island wreck in 1991 incensed Pensacolians; rewards were offered for evidence to prosecute the looters (who were never caught). This attitude of protection and concern still lingers and is perhaps one of the best safeguards for the Emanuel Point Ship. Local news reports still occasionally print a story on the project, generally focusing on the artifacts. Area diving instructors use the ship as an example of the benefits of archaeology over salvaging and also do their part in warning divers not to molest the remains.

Conclusion

Although the first phase of excavation of the 16th-century Spanish ship off Emanuel Point in Pensacola Bay has been concluded, there is much work still to be done at the site and in the laboratory and archives. Much benefit has come of the investigations to date. Careful study and analysis have shed light on this poorly understood area of history and maritime technology. The public, on whom the science of archaeology is dependent, has come to better appreciate the wealth of information obtainable through scientific means, particularly where their maritime heritage is concerned and can view the shipwreck artifacts interpreted for them through Pensacola's long history. The joining of two branches of state government with city government has provided a precedent for future work. The Pensacola partnership anticipates a long relationship of work on the investigation, preservation, and interpretation of Florida's earliest shipwreck.

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"Ring-Around-A-Radeau," or, Fencing in a 1758 Shipwreck for Public Access and Preservation

Introduction

In the summer of 1990, a group of Lake George, New York, shipwreck preservation enthusiasts discovered the *Land Tortoise*, a radeau-class French and Indian War vessel sunk by British and colonial troops in 1758. The Smithsonian Institution now accepts this vessel as "...the oldest intact war vessel of European style in North America, while the *Philadelphia* [previously described as the oldest] is redefined as the oldest armed and battle-proven United States man-of-war" (Lundeberg 1995). In July 1995, the *Land Tortoise* was listed on the National Register of Historic Places, and it has been nominated for National Historic Landmark status.

The Radeau—Underwater Archaeology

The *Land Tortoise* became the focus of an intense study sponsored by Bateaux Below, Inc. and a group of volunteer divers and other specialists. From 1991 to 1994, the team completed controlled field work, making results public through numerous presentations and media interviews; we have published books, popular articles, a photomosaic, and professional notices and reports, including yearly updates at the Society for Historical Archaeology conference (Abbass et al. 1992; Zarzynski et al. 1994; Zarzynski et al. 1995).

Although the radeau's location was not made public during the research phase, the *Land Tortoise* sits only about a mile from the Lake George village center and a local dive charter business; this meant that the site location quickly became common knowledge, and public pressure to dive the site increased. The State of New York decided not to close the site to the public, preferring to rely on fading site location, secrecy, and the good will of the dive community to protect it, even during the formal archaeological research sessions. This laissez faire posture met with limited success. Therefore, Bateaux Below, Inc. took the lead to communicate with dive shops, clubs, and publications to ask that non-team divers delay their visits until the State of New York decided on its long-term preservation plan. Bateaux Below, Inc. also published a Lake George preservation poster, and T-shirts with the same image were available from a local museum. The archaeology team members also gave numerous public presentations and media interviews about the importance of protecting this irreplaceable cultural resource.

Although most divers respected the team's informal requests to stay off the radeau, there were some who did not, and there were even incidents in which divers harassed the research team, causing it to lose valuable research time. It became increasingly clear that dive traffic at the radeau would continue and grow. Therefore, in the autumn of 1993 the project's focus shifted from research to the administrative hurdles surrounding the creation of a protected radeau preserve.

Planning for the Radeau's Future

Decision-making about the site was complex because of the number of agencies that had some responsibility for the vessel or for the waters and lake bottom in which it was found. These include the State Department of Environmental Conservation, the State Museum, the State Office of General Services, and the State Office of Parks, Recreation and Historic Preservation; local agencies include the Lake George Park Commission and the Warren County Sheriff's Department.

In October of 1992, Bateaux Below, Inc., the Lake George Historical Association, and the National Trust for Historic Preservation sponsored a public meeting at Lake George to consider options for the radeau's preservation. Spe-

cialists spoke on the advantages and disadvantages of its removal to shallower water or to a shore-side museum, and of leaving the vessel in situ, either closed to the public (and possibly bermed) or available to divers as a state-administered shipwreck preserve. The greatest number of public attendees were sport divers, dive charter operators, and dive shop owners who petitioned for access to the site. We published the consultants' recommendations and the public's response in a report that was then presented to the state agencies responsible for the radeau's future (Abbass 1993).

Creating a Shipwreck Preserve System

Because of the vessel's rarity and fragility, the best choice for her preservation would have been to close her to the public. On the other hand, increasing pressure to visit the site made it politically difficult for the state to deny public access completely. In the end, a compromise was reached to treat the site as a controlled public access preserve. To this end, during the winter of 1993-1994, Project Archaeologist Abbass traveled from Newport, Rhode Island, to Albany, New York, to attend many state interagency meetings. A principal in these discussions was Bateaux Below, Inc., a not-for-profit educational corporation instrumental in the installation of "The Sunken Fleet of 1758" and "The *Forward*" shipwreck preserves. Known as New York State Submerged Heritage Preserves, these two sites opened in Lake George in September 1993 (Zarzynski 1993:1).

Although these two earlier preserves were models for the radeau, there were significant differences between them and the *Land Tortoise*. The first difference lies in the depth of the sites and the potential for diver accidents. "The Sunken Fleet of 1758" and "The *Forward*" preserves are in shallow water—45 ft. or less—and thus are dives for novice- to intermediate-class divers. In 107 ft. of water, the radeau is only for advanced divers and those with auxiliary safety equipment.

The second difference lies in the age, rarity, and fragile nature of the radeau. Like the radeau, the seven bateaux of "The Sunken Fleet of 1758" are from the French and Indian War (1755-1763), but approximately 40 bateaux were located in Lake George in the 1960s. Although many of these are now disturbed or removed, they are not exceedingly rare, and much is known about bateaux from related studies. In contrast, very little is known about the radeau class; until the discovery of the *Land Tortoise*, most of what was written about radeaux was conjectural. The *Forward* is of interest because she probably was the first gasoline-powered launch on Lake George, but she is from a common class of vessels; her historical importance pales in comparison with that of the *Land Tortoise*.

"The Sunken Fleet of 1758" and "The *Forward*" preserves are open to the diving public on demand from Memorial Day into early October. Nothing but seasonal installation and removal of the site buoys controls public access to these preserves. Both the seven preserve bateaux and the *Forward* have suffered some damage; some of this damage is the expected wear and tear from increased diver traffic in the area, but some of it is malicious, such as the removal of interior silt from two of the bateaux, and damage to the *Forward*'s stern. In the absence of special arrangements, similar damage was predicted for the *Land Tortoise*.

The Radeau—Controlled Public Access

The greater diving hazards of the radeau site determined the need for increased safety procedures; therefore, it was decided to open the site by permit only and only to those divers who could present a proper diver certification card. The permit allowed access to the site buoy, the only means to identify easily the site location. Each day was divided into three appointments of two hours in which as many as eight divers in a boat could be on the buoy, with one hour between each appointment. The typical dive at

the radeau depth was about 12 to 15 minutes bottom time, plus a recommended safety/decompression stop. The one-hour period between dives was necessary to allow the lake bottom's fine silt to settle and to clear visibility on the site for the next set of divers

In addition, the radeau was to be open to the public only from early June to Labor Day. This would best accommodate the regular state cycle of lake equipment installation and the availability of state park rangers to issue dive permits. It was also the optimum time when marine patrols and dive rescue teams were on duty.

The physical arrangements of the radeau preserve were more complex than those of the other preserves, including a lead line from the mooring to the site and a plastic chain barrier around the vessel to indicate how close a diver should approach. Site signage underwater was added to repeat brochure safety information.

Once the administrative arrangements and physical form were determined for the radeau preserve, it was difficult to come to consensus about which agencies would be responsible for the preserve management plan. In these times of limited state governmental economic support for preservation, and especially in the tempestuous internecine struggle by various state agencies to avoid commitment of either funds or personnel, no one agency would take the lead. However, at last the New York State Department of Environmental Conservation agreed that park rangers from an island near the radeau would oversee the permitting. The State Office of General Services printed preserve informational brochures (State of New York 1994), and the State Department of Environmental Conservation handled publicity. The State Office of Parks, Recreation and Historic Preservation produced signage for the preserve, and the State Museum issued relevant permits for archaeology and preserve installation-related work at the site.

Another grant from the National Trust for Historic Preservation was a lever to help convince the state agencies to cooperate with one another. This grant supported an engineering test of the proposed barrier posts and lines to be installed around the *Land Tortoise*. The actual site equipment—mooring anchor, mooring buoy, line, plastic chain, and posts—was purchased by the Lake George Historical Association and Bateaux Below, Inc. Members of the archaeological team, led by Bateaux Below, Inc., installed the site equipment, and by a Memorandum of Understanding, Bateaux Below, Inc. is responsible for periodic inspection of the preserve. While the various agencies began the work of creating the administrative infrastructure, we started work on the installation of the physical plant.

Installing the "Ring-Around-A-Radeau"

The supports for the protective barrier rail are 12- to 15-ft.-long, 4-in.-diameter, high-visibility white polyvinyl chloride (PVC) pipes driven vertically several feet into the lake bottom. The area which received the posts was surveyed first to determine if any structure related to the vessel was in the impact zone. The low-tech mechanics of manually driving each PVC support into the soft silt was labor intensive but provided the least opportunity to damage the site. These pipe stanchions support a white plastic chain completely forming our physical "ring-around-a-radeau" (Figure 1). The chain allows divers to approach the vessel as close as 4 to 5 ft. and is attached to the PVC supports by breakaway ties in case of wayward anchor or fishing snags. There are informational signs near the mooring and at regular intervals around the vessel.

The Radeau Preserve's 1994 and 1995 Seasons

The installation of this equipment took the major portion of the research team's 1994 season. The preserve named "The *Land Tortoise*—A 1758 Floating Gun Battery in Lake George" opened on 8 August 1994.

Public diving of the radeau in 1994 was limited to four weeks at the end of the summer; 61 divers registered to dive the site during that time. There were also special requests to dive the site in the autumn and even for a winter ice dive. In the beginning, the state refused most of

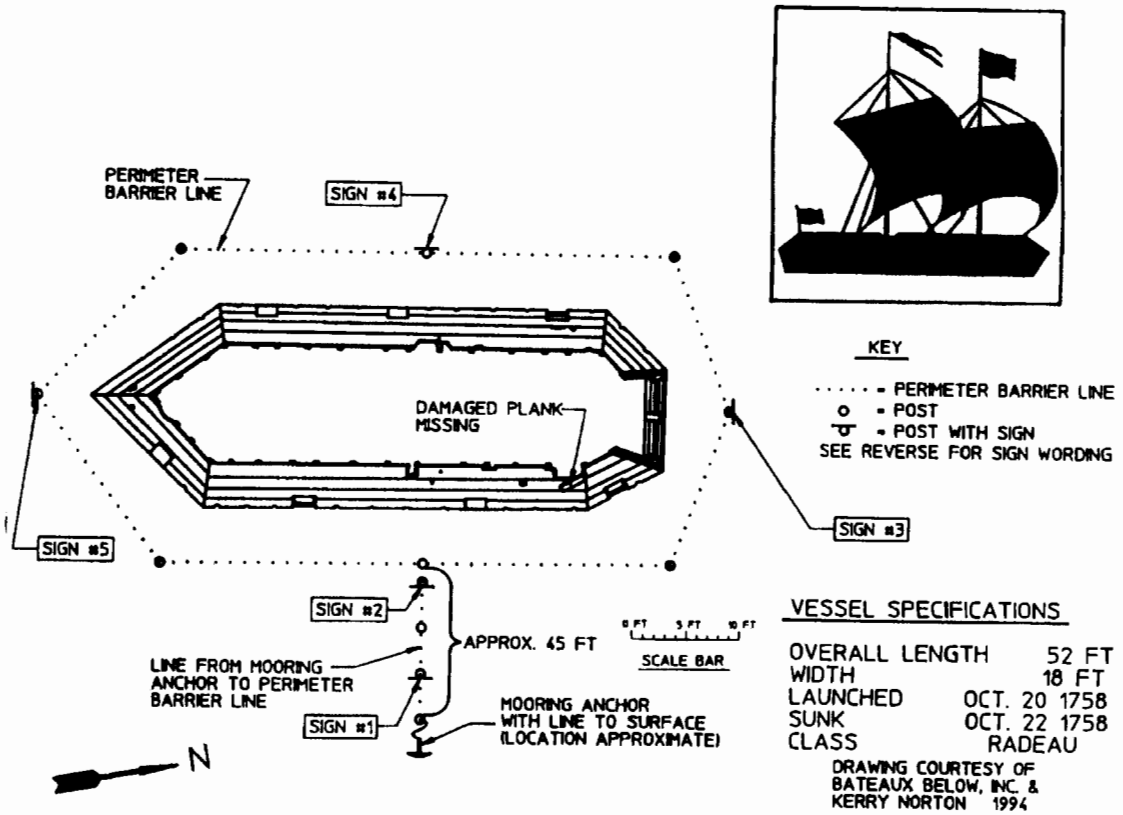

FIGURE 1. The *Land Tortoise* preserve has a perimeter constructed around it made of high-visibility white polyvinyl chloride pipes and plastic chain. This "ring-around-a-radeau" protects the fragile shipwreck.

these requests due to safety issues. However, increasing pressure from the dive community combined with a state government looking to bolster its public image resulted in off-season permits being granted with increasing frequency.

Although 130 people registered with the state to dive the radeau in the 1995 season, this is a somewhat false figure of the dive traffic on the sunken warship. Divers have been noted on the site when no one had registered and after the public season closed.

In addition, the state has been slow to install and maintain some of the required preserve hardware due to budget cuts and bureaucratic obstacles and because New York has no state underwater archaeologist to coordinate such activities. Since 1993, several boats have collided with state buoys at "The *Forward*" and "The Sunken Fleet of 1758" preserves because the buoys were installed without navigational lights, even though such lighting is required. After two years, "The Sunken Fleet of 1758" navigation buoy is still not lighted. State-maintained lettering on all preserve buoys has peeled off, leaving them in a shabby and nearly illegible state. Repeated requests for repairs and required navigation lighting have not been met (Zarzynski 1995).

Many individuals in the state system, most notably the archaeologists, support the preserve effort, but the burden of the state bureaucracy and inattention by the agencies responsible for the day-to-day administration have compromised carefully designed preserve efforts. Such indifference is bearing bitter fruit in the increased damage now obvious on the radeau. On regularly scheduled inspection dives, members of Bateaux Below, Inc. have noted hand prints and scrapes on planks indicating that the numerous notices to divers not to touch the radeau are often un-

heeded. Top bulwark strakes, those most accessible for divers to grab and pull themselves along, show some wastage. Most despicable of all is the evidence of a 1995 attempt to remove two of the cannon port lids from their seats along the gunwale. Fortunately, these lids appear to have resisted the efforts of the "lid-nappers."

This evidence indicates that the physical "ring-around-a-radeau" is not a sufficient barrier to protect her from intentional vandalism, nor is the administrative effort sufficient to administer the preserve program. Administrative details are too easily lost in the maze of a state bureaucracy trying to avoid responsibilities. On the other hand, the radeau permit system's emphasis on diver safety has met with success. To date, no divers visiting the site have reported any dive injuries.

Although many individuals in New York, including some state bureaucrats and members of the dive community, are passionate to protect the Lake George *Land Tortoise* radeau, the lack of an effective central governing authority makes it difficult for competing agencies to cooperate, a fact made worse by current political and economic conditions. The radeau preserve could work if greater attention to its administration is executed by the state and if the divers who visit the site are more sensitive to its preservation.

Conclusion

The lesson to be learned from the *Land Tortoise* radeau preserve is that passion and good intentions are not enough. There must also be some reliable mechanism in place for oversight and enforcement. The State of New York is entitled with custodial care of the historic radeau. Unless the state provides such a mechanism to convince the various agencies to fulfill their individual and collective obligations, and until the state assumes a greater role in educating the public about the preservation of submerged cultural resources, the "ring-around-a-radeau" will be breached and the *Land Tortoise* will be forever compromised.

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International Protection of Underwater Cultural Heritage

In the future, shipwreck research and recovery will be swamped by a tidal wave of technology and battered by hurricane winds of government regulation. Technology is increasing our access to the ocean floor, and regulation is restricting our choice of action. This paradigm is obvious in the Draft Convention for the Protection of the Underwater Cultural Heritage (Convention).

This essay has two purposes. One is to offer criteria to define parameters for the concepts of ownership and abandonment. The second is to consider the concept of technology: its discovery, availability, and use. The concepts of abandonment and technology are used in the Convention but are not yet explained. However, in modern society, the Convention is not the only forum for the consideration of abandonment and technology. Issues relating to private property rights and technology are not unique to the Convention but rather part of a common global evolution of social issues. People are struggling to define the role of technology in the world, from privacy in cyberspace to the basic management of land, air, and water resources.

The following are the pertinent provisions of the Convention:

Article 1: Definitions

For the purposes of this Convention:

1. "Underwater cultural heritage" means all underwater traces of human existence including:

(a) sites, structures, buildings, artifacts and human remains, together with their archaeological and natural contexts; and

(b) wrecks such as a vessel, aircraft, other vehicles or any part thereof, its cargo or other contents, together with its archaeological and natural context.

2. Underwater cultural heritage shall be deemed to have been "abandoned":

(a) whenever technology would make exploration for research or recovery feasible but exploration for research or recovery has not been pursued by the owner of the heritage within 25 years after discovery of the technology; or

(b) whenever no technology would reasonably permit exploration for research or recovery and at least 50 years have elapsed since the last assertion of interest by the owner in the underwater cultural heritage.

Article 2: Scope of the Convention

1. This convention applies to underwater cultural heritage which has been lost or abandoned and is submerged underwater for at least 100 years. Any State Party may, however, protect underwater cultural heritage which has been submerged underwater for less than 100 years.

2. This Convention does not apply to any warship, military aircraft, naval auxiliary, or other vessels or aircraft owned or operated by a State and used for the time being only on government non-commercial service, or their contents.

The perspective of this essay is rooted in the Anglo-American maritime tradition, but the principles described have been adopted by the broader global community. Traditionally, an abandoned vessel is one that has been deserted by the owner, that is, the owner has physically left the vessel with no intention of returning and no retention of rights. Proof of abandonment has been demonstrated by the passage of time, the initiation of an insurance claim, or perhaps a public declaratory statement. Salvage law has been based on the assumption that in absence of a contract, or in the case of a conflict, a court would decide the amount of award due the salvor from an owner.

When the court hears a case concerning marine affairs or admiralty, the court applies the precedents of previous case law and makes an award to the salvor. The court makes a salvage award considering three criteria based on rules established in the Blackwall (77 U.S. [10 Wall 1, 19L.Ed.870 (1869)]) opinion: (1) a marine peril, (2) voluntary service, and (3) success in recovering the vessel or cargo (*Benedict on Admiralty* 1980:2-1). Further, the court will consider the degree of danger present in the rescue, the value of the property recovered, and the time

and labor expended by the salvor. In the case of abandoned property, the salvor may receive the property or the proceeds from the sale of the property.

Note that *Benedict on Admiralty* (1980) and Gilmore and Black (1975) remind us that the vast majority of salvage operations have been conducted at sea level; the salvage of wrecks in even moderately deep water is rare. Maybe one or two wrecks a year in the world fall into this category, and then the cargo, usually gold, has been the focus of the recovery instead of the ship. Moderately deep water may be less than 100 ft. (30 m) or a few hundred feet; deep water is usually measured in miles.

Now let us consider property law and ownership in some familiar contexts. For example, if you go to a police station and say that your watch was lost or stolen, you cannot expect the police to allow you to survey their collection and select a watch. The police will want some proof that you had a watch and some documentation of what it looked like and how it could be identified. If your watch was lost or stolen and you do not try to locate or recover it, you have abandoned it, and the watch may become public property. If your watch was stolen and the statute of limitations has elapsed, if you find someone wearing the watch and they have a legal bill of sale, you do not have a right to that watch. Finally, if you lose your watch walking on someone's land and the landowner picks it up some years later, the watch becomes the property of the landowner. Ownership can shift over time.

To go back to shipwrecks, I suggest a five-part test for determining when a ship and cargo are abandoned and when there is ownership. A ship and cargo should be considered owned if all five criteria can be documented:

1. There is a record of the ownership of the vessel and cargo. Such a record might be a bill of sale or copy of the ship's registration.

2. There is a record of the loss of the ship and cargo. Such a record may be an office memorandum or copy of a newspaper article.

3. There is a record of the location of the sinking, as far as it is known at the time. The record may be a letter or document to the file.

4. The ship and cargo continuously appear as assets on appropriate tax, personal, or business records.

5. An effort has been made to locate the wreck site, and a periodic evaluation of the possibility of recovering or actual efforts to recover the wreck and cargo have been documented. Contracts for this work or other documents, such as logs, should exist.

The burden of proof should be on the owner to show an interest in and a responsibility for the property in question, here a ship and cargo. If all five criteria are not met, then the ship and cargo should be considered abandoned. A clear statement of abandonment, a salvage/removal contract, or an insurance claim may also qualify the ship and cargo as abandoned. These criteria are, in my view, consistent with the intent and content of the Convention.

Now let us consider the discovery, availability, and use of technology. I suggest that there are five criteria for determining when technology may be considered available. Those criteria are applicability, risk, cost, jurisdiction, and discretion.

First, the technology must have been designed, built, and functioning in the subject application. Technology which is still a theory or exists only as a drawing is not available. In the modern world technology and applied science are often used interchangeably. Examples of theory and drawing of technology are the flying machines sketched by Leonardo da Vinci. Flying machines were not available during the 15th century for the purposes discussed here.

The technology must be being used in an integrated manner with other necessary technologies or it is not available. The dependence of one computer on another in a watery environment is critical to the success of a project. For example, a fine piece of remote sensing equipment is useless if it does not integrate with the locational system. Technology which is function-

ing in one application, such as remote sensing equipment which works on land or even in fresh water, should not be considered available for work in salt water.

Innovative technology and the innovative use of technology should be encouraged, but innovation and adaptation require experimentation; experimentation should not be considered availability. The cultural acceptance of a technology and where individuals choose to put their money will vary widely, and consequently availability will vary widely. In part, a technology is available when there is at least one functioning example of the use in the subject application.

Second, the risks to human health and the environment need to be considered. The results of using the technology may result in loss of quality of life or quality of the environment. The risks in using the technology may outweigh the stated purpose. If the risks are considered too high, the technology should not be considered available. The Spanish diving bell of the 16th century worked in the recovery of shipwrecks at 100 ft. (30 m), but the loss of life would not be acceptable today. Similarly, the use of powerful propwash deflectors that destroy grass beds and fish nursery areas may not be acceptable.

Third, the cost of the technology needs to be considered. If the cost of the technology is so high that few, if any, can purchase or operate it, the technology is not available. Technology classified by the military may also fall into this category as not being available. If one had enough money, one might be able to do the necessary research to duplicate the technology, but few would have the money.

Fourth, the technology must be available within a particular jurisdiction. The prohibition of technology transfer and a broad range of trade sanctions may make technology unavailable in particular jurisdictions. Jurisdiction over the people and submerged lands involved in a particular case may also be critical.

Fifth, the operator's discretion to use a particular technology must be considered. A government requirement for use of a technology should use a different standard for availability, risk, and cost than the voluntary and discretionary use of a technology by an individual or a project. Currently a "million" rule might be considered a guide. A government body should not consider a technology available if the cost to the operator is more than a million U.S. dollars or if the risk to human health or the environment is more than one in a million. If the operator has discretion to act, the assumption may be made that they will do so for their own benefit and that they will evaluate the listed criteria accordingly.

The world of salvage has changed. The purpose of the modern salvor has changed from the recovery of people, cargo, and ships, that is property, to pollution prevention. The Salvage Convention and the Ocean Pollution Act do not value saving property. The goal is pollution prevention, and how the activity is conducted is dictated by government regulators. In many areas of human activity, technology is changing what we do and how we do it. The global village is a place of complex interrelationships; complex analyses are required.

This essay suggests that a wreck and cargo are abandoned if the ownership is not documented and location and recovery efforts are not documented. The suggestion is made that availability of technology must consider applicability of the technology, risk to human health and the environment, cost, government jurisdiction, and discretion to use a technology. If the Convention language of technology being feasible, discovered, and reasonable is understood to be equivalent to available as used here, there will be some basis for case-by-case evaluations of shipwreck sites. Using these criteria, many shipwrecks will not be abandoned, and many technologies will not be available. Nevertheless, we must struggle to protect both private property and the public good. Court salvage awards have generally given way to contracts. Courts and governments must be careful not to confuse profit with property rights and responsibilities.

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Education Versus Legislation

Bordering the Pacific Ocean, British Columbia (BC) is Canada's westernmost Province. Virtually separated from the rest of the country by the Rocky Mountains, BC has more than 17,000 mi. of rugged coastline dotted with islands and punctuated with fjord-like, deep-water sounds, some more than 20 mi. in length. Buried beneath the silt and rocks lie representative examples of every era of coastal development from prehistoric settlements; First Nation's cultural remains; Spanish, Russian, and English explorers; fur-traders; and settlers.

Whether prehistoric sites were submerged by sea level changes or ships were lost due to storms, fire, collisions, misjudgment of navigational hazards, or drunken skippers, the coast and inland waters of BC have become a storehouse of a rich, yet fragile heritage resource. This resource, which until 20 years ago was little appreciated by any level of government, academia, or the general public, was being systematically pilfered and plundered by souvenir hunters and salvors.

Recognizing that the very shipwrecks which lend such drama to the Province's heritage were a finite resource which was disappearing at an alarming rate, a group of 20 divers who were taking a Continuing Education course in Maritime Archaeology at the University of British Columbia (UBC) formed the Underwater Archaeology Society of British Columbia (UASBC) in 1975. The UASBC is a non-profit, avocational organization dedicated to promoting the science of underwater archaeology and to conserving, preserving, and protecting BC's maritime heritage lying beneath our coastal and inland waters.

The task of protecting BC's submerged cultural resources is a daunting one. Despite its incredibly rich maritime heritage, BC has never had a provincial underwater archaeologist or a submerged cultural resource program. If the new Society were to succeed, its first task would have to be the establishment of a working relationship with the provincial government archaeologists and the education of various levels of government about the importance, extent, and fragile nature of their submerged cultural resources.

Starting with surveys of two wrecks of 19th-century sailing ships, *Panther* and the *Zephyr* in the Gulf Islands, the UASBC created a successful liaison with the provincial archaeologists. As the scope, complexity, and professionalism of our regional surveys have grown over the past 20 years, so has the provincial government's financial support of the Society. Core funding and specific project funding is now supplied in return for a pre-approved program of site surveys, inventory data, historical research, and management advice. Early on in this symbiotic relationship, the Province, prompted in part by financial constraints, made the decision not to establish its own division for submerged cultural resources but rather to rely solely on the input and assistance of this active avocational association. Through the years, as the expertise and competence of the UASBC increased, the provincial authorities have increasingly relied on the Society to advise on management decisions regarding the preservation of all underwater sites.

From the start, the UASBC recognized that the shipwreck resource had to be identified and quantified before it could be managed. Since 1980, the Society has completed shipwreck inventories in the Gulf Islands; Clayoquot, Nootka, and Barkley Sounds on the west coast of Vancouver Island; southern Vancouver Island (including Victoria); Howe Sound; and Burrard Inlet around Vancouver. Funding has just been received for a three-year project to inventory shipwrecks around northeast Vancouver Island, starting at Campbell River (Marc 1994:3). Additionally, we have an ongoing project in the Kootenay Region, in southeast BC, where, to date, members have surveyed and identified more than 50 sites of steamships, lake barges, and train wrecks in the interior lakes.

The UASBC's inventories do not just provide the provincial government with the names and locations of cultural sites and vessels, they also

provide the history of each vessel, including details regarding its construction and unique features. Accounts of the vessel's wrecking (if known), salvage attempts (if any), and present location and condition are all documented. Site maps, video, and still photographic records are made of all visible features, and detailed computer data forms are completed. Finally, our recent inventory reports contain recommendations on further action that should be taken with regard to the management and preservation of each site.

Recommendations for the management of each site are developed based on the accessibility of the particular wreck, sport divers' knowledge of the site, historical significance, presence of collectible artifacts, or suitability for an underwater interpretive trail.

It is not, nor has it ever been, the intention of the UASBC to restrict public access to shipwreck sites; rather, we want to ensure that these sites are managed today so that they will survive for tomorrow.

If a wreck's location is widely known, if it is not of particular significance to the Province's maritime history, and if it lacks abundant collectible artifacts, we would normally recommend that no further action is required other than allowing for safe public access to the site. We may also choose to establish a mooring buoy or place a plaque on a site to identify the ship, as we did at the site of the *Del Norte*.

However, if there are some interesting structural remains left, we have recommended that an interpretive trail be developed for the public. This was done with the 260-ft. iron-screw steamer the *Bernard Castle*. Built in 1878 in England, the ship hit Race Rocks off Victoria and sank en route to San Francisco with a load of coal. There are eight plaques around the 131 ft. of extant hull identifying boilers, crankshafts, and other hull features, as well as cargo. Funding for the development of the trail and printing of the pamphlet (which includes a site map, history, and photo of the ship, plus diving safety tips) was provided by the BC Heritage Trust. Other interpretive trails are being planned for two wrecks in Bedwell Bay, a popular local dive spot near Vancouver.

If a wreck site is not widely known, figures significantly in the maritime history of BC, or contains a wide variety of "collectible artifacts," the UASBC takes a number of different measures to protect the resource.

First, if the site is not readily accessible, we keep the location quiet, reporting it only to the provincial authorities and restricting our diving on it so as not to draw attention to the location. This approach was taken with the *Ericsson*, the first and only side-wheeled, caloric-powered ship, which ended its days as a clipper ship running aground in Barkley Sound in 1892. After surveying the vessel and tagging all important artifacts, we alerted the local community of Bamfield about their important and unique site. The community has since taken over responsibility for the protection of this shipwreck, reporting any suspicious activity to the local police. While our bright yellow survey tags may not totally deter souvenir collectors, they do send out a message that a site is being monitored and studied.

Although the UASBC has undertaken some small test excavations, it is our current policy to restrict this type of activity, and only diagnostic artifacts are removed from a site to confirm the identify of a vessel. To avoid theft, sensitive artifacts may also be removed. This is done only with the permission of the Provincial archaeologist and once we have mapped the site and arranged for conservation of the artifacts.

If a shipwreck features prominently in BC's history, we pursue the ultimate legislative protection by having it designated as an Underwater Heritage Site under the Heritage Conservation Act. This law makes it illegal to remove any object from the wreck without permission of the Archaeology Branch of the Provincial Government (Marc 1994:3). A plaque identifying the extant remains as a Heritage Site is placed on the wreck, if possible, or adjacent to the shore if the site is too deep, as is the *City of Anisworth*, a paddle-wheeler at 330 ft. in Kootenay Lake. This, however, is a lengthy process. To date we have designated six shipwreck

sites and will be seeking similar protection for the Province's oldest train wreck site at Procter Point on Kootenay Lake.

Working in parallel with the provincial and professional archaeologists, the UASBC's efforts to elevate the status of submerged cultural resources were realized in 1994 when the Provincial Legislature passed the Heritage Conservation Amendment Act which affords the same protection to terrestrial and submerged cultural sites—including shipwrecks and aircraft older than two years. Lawyers who are members of the Society had a role in drafting parts of this legislation.

The UASBC's task of educating and liaising with government did not begin and end with the Archaeology Branch. Because of the intense development activity on the southern coast of the Province, members of the Society have made presentations to, and met with, many Ministries of the Provincial Government to apprise them of the significance of submerged cultural resources. Although not usually required by law, the Ministry of Lands and Recreation does send us notification of all foreshore lease developments and requests our input. This includes permits for log-boom moorings, fish farms, and pipe and cable installations. The BC Ferry Corporation has consulted with us prior to constructing new docks at Bella Bella and Snug Cove. Likewise, the UASBC has developed a good working relationship with the major Federal Port authorities, who are now cognizant of the submerged cultural resources within their jurisdiction.

From its inception, the UASBC realized that governments and legislation alone would not protect cultural sites from indiscriminate salvage; there are simply too many sites to make this practical. Educating the public about their rich maritime heritage and its fragile, non-renewable nature would have to play a significant role in influencing public behavior. Education and public awareness campaigns have been a focus of the Society throughout its 20-year history. We feel strongly that if the local community is educated about the importance of their unique cultural resource, then they will be empowered to protect it for the next generation.

Through time the UASBC's public education program has taken many forms and has been tailored to suit the audience, venue, and available technology. Upon the completion of each regional survey, the UASBC has developed a slide show of its findings. Concentrating first on the schools, service clubs, and local historical societies in the area of the survey, members have detailed the significant finds, plus the aims and objectives of the Society. These presentations have been successful in promoting awareness of local maritime heritage and instilling a sense of community ownership and non-destructive appreciation of a resource. Our message that shipwrecks and submerged cultural sites are non-renewable resources of equal importance to the dwindling first-growth forests and fish stocks of the Pacific Northwest has been well received. With the assistance of our part-time archivist and members who are photographers, our public presentations can be tailored for any age and interest level.

Dive clubs and shops continue to invite us to speak with new divers. These presentations, as well as our annual SHIPWRECKS Conference, continue to generate new diving and non-diving members.

Four years ago the UASBC received a federal grant to develop a trade show display, with informational pamphlets, that could be manned by volunteers. This exhibit has been shipped all over the Province and set up in shopping malls, banks, museums, libraries, and schools. Additionally, it has been used at conventions and boating and diving trade shows.

The UASBC has rewritten, illustrated, and published three of its five survey reports into general interest publications. These reports are available through local libraries and bookstores. Members have also written a wide variety of articles for the popular press.

Our recently published *Wreck Diver's Guide to Sailing Ship Artifacts of the 19th Century* has been reviewed favorably by several international journals. Recent wrecks, with relatively intact hulls, are easy to explore and understand. Scattered remains are more challenging, and the in-

tent of the guide is to educate the general diving public and assist them to "read" wreck sites, note the location of artifacts, and mentally reconstruct the original vessel. The conservation message runs throughout the book. Sales of this book will assist us with our next publishing venture: *Wreck Diver's Guide to Steamships*.

Consistency and professional growth have been key to the success of the UASBC over the past 20 years. Education of our own members has been instrumental in ensuring that we continue to attract a wide variety of lay-professionals, students, and archaeologists. We produce a quarterly publication and a monthly bulletin, and have established a computer-accessed bulletin board system (BBS). Articles from our publications, site reports, scholarly papers, dive schedules, and Minutes of the monthly meetings held in Victoria, Vancouver, and Nelson are made available to our members on the BBS. This BBS system is shared with other societies belonging to the Underwater Council of BC, so it has a dual purpose of keeping our own members informed while being accessible to a much wider diving audience.

In the past, the UASBC has conducted its own remote sensing and underwater survey courses. Feeling the need for more in-depth and structured courses, we successfully approached the federal Minister of Heritage who assisted us in purchasing the Nautical Archaeology Society (NAS) training program from the UK and fly two NAS instructors out to teach the NAS Level I and the Tutors training course to 20 people. The UASBC will be conducting its first Level I course for our members in March 1996. Additionally, our next inventory project will enable some members to work toward their NAS Level II certificate. In the future, all NAS programs in BC will be open to the public and conducted under the auspices of the UASBC.

Over the years, the UASBC has chartered a number of dive vessels for our projects. Enlisting the charter-boat operators' support in preserving our maritime heritage has been crucial to the success of our endeavors. We knew if they could be encouraged to adopt strong conservation ethics and educated all their diving patrons about the importance and fragile nature of heritage sites, then BC's shipwrecks would stand a better chance of survival. Our efforts in working collaboratively with this sector were rewarded two years ago when the newly formed BC Dive Tourism Operators Association included in their Code of Ethics a statement regarding their obligation to preserve shipwreck sites by not allowing any collection of artifacts or destruction of cultural remains. This was a significant change for many operators who had hitherto advertised "port-hole collecting" dive excursions.

Another initiative started by members of the UASBC was a series of artificial reefs made up of modern shipwrecks. Working on the premise that if there was an exciting, preferably large, three-dimensional wreck on which to dive, sport divers could be steered away from the more sensitive heritage wrecks. The Artificial Reef Society (ARS) started with a 150-ft. freighter, the *G. B. Church*, and then graduated to 366-ft. Canadian Navy destroyer escorts: the HMCS *Chaudiere* and HMCS *Mackenzie*. The ARS has negotiated to sink two additional destroyer escorts in 1996. The program has been a financial success for the communities and dive operators adjacent to the new reefs and has diverted divers away from cultural sites. Additionally, it has helped us form collaborative relationships with the marine science community.

Many of the submerged cultural sites and several important shipwrecks lie within the jurisdiction of BC's Indian reserves or areas that are currently subject to native land claims. While some bands recognize the importance of archaeological evidence to support these claims, other are very sensitive to any disruption or analytical study of their cultural remains. The issue of ships that may have been captured and sunk during the course of the last century is understandably sensitive. Building strong relations with various First Nations groups has been slow; however, in the last few years we have received permission to survey Friendly Cove, the first Spanish site in BC and an active fur-trading depot in the early 19th century. The band in Bella Bella has invited members of the UASBC to teach archaeological survey techniques to na-

tive divers so they could manage their own resources. We visited Bella Bella a second time last year to survey the areas adjacent to the Hudson's Bay Company's dock built soon after Fort McLoughlin in 1835. In each case, education and advice on responsible management of heritage resources have been the foundation for advancing and building strong relationships.

BC is fortunate to have maritime museums in both Vancouver and Victoria. Both institutions maintain excellent libraries and archival and photographic collections, and their staff provide invaluable assistance in our research. In return, we assist the museums by providing public lectures. The Vancouver Maritime Museum (VMM) also provides us with storage, conservation, and meeting space. Private sponsorship support has recently been secured to enable the VMM and UASBC to develop a science program on underwater archaeology for secondary school children.

The UASBC has maintained strong ties with UBC and Simon Fraser University (SFU). The UBC occasionally offers night courses in maritime archaeology through the Classics Department. SFU has offered third-year courses in nautical archaeology taught by UASBC members with post-graduate degrees in archaeology. SFU also invites the Society to present a seminar on submerged cultural resources to all historical archaeology classes. Some of our most active members come from these institutions.

From an academic perspective, it often appears that government cultural resource management is dictated by those operating the pile-drivers and bulldozers. Because professional archaeologists spend the majority of their time recording and protecting threatened sites, there are few opportunities to pursue research-driven archaeology (Robinson 1995:12). As an avocational society, the UASBC enjoys a degree of flexibility and independence not afforded the professional community. In the future we must develop the expertise to do more than just collect a "sea" of survey data; we must focus the collection of this data on a specific research design so as to interest the wider professional community in our work (Robinson 1995:12).

Five years ago the Society convinced the BC Heritage Trust to support a pioneering, research-driven project to locate and conduct test excavations of a prehistoric site in Montague Harbor on Galiano Island. The academic and government archaeological communities did not believe that the methods existed to get meaningful results from an underwater context. Sea level was 300 ft. lower immediately after the last Ice Age than it is today, therefore the earliest evidence of coastal settlements is underwater. The four-year project produced a wealth of paleo-environmental data regarding occupation patterns and sea level changes occurring 6,000 to 1,000 B.P. and proved that this method of investigation was worth pursuing. The results and methods developed at Montague Harbor have been the foundation for new underwater research programs on prehistoric sites in Canada.

Legislation is effective only if the jurisdiction has the resources and the manpower to enforce it. Faced with budget shortfalls and growing deficits, governments everywhere are decreasing, versus increasing, their support of heritage conservation initiatives. Educating and empowering the public to adopt the same conservation and protection ethic they now espouse to have with regard to the environment may be the only solution. Government agencies are not always well positioned or equipped to take on this task. Twenty years ago the government in British Columbia opened its door to a group of concerned sport divers who formed an archaeology society. They involved and empowered an avocational group to take ownership and responsibility for a unique resource. As a result, the avocationals are working in a collaborative and professional manner with the relevant government agencies, dive operators, academic institutions, and native bands, rather than in conflict or competition. A huge amount of work has been done for a relatively minimal investment on the government's part. Most importantly, the resources are now being preserved and managed in a manner that benefits the site, government and academic communities, as well as the sport diving population.

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Thinking Nationally—Acting Locally

Canada boasts the longest coastline of any nation in the world. Much of this littoral borders on arctic waters where underwater sites are few and scattered. However, shipwreck sites in this environment, such as the three 16th-century galleons in Red Bay, Labrador (Stevens 1985, 1992), or the 19th-century *Breadalbane* (MacInnis 1983), demonstrate the exceptional state of preservation these cold-water sites can offer.

Canada's eastern coastline was of immense importance to early European navigation in the New World. The fisheries of Newfoundland and Nova Scotia attracted heavy traffic from the mid-16th century onward, while the St. Lawrence River became the primary gateway of European expansion into the North American continental interior. The region's submerged archaeological sites are of commensurate interest and archaeological value.

In the Great Lakes, historical archaeological sites are more recent, but these sites may be preserved to an exceptional degree as demonstrated by the wrecks of Fathom Five National Marine Park, for example (Soegtrop 1988; Ringer and Folkes 1991). From the Great Lakes westward across the northern half of North America, it is sometimes forgotten how important navigation was on lakes and rivers, by canoe, York boat, later by steamer and sundry small craft, first to the fur trade and then to the spread of European settlement from east to west. This watery network of exploration and transportation routes is generously flagged with sites (e.g., Waddell 1979), incalculably expanding submerged cultural resources beyond those adjacent to marine coastlines.

The historic period for the West Coast has been brief, but its submerged cultural resources are perhaps all the more valuable for the insight they allow into the contact period between shipborne Europeans and North American Natives. Used in conjunction with a relatively rich historic and ethnographic record, archaeological data from this period are under-utilized tools for better understanding analogous events occurring 200 to 300 years earlier on the East Coast and elsewhere in the world.

So far unmentioned are submerged prehistoric Native sites. This omission consciously reflects the preoccupation with shipwrecks as objects of submerged cultural resource management in Canada up to the last few years. Certainly Native small craft are far less easily found archaeologically than ships, but the most promising submerged prehistoric sites are settlements inundated by eustatic sea level rise prior to 4,000 years B.P. In British Columbia, sites like the one examined in Montague Harbour (Easton and Moore 1991; Easton 1992a) may be particularly numerous and may even some day shed light on how the continent was first populated (Easton 1992b). But these sites are bound to exist as well in virtually every coastal environment of Canada, including the Great Lakes.

Government archaeological offices at the provincial level bear responsibility for managing the bulk of archaeological resources in their respective jurisdictions. However, in only one province out of the ten is there an administrative section dealing specifically with submerged cultural resources; this is the Archaeological Marine Heritage Branch of Ontario. Its archaeological staff was reduced to one a few years ago, and with public sector job cuts promised in Ontario, its future is uncertain. With no trained underwater archaeologist on staff in any other provincial agency outside of Ontario, it is not surprising that little understanding of the specialized nature of submerged cultural resource management has been demonstrated at the provincial level. Though provincial legislation often calls for it, archaeological assessment and mitigation projects are rarely requested for underwater or intertidal environments.

At the federal level, the profession of nautical archaeology is better represented. Underwater Archaeology Services (UAS) of the Federal Archaeology Office, Parks Canada, is an agency that has been active since the mid 1960s. It has

maintained an archaeological and technical staff of nine to ten individuals over recent years and has also benefited in having access within the Parks' system to historical research, material culture research, conservation, publication, graphic, and other services. The management mandate for UAS has ostensibly pertained only to those waters which specifically fall under federal jurisdiction, including National Marine Conservation Areas, National Parks, National Historic Sites, the Canadian Heritage Rivers System, and Historic Canals. In addition, however, expert advice has also been provided on National Historic Site designation and the development of federal environmental and shipwreck legislation. UAS has also undertaken some field work outside the parks system, including major research-driven excavations, the best-known of these being the Red Bay Project (Stevens 1985, 1992).

The completion of the final Red Bay report this year will mark the end of an era for UAS. Not in the foreseeable future will another research-driven project be undertaken on anything like its scale. The work-load for the agency will not be diminished, however. The national objective of having 3 percent of Canada's land mass in the national park system by the year 2000 is just over half accomplished. Parks' policy requires the survey and inventory of cultural resources in newly acquired parks (Canada, Department of Canadian Heritage, Parks Canada 1994:105). New shipwreck and environmental legislation will require expanded commitments outside waters strictly under federal jurisdiction. Despite these broadening responsibilities, UAS will have its staff reduced to eight by March 1997.

Government agencies in Canada are facing the same set of problems now being confronted by most government heritage agencies in the developed world; in short, funding and staffing are insufficient to meet current demands, but, for the foreseeable future, demand for services will grow while funding and staffing levels stagnate or shrink. The cultural resources themselves, however, should not suffer proportionately, thanks in large part to changing public perceptions expressed most usefully in the form of avocational archaeological groups.

With core funding supplied by the province, the Underwater Archaeological Society of British Columbia (UASBC) provides a case in point. The society has proven an often more than adequate and always inexpensive means of accomplishing goals increasingly in areas usually considered part of the professional sphere (Woodward 1996). If there is one key to the UASBC's success and growth, it may be the cooperative spirit the society has enjoyed and helped engender. This spirit has merged the interests and activities of the sport diving community with those of professional archaeologists and other representatives of academe, museums, and the provincial government to the clear benefit of underwater cultural resources.

In Ontario, similarly well-protected resources owe much to that province's avocational organizations, POW (Preserve Our Wrecks) and the larger SOS (Save Ontario Shipwrecks). POW has enjoyed a close relationship with the Maritime Museum of the Great Lakes, and critical to the success of both these organizations is the strength of the liaison between them and the Ontario provincial government, a relationship without parallel in Canada.

Unfortunately, outside Ontario and British Columbia no avocational group has enjoyed sustained success. In Alberta, the Alberta Underwater Archaeological Society was given responsibility by the province for a 10-year monitoring project of sites flooded by the construction of the Oldman River Dam. Though the project continues, the society, now reduced to about 10 members all residing in one city, can no longer properly be called an active provincial society.

There are no avocational groups in Saskatchewan or Manitoba, and none existed for many years in Quebec, New Brunswick, or Prince Edward Island. In both Newfoundland and Nova Scotia, avocational societies were formed but later collapsed. Limited funding, internal politics, and lack of cooperative support from professional organizations and government agencies each played a role in their demise. Mean-

while, the level of legal and illegal non-archaeological interventions on East Coast sites has been and continues to be high.

Taking as a given that an avocational group with a stable membership and following a firm heritage ethos is a positive force for the submerged cultural resources of a region, what then can a federal government agency, specifically UAS of Parks Canada, do to encourage the growth of same in areas where they did not formerly exist? What can be done to ensure the sustained success of established organizations?

The latter question has been of less concern if only because of the principle "if it ain't broke, don't fix it." Involvement on the part of UAS with the UASBC, POW, and SOS has been basically passive and consultative of recent years. Some funding was supplied by the Access to Archaeology Program administered by the federal Department of Communications, but this program has unfortunately been terminated. Although having no means of providing financial support, UAS has established a national Shipwreck Inventory Database and has begun making regular contributions to the newsletters of both the UASBC and SOS. UAS hopes that this will be an informative way of reinforcing the heritage ethos, fostering goodwill between avocational groups and the federal government, and enhancing the national perspective of regional organizations.

The question of how to help create successful avocational groups poses a far more difficult problem. However, offering an introductory course in nautical archaeology is an obvious starting point. Countless courses offered by the Archaeological Marine Heritage Branch of Ontario have undoubtedly been the critical formative event in the numerous chapters of the SOS organization. Members of UAS have been irregularly giving cultural resource management courses for years; the UASBC was born of such a course offered by Parks' archaeologist Peter Waddell and others over 20 years ago. Volunteers have been trained and organized to work within federal marine parks and conservation areas; Friends of Fathom Five, a group operating out of Tobermoray, Ontario, is a highly successful example. In 1995, UAS officially adopted the Nautical Archaeology Society (NAS) training program to help formalize and focus public education activities. The "hands-on" emphasis of this training program fits well with a new component of the unit's mandate which is to offer "training programs to develop a pool of divers who can undertake CRM activities on submerged cultural resources."

We have now offered four NAS Level 1 courses in eastern Canada. We hope to continue these courses because they appear to be a valuable component in a dramatic turn of events taking place in the eastern provinces. Following work initiated by Marc-André Bernier in Sept-Iles, Québec, individual divers and dive shops, formerly hostile to any attempts by government representatives to encourage underwater heritage preservation, are now keen participants in monitoring the wreck site of the 17th-century *Vaisseau du Roi*, the *Corossol* (Bernier 1995). The introductory NAS course has broadened perspectives of these divers and increased their usefulness in the monitoring project. Word of this successful cooperation has spread down the *Côte Nord*, an area once as notorious for its artifact collectors as for its numerous wrecks. New sites are now being reported to us. Two more NAS courses have been given in Baie Comeau and Sherbrooke at the request of local divers and the Québec government which has contributed funding. We have been able to reinforce classroom training and provide experience that may be used toward an NAS Levels 2 and 3 certification by involving some of these avocational divers in two more Québec projects, in addition to work on the *Corossol*. Three avocational societies have now been formed in Québec. Based on progress made to date and the commitment already demonstrated by the provincial government, we might venture some optimism about the long-term success of these groups in Québec.

A fourth course was offered in Prince Edward Island. We offered this course in conjunction with a survey project being undertaken on the wreck site of the *Marco Polo*, the New Brunswick-built ship which gained fame in the 1850s as the "fastest ship in the world." We

hope that divers on Prince Edward Island will adopt the wreck as their own, discourage looting of the site, participate in future monitoring and survey work, and perhaps form their own society. Divers from the fledgling Underwater Archaeological Society of New Brunswick also joined us for the course and survey work, thanks in part to funding provided by the Archaeology Branch of New Brunswick. The Coast Guard kindly provided us with a diving platform large enough for our class. Again, a positive cooperative environment seems to have been established, although there is much work left to be done.

In the coming year we hope to continue the *Marco Polo* survey project, as well as at least two projects on the *Côte Nord,* where both UAS and volunteer divers may gain from further shared experiences. We would also like to offer NAS Level 1 courses at Lake Minniwanka in Banff National Park, Alberta, and in Louisbourg Harbour, at Fortress Louisbourg National Historic Site on Cape Breton Island (Stevens 1988, 1994; Pagé 1991). In both cases the objective will be to train a small group of local volunteers and Parks' staff in order that they may form organizations modeled on the Friends of Fathom Five to help monitor underwater cultural resources located within park boundaries.

Beginning next year, Fortress Louisbourg will also be the site of a cooperative venture between Parks Canada and an eco-tourism company. The objective is to provide a permanent international training site for avocational divers. Students will receive credit toward the middle levels of NAS certification. This proposal has already generated considerable interest in Europe. Lectures will be offered by archaeologists, historians, and conservators from the Fortress and St. Mary's University. Underwater field experience will be gained on the wreck site of the 64-gun ship-of-the-line *Célèbre,* which exploded and sank in 1758. This site will be carefully gridded in advance to aid the students in their mapping assignments and also for resource protection.

While it may appear that Parks Canada is leaping into avocational diver training and the NAS training program specifically, it is actually doing so only with caution and careful marshaling of human resources, and not without some trepidation. There are no plans to offer courses in British Columbia and Ontario where successful avocational groups already exist and where other trainers are capable of offering courses. We are reluctant to offer a course in any area where we are not involved in a field project; this is not only to economize on travel costs but also because we feel it important to reinforce basic NAS Level 1 pool training with field experience as soon as possible. We are also reluctant to offer training in an area where there is not some committed local or regional support for the novice trainees, whether it be from a local park, maritime museum, university, provincial government agency, or, ideally, all of the above. As a federal agency we are poorly placed to build on the investment put into a course. We are out of the province often within days of giving a course, frequently not returning even to the phones of our offices for weeks, and we can never assure our return the following year. If an avocational group is formed, the stakes are raised, but we have no mechanism for providing financial support. If an avocational group is formed but later fails, it may be worse than if it had never existed; the poisoned political atmosphere in both Nova Scotia and Newfoundland amply attests to this.

The NAS course itself has created problems, and it is already beginning to create demands for more training than UAS may be capable of providing without severely curtailing other activities. Some new students set their hearts on becoming NAS tutors even before they have heard the entire introductory lecture. At the moment there are no plans for training more tutors in Canada, but how long will it be before the demands become overwhelming, and who will then administer the NAS courses across Canada to ensure minimal teaching standards, etc.? Again, with reduced staff and budgets, UAS is loath to further increase its administrative responsibilities.

Finally, the whole issue of volunteerism has to be addressed. The sometimes surprising degree of expertise and energy volunteers bring to the field is a terrific resource. An avocational group takes a long time to grow, however, and

usually remains a relatively fragile entity. Its activities, ethos, and ultimate survival rely heavily on the personality, energy, competence, and philosophical approach of the very few individuals willing and able to commit most of their spare time in leadership roles within the group. Neither individual members nor the avocational group as a whole can effectively be held accountable for their actions; by definition, professional standards, though they may often be met, cannot be demanded or even expected of avocationals. A pessimist might see our profession on the edge falling through the looking glass into a topsy-turvy world. Here, professionals, experienced and perhaps gifted in the field of archaeology, become teachers and administrators, while avocationals (many of whom may be highly skilled educators and administrators in "real life") are left to do the archaeology.

A balance must obviously be found. For now, it seems clear that greater avocational involvement, where successful avocational societies do not now exist, will improve the outlook for submerged cultural resources in those regions. To this end, NAS training is a seed UAS will continue to sow. But, carrying the botanical analogy further, to grow successfully a new avocational organization will need fertile soil, shelter, water, and even the occasional pruning. All of these cannot be provided from the federal level, nor should they be. Establishing strong and varied partnerships seems to be vital for a thriving avocational society. One of the most effective roles for a national agency to play may be as a facilitator for improving relationships among regional organizations, institutions, and agencies with a shared interest in the preservation of local submerged cultural resources. Strictly speaking, this is not archaeology, but in the long run it is in the best interests of the archaeological resource.

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Underwater Cultural Resource Management in Mexico and the Caribbean

In Latin America and the Caribbean, underwater cultural remains have often been viewed as objects to be salvaged for their monetary value. It is well known that in these regions many ships wrecked with precious cargoes while en route from the New World, after its discovery by Columbus, to the Old. Today, however, nations are beginning to realize that inundated historical and prehistoric sites, whether or not they contain "treasure," hold the tangible remains of their heritage and deserve to be managed for the public good.

The following information concerning the status of underwater archaeology in Mexico and other Latin American countries was related by Pilar Luna Erreguerena (1995, pers. comm.), Head of Mexico's *Subdirección de Arqueología Subacuática* of the *Instituto Nacional de Antropología e Historia*. Señora Luna has done an exemplary job in Mexico, first seeking information and experience through academic and governmental sources based in the United States and Canada, and later educating Mexican colleagues and government officials. Her efforts over the past 20 years have resulted in a successful underwater CRM infrastructure for her nation.

Mexico's terrestrial cultural resource management goes back more than 200 years, to the date when the Aztec Calendar stone was found in Mexico City. From that time forward, official and social consciousness regarding the importance of Mexico's archaeological heritage has grown gradually but steadfastly. Since 1827, laws and regulations have been issued in order to protect, research, and conserve the vast cultural richness of the nation.

Underwater archaeology and the management of Mexico's submerged patrimony, however, are young disciplines in Mexico. Nonetheless, the existing laws and regulations apply to underwater cultural resources. In times past, underwater sites were indiscriminately ravaged, and part of the nation's archaeological and historical treasures were lost forever. But, today, Mexico has a permitting system as an important management tool to protect her underwater cultural heritage. It provides that:

> any project to be done in Mexican waters related to underwater archaeology should be sent to the *Consejo de Arqueología del Instituto Nacional de Antropología e Historia* in order to be approved. It should cover all the requirements written in the *Disposiciones Reglamentarias para la Investigación Arqueológica en México*. Briefly, and among other aspects, the project should be a research project—not a treasure hunting project—presented by an archaeologist with the support of an academic institution. It should include the objectives of the research, the area or site to be researched, the methodology and techniques, personnel involved and responsibilities, calendar, budget, etc. The researcher or researchers have the right to study all the materials and information recovered and publish the results, but can't keep any of the materials or artifacts found (Pilar Luna Erreguerena 1995, pers. comm.).

INAH's *Subdirección de Arqueología Subacuática* is the agency responsible for all national issues regarding Mexico's submerged cultural resources. In addition to controlling access to these resources, the department is the principal entity active in the investigation of Mexico's underwater archaeological sites. For example, in 1995 a shipwreck survey was conducted on Alacranes Reef in the Gulf of Mexico as part of a major program to create a national marine park. Seven sites were registered, and recommendations for their protection were presented to program authorities. Additionally, the first stage of a long-term research project, to search for the remains of the *Nueva España* fleet which was lost in 1631 in the Gulf of Mexico, was undertaken. The project goals are to develop underwater archaeology and the conservation of submerged cultural resources in the country and to create a world-class maritime museum for Mexico. Assistance will be sought from institutions and researchers in Mexico and abroad.

Also, in an effort to encourage more Mexican involvement in the study of the nation's re-

sources, Señora Luna worked to develop a master's-level course on the subjects of underwater archaeology and conservation. It was first offered in Mexico in 1994. The six-month course, consisting of academic studies and fieldwork, was taught by professionals from the United States, Canada, and Mexico. Twenty students, including 18 whose principal university studies were in archaeology and conservation, successfully completed the course. Educational efforts such as this contribute significantly to the future of underwater CRM in Mexico. Mexican underwater archaeology is at an important stage with a very promising future.

Since underwater archaeology is a relatively new field, many countries are just beginning to discover that significant cultural resources, which they can access, are located in their waters. The Mexican example is starting to make an impact on other Latin American countries. In 1995, the government of Uruguay invited Señora Luna to assist them in underwater archaeology and the protection of their cultural heritage. Her authority on the subject was recognized by her professional standing in Mexico, as well as in the fact that she is a member of the SHA Advisory Council on Underwater Archaeology and the ICOMOS International Committee on the Underwater Cultural Heritage. During her visit to Uruguay, she met with President Sanguineti and other top Government authorities. Nine lectures were given to scholars, students, and the general public, and interviews were broadcast on national radio stations and television programs.

During the Uruguay trip, Señora Luna was invited by Argentinean authorities to come to their country to present two lectures and discuss issues regarding the creation of a program to develop underwater archaeology and protect the underwater cultural heritage of Argentina. In Uruguay, and later in Mexico City, she met with Brazilian archaeologists and authorities regarding the development of underwater archaeology in Brazil. If Brazil, Argentina, and Uruguay choose to take responsibility for their underwater heritage and develop programs in underwater archaeology, Pilar Luna's efforts and the Mexican example will have influenced decisions for most of the Atlantic coast of the South American continent.

Mexico's position on protecting submerged cultural resources was also presented at the *VIII Reunión del Seminario Permanente de Estudios México-Guatemala*, held in Tikal, Guatemala in 1995. An international audience will be reached by *Arthur C. Clark's Mysterious Universe* in early 1996, when *El Castillo* at Tulum, Quintana Roo, Mexico, a possible Maya navigational aid, will be featured on television.

The eagerness of other Latin American countries to learn from Mexico's experience in underwater archaeology underscores how a good example, and willingness to share knowledge, can produce unexpected achievements on a regional and even global level. While there are notable exceptions to the positive trend, such as Honduras, which is presently engaging in contracts with treasure hunters, there is hope that one day they, too, will follow in the footsteps of Mexico.

Underwater Cultural Resource Management in the Caribbean

The island nations of the Caribbean are much smaller than Canada, the United States, and most Latin American countries. Nonetheless, their problems regarding the protection of underwater cultural heritage, particularly shipwrecks, are just as large. Archaeological sites located in the warm, clear waters of the West Indies are particularly vulnerable and have been threatened or severely impacted by treasure hunters since the advent of scuba diving. These individuals can often dazzle small countries with promises of filling their bank vaults with 25% of the profits (less project costs) resulting from the sale of artifacts from shipwrecks. Although profits are seldom achieved, and irreplaceable cultural resources are lost forever, it is difficult to understand such exploitation until it happens to a country firsthand.

Underwater CRM is a new concept in the Caribbean. Therefore, all professional archaeologists residing there, or working in the area on short-term projects, should encourage West Indian nations to recognize the value of their un-

derwater heritage and cease permitting activities that result in its destruction. Many islands have small populations and limited financial resources, but all have a wealth of underwater cultural resources. Many countries depend on tourism as a major economic factor. Thus, showing them that archaeological sites can be preserved in situ as underwater museums, or that archaeological investigations can result in exciting museum exhibitions for the benefit of the public, can help Caribbean nations make informed decisions about the best long-term use of limited cultural resources. Preserving a country's heritage benefits the public through education and national identity and has the important financial side effect of benefiting tourism.

While there is a regional bond in the Caribbean, West Indian countries remain separated by the sea and by diverse cultures, languages, and legal traditions. This separation has traditionally led to isolation, but barriers are disappearing in our modern world of global communication. West Indian countries are now, more than ever, poised to help one another learn by their experiences with underwater CRM that there are favorable alternatives to losing the common heritage of the Caribbean region to profiteers. While it will be a great challenge to implement national, regional, and international programs for the management of underwater cultural resources in the Caribbean, independent and cooperative efforts are already underway.

Over the past 15 years, archaeological projects have been conducted in the Caribbean by academic institutions such as Texas A&M University and East Carolina University, and by non-profit organizations such as the Institute of Nautical Archaeology (INA), Ships of Discovery, and the Pan-American Institute of Maritime Archeology. Work has been undertaken in the Cayman Islands, the Turks and Caicos Islands, Jamaica, the Bahamas, and the Dominican Republic, among other West Indian countries, and in Bermuda (which is sometimes grouped with them). Successful archaeological projects resulting in museum exhibitions, such as in the Dominican Republic, are beginning to influence hosting countries to take responsibility for protecting their underwater heritage. Of course the process is slow, and exemplary legislation has yet to be enacted in West Indian countries, although the Turks and Caicos Islands have adopted an excellent permitting system, and in the Cayman Islands we are working to replace the existing law with improved legislation to protect underwater cultural resources.

Some of the earliest professional underwater archaeological work in the Caribbean was undertaken in the Cayman Islands. At the request of the Cayman Islands Government, INA conducted an underwater archaeological survey of the three islands in 1979-1980 under the direction of Roger Smith. In 1990, the inventory the INA team compiled 10 years earlier was used to form the core of the National Shipwreck Inventory that is archived and currently being enlarged by the Cayman Islands National Museum. By 1993, the National Museum had made a commitment to preserving the islands' underwater and terrestrial cultural resources by employing this author in a full-time capacity as their professional archaeologist. In support of underwater CRM, the Ministry of Culture also formed a Marine Archaeology Committee which has identified points to be included in a new law to replace The Abandoned Wreck Law of 1966, and which has been successful in preventing permits from being issued to salvagers under the present law. The National Museum is working to bring archaeology into the public eye in Cayman. For example, in 1994 we prepared a special exhibition to commemorate the 200th anniversary of a shipwreck disaster known as the Wreck of the Ten Sail. At the same time, we seized the opportunity to interpret the event for the public through cooperative projects with other organizations: a Philatelic Bureau stamp issue, a Currency Board commemorative coin, a National Archive publication, a Visual Arts Society art competition, public lectures, and radio and television appearances. By involving the public in archaeology and the interpretation of an important historical shipwreck event, we hope to win their support as we bring a new law forward for enactment. We also intend to seek the cooperation of water sports operators to leave shipwreck sites undis-

turbed and to discourage tourists from unwittingly disassembling sites. We want these diving professionals to become guardians of the underwater past so that everyone visiting Cayman's shipwreck sites will have the chance to view and experience them.

Another Caribbean country that is developing a government program in underwater archaeology is Puerto Rico. Puerto Rico enacted legislation, although it contains some compromising points, and established the *Consejo para la Conservación y Estudio de Sitios y Recursos Arqueológicos Subacuáticos* in 1987. The *Consejo*, currently under the direction of Jerome Hall, is conducting archival research and archaeological fieldwork to compile an inventory of Puerto Rico's underwater archaeological sites. Plans are also underway to establish conservation facilities for future projects.

In support of underwater CRM in the Caribbean in 1995, this author has provided printed information and advice to individuals and government representatives from Anguilla, Dominica, and Trinidad regarding the protection of underwater archaeological sites. As a result, Robert Conrich, a member of Anguilla's Historic Wrecks Advisory Committee, is attending the Cincinnati SHA Conference to meet professionals who may be able to help Anguilla with two 1772 Spanish shipwreck sites. Claire Broadbridge, Director of the Trinidad and Tobago National Museum, had already succeeded in having her government enact basic legislation to protect several French Louis XIV-period shipwrecks buried in harbor sediments off the island of Trinidad. She was, however, interested in additional information to help her strengthen the law.

When the Museums Association of the Caribbean (MAC) met in the Cayman Islands in November 1995, this author gave a presentation on the Wreck of the Ten Sail, and more importantly, conducted a brief workshop entitled, "Protecting Archaeological Sites Underwater: Tools for the Caribbean." Participants were provided with a notebook of information which they can reference for the protection of the underwater heritage in their own countries. The notebook has been provided to individuals from the Cayman Islands, Jamaica, the Turks and Caicos Islands, Bermuda, Puerto Rico, Anguilla, St. Kitts, Nevis, Guadeloupe, Dominica, Martinique, St. Lucia, Grenada, Barbados, Trinidad, Mexico, and the United States. We are also offering it, through the MAC newsletter, to institutional members who were unable to attend the annual general meeting.

To keep communication lines open, several board members and this author have organized a network to keep three Caribbean organizations abreast of developments in underwater archaeology in our region: the International Association for Caribbean Archaeology (IACA), the Museums Association of the Caribbean (MAC), and the Caribbean Conservation Association (CCA).

Conclusion

The future of underwater CRM in Latin America and the Caribbean will be influenced by professionals working in the region, the successes of projects that are underway today, and communication avenues in our global village. Although the path will not be easy, Latin American and Caribbean countries that choose to accept responsibility for their underwater cultural heritage will find the long-term benefits to their people, and to world heritage, immeasurably worthwhile.

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The Wreck of America's First Yacht: *Cleopatra's Barge (Ha 'aheo o Hawaii):* 1995 Survey

Introduction

In July 1995, the Smithsonian Institution's National Museum of American History (NMAH) conducted a survey for the wreck of *Ha 'aheo o Hawaii* (ex-*Cleopatra's Barge*) in Hanalei Bay, Kauai (Figure 1). When she sank there on 5 April 1824, the hermaphrodite brig was the Royal Hawaiian yacht of King Kamehameha II (Liholiho). The purpose of the survey was to locate and assess the remains of the famous vessel—the first deepwater yacht built in the United States.

History

Cleopatra's Barge began life in Salem, Massachusetts. In 1815, the local shipping firm of George Crowninshield & Sons was dissolved upon the death of its founder, who was among the wealthiest individuals in the United States. In the spring of 1816, his eldest son and namesake George, Jr. commissioned a new vessel from Retire Becket, one of Salem's most prominent shipbuilders. Built for his private leisure on the lines of *America* IV—another Crowninshield ship and the most successful privateer of the War of 1812—the new hermaphrodite brig measured 100 ft. on deck, 23 ft. in beam, 11.5 ft. in depth of hold, and $192^{41}/_{95}$ tons. Named *Cleopatra's Barge*, the first oceangoing yacht built in the nation cost $50,000 to construct and another estimated $50,000 to fit out and furnish. No expense was spared at a time when a conventional deepwater merchant vessel cost one-tenth as much; Crowninshield commissioned special china and silver for his fancy new toy, and as many as 2,600 people per day visited the unique ship during the winter of her construction and fitting-out.

Crowninshield embarked upon a "voyage of pleasure" in March 1817 to "...one or more ports, places, cities, islands, towns, boroughs, villages, bays, harbors, basins, rivers, creeks, lakes, inlets, outlets, situated in the known world...once or more times" (Crowninshield 1913). This became a six-month Mediterranean cruise, during which he underwent a series of adventures (and misadventures) in 16 ports, hosting up to 8,000 curious visitors per day. He returned in August 1817 and died that November while planning his next cruise. After an unsuccessful attempt by a brother to steal the *Barge*, she was auctioned in July 1818 for $15,400 (Figure 2). Prior to the sale, the famous brig was stripped of her furnishings by the Crowninshields; many of these items are now at the Peabody Essex Museum in Salem, Massachusetts (Whitehill 1959). She subsequently made a coffee voyage to Rio and then worked briefly as a packet between Boston and Charleston, South Carolina.

In 1820, the Boston merchant firm of Bryant & Sturgis sent the *Barge* to Hawaii under Captain John Suter. Active China traders, Bryant & Sturgis planned to sell the famous yacht to Liholiho in exchange for Hawaiian sandalwood, a commodity highly prized by Chinese artisans for the decorative arts. Within 24 hours of her arrival on 6 November 1820 at Lahaina Roads, the king inspected the famous ship; nine days later she was his for $80,000 in sandalwood. Archival sources indicate that the famous yacht's condition was not as advertised when sold to Liholiho but that he cherished her nonetheless, renaming her *Ha 'aheo o Hawaii* (*Pride of Hawaii*) and using her as his royal yacht for the next three years. She also saw limited use as an inter-island merchant vessel.

In late 1823, Liholiho went to England to meet King George IV. He embarked upon a British whaler with his wife and $25,000, most of which was stolen at Rio. While awaiting a

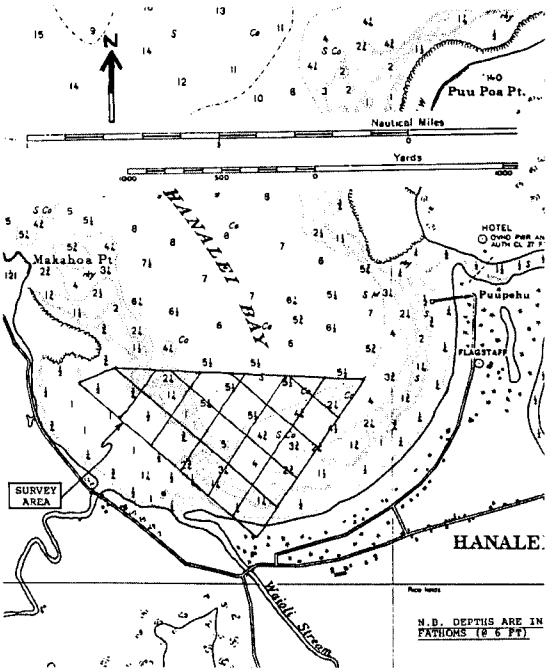

FIGURE 1. Hanalei Bay is on the north side of the island of Kauai, Hawaii.

royal audience, he and his wife died of the measles. Meanwhile, his royal court had taken *Ha 'aheo* for a cruise around the island of Kauai. On 5 April 1824, the brig grounded on a reef in Hanalei Bay, on the north end of the island.

Despite a valiant rescue attempt by local Hawaiians, *Ha 'aheo* could not be salvaged and was declared a total loss. A section of her hull washed ashore during a storm on 30 December 1844 and was declared "in quite a sound state;" the last historical reference to her dates from the mid-1850s, when Hawaiian A. S. Nuuanu obtained a permit to salvage her remains. He ceased operations after recovering two cannon and a wooden and metal object—possibly a capstan.

The yacht and her New England story are so renowned that no fewer than three books have been written about her (Crowninshield 1913; Whitehill 1959; Ferguson 1976), along with several articles (Alexander 1906; Lydgate 1919; Dodge 1954). However, little is known of her Hawaiian history, and nothing of her ultimate fate was known after the 1850s.

The Survey

In 1994, the NMAH submitted an application to the State of Hawaii to conduct a survey of the wreck of the Royal Hawaiian yacht. This permit application for a scientific underwater archaeological survey was the first ever received by the state. The goals of the project were to locate the wreck site and assess its extent and condition through a combination of remote sensing and manual ground-truthing. No fewer than 26 state and federal agencies reviewed the application, which resulted in five separate permits (and one non-permit) containing a total of 48 conditions.

The survey was undertaken in July 1995. Remote sensing was conducted by means of a Geometrics 866 proton precession magnetometer towed at 50-ft. intervals along the southwestern side of Hanalei Bay. This area was indicated by the eyewitness account of Boston missionary Hiram Bingham of the unsuccessful 1824 salvage attempt (Bingham 1847[1981]:220-223). Targets were isolated from the ambient basalt bay bottom signals, buoyed, and subsequently confirmed by a submersible Fisher metal detector. Divers inspected the surface of the bay bottom at each target and eliminated those manifestly modern or intrusive (reef fishing anchors, iron rebar, iron sign post, etc.). Other, more promising targets were investigated with a propeller wash deflector mounted at the stern of the research vessel, itself anchored overhead on a four-point mooring. The permits allowed a total of twelve 1-yd^3 test trenches to be dug; after these trenches were completed, they were backfilled. The total bottom time for the 1995 survey was 50.01 hours.

The wreck of the famous brig (Site #50-30-03-5000) was located in a natural reef cut at the mouth of the Waioli Stream on the southwestern side of the bay (Lat. 22°12.295; Long. 159°30.464). The 1841 Waioli Mission Church in Hanalei also was surveyed for historic ship timbers; other 19th-century buildings were inves-

tigated as well and their owners interviewed for relevant information, as were local elders for folk stories. A surface survey of the entire beach and shoreline of Hanalei Bay also was conducted. Neither the interviews nor the shore surveys yielded relevant results.

Artifacts

All artifacts found in the trenches were recovered, deposited in bay (salt) water, and cataloged; concretions were x-rayed at the Wilcox Memorial Hospital in Lihue, Kauai. After the survey, artifacts were transported to the NMAH in Washington, D.C. for further treatment, documentation, and study prior to their return to Hawaii.

Both organic and inorganic artifacts from the past two centuries were recovered at the wreck site. Among the organics were bone, rope, and wood, as well as two soft concretions. Inorganics consisted of ceramics, iron-content concretions, copper fasteners, glass, copper hull sheathing, lead patching, and ballast. The results presented below are preliminary; further study is necessary before any conclusions may be drawn.

Inorganics

Of the 16 ceramic fragments recovered, only one annular ware sherd (CER4) is clearly contemporary with the wrecking event. Five Chinese brown stoneware sherds (from at least three containers) may be from the wreck, although such wares were made well into the 20th century. Similarly, sherds of stoneware, redware, and a porcelain teacup were non-diagnostic since these ceramics enjoyed long production runs. Two specimens appear to date to the late 19th or early 20th century, and three others may be Chinese but are too small for positive identification. A partial brick may have served as ballast or part of the cookstove. Of the six glass sherds, only one, a dark green body fragment with air bubbles, possibly from a case or a gin bottle, may date to the wreck; the remainder appear intrusive (McDermott 1996).

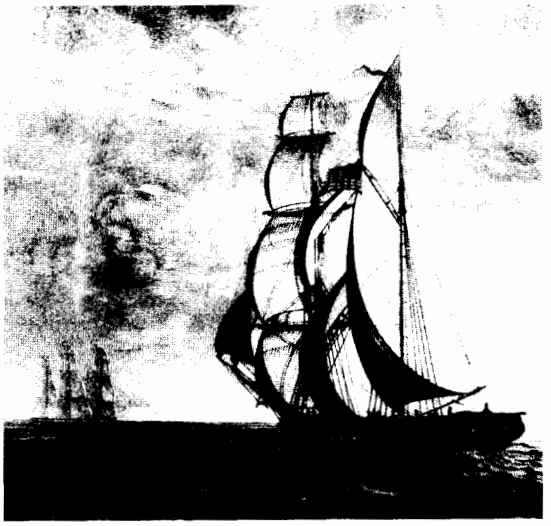

FIGURE 2. Cleopatra's Barge in 1818. (Courtesy of the Peabody Essex Museum of Salem, Massachusetts.)

The 68 concretions revealed a variety of objects through x-ray and mechanical reduction; nearly half turned out to be modern barbed wire, sections of pipe, chicken wire, or other grating/fencing material. Among the more significant concreted finds are a folding (pen) knife, rigging elements, and a two-tined fork. Several preserved the forms of various sorts and sizes of fasteners, ranging from square iron spikes to round metal nails and wooden treenails of various dimensions. One concretion contained a lens of zinc carbonate (hydrozincite) mixed with smithsonite—a mineral named after James Smithson, founder of the Smithsonian Institution. It is not yet clear whether this concretion is an artifact or a corrosion product. Two copper fasteners also were recovered, one bent drift pin and a long, barbed, chisel-pointed spike for hull sheathing. Both are almost pure copper. Three pieces of folded lead patching were ostensibly unused, given the absence of fastener holes or wear marks.

Ten pieces of copper hull sheathing were recovered in various degrees of preservation, ranging from intact to tiny fragments. In all but a few examples, both interior and exterior surfaces were uncorroded. Another's original 14-in.

width is also intact; in the lower right corner of its external surface is preserved the two-line stamp "W&G/G 24." This 24-gauge copper is of British sizing; before and after the War of 1812, most copper sheet was purchased from the English either in Bristol or Liverpool (Whiteman 1971). Preliminary research indicates that the source of the stamped piece is the Liverpool copper merchants Williams & Grenfell & Co. (Harris 1964:148-183; Michael K. Stammers 1995, pers. comm.), and that it came from the midship section of the royal yacht (Figure 3). Elemental analysis (x-ray fluorescence and scanning electronic microscopy) of seven of the samples by the Smithsonian's Conservation Analytical Laboratory (CAL) indicated two different sources or batches for the sheathing, which were almost pure copper (±97.5 and ±98.5 percent) (Campbell 1995).

Approximately 67 stones ostensibly foreign to the Hawaiian islands were recovered from the test trenches, ranging in size from 0.7 to 15 oz. Included are granite, tonatite gneiss, quartzite, quartz-bearing breccia, gabro, limestone, mafic gneiss, granite gneiss, mylonite gneiss, blue schist, basalt or tolonite, and basalt. With the possible exception of the last two, all are non-Hawaiian, according to preliminary analysis by the Geology Department at the University of Hawaii (Thomas Hulsebosch 1995, pers. comm.), indicating that they were ballast from the wreck site. The blue schist is of particular interest; it is known to originate from only a few places globally, one of which is in the area of Rio de Janeiro. Since the *Barge* made a coffee voyage to Rio, it is possible that this ballast may be a result of that voyage.

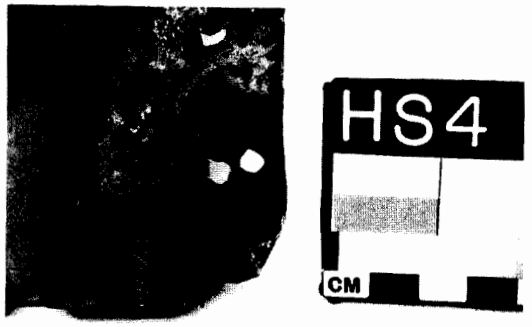

FIGURE 3. Copper merchants Williams & Grenfell of Liverpool provided this 24-gauge hull sheathing for the Barge; its weight suggests an origin in the midships region. (Photograph by Eric Long, Smithsonian Institution.)

Organics

Six pieces of bone were recovered, including a button and the lower mandible of a pig (*Sus scrofa*) more than three years old (i.e., too old for eating); the others are cow (*Bos taurus*) and domestic dog (*Canis familiarus*) bones (Zeder 1995). Two short segments of three-strand rope (hemp?) were found in a disassociated context (Campbell 1995); another short strand warranting further study was found wrapped around a thimble-like iron concretion. Seven small pieces of wood also were recovered, the largest of which is only 12 in. long. All are tropical woods of wide distribution (Wachowiak 1996). No hull structure, aside from tiny fragments associated with iron fastener concretions, was located during the survey. The two soft concretions were analyzed respectively as (1) hydrocarbon (CON58) and (2) hydrocarbons, fats, and resin (CON59)—"an organic garden"—bonded with wood fiber, triglycerides, and diterpine resin (Hopwood 1995:1). CON 58 originally may have been fuel or waterproofing material, now degraded; the natural resin of CON59 is consistent with a conifer source, suggesting pine tar. It may have been a torch or even a traditional folk remedy.

Wrecking Process

The artifacts and their deposition, relative positions, and proximity to the reef revealed much postdepositional information about the wreck site. From them, it is clear that a number of factors account for the absence of hull structure and resulting lack of provenance for the artifacts.

Among these are the very shallow water depth over the site (7 ft.); its position hard against a reef right at the littoral; the likelihood that the site was scavenged by local Kauaians around the time of wrecking; heavy storm surge

and winter wave action up to 50 ft. high; two mid-20th-century tsunamis; and the devastating hurricane Iniki in autumn 1992, which stalled over the island for three hours and whose eye passed directly over Hanalei Bay. These, and possibly other factors as well, account for the low numbers and poor condition of artifacts and the high proportion of modern, intrusive material mixed with them.

Conclusions

The dearth of material, and especially hull structure, as well as the condition of what *has* survived from the 1824 wreck site of the Royal Hawaiian yacht, indicate that little remains of the famous yacht, and that what does remain is in considerable peril of imminent loss due to its dynamic environment. Consequently, permits are being sought for a 1996 season to complete the study of the ship.

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Preliminary Investigation of an Early Nineteenth-Century French Vessel Located off Chubs Head, Bermuda

Introduction

Participants and students with the program in Maritime History and Nautical Archaeology at East Carolina University, in conjunction with the Bermuda Maritime Museum, have conducted over a decade of extensive field-season research off Bermuda's coastline. This research has involved site surveys of the reef structure surrounding Bermuda as well as the recording of various underwater sites. The 1995 field season marked an increase in the normal pace of investigation. Two projects were undertaken to emphasize the importance of excavation and to create comprehensive data bases from non-destructive information sources. The *Herminie* project in particular was an attempt to find out as much as possible about a wreck site through such methods.

The remains of the *Herminie* are listed on the Bermudan 1959 Unprotected Wrecks List, the island's first official attempt to recognize the importance of the shipwreck as an irreplaceable and non-renewable cultural resource of national significance. The site is listed as the *Hermione* but has the same coordinates as the vessel commonly known to the island's diving community as the *Herminie*. As such, it is available as a dive site to any diver, without license. Unprotected wreck sites such as this one are protected by Bermudan law from damage caused by any explosive or pressure air-hose, water-hose, or vacuum-hose. Despite its popularity as a pleasure diving destination, no plan of the roughly 150-m artifact scatter referred to as the *Herminie* wreck exists. The vessel has been mentioned in numerous diving articles, but only briefly as an archaeological resource. Artifacts attributed to the wreck reside in several known collections, including the Downing and Tucker collections housed at the Bermuda Maritime Museum; Gibbs Hill Light collection, Bermuda; and the NMAH collection at the Smithsonian Institution.

Historical Background

Research was begun before the field investigation and continued after the site had been documented. Historic investigation included searches of official records from the Bermuda Archives in Hamilton and French archival sources. Following is a brief outline of the vessel's history.

The frigate *Herminie* was launched at the dockyards of Lorient in 1824 and outfitted there in 1830 to begin its tour of duty with the French Navy. The vessel served both South American and Mediterranean tours, and was rearmed in April of 1835 to replace a vessel called *Dryade* (Grincort 1962).

At the beginning of 1837, the French government designated *Herminie* as part of a subdivision of naval forces stationed in the Gulf of Mexico. A sizable colony of French citizens, the source of controversy between France and Mexico, increased tension between the two countries. The French decided to send a show of military force, demanding reparations from the Mexican government for attacks on French property and citizens residing in the Mexican territory. Mockingly, the Mexican government nicknamed the demands the Pastry War, as one of the French claimants was said to be a pastry cook whose store had been looted.

The *Herminie* left for the Antilles in June of 1837, serving as command ship of Post Captain Bazoche. The squadron was composed of five brigs and two frigates. In July *Herminie* arrived in Martinique, then promptly left for Havana. Anchoring in Santiago de Cuba, the vessel waited three months for the French Counsel General to arrive with further orders (Brossard 1966).

Instructed to leave Havana, the vessel headed for Vera Cruz in February 1838. In this new station, the crew fell victim to their first violent epidemic of fever, which increased the difficul-

ties of the mission. The division arrived just as the French Foreign Minister to Mexico, Baron Antoine Louis Deffaudis, was returning to France to resign his post. Although the emergence of French military backing in response to Deffaudis's earlier requests for naval support had arrived rather late, the Foreign Minister decided to stay on as negotiator. Deffaudis proceeded with the demand that the Mexican government pay France 600,000 pesos in damages. A blockade was internationally announced for the whole of the Mexican Gulf Coast in April, following Mexico's denial of the claim. The *Herminie* remained situated outside Vera Cruz during the blockade.

Deffaudis left the blockade in June 1838, reportedly due to illness brought on by the coastal climate and the weakness of the French position. After Deffaudis abandoned his post, Bazoche realized by August that "the *Herminie*...[was] now in need of major repairs and almost unseaworthy. The inevitable attrition arising from sickness and accidents would soon render its position untenable" (Barker 1979). The French government decided to relieve the dilapidated squadron and send in Rear Admiral Baudin with a larger fleet. The *Herminie* left its post and was homeward bound for France by November 1838. On 3 December, near the island of Bermuda, it struck the Chub Bar reef and almost directly bilged (*Bermuda Royal Gazette,* 11 December 1838:2). After the distress signal was perceived by Bermudans, assistance was sent from the Royal Naval dockyard, and the entire crew, consisting of 495 persons, was saved. The following morning part of the stores was salvaged. The crew was housed at the Royal Naval Dockyard until passage to Martinique could be secured.

Field Investigations

Located by East Carolina University students and staff during a routine systematic reef survey in 1994, the wreck site showed obvious signs of disturbance from human activity. There was substantial damage to the reef and general area of the site; the sand appeared to have been blasted or pumped into mounds and onto the local coral, and there was floating wood debris in the area. This disturbance was subsequently reported to the Bermudan Collector of Custom and Receiver of Wreck, whose office regulates the Unprotected Wrecks List. Because of the rich background of information, artifacts, and the threat of continuing disturbance, a reevaluation of the wreck site was proposed as a research project. The project would ultimately include the efforts of the Maritime Archaeological and Historical Society (MAHS) and East Carolina University, carried out in conjunction with the Bermuda Maritime Museum.

Objectives

The only scientific offerings regarding this vessel are descriptive and view the wreck and related materials as historic relics or artifacts useful as examples of conservation methods. In response to this, a research design was created for a controlled approach to data recovery. The *Herminie* shipwreck is the only vessel equated with this particular site. Such symmetry cannot be assumed, as several items, including the ship's anchor, were found at varying distances out on the sea floor. This, in addition to the dynamic nature of the Bermudan reefs, may indicate the intrusion of other shipwrecks. The assumption that the observed attributes of this site are associated as though at the time of sinking, while logical, must be thoroughly examined. There have been various factors affecting the integrity of the ship after it first wrecked. Misleading conclusions may be drawn if no effort is made to control for postdeposition factors such as extensive salvaging, sea bottom sedimentation, and the effects of natural processes. Consequently, the research agenda for the *Herminie* project included: (1) determination of the site's extent; (2) examination and limited documentation of exposed material culture; (3) creation of a preliminary site plan, with potential for use as an underwater field guide; and (4) assessment for additional research potential.

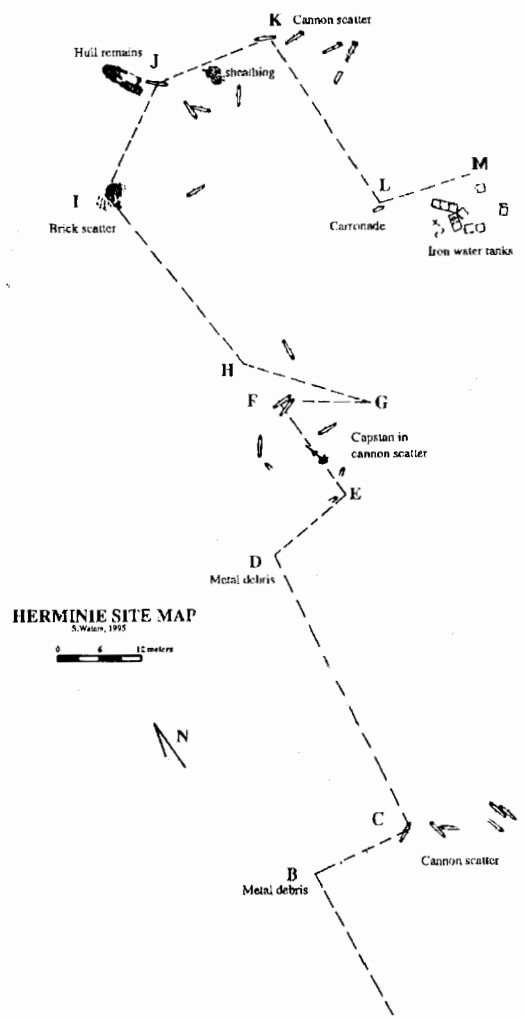

FIGURE 1. Map showing artifact scatter.

Methods

A hand-held global positioning system unit and divers with tow-boards were used to relocate the site during the 1995 field season. The timely arrival of Hurricane Louis not only cut the expected field time in half but also exposed the remains of undocumented hull structure. The location was buoyed, and two underwater scooters were used to conduct the initial visual search. The perimeters of the site were determined by divers snorkeling over the artifact scatter and setting a second buoy. A large anchor defined the southeastern end of the site, which stretched to the northwest for 155 m, ending at a scatter of cannon. Between these two points, the scatter of artifacts ranged from 30 to 54 m across. Once the site area had been defined, a baseline was established connecting large artifact concentrations.

Application of a grid system applies to survey as well as to excavation in any archaeological environment. A typical mechanical grid system was not an option on the *Herminie*, as the size of the artifact scatter, surges, and the constant presence of dive tours made utilizing grid equipment impossible. Instead, a weblike baseline was used which served to control the mapping of the site and provided a reference for any future work. Beginning at the southern extent, a length of polypropylene line was tied around an object in each major artifact scatter between the two established site ends. Two-meter intervals were marked on the line between each scatter area to create points of reference for trilateration from any given object to be mapped.

Once the baseline was in place, the MAHS volunteers began mapping major artifacts by using the 2-m increments on the baseline as reference points (Figure 1). As the scatter of material from the vessel was so extensive, MAHS focused on recording the most likely diagnostic features of the wreck site. Each scatter area was given a letter designation and assigned to a two-member dive team. The dive teams first identified all non-naturally occurring items in their specified area and gave each a number designation. Each of these artifacts was then measured and added to the base map using the trilateration points previously established. Once the scatter in each area had been mapped, readily identifiable objects such as cannon were given brief descriptions and measurements. The process of compiling cannon data was greatly facilitated by the creation of pre-printed cannon recording forms developed by MAHS and easily adapted to this particular site. The distance between the immediate 2-m intervals on either side of a tie-off point was also measured along with the linear distance between areas to provide distances and angles to transfer to a larger-scale base map. All exposed remains were photographed with the

line system in place for use as a reference in creating the site map. After exhausting all possible field time for the purposes of recording, the baseline was removed from the site with no disturbance to any artifacts or natural areas. Buoys were also removed from the site in anticipation of additional foul weather.

The Site

Twenty-three large cannon and one smaller gun resembling a carronade were established on-site. There were several cannon noted beyond this count, but as they were almost totally contained in the reef structure, time did not allow for their recording. Guns observed were all made of iron; no type of ornamentation was observed. The guns were plain, tapered, and smooth-surfaced, with little muzzle swell. Reinforcing rings were apparent only near the breech end and the swell of the muzzle. The cascabels were all made of a ring and knob joined together at what appeared to be a reinforcing base ring. A covering of sand preserved a few cannon from encrustation and showed a 15-x-9-cm vent just past the base ring. Trunnions all displayed 5-cm-thick shoulders. The midpoints of the trunnions were located 1.3 m from the breech end, leaving a chase of approximately 1.7 m. The overall lengths of 22 cannon ranged from 2.9 and 3.3 m. Allowing for variance in measurement from encrustation, this gives a general length of 2.9 m for all the cannon, with a maximum difference of 4 cm. Many of the calibers were impossible to measure as the bores were filled with natural debris. Only nine cannon yielded bore diameters, and they varied between 15 and 20 cm. Based on these measurements, eight cannon were estimated to be of 15-cm caliber; the ninth had a 20-cm caliber. Shot poundage could not be determined at this time, as none that could be measured for comparison was found on site. No definite carriage remains were noted for the guns; however, many circular iron artifacts with a diameter of 46 cm were noted in the vicinity of the cannon. This may correspond to an English 24-pounder carriage iron fore truck (Manucy 1949).

The gun resembling a carronade was observed to have a lug cast in the lower barrel for carriage anchoring. A ring and knob cascabel was also apparent; the knob seemed constructed to incorporate a vertical bolt. Debris near the carronade may indicate the remains of an associated carriage. Constructed of iron, the small gun was smooth cast with no discernible reinforcements. The length of the gun measured 1.8 m with a caliber of 18 cm.

A large, uniform brick scatter was also drawn in detail as one of the major site features. It may have been utilized as a heat-resistant platform of various-sized, similarly composed bricks. The standard rectangular brick measured 22 x 10 x 6 cm, and the square were 20 x 10 x 6 cm. There were at least two apparent brick layers set in a circular iron floor 5 cm thick. An iron casing approximately 2 cm thick remained in some areas. A scatter of iron boxes was located near the carronade (Figure 2). The 13 discernible boxes, uniformly square, were 1.25 m per side. Only two boxes remained fairly intact. No contents were found associated with the boxes; they appear to be iron water tanks (Lavery 1987).

Recently exposed hull structure, generously covered in brick, sand, and other debris, was observed at the northern end of the site. Treenails, fasteners, timber size, and orientation were noted in a preliminary sketch. There were several large, jagged sheets of iron fastened with bolts approximately 60 cm over the timbers. Two large sections of copper sheathing with nail

FIGURE 2. Remains of several iron water tanks.

holes were also located close to the exposed timbers.

The site contained numerous metal anomalies, fasteners, barrel hoops, shards of porcelain, shards of glass, portions of bone, and pieces of leather and rope, among countless other objects reported by investigating divers. One of the ship's anchors remained in an upright position, partially encased in a coral head. With no remaining stocks, the anchor retained a ring with one link of chain on its 5.2-m-long shank. Portions of an iron capstan remained in one of the sand fields, with what resembled a portion of a drumhead and collar.

Previous Artifact Assemblage

The artifact assemblage amassed thus far from established collections includes over 300 items. While the Smithsonian collection remains to be investigated, most artifacts should eventually be linked to the *Herminie*. Items that were photographed from the Bermuda Maritime Museum's collection include olive oil bottles, brass and copper fittings and fasteners, what appear to be brass gun parts, five French commemorative tokens, a keyhole escutcheon, and a silver seal. Many of the artifacts, donated after a long existence in private collections, are quite deteriorated. By studying all the artifacts associated with the *Herminie*, a comprehensive list should assist curatorial and conservation staffs in deciding how to properly utilize the collection.

Conclusions

Despite some technical difficulties and foul weather problems, the initial seven-day project accomplished the following: (1) data collection to help establish the parameters of the wreck site to benefit future investigations; (2) data collection which may link various artifacts with the site for future compilation and research; (3) establishment of a site map which led to the creation of a field guide for use as an underwater navigational aid for divers visiting Bermuda.

These accomplishments provide a framework for any subsequent archaeological study of the *Herminie*. For example, the site map will make it possible to measure the recently exposed hull structure with sufficient accuracy to begin systematic comparisons with the historical evidence already collected and the bountiful artifact scatter remaining.

The investigation of the *Herminie* was a unique effort combining the resources of the Bermuda Maritime Museum with the volunteer power of MAHS and ECU for the purpose of scientific research of a significant cultural resource. This research was conducted under the supervision of qualified archaeologists operating in accordance with the rules and regulations of the Bermuda Government. Every portion of this investigation was undertaken with extreme care not to disturb any portion of the *Herminie* site as this was an exercise in documentation of naturally exposed materials.

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The HMS *Proselyte* Project: Survey of an Eighteenth-Century British Frigate in Great Bay, Sint Maarten

Introduction

During the summers of 1994 and 1995, the Sint Maarten National Heritage Foundation, the Ministry of Culture, the Department of Planning and Environment (VROM), and Maritime Archaeology and Research co-sponsored an investigation designed to survey, identify, and map historical material at the *Proselyte* shipwreck site, located south of Great Bay on Sint Maarten's southern coast.

One of the Leeward Islands in the Netherlands Antilles, and located approximately 150 miles east of Puerto Rico, Sint Maarten/St. Martin was first settled in 1631 by the Dutch. About the same time, a small band of Frenchmen landed and inhabited the area now known as the French Quarter (Bequette 1994:13). Over the next 200 years the Dutch, Spanish, English, and French made sporadic visits to the island. By 1816, the island government had changed hands 16 times. A permanent boundary was finally established between the Dutch and the French sides in 1817 (Bequette 1994:18).

Settlers on the island of Sint Maarten developed a plantation agricultural system, producing tobacco, cotton, salt, and sugar for export (Bequette 1992:23). The anchorage of Great Bay provided a protected harbor for vessels engaged in trading agricultural produce, salt, slaves, and European manufactured goods. By the end of the 18th century, the town of Philipsburg adjacent to Great Bay provided one of the most commercial markets in the Lesser Antilles.

One such vessel to frequent Sint Maarten's shores during the island's English occupation was the HMS *Proselyte*.

The Ship

The HMS *Proselyte* began its illustrious career as a Dutch war frigate named the *Jason*. Built in Rotterdam, Holland, in 1770, the *Jason* served the Dutch crown until 1796, when the mutinous Dutch crew freely gave the ship to the British. The English outfitted the ship, changed its name to the *Proselyte*, and sent the vessel to patrol and protect the English territories in the Caribbean. The *Proselyte* was 133 ft. in length and 36 ft. in beam. She had a 12-ft. depth of hold, carried 244 men, and had 32 guns: twenty-six 12-pounders on the upper deck, four 6-pounders on the quarter deck, and two 6-pounders on the forecastle. While on a routine stores run from St. Kitts, the *Proselyte* struck a submerged reef and sank on 2 September 1801.

The Shipwreck Site's History

On Sint Maarten, little emphasis has been placed on underwater site management and protection. Until very recently, submerged cultural resources have attracted little scientific study, and archaeological data gathered on shipwrecks have been limited. However, the discovery and identification of shipwreck structures in the vicinity of Great Bay by local sport divers and salvage operators have aroused more attention and interest in investigation and the possible preservation of the wrecks. These discoveries also stimulated considerable interest in protecting shipwreck remains among members of the Sint Maarten National Heritage Foundation and the Ministry of Culture.

Vast numbers of artifacts have been salvaged from the *Proselyte*. Records show that the ship was initially salvaged by her crew in 1801 before she sank. The wreck was again salvaged in 1950, and this has continued over succeeding years. Today, approximately 467 known artifacts from the site exist in private collections around the island. The archaeological work on the HMS *Proselyte* focused on identifying the extent of submerged cultural material at the site in hopes

of developing a management plan for protecting the historic site from looting or attempted salvage.

Survey—The Shipwreck Site

The intent of the 1994 and 1995 summer field seasons was to accurately map and identify any surface material at the *Proselyte* shipwreck site. Project personnel consisted of 1 underwater archaeologist, 1 historical archaeologist, 2 graduate students from the Maritime History and Nautical Archaeology Program at East Carolina University, and students and volunteers from Colorado, California, New York, Virginia, Maryland, Canada, Italy, and the MAHS organization of Washington, D.C.

Students and volunteers assisted archaeologists in surveying, mapping, cataloging artifacts, and with boat and equipment operations. Project equipment was loaned from Maritime Archaeology and Research, and boat and vehicle arrangements were made by the Sint Maarten National Heritage Foundation.

Divers surveyed the *Proselyte* reef in an attempt to locate the remains of the ship. They spent July 1994 conducting reconnaissance and formulating preliminary identifications of the shipwreck area. Plotting the artifacts underwater also began that summer, as did the cataloging of 467 previously salvaged *Proselyte* artifacts located at the Sint Maarten Museum and at the Trade Winds Dive Shop. The summer of 1995 was spent plotting the remaining *Proselyte* artifacts underwater.

Archaeologists visually surveyed and mapped the shipwreck site and maintained provenience control using an underwater transit positioned in the sand just off the wreck. From this datum point, angles and distances were used to establish a baseline closer to the wreck. Because the debris field was too widely scattered and on too many levels, a dogleg series of baselines had to be established. Twenty-two such doglegs were plotted around the wreck. By trilaterating between each of the baseline segments, archaeologists, students, and volunteers were able to accurately map any shipwreck structure or artifact.

Archaeologists, students, and volunteers made a total of 78 dives on the site during the summer of 1994 and 120 dives during the summer of 1995. The dives involved attaching the datum point, establishing the baseline segments, trilaterating and mapping the site, and photographing the wreck site and debris field. Additional time was spent preparing equipment, conducting surface operations, and cataloging artifacts previously removed from the *Proselyte*.

Description of Findings

Comprised of a rock ballast pile 6 m high, the *Proselyte* shipwreck site, labeled USM-101, is resting in 50 ft. of water and lies on her starboard side. Numerous cannon, barrel and mast hoops, ballast bars, and anchors are scattered around the wreck. The rock ballast and the scatter of artifacts are completely overgrown with giant tube sponge, common sea fans, deepwater gorgonia, sea whips, pilume worms, and fire coral. Sea anemonae, trunk fish, squirrel fish, trigger fish, French angels, grey angelfish, groupers, bluehead wrasse, barracuda, sea turtles, moray eels, sharks, and stingrays are a few of the inhabitants of this artificial reef.

Mapping of the site established that the hull lies perpendicular to the mouth of Great Bay on an axis of 345 degrees magnetic north. The bow was found heading in the direction of the Bay and was identified by four large anchors lying to starboard. The stern area lies 40 m aft the anchor.

Investigation of the surviving wreck structure indicates that the stern area of the vessel has been almost completely destroyed by the presence of a light buoy. Constant surge in the area has caused the light buoy anchor chain to wear down the stern section of the *Proselyte*.

Systematic probing of the wreck site confirms that the *Proselyte* has settled on top of a coral reef. Coral was identified in all areas probed. Neither probing nor examination of the hull structure exposed above the sand revealed wood. However, small pieces of wood were discovered under the sand. It is possible that wood may exist under the ballast rock pile. In addition

to the wood fragments, divers identified 14 cannon, 4 anchors, numerous barrel and mast hoops, miscellaneous pipe fragments, and approximately 200+ bars of various sizes scattered around the wreck site. Smaller artifacts, such as copper and ceramic, were also identified.

Conclusion

The *Proselyte* shipwreck site is of interest to archaeologists in that it is representative of the British vessels of the 18th and 19th centuries. These types of ships were crucial to the economic and historical development of Sint Maarten, and questions regarding her loss provide new historical perspectives on the complexities of sea navigation and the British impact to the island. Archaeologically, the *Proselyte* site is a valuable source of data concerning shipboard life and British and Dutch ship building.

Examination of the *Proselyte* shipwreck site confirms that not much of the hull has survived, while many other features, such as anchors and cannon, indicate the possibility that other unidentified materials may exist.

Further investigation of the *Proselyte* site is recommended before total destruction of the site takes place. Any material discovered should be mapped, analyzed, and preserved, as should any artifacts recovered from the site. A display of these artifacts would additionally enhance historical material already preserved at the Sint Maarten Museum in Philipsburg and in the archival collection.

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The Midway Dauntless Project: Historic Aviation Resource Management and an Aircraft Case Study

Introduction

In January of 1994, BuNo 2106, an early Douglas SB-2 Dauntless scouting and dive bombing aircraft, was recovered by the National Museum of Naval Aviation (NMNA) from the bottom of Lake Michigan, where it had lain for just over 50 years. Traditionally referred to by the Navy by their "bureau numbers," or "BuNos," this particular craft was assigned the Bureau of Aeronautics serial number 2106, and was the fifth -2 (pronounced "dash two") model built for the Navy by Douglas Aircraft at their El Segundo, California, facility (Van Vleet et al. 1970:347; Andrade 1979:221). SBD-2 BuNo 2106 was delivered to the Navy in 1940. This Dauntless was later evidently given the unofficial name Midway Madness.

Following its identification, the NMNA and the Naval Historical Center (NHC) determined that BuNo 2106 was a naval craft which possessed unusual historical significance. After recovery, the Dauntless was transported to the museum's facilities at Naval Air Station (NAS) Pensacola, Florida (Figure 1), where it began to undergo a limited structural restoration. Seeing a need to investigate and document this significant naval craft before the restoration process was completed, the Naval Historical Center and the Institute of Nautical Archaeology (INA), in cooperation with the National Museum of Naval Aviation, initiated a project to meet this need. The active documentation phase of this project took place in March of 1995.

Historical Significance

BuNo 2106 is significant for three distinct reasons: (1) it is a rare surviving example of an important early naval aircraft design, the SBD; (2) it is the only surviving accessible SBD-2, a significant Dauntless model type; and (3) it has been connected with a number of important historical associations.

The design of the Douglas SBD Dauntless/A-24 Banshee series was conceived through the combined efforts of aeronautical engineers John K. Northrop, Ed Heinemann, and Donald W. Douglas. It incorporated a number of significant aeronautical design advancements. The result was that the SBD Dauntless became the first U.S. naval shipboard dive bombing platform to be considered tactically and strategically successful (Tillman 1976).

Ironically, the SBD Dauntless was widely regarded as obsolete at the time of America's entry into the Second World War. In spite of this, it ultimately emerged as one of the most important and successful aircraft designs of the war. It played a distinguished role in many of the Allied tactical and strategic successes in the Pacific Theater of Operations, and it was the only American aircraft type which participated in all five of the naval engagements in history that were fought between aircraft carrier forces. Particularly, it performed the central successful aviation role in the Battle of Midway, where it was responsible for destroying half of the Japanese Combined Fleet's total carrier tonnage. Following the war, the legacy of the Dauntless was summed up by Samuel Eliot Morison, who characterized these craft as "the most successful and beloved by aviators of all our carrier types during the war" (Morison 1963:156).

Of the 87 SBD-2 models (BuNos 2102-2188) known to have been built by Donald W. Douglas's craftspeople, only this one is presently available for study. In that regard, it is rare. The SBD-2 was the front-line model of the SBD in service at the time of Pearl Harbor, and as such it suffered losses at Pearl Harbor, in the early Pacific carrier raids (or "revenge raids"), and at Coral Sea. By the time of Midway, the -3 had been largely phased into service, and the -2 had been relegated to hand-me-down status; this often meant being given to the Marine Corps. This

is precisely what happened to BuNo 2106 and many of its surviving sisters.

In addition to its rarity as an aircraft type and model, BuNo 2106 has a number of significant historical associations. This aircraft's initial assignment was as a member of Bombing Squadron Two (VB-2) aboard the early aircraft carrier USS *Lexington* (CV- 2). BuNo 2106 operated from *Lexington* for most of 1941 and early 1942 as ship number two (2-B-2) in VB-2's organization. One important exception in this timeline was a cruise in which the Dauntless was left behind at Bombing Two's hangar facility at NAS Ford Island, Territory of Hawaii, on 5 December 1941, for the purpose of repairing engine damage suffered during an earlier war game exercise. As a result, BuNo 2106 was present for and survived the Imperial Japanese Navy's devastating carrier-based raid on the U.S. Navy's Pacific Fleet anchorage at Pearl Harbor on 7 December 1941.

BuNo 2106 was back in the returned *Lexington* with a new powerplant by 12 December, in time to perform a role in the Navy's early 1942 Pacific carrier operations, including the notable 10 March 1942 trans-mountain raid on Japanese naval vessels at Lae and Salamaua Harbors in New Guinea. It was flown in this action by Lieutenant Junior Grade (LTjg) Mark Twain Whittier and Aviation Radioman Second Class (ARM2c) Forest G. Stanley. LT(jg) Whittier and Petty Officer Stanley helped to lead their squadron in the raid, pressing home their attack in the face of anti-aircraft fire to dive bomb a vessel they were credited with sinking.

While it did not cause the severe blow to Japanese naval strength that was initially hoped, the Lae-Salamaua Raid ultimately had the effect of delaying the planned Japanese invasion of the Pacific ports of Port Moresby and Tulagi, and it provided necessary experience and morale to the participating American sailors during the darkest days of the war. Furthermore, it proved to be the precipitating factor which directly resulted in the subsequent Battle of the Coral Sea, the first naval engagement fought in the air between carrier forces.

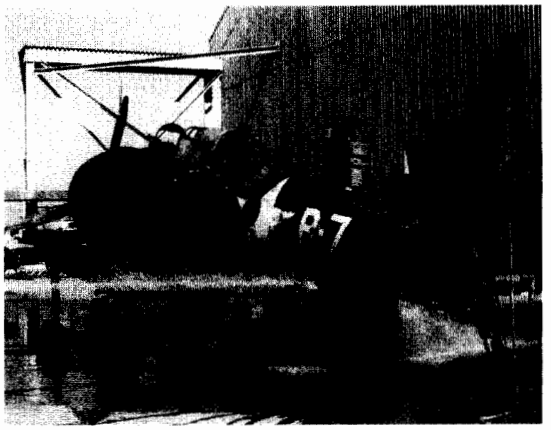

FIGURE 1. Midway Madness following its arrival at the National Museum of Naval Aviation. The outer wing panels, horizontal stabilizers, elevators, and tail cone have been removed, and the rudder unhanged. The craft is being sprayed with ACF-50, a water-displacing anti-corrosive metal preservative. (Photograph by Jim Curry/NMNA.)

When the Lexington sailed for the Coral Sea in late April 1942, BuNo 2106 was rotated out of Bombing Two and left behind at Pearl Harbor for reassignment. The *Lexington* never returned; it was ultimately lost in the Battle of the Coral Sea along with all but five of Bombing Two's Dauntlesses (Tillman 1973). Instead of suffering the early fate of many of its sisters, BuNo 2106 was transferred to Midway Island in May for the purpose of strengthening the U.S. Marine Corps's hastily organized Scout Bombing Squadron Two Forty-one (VMSB-241), in preparation for the upcoming offensive which was anticipated to focus on that small atoll.

Due to cryptoanalytical intelligence, the U.S. Navy was aware of the Imperial Japanese Navy's intentions, and in response dispatched its remaining carrier assets to meet it. On 4 June, the Japanese carrier force launched their aircraft strike group with the intention of neutralizing Midway's aviation capability. As this strike group approached, VMSB-241 took to the air to attack the Japanese carrier task force as part of the U.S. Navy's larger strike plan. BuNo 2106 was one of 16 Marine SBD-2 Dauntlesses that made up part of that squadron, and was crewed by First Lieutenant (1stLT) Daniel Iverson, Jr.

and Private First Class (PFC) Wallace Reid, both survivors of the 7 December action on Oahu, Hawaii. Upon sighting the carrier force, the Dauntless pilots targeted one of the four carriers, HIJMS *Hiryu*, as their target, and were met with fierce resistance from that ship's protecting air cover of Mitsubishi A6M2 Type 00 fighters (*kansen*). Six of the Dauntlesses were quickly shot down in the attack and lost with their crews. Two more were forced to ditch on the way back (Cressman 1992:75-82).

Iverson and Reid survived their squadron's initial attack, but became caught in a running battle with four *kansen* whose pilots took turns trying to shoot down the slower Dauntless. BuNo 2106 was repeatedly riddled with projectile holes while attempting to evade these pursuers. By the time they were able to escape into a cloud bank, Iverson and Reid were both wounded. When they attempted to land at Midway, they found that their landing gear would not fully extend. Iverson landed the craft on only its starboard main wheel, and managed to neatly skid in without damaging any of the other aircraft parked along the runway.

Following their crash-landing, another Dauntless pilot recorded that 2106 was found to have a bullet lodged in the locking mechanism of the wheel which would not fully extend (Moore 1943:77-78). At least 210 projectile holes were counted in BuNo 2106's airframe upon its return, although some discrepancy exists regarding the exact number. A Dauntless pilot recorded that Iverson and Reid's ship was "in a bad way," having "returned from the first attack with over 200 bullet holes in it" (Moore 1943:77-78). Another witness counted 210 and stated that viewing the aircraft was like "looking through a colander" (Coale 1944:117). The after-action report for VMSB-241 indicates that the aircraft had "over 210 bullet and shrapnel holes in it scattered over every portion of the plane." Three leading Second World War historians also disagree over the numbers. Robert Cressman mentions that 219 holes were counted (Cressman 1992:79). Samuel Eliot Morison recorded that 259 holes were counted (Morison 1949:110), as did Robert Sherrod (Sherrod 1952:60). Whatever the exact number, it appears that there were at minimum 210 projectile holes in the aircraft.

Following its action at Midway, the war-weary 2106 underwent overhaul in San Diego and was attached to the Carrier Qualification Training Unit (CQTU) at NAS Glenview, Illinois, for the important mission of helping to train new pilots. On 11 June 1943, it was accidentally stalled and spun into Lake Michigan during a routine carrier landing exercise. The pilot was rescued unharmed, but the craft sank and was lost. The Dauntless rested in 170 feet of cold, fresh water until its recovery 50 years later.

Today, BuNo 2106 appears to be the only extant Navy aircraft which was present during the Pearl Harbor attack. Furthermore, this Dauntless seems to be the sole surviving craft of any type that is known to have performed a role in the decisive Battle of Midway, the turning point of the Pacific War.

Findings of the Investigation

Following the museum's recovery of the aircraft, a number of control surfaces and components were found to still be oriented in specific positions, indicating that the craft had been trimmed for a carrier landing at the time of loss. The landing gear was fully extended. The flaps were intact and found to be set in a "down" position, in agreement with the positioning of the pilot's flap selector controls. Although the arresting tailhook at first appeared externally to be in the "up" position, upon further study the interior control was found to be locked in the trap or "down" position. The hook may have been forcibly pushed back just aft of where it entered into its actuator fairing, possibly due to the physical nature of the ditching. The forward canopy was retracted in the open position and remained somewhat intact, despite structural damage and corrosion. The cowl flaps were open. Despite the presence of two fixed .50-caliber and one flexible .30-caliber guns, no ammunition was present.

A number of various components were found to be damaged or entirely absent following the

aircraft's recovery. The starboard outer wing panel displayed evidence of having suffered a violent separation of its outboardmost 4-ft. section and tip from the rest of the panel. The cowling assembly was dented in the lower center and starboard areas of the outer and inner cowling rings. Some of the inner cowling ring and engine compartment access panels were missing, and others showed evidence of having been forcibly stove inward. The port side forward fixed gun compartment door was missing. The tip of the mast was broken off. The cockpit windscreen was disintegrated and largely missing. In the pilot's retractable overhead canopy assembly, one Plexiglas panel was broken, and at least two other panels were fractured. The aft retractable canopy was absent. The upper fuselage access hatch to the parachute flare tube station was missing. In the cockpit, some instrumentation still registered frozen readings. The aft retractable canopy was missing entirely, and the aft flexible gun was found unshipped from its normal stowed position. It is possible that the gun was ejected from its well as a result of the ditching. The aft gun well doors were both missing.

The structural evaluation of the BuNo 2106 Dauntless was made through taking into consideration two general concepts: the basic SBD-2 design and construction characteristics as they are already recorded in extant historical technical information, and the analysis of particularly unusual evidence of post-production modifications and anomalies present within the construction of this SBD-2 that is not in agreement with the recorded construction characteristics.

We specifically defined a structural deviation as any damage, modification, or replacement of components which occurred previous to the incident of loss. This included foreign object damage (FOD). In terms of structural damage, extant repairs within the aircraft construction were found to correspond with historical accounts of the damage suffered by BuNo 2106. Among such deviations, we discovered a total of 122 individual areas of foreign object damage or modification probably related to foreign object damage. These areas included: 42 patches in the port and starboard side fuselage exterior surfaces; 16 patches on the upper exterior surfaces of the center panel; 16 areas of repaired spar and stringer damage in the internal construction of the center panel; 4 patches on the cockpit firewall; 28 areas of FOD within the interior fore and aft cockpits and inter-cockpit structures, as well as 2 further areas of apparent reinforcement due to wear; and 14 areas of repaired projectile damage in the internal frames and bulkheads, tail structure, horizontal stabilizers, fin, rudder, tail cone, and other structures. When the damage which may have been present in the outer wing panels, which were apparently replaced following the battle, is taken into consideration, the extent of damage seems to approach what was described in historical sources.

Components which have particular dates or locales of maintenance activity stenciled or stamped upon them, or which are labeled with a model designation inconsistent with that of the original airframe, can reveal valuable information regarding the individual aircraft's history. In the case of 2106, it was discovered that the inboard wing tanks and liners, and the oil tank, were backfitted SBD-3 or -4 model parts. The inboard fuel tanks were found to have their dates and location of maintenance marked upon them. One tank had stenciled upon it the date of 30 June 1942, less than a month after the Battle of Midway. The extensive repaired projectile damage present in the center wing panel's internal spar and stringer construction surrounding the tank seems to indicate the reason for the replacement. The chronology of this replacement is consistent with the fact that SBD-2s were being phased out of service by the period of the stenciled dates, during which time the SBD-3 and -4 were the dominant model types of the Dauntless series. This dominance evidently also carried over into parts availability.

Paint coating and marking patterns also provided valuable information regarding the aircraft's identity, operational mission, and travels. Specific identifying markings, general color pattern applications, and paint layer stratigraphy were found to be conclusive identifying characteristics.

The exterior blue gray over light gray camouflage pattern was worn through in some areas to reveal earlier, different color schemes. The starboard center panel leading edge in particular showed signs of intense paint wear. The yellow paint visible beneath the later coatings on the leading edge corresponds with BuNo 2106's recorded prewar mission, during a time when peacetime Navy ship-based aircraft had their wings painted bright yellow. Furthermore, the yellow paint discernible beneath later camouflage applications on the aft fuselage and empennage is consistent with the peacetime tail-color coding system which distinguished Lexington's yellow-tailed Air Group Two from other carrier air groups.

Conclusion

At a time when the responsible management of aviation cultural resources is only beginning to receive the attention required, the recovery of BuNo 2106 provides a useful case study which addresses some of the archaeological and preservation issues encountered in dealing with historic aircraft wrecks.

In their farsighted cooperation, the NHC, the NMNA, and the INA have demonstrated the need for naval aircraft to be properly appreciated for their role within the dynamic hierarchy of naval craft as this concept is understood by historians and anthropologists. Furthermore, this opportunity has allowed for an exploration and better comprehension of some of the lesser understood ways in which the methods of historical archaeology can be applied to specialized aeronautical archaeological identification and documentation issues. It is hoped that this contribution will strengthen the minute body of currently available work on this specialized subject, and encourage a higher level of scholarship for future studies undertaken within this area.

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The Discovery of the Confederate Submarine *H.L. Hunley*

Introduction

The *H.L. Hunley* was the first submarine in history to sink a warship in combat. The submarine was one of many technological advancements wrought by the American Civil War. Although the idea for submarines had been around since the 16th century, it was during the American Civil War that the idea was put to practical use and testing. The nature of the American Civil War along with rapid technological advancements spawned by the Industrial Revolution made for dramatic changes in naval warfare throughout the world. The birth of submarine warfare has proven to be one of the most important maritime advancements in history.

Background

In 1861, an inventor by the name of Frances Smith wrote a letter which first appeared in the *Columbia Herald* (Columbia, Tennessee) on June 10th and was subsequently reprinted in papers throughout the South. In this letter, he urged the development of cigar-shaped submersibles about 30 ft. long. He also prepared a detailed memoir on submarine warfare (Ragan 1995:15). In late 1861, Horace L. Hunley, a wealthy lawyer and planter from Louisiana, became interested in the idea of submarines and joined James McClintock and Baxter Watson, who were already building a small submarine called *Pioneer* or *Pioneer I*. Although the submarine was successfully built and tested, it was necessary to scuttle the vessel in Lake Pontchartrain when New Orleans fell into Union hands early in the war. Undeterred, Hunley, McClintock, and Watson moved their operation to Mobile, Alabama, where they constructed their second submarine called either *Pioneer II* or *American Diver*. Unfortunately, this second attempt was an impractical design and was lost when it inexplicably sank while being towed from Mobile to Fort Morgan located at the entrance to Mobile Bay. Still undaunted, Hunley, McClintock, and Watson continued their belief in the usefulness of submarines to the Confederacy. With financial support from other investors, a third submarine (to be named later the *H.L. Hunley*) was built at the Park and Lyons machine shop in Mobile during the winter of 1863. Lieutenant William Alexander, a mechanical engineer with the Alabama Infantry Regiment, was on duty at Park and Lyons during the building of the *H.L. Hunley*. He wrote a post-war article giving the following firsthand description of the submarine:

> We decided to build another boat, and for this purpose took a cylinder boiler which we had on hand, 48 inches in diameter and twenty-five feet long (all dimensions are from memory). We cut this boiler in two, longitudinally, and inserted two 12-inch boiler iron strips in her sides; lengthened her by one tapering course fore and aft, to which were attached bow and stern castings, making the boat 30 feet long, 4 feet wide and 5 feet deep. A longitudinal strip 12 inches wide was riveted the full length on top. . . . On each side of this shaft, outside of the boat, castings, or lateral fins, five feet long and eight inches wide, were secured. This shaft was operated by a lever amidships, and by raising or lowering the ends of these fins, operated as the fins of a fish, changing the depth of the boat below the surface at will. . . . There were two hatchways—one fore and one aft—16 inches by 12, with a combing 8 inches high. These hatches had hinged covers with rubber gaskets, and were bolted from the inside. . . . There was an opening made in the top of the boat for an air box, a casting with a closed top 12 by 18 by 4 inches, made to carry a hollow shaft. This shaft passed through stuffing boxes (Ragan 1995:26).

By July of 1863, the new submarine was ready for testing. On 31 July 1863, with several high-ranking Confederate Officers as witnesses, the tiny submarine successfully submerged and blew up an old coal barge in Mobile Bay. At this stage of the war, the Union was successfully strangling the Confederacy by cutting off supplies with a Naval Blockade of all Southern ports. Charleston, South Carolina, was not only a strategic port, but it was a focal point of the

Southern cause. After successful testing of the new submarine in Mobile Bay, word of the tiny submarine reached General Pierre Gustave Tousant Beauregard, commander of military forces in Charleston. Charleston was under heavy siege, and the situation was rapidly deteriorating. General Beauregard immediately agreed to have the submarine brought to Charleston in a desperate attempt to break the blockade and bring relief to Charleston and the Confederacy.

Thus, in August the tiny submarine was secretly shipped by rail to Charleston. The submarine was to go to work immediately destroying Union ironclads. However, the crew sent to operate the submarine was slow to respond and missed more than one opportunity to destroy enemy ships. As a result, and in light of the desperate circumstances, General Beauregard seized control of the submarine from her civilian owners and placed an inexperienced volunteer military crew in the boat. The result was disastrous. Five men of the nine-man crew were killed when the submarine accidentally sank while preparing for an exercise. The loss caused General Beauregard and others to abandon their hopes to use the unlikely vessel to attack Union blockading forces. Shortly after the accident, Horace L. Hunley in Mobile wrote a letter to General Beauregard requesting that he be placed in command of the submarine. Hunley suggested that he could provide a more experienced volunteer crew. At Hunley's urging General Beauregard agreed to give the submarine another chance.

Horace L. Hunley arrived in Charleston with Lieutenant George E. Dixon of the 21st Alabama Regiment. Like Alexander, Dixon had been on hand during the submarine's construction. Dixon must have proven himself to the owners and builders to be a capable engineer and leader. Apparently, McClintock and Dixon commanded the first crew that successfully tested the tiny submarine in Mobile Bay.

Lieutenant Dixon was made captain of the boat. He then began working with the submarine and training his crew immediately. They soon became proficient at diving the boat and making mock attacks around the harbor. Unfortunately, tragedy struck once again when one day Horace L. Hunley decided to go out with the crew in Lieutenant Dixon's absence. Although Hunley must have dived the submarine before, he did not have Dixon's experience. When Hunley and his crew of seven dived the submarine, they never came up and were asphyxiated. The accident was blamed on Hunley's inexperience. General Beauregard, having witnessed Lieutenant Dixon's successful sea trials, allowed Dixon to recover and recruit a new crew for the *H.L Hunley* (Ragan 1995:70).

After the submarine was recovered, the vessel was formally named the *H.L. Hunley* in honor of its benefactor and owner. Under the command of Lieutenant Dixon, a new crew was assembled and trained. The *H.L. Hunley*'s crew was stationed on Sullivans Island, South Carolina. The submarine was kept at the north end of Sullivans Island at Battery Marshall near Breach Inlet. They practiced in the shallow creeks and bays behind Sullivans Island and eventually made regular patrols out of Breach Inlet. They trained whenever possible through November and December of 1863 and into the winter of 1864. After training they were able to crank their tiny submarine several miles out into the ocean and return safety. They were also able to dive the boat and remain submerged for extended periods of time.

On a cold but clear and calm night on 17 February 1864, Lieutenant Dixon and his crew of eight began their last patrol. They had decided to attack the USS *Housatonic,* a sloop of war at anchor more than 4 mi. off Breach Inlet. The unique submarine and her crew pulled away from the dock well after dark at about 7:00 P.M.

At about 8:45 P.M., on board the *Housatonic* an object was spotted in the water moving toward the *Housatonic*. At first the crew of the *Housatonic* did not recognize the object as a threat, but as the *H.L. Hunley* continued to move closer the alarm was sounded, and the crew began firing small arms at the unusual indistinct craft.

Reports from the crew of the *Housatonic* suggest that the *H.L. Hunley* moved rapidly up to the aft starboard quarter, attached a torpedo to

the lower hull of the *Housatonic*, backed away, and detonated the bomb. Following a large, somewhat muffled explosion (of sufficient size to violently shake the ship), the *Housatonic* sank within seconds.

The *H.L. Hunley* was the first submarine to sink a ship in combat. However, the tiny submarine and crew never returned—mysteriously lost following the explosion. Most contemporary accounts suggest that the submarine was sucked down with the *Housatonic*, although divers and salvors sent to investigate the *Housatonic* never found any sign of the *H.L. Hunley*. Most researchers and salvors had given up any hope of ever finding out what happened to the tiny vessel. Many concluded that it had been inadvertently salvaged or destroyed with the *Housatonic* in the years following the war.

The Search for the H.L. Hunley

In the summer of 1980, the National Underwater and Marine Agency (NUMA), led by its founder, best-selling author Clive Cussler, came to Charleston to attempt the first modern search for the *H.L Hunley*. Cussler had an acute interest in the *H.L. Hunley* mystery. Cussler felt that the *H.L. Hunley* could be found, basing his opinion on accounts from the crew of the *Housatonic*. Crew member testimony in hearings that followed the sinking of the *Housatonic* suggest that the submarine was seen moving away following the explosion. Cussler decided that a modern remote sensing survey might answer the questions as to the fate of the submarine. The search was concentrated in the vicinity between Breach Inlet and the approximate wreck site of the *Housatonic*. The search was based on the logical conclusion that the submarine had survived the attack on the *Housatonic* and was attempting to return to Breach Inlet when it sank. A marine magnetometer was used to search an area approximately 1 mi. wide and 3 mi. long which was parallel to the beach and across Breach Inlet. A second search was made on an area approximately 2 mi. wide and 2.5 mi. long near what is believed to be the wreck of the *Housatonic*. Four magnetic anomalies were identified in the offshore search area, and one was located in the inshore area. The four offshore targets were identified as the scattered remains of the *Housatonic*, while the inshore target lacked the magnetic intensity to be the *H.L. Hunley*.

Encouraged by the results of the 1980 project, NUMA returned in the summer of 1981 and continued the search, expanding the 1980 search area. A shore-based Motorola Mini-Ranger III Tracking System was employed as a positioning system to maintain and record survey track lines and to record the positions of magnetic anomalies. With the new tracking system, the search area was expanded to include a large rectangular area 3 mi. wide and 5 mi. long, extending from Breach Inlet well past the site of the *Housatonic*. A total of 19 magnetic anomalies was recorded by the survey. Only four targets were positively identified, due to weather conditions and the difficulties in exposing the objects creating the target signatures. Eight of the magnetic anomalies were discounted because of their small size. Although seven of the magnetic anomalies had the magnetic intensity to potentially be associated with the *H.L. Hunley*, they remained unidentified at the end of the 1981 season.

Due to other commitments, NUMA was unable to return the following summer season to identify the remaining target signatures. NUMA became involved in other investigations, and consequently the search for the *H.L. Hunley* was delayed until 1994.

The first two projects had been conducted after obtaining a search license from the Institute of Archaeology and Anthropology at the University of South Carolina (SCIAA), Columbia. Ralph Wilbanks was at that time Assistant State Underwater Archeologist with the Institute, a position he held for nine years until 1984. He was present during most of NUMA's 1980 and 1981 field operations as a liaison for SCIAA. Because of his association with the first two projects, Wilbanks was contacted in the early summer of 1994 by Walt Schob, the logistics coordinator for NUMA, about a return expedition to Charleston. NUMA wanted to try one more

time to locate the *H.L. Hunley*. There were seven magnetic anomalies that had been located during the 1981 search that had not been positively identified. Schob informed Wilbanks that the SCIAA and NUMA were going to join forces in the search. NUMA was to relocate the seven magnetic targets, and SCIAA was to provide all the equipment and expertise to positively identify the targets. Wilbanks was contacted because of his past association with the *H.L. Hunley* project and his experience with submerged cultural resource surveys for various companies including Tidewater Atlantic Research, Dolan Research, and Mid-Atlantic Technology. Wilbanks assured Walt Schob that he could provide the survey boat, a highly accurate positioning system, navigation program, marine magnetometer, side scan sonar, and sub-bottom profiler. Wilbanks then contacted Wes Hall of Mid-Atlantic Technology to assist for "a few days of survey." As it happened "a few days" turned into the "Nine Days of August," as it is now called by the crew. During this time, Wilbanks and Hall provided all the equipment and expertise to relocate NUMA's old targets and survey new large areas.

Unfortunately, during the nine-day period, SCIAA personnel and volunteers were successful in partially identifying only one magnetic anomaly. This target was identified as a possible wooden wreck, but not the *H.L. Hunley*. Of the remainder of the targets, three were dived and determined not to be the *H.L. Hunley*, although they were not identified. Two of the seven magnetic anomalies from the 1980-81 season were discounted by NUMA as not generating a large enough magnetic signature to be associated with the iron submarine. One of the 1980-81 targets was not relocated. Later, it was discovered that shrimpers had snagged an old boiler and dragged it completely out of the survey area.

During the nine-day survey conducted by NUMA and SCIAA in 1994, state-of-the-art marine survey equipment was used, including a Geometrics 866 Magnetometer with a marine tow fish, a Klein 500 kHz side scan sonar with 531T three-channel recorder, a 3.5 kHz Klein Sub-bottom profiler, Navstar Differential GPS positioning system, HYPACK Coastal Oceanographic's software, and an on-board 486 computer and helm monitor. Generally, side scan sonar was used only to check whether objects generating a magnetic anomaly protruded above the bottom surface. The sub-bottom profiler was used in the same manner but proved ineffective in penetrating a series of hard shell layers that characteristically are found in Charleston Harbor. The magnetometer was the most effective tool. The survey was conducted from a 25-foot survey boat equipped with a cabin.

Routinely, while SCIAA tried to identify the relocated targets from a separate boat, NUMA continued to resurvey old search areas and expand into new ones. Six of the seven original targets were relocated within three days. Search areas were widely separated. Each day, NUMA's boat began by positioning SCIAA's boat and crew on a magnetic anomaly for them to identify. Then, while SCIAA's crew attempted to identify the anomalies, NUMA's boat either relocated and positioned other targets or surveyed new areas. On the last day, in true eleventh-hour fashion, a magnetic anomaly of sufficient duration and intensity to be associated with the *H.L. Hunley* was found. SCIAA had already gone back to shore, so NUMA contacted them via radio and asked them to return to dive the target. They returned and met the NUMA boat at the newly acquired target. They attempted to dive on the magnetic anomaly but had a series of problems with divers and equipment that kept them from identifying the target. Mixed with problems and frustrations generated from the proceeding days, SCIAA suddenly packed up and left with little in the way of explanation. The Nine Days of August ended with little resolved and even more questions left unanswered than when the 1994 project began.

Partially because of the disappointment of not finding the *H.L. Hunley* and partially because of the disappointment with the poor performance by SCIAA, Clive Cussler asked Wes Hall and Ralph Wilbanks to continue to conduct a magnetometer search for the *H.L. Hunley* as their work schedules permitted. Wilbanks and Hall agreed and continued to survey under the direc-

tion of Clive Cussler. The continued survey was conducted in two- and three-day survey periods through the fall of 1994 and into the spring of 1995. There was loose verbal agreement between Cussler and the survey team. Generally, the process occurred thusly: a large, 20-mi.^{2} area was divided into survey blocks; at the completion of a survey block, Hall and Wilbanks would report their findings to Cussler, who would then suggest a new area on a chart; and Hall and Wilbanks, when time and weather permitted, would carefully survey that area.

By April 1995, the team of Wilbanks and Hall had surveyed 796.6 line mi. using 100-ft. line spacing covering more than 15-mi.^{2} of ocean bottom in a total of 29 days of surveying. Several new magnetic anomalies were discovered; however, only one had the duration and intensity to potentially be associated with the *H.L. Hunley*. During this period, SCIAA was fully aware of NUMA's continuing survey efforts, although not the findings or the areas that were surveyed.

In late April 1995, after many long, sometimes arduous days of surveying, Hall and Wilbanks recommended to Cussler that the single target had potential and should be identified before going any further. Cussler agreed and called Mark Newell at SCIAA who had been the NUMA's primary point of contact throughout the 1994 season. Cussler asked for permission to dive and excavate to identify "a couple" of targets that Hall and Wilbanks had found. Newell agreed, stating that there would be no problem. Weather delayed the original planned diving date for some days. When a new date was set, Wilbanks again checked with Cussler, and for a second time Cussler contacted Newell to confirm SCIAA's permission to identify the anomalies.

Thus, on May 3rd, with Harry Pecorelli III on board as a third diver, Hall and Wilbanks went to the site of the new possible *H.L. Hunley* target. The team pulled the magnetometer over the anomaly, relocated it, and put Pecorelli and Hall in the water to probe with a 4-ft.-long, 1/4-in. stainless steel rod. Within a short time, Hall and Pecorelli found an early 20th-century winch and drum protruding above the bottom. Consequently, the team packed up and considered what to do next.

This was a crossroad. All of the high-probability areas from the wreck of the *Housatonic* to Breach Inlet had been surveyed. There was no doubt that all the possible magnetic anomalies that could be associated with the *H.L. Hunley* had been found by the survey. Cussler had indicated that if the *H.L. Hunley* was not found, he wanted to keep looking indefinitely. Hall and Wilbanks were faced with the task of surveying far and away from the highest probability areas between the wreck site of the *Housatonic* and Breach Inlet. A brief conference between Wilbanks and Hall was held on the boat. It was decided that before continuing the magnetometer survey well out into the hinterlands, all of the original targets that NUMA had found in 1980-81 should be positively identified. These were the targets dived by SCIAA in the Nine Days of August. Only one had been positively identified as a wreck. SCIAA had not identified the others but discounted them as not being the *H.L. Hunley*. All of these anomalies were located well more than 3 mi. off South Carolina's coastline at Sullivans Island.

Four targets were of particular interest. One was chosen simply at random. The boat was moved to the site, and the team followed the standard practice of "magging up" the target, throwing a buoy, magging some more, and throwing more buoys until they had a tight triangle of the buoys marking the anomaly's location on the bottom. Next, Pecorelli manually probed the target to locate it. Hall and Wilbanks readied the pump and jet probe as well as a 4-in. hand-held induction dredge. Pecorelli located the object below the bottom surface in short order and started jetting away the overburden. After about 15 minutes, Hall entered the water to assist Pecorelli. A few more minutes later, Hall surfaced with an unmistakable expression of success. The *H.L. Hunley* had been found. Just to make sure, the team continued to expose what turned out to be the forward hatch, hatch coaming, ventilation box, and port side of the vessel down to the port dive plane. The exposed area was relatively small—only 3 ft. wide at the

base of the test hole. It was about 3:00 P.M. on 3 May 1995 that Hall, Wilbanks, and Pecorelli confirmed the final resting place of the *H.L. Hunley* and its crew of nine.

The *H.L. Hunley* was completely buried. A test hole, only large enough to expose diagnostic features of the submarine, was excavated. The portion and features of the vessel exposed were in relatively good condition. Hall and Wilbanks have extensive experience with Civil War-era and earlier wrecks with boilers. In every case the boiler was generally in good condition when compared to other mechanical features of the wreck. Since the *H.L. Hunley* was constructed from a boiler, it was not unexpected to find the submarine in a reasonable state of preservation. Probes were used to determine that the length was at least 34 ft. Every indication suggested that the *H.L. Hunley* was completely intact.

Following the discovery, and still a little bewildered, the team headed back to shore to contact Clive Cussler with the news. It was not until the morning of the 4th of May that Cussler was finally contacted. After some initial confusion, the implications began to sink in, and it was decided that video documentation of the wreck was needed. On the 7th of May, the team returned to the site, re-excavated the test hole, and shot underwater video and still photos of the exposed features. With the visual documentation in hand, Clive Cussler and NUMA held a long-awaited press conference to announce the discovery on 11 May 1995.

ACKNOWLEDGMENTS

The authors wish to thank Clive Cussler and NUMA for their support, dedication, and hard work in the discovery of the H.L. Hunley. Without Mr. Cussler's perseverance and financial backing through three field projects to search for the H.L. Hunley, the mystery of the submarine's disappearance would remain unsolved. Clive Cussler is a unique individual. He invests his personal money to locate historic wrecks and remands the information to the proper authorities. His intentions are not for treasure or financial gain but for public benefit and simply the adventure of discovery.

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The Search for the Wrecks of the USS *Eastport* and the *Edward F. Dix*

In June of 1865, the sidewheel steamer *Edward F. Dix* was making its way up the Red River in Louisiana with a cargo of material and supplies destined for Union troops stationed along the river. The war had just ended, and the *Dix* was one of several steamers sent to supply Union forces still occupying the areas around Natchitoches and Shreveport. Just below the town of Montgomery, the *Dix* struck the wreck of the ironclad gunboat *Eastport* which had been abandoned and scuttled a year earlier by the Union navy. The *Dix* apparently sank rapidly, coming to rest on top of the remains of the *Eastport*. The Red River region had been severely impacted by the Civil War, such that there were no local newspapers extant to even report the sinking of the *Dix*. It was, however, reported in the pages of northern newspapers. The Red River soon shifted, the wrecks of the *Dix* and the *Eastport* became covered with sand and silt, and the events of the loss of the *Dix* were largely forgotten. The *Eastport*, however, was another matter. It was a large naval warship whose loss had been widely reported. The fact that its remains rested somewhere near Montgomery was well known. Almost five years ago, a search for the remains of the *Eastport* and the *Edward F. Dix* was begun, stimulated in response to the development of navigation on the Red River Waterway by the Vicksburg District, U.S. Army Corps of Engineers.

Relatively little is known about the *Edward F. Dix*, but the history of the *Eastport* is fairly well documented. The *Eastport* was a sidewheel steamboat built at New Albany, Indiana, in 1852. It was a fairly large boat, measuring just over 230 ft. long, and was built specifically for trade along the larger western rivers (Way 1983:137). Until the outbreak of the Civil War, the consortium that owned the *Eastport* used it mainly to carry freight and passengers on the lower Tennessee, Cumberland, and Ohio rivers. The steamer also served on the Mississippi River, traveling several times to New Orleans with cotton as the main cargo (Birchett and Pearson 1995:10-11).

With the outbreak of the Civil War, the Union army and navy took control of the lower Ohio and upper Mississippi rivers, preventing boats from reaching southern ports. The Confederate government recognized the South's vulnerability from attack by rivers which would provide Union forces access into the heart of the Confederacy. Therefore, early in the war they began to develop fortifications along major rivers and to prepare boats for wartime use. One approach taken by the Confederacy was to convert river steamers into gunboats. The *Eastport* was one of the first vessels taken for this purpose. In 1861, one of the *Eastport*'s owners ran the steamer up the Tennessee River from Paducah, where it had been lying, and sold it to the Confederate government. General Leonidas Polk, commander of Confederate forces in western Tennessee, purchased the *Eastport* for just under $10,000 and took it to the river town of Cerro Gordo, Tennessee, where it would be converted into an ironclad gunboat (National Archives:1861).

In early February, the combined forces of General Ulysses S. Grant and Flag Officer Andrew H. Foote, commander of the federal naval forces on western waters, moved up the Tennessee River. After a heavy bombardment by Union gunboats, they took Fort Henry, the Confederate position guarding the river. The Tennessee River was now open, and three Union ships under the command of Lieutenant Samuel Phelps pushed up the river and captured the partially converted *Eastport* (Kitchens 1985:87-88). After its capture, the *Eastport* was towed down the Tennessee to Mound City, Illinois, to continue the conversion into an ironclad. The conversion, completed in August 1862, changed the *Eastport* into a strange-looking warship, now measuring 280 ft. long and 43 ft. wide, with a depth of just over

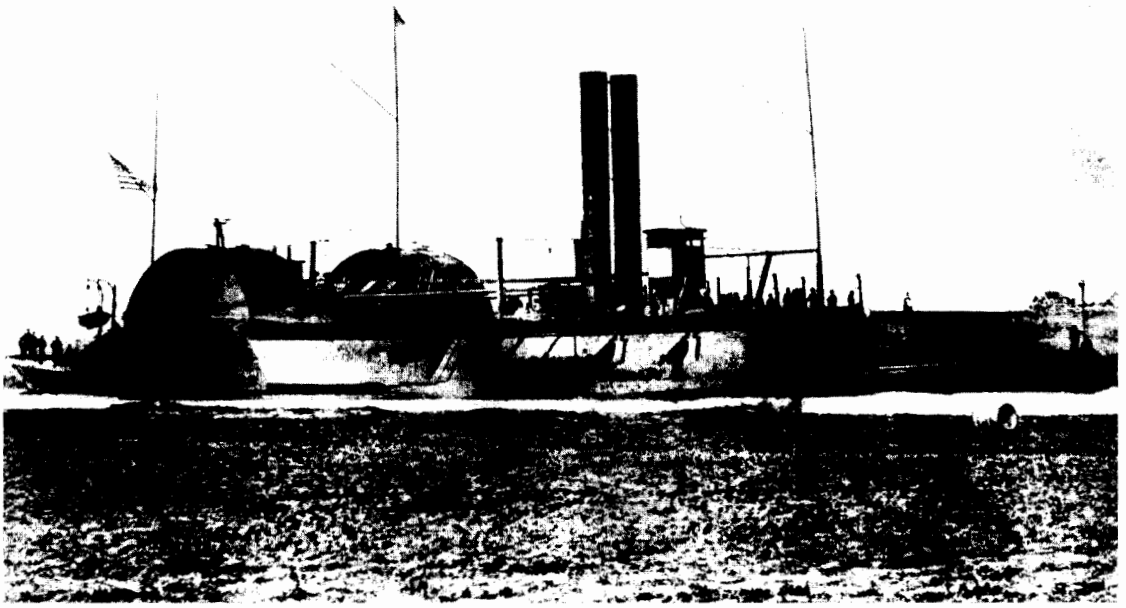

FIGURE 1. The USS Eastport, circa 1864. (Courtesy of the Naval History Division.)

6 ft. All of the *Eastport*'s superstructure was gone, and the stacks rose high above the casemated gun deck. The boat's paddlewheels were armored by wood and iron and appeared as two strange-looking projections. A boxlike pilot house rose above the gun deck (Figure 1). The *Eastport*'s low casemate was reportedly armored with 1-in.-thick iron plate, and when launched the warship was armed with 8 guns and a complement of 150 men (Gibbons 1989:14; Silverstone 1989:156).

The *Eastport* operated along the Mississippi River for the next two years, part of that time serving as the flagship of the Mississippi Squadron. The last major campaign involving the *Eastport*, and the Mississippi Squadron as a whole, was the Red River Campaign of the Spring of 1864. The Red River expedition was a combined army-navy venture designed to move up the Red River to gain control of the Trans-Mississippi region and cut off supplies flowing from Texas. The campaign was a complicated one, involving over 30,000 soldiers and 25 gunboats, transports, and supply vessels. The overall commander of the campaign was General Nathaniel P. Banks; the naval forces were commanded by Rear Admiral David D. Porter. The plan was for General Banks to march 22,000 men overland from New Orleans to the lower Red River where they would meet Porter's naval forces, plus 11,000 men under the command of General A. J. Smith (Flinn 1887:93; Smith and Castille 1986). The army forces would then march up the south side of the Red River to Alexandria, and eventually to Shreveport, while the naval vessels moved in support up the river. Opposing the Union forces were about 6,000 troops under the command of General Richard Taylor (Johnson 1958:347).

On 11 March, Porter's fleet began to move up Red River; by 16 March most of the naval forces had reached Alexandria, and Banks's land forces had begun to arrive. At Alexandria, the boats had a difficult time getting over the rapids located there because of low water. The *Eastport* ran aground, and it took two days to pull it off the rocks and above the rapids. Eventually, Porter had to leave some of his ships behind, proceeding upriver with 12 gunboats and 30 transports and supply vessels. Low water continued to plague the fleet, with boats constantly running aground.

The army forces under Banks were attacked by Taylor's troops near Mansfield on 8 April and then at Pleasant Hill, and were forced to retreat toward Alexandria. Hearing this, on 13 April Porter turned his gunboats around and headed downriver. By now, in addition to low water, the boats had to contend with "torpedoes" planted in the river by the Confederates, plus sniper fire from the riverbanks (Birchett and Pearson 1995). As the fleet moved downriver, the *Eastport* continually ran aground; there is speculation that it struck a Confederate mine, because the boat began to take on water and sank in shallow water. Through tremendous effort the gunboat was pumped out and lightened of much of its heavy gear, allowing the crew to float the stricken vessel down the river. Over the next several days the boat continued to ground, and eventually all the guns were taken off, as well as the ordnance. Several boats had to aid the *Eastport*, and these delays began to endanger the entire fleet because of the continually dropping river and harassment from Confederate snipers and batteries on shore. Finally, on 26 April, just below the town of Montgomery, Captain Phelps placed eight barrels aboard the grounded *Eastport* and blew it up, reportedly "utterly destroying her" (National Archives 1864).

The remains of the *Eastport* remained a navigation hazard for several years. In 1865 the *Edward F. Dix* struck the wreck and sank on top of it, and at least two other steamers are reported to have been damaged when they hit the wreck (Birchett and Pearson 1995). Soon, however, the Red River shifted, the wrecks of the *Eastport* and the *Dix* became covered with sand and silt, and the events and exact location of the wrecks were largely forgotten.

The search for the *Eastport* and the *Dix* consisted of several phases of investigation: (1) historical research, including a study of the changes in Red River courses in the presumed vicinity of the wreck; (2) an initial reconnaissance search using remote-sensing equipment; (3) the use of drilling equipment to confirm the presence of buried boat structure; and (4) detailed magnetometer and topographic mapping of the identified wreck area to provide a basis for proceeding with identification and evaluation of the wreckage for National Register eligibility.

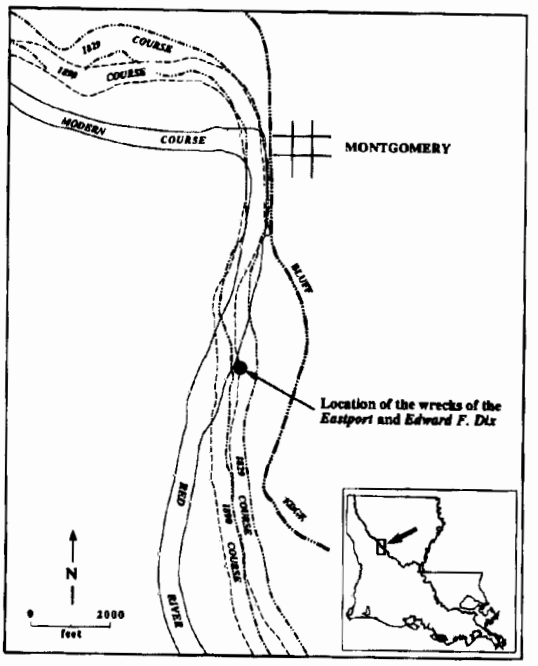

FIGURE 2. Reconstructed sequence of Red River course changes below Montgomery, Louisiana, and the locations of the wrecks of the USS Eastport and the Edward F. Dix.

The historical research concentrated on the *Eastport*, simply because so little was known about the *Edward F. Dix*. This research was particularly important in identifying the most probable location for the wreck. Detailed accounts found in the logbooks of the *Eastport* and other vessels in the Union fleet were specific in indicating that the *Eastport* was abandoned a mile or two below the town of Montgomery. Armed with this information, several 19th-century maps were used to reconstruct the sequence of Red River channel changes below Montgomery. This reconstruction revealed that the Red River has shifted westward in this area since at least the mid-19th century, signifying that the remains of the *Eastport* and the *Dix* lay east of the present course of the river (Figure 2). The search for the wrecks was concentrated along the east side of the Red River, in the floodplain below Montgomery.

Initially, a pedestrian survey of open fields in the selected area was attempted using a portable magnetometer (Geometric 856). Most of the area selected for survey, however, was wooded or swampy, and the pedestrian survey was soon abandoned in favor of an aerial survey. The aerial survey was flown along transects parallel to the river with the magnetometer sensor suspended 75 ft. below a helicopter. This technique revealed a very large magnetic anomaly on the east side of the river just over a mile below the town of Montgomery, in the area where the wreck was thought to be. Subsequently, a preliminary pedestrian magnetometer survey was conducted over this anomaly location, and a magnetic contour map was produced. This information was used to direct a drilling program to gather information on the depth, orientation, and composition of the source creating the anomaly.

The various borings conducted at the anomaly location encountered wood, coal, and metal at depths ranging from 38 to 51 ft. below the ground surface. Some inconsistencies were noted between the magnetic contour map and the results of the borings, and it was determined that some measurement errors had been made in establishing the grid for the pedestrian magnetometer survey. Another, more detailed and tightly controlled magnetometer survey was conducted over the site, and the resulting contour map was correlated with the results of the borings (Figure 3). Together these data strongly suggested the presence of buried boat wreckage, and the Vicksburg District decided to conduct excavations to determine if the wreckage was that of the *Eastport* and/or the *Edward F. Dix*.

The fieldwork for the identification and evaluation of the wrecks was conducted between April and June 1995 and was undertaken jointly by two cultural resources management firms, Coastal Environments, Inc., of Baton Rouge, and Panamerican Consultants, Inc., of Tuscaloosa, Alabama. The excavation was a complex undertaking, involving the removal of 35 ft. of overburden from an area approximately 300 ft. square. The excavation was conducted by Dillard Construction Company of Nashville, Tennessee, primarily using a 10-inch hydraulic dredge suspended from a drag line. The placement of the excavation was guided by the results of the magnetometer survey and the borings, but excavations could not be conducted too close to the bank of the Red River because of the danger of bank collapse. As shown in Figure 3, the excavation was positioned toward the eastern end of the magnetic signature. Because of the proximity to the river, a dry excavation was not feasible, and the excavation was allowed to fill with water as the digging proceeded.

Excavations with the hydraulic dredge were conducted to the depth of wreckage as indicated in the borings. In some areas, however, boat remains were struck by the hydraulic dredge at slightly higher elevations. Once this occurred, excavations with the hydraulic dredge were stopped, leaving a large, 30-ft.-deep pool filled with silt-laden water within which the dive team would work.

All diving was conducted from a small barge floating in the pool. Underwater visibility was zero due to suspended sediments in the water, and diving was conducted using surface-supplied air and surface-to-diver radio communication. The initial phase of underwater work involved

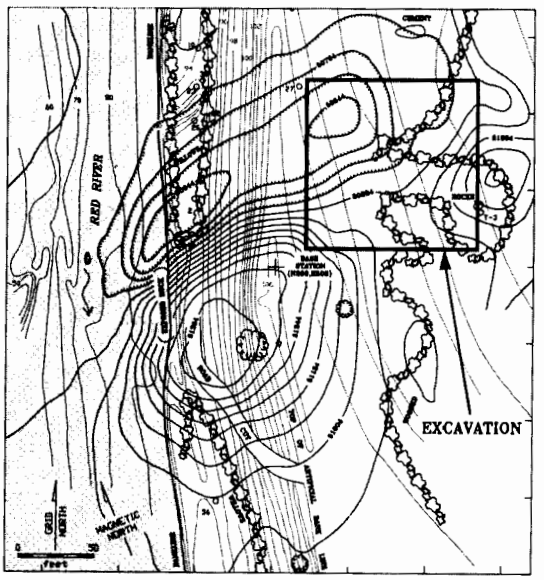

FIGURE 3. Topographic and magnetic contour map of the Eastport wreck site showing the location of the excavation.

systematic probing of the bottom of the pool with a hydraulic probe to locate and delineate buried remains. Probing provided a fairly good idea of the distribution and depth of wreckage, and enabled a distinction between wood and metal materials. The probing also suggested two major masses of wreckage, oriented almost at right angles to one another, and revealed that the shallowest wreckage lay near the center of the northern slope of the pool. Excavations were begun at this location using a 4-in.-diameter, hand-held venturi dredge. It was soon found that a strong water jet had to be used to break up the tenacious clays before they could be removed with the venturi, and all subsequent excavations were conducted using these two tools.

The initial excavations encountered an articulated, wooden boat structure at a water depth of 30 ft. Once this structure was encountered, excavations were expanded, and it was determined that the remains represented the port side of the hull and portions of the outboard guard of a relatively large vessel. Eventually, excavations were extended for over 30 ft. along the hull line and for about 20 ft. across the still-intact main deck (Figure 4). It was determined that the exposed portion of hull comprised an area near the bow. A considerable amount of structural information was obtained from this well-preserved and almost intact segment of vessel, although the actual bow of the vessel was impossible to examine because it extends into the northern wall of the excavated pool. Dimensions derived from these excavations and from the probings suggested that the wreck represented the remains of the steamer *Edward F. Dix*. Subsequently, the bow hatch of this wreck was discovered, and limited excavations were conducted in the hold. Structural information on the interior of the vessel was collected, and many pieces of cargo containers, mostly the remains of wooden boxes and barrels, were recovered. Stenciled lettering on some of these containers identified the contents and place of origin. All of the marked containers held foodstuffs, such as beans, flour, and bread, and many were shipped from the United States Quartermaster depot at Jeffersonville, Indiana. Several are marked with

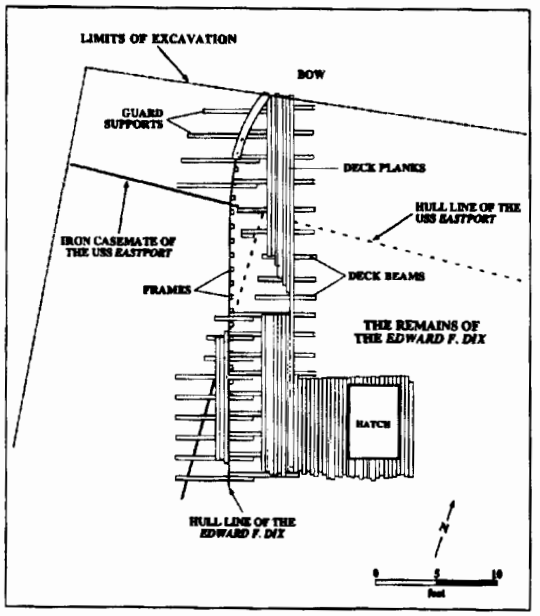

FIGURE 4. Features recorded during the excavation showing the remains of the Edward F. Dix lying on top of the USS Eastport.

the dates of April or May 1865. This material is seen as conclusive proof that the wreck is that of the *Edward F. Dix*, since it is known that the *Dix* was carrying government supplies up the Red River when it struck and sank on the remains of the *Eastport* in late May of 1865.

Probing along the port side of the *Dix* encountered a considerable expanse of vertical metal plating. This metal proved to be portions of the intact iron-clad casemate of the *Eastport*. Excavations here revealed the location where the armor of the *Eastport* penetrated the hull of the *Dix*, the cause of the latter's sinking in 1865. The remains of the *Eastport* are more deeply buried than those of the *Dix*, and removal of the greater amount of overburden proved to be extremely difficult. Ultimately, portions of two sides of armored casemate and a segment of the casemate's interior deck were exposed. It is believed that the section of casemate exposed represents the forward, portside corner of the *Eastport*'s main gun deck. The armor on the casemate consists of 1-in.-thick sheets of iron measuring 8 to 12 inches wide and 9 to 11 feet long. The timber backing and interior supports of

the armor plating were mostly absent; only charred fragments of timber remained, and the heavy timber decking was extensively burned. It is presumed that the burning occurred when the *Eastport* was "blown up" in 1864.

Additional probing and excavations revealed that the remains of the *Eastport* extend completely across the excavated pool, possibly even into Red River. The remains of the *Dix* seem to rest against the forward end of the *Eastport*'s casemate and on its bow. It is also apparent that a considerable portion of the *Eastport* is extant, at least from the main deck down to the bottom of the hull in the area excavated, and in very good condition, despite the efforts by the Union navy to destroy it. Similarly, it appears as if almost the entire hull, including the main deck, of the *Dix* is extant, although all of the vessel's superstructure has apparently been removed.

The objective of this study was to locate the *Eastport* and the *Edward F. Dix* and assess their condition. The straightforward, phased approach used here, involving careful historical research, reconstruction of historic river courses, remote-sensing survey, coring, and finally excavations, has proven extremely successful. Excavations were conducted only to the extent necessary to identify the two vessels and to make an assessment of their condition. No efforts are currently planned to conduct additional work on the two wrecks; in fact, the Corps of Engineers has filled the large hole at the site to prevent damage to the remains. The artifacts recovered from the two vessels are being conserved at Northwestern Louisiana State University in Natchitoches. Once the conservation is completed, a complete report on the search for and discovery of these two unique vessels will be prepared.

ACKNOWLEDGMENTS

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Scientific Visualization of Historic Shipwrecks

Introduction

In 1995, archaeological investigations were conducted at a multicomponent historic shipwreck along the Red River in northwestern Louisiana. This work was sponsored by the United States Army Engineer District, Vicksburg, and conducted by Coastal Environments, Inc. of Baton Rouge with the help of Panamerican Consultants, Inc. of Memphis. In support of this study, the U.S. Army Waterways Experiment Station (WES) at Vicksburg produced a video film that includes a graphic animation portraying the sinking, deposition, overburden excavation, and sampling of the two historic ships: the USS *Eastport* and *Edward F. Dix*. The *Eastport*, a Civil War Union ironclad, was the largest vessel in Admiral Porter's fleet of his failed Red River Campaign of 1864. The gunboat was scuttled and abandoned in the Red River channel during the Union retreat. The *Dix*, a sidewheel packet, wrecked atop the *Eastport's* remains a year later. Since then the Red River migrated to the west, and the wrecks were subsequently buried by silty alluvium.

The Search for the USS Eastport has been documented in a short (15-minute) video. The scientific visualization contains animation blended with actual investigation and excavation footage documenting the history and investigation of the shipwrecks. The animation portrays the final moments of the gunboat, the crash of the *Dix*, historic river migration with resulting burial of the boats, and underwater dredging to remove overburden alluvium. Written documentation of the investigation and findings can be found in the previous paper (in this volume) by Birchett and Pearson (1996) or their survey report (Birchett and Pearson 1995). The supporting engineering geology efforts of the project were noted in Albertson et al. (1989) and Albertson and Birchett (1990). In-depth description of geotechniques and analyses are reported in Albertson and Hennington (1992). Later, the testing for the USS *Eastport* was placed in a broader geoscience strategy for cultural resource management (Albertson 1995).

WES's present purpose is to preview the video to the Society of Historic Archaeology. In this written format, we will present the script of the video with selected snapshots or frames. The following textual presentation is intended to provide the reader with an understanding of the video. The actual video may be obtained by contacting the authors.

Script

The *Eastport's* fate is entangled in the river's history of navigational problems, i.e., sand bars, rapids, and sudden river stage changes. To solve these navigational obstacles, the U.S. Army Corps of Engineers constructed river works consisting of locks and dams, and revetments to assure 9-ft. navigation from the confluence with the Mississippi River to Shreveport, Louisiana. Along with the navigational mission, the Vicksburg District conducted cultural resource studies. Our purpose was to identify and evaluate the significance of the USS *Eastport*.

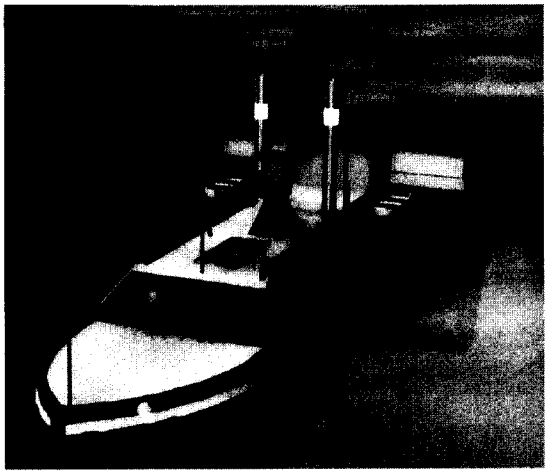

FIGURE 1. Video frame showing animation of USS Eastport traveling downstream shortly before abandonment in April 1863.

Historically, the Red River was the scene of the Union's ill-fated campaign to secure the western Confederacy. The military planned a joint army/navy assault up the Red River Valley in 1864. The army met resistance and was repelled at Pleasant Hill and Mansfield, Louisiana. Thus, the campaign was ordered to retreat down the valley. The navy fleet faced another foe, unexpected and unusually low water.

Photographs located during archival research show the Union fleet at Alexandria, Louisiana early in the Red River Campaign. The line drawing portrays the side view as 280 ft. long and the front view as 43 ft. wide. Shown in one of the few existing photographs of the ironclad, the refurbished sidewheeler with ironclad casemates was the largest vessel of Admiral Porter's fleet (Figure 1).

On 14 April 1864, the USS *Eastport* departed Grand Ecore to retreat with the rest of the fleet, but due to its exceedingly large size and draft of 6.6 ft., it continually dragged on sandbars and other obstructions. The retreat was further compounded by the harassment action of the Confederacy. On 15 April a torpedo (water mine) hit the *Eastport* and damaged its hull, resulting in its taking on some water. After repairs, the *Eastport* limped its way down the river.

On 25 April, it ran aground on a Miocene siltstone ledge in the vicinity of Montgomery. After attempts to pull the gunboat off the rocks, the Union forces were unable to free the Eastport. Finally, the decision was made to abandon the USS *Eastport*. It was off-loaded for 12 hours, with cannon and other valuables, even the kitchen stove, removed. Then, 3,000 pounds of black powder were loaded and detonated. Captain Phelps was quoted to say, "The vessel was completely destroyed, as perfect a wreck as ever was made by powder."

Almost a year after the *Eastport*'s abandonment, a civilian steam packet, the *Edward F. Dix*, was headed upstream to Shreveport. Under contract by the Army Quarter Master Corps, the *Dix* was carrying supplies to Cavalry regiments in the Indian Territory. Under high water, the wreckage of the *Eastport* was hidden to the approaching *Dix*. Thus, unexpectedly the *Dix* crashed into the wreckage and sank. The *St. Louis Democrat*'s newspaper river report read that: "Steamboat *E.F. Dix* was sunk in the Red River by striking the wreck of the gunboat *Eastport* and will be a total loss. ... The *Dix* lies across the wreck of the *Eastport*."

FIGURE 2. Video frame showing animation scene of hydraulic dredge at work removing sediment in the water-filled excavation pit. Note the artistic license depicting a portion of the Dix wreck revealed above the sediment. Diving conditions of zero visibility prevented the capturing of actual video footage of this scene.

Based on historic maps, vintage 1830, 1890, 1930, and 1979, the Red River migrated approximately 150 ft. to the west from 1865 to the present. As the river migrated, the shipwrecks were buried, first with lateral accretion sand deposits, then by vertical accretion silt and clay deposits. During the burial process, driftwood accumulated against the shipwrecks.

Infrared and black-and-white photographs were examined to define a survey area to search. Due to access problems and to reduce survey time, a helicopter was used to conduct an aerial geophysical survey. The aerial magnetometer sweeps produced a promising signal. Following up on the significant aerial magnetometer reading, a detailed pedestrian survey detected magnetic anomalies. Specifically, two dipolar anomalies with a strong high and low were detected. Such strong dipolar anomalies are characteristic of buried iron. The large magnetic difference indicated a large object, possibly the ironclad.

Borings were taken to verify the magnetometer anomalies. The first round of borings was done by auger but failed to detect any evidence of the boats in the upper 30 ft. Deeper fishtail borings revealed evidence of buried shipwrecks. Significant artifacts or clues included pieces of wood with saw marks, coal fragments, and iron. The shipwrecks were further defined using a cone penetrometer (CPT). Simply put, the CPT is a hydraulic spear which was stabbed into soil for hits or misses of the shipwrecks. Collectively, the borings and CPT hits allowed for delineation of the boats.

The excavation or dirt work consisted of removal of approximately 10 ft. of overburden by conventional dragline methods. Once ground water was encountered, hydraulic dredging was used to remove the saturated sand overburden. The hydraulic dredge worked like a large wet-vacuum cleaner. The pit was maintained full of water equal to the river level to balance pore pressures and assure stability of side slopes. When the dredge operator contacted historic wood, the outline of the steamboat *Dix* was noted (Figure 2). At this point, the project was transferred to the archaeological contractors (Coastal Environments, Inc. and Panamerican Consultants, Inc.)

The archeological phase of investigation consisted of diver archaeologists working down to 40-ft. depths in the water-filled pit containing silt-laden water with zero visibility. The techniques used to document the shipwreck materials included probing, attaching inflatable buoys to known features for mapping, and measurements done in an essentially "blind" work context. All this effort was extensively documented through records made by verbal communication from the divers to the support staff on the barge, via radio. Selected pieces of the shipwreck were sampled. Only enough artifacts to identify and evaluate for significance were brought to the surface, because the project was geared toward sampling the shipwrecks rather than entire recovery.

Following the archaeological investigation, the pit was backfilled. The cultural resource management decision was to preserve the shipwrecks in place. The recovered artifacts were taken to the conservation laboratory at Northwestern Louisiana State University. There the artifacts are undergoing state-of-the-art preservation techniques.

The search for the USS *Eastport* relied on a geoscience strategy which blended the many disciplines of history, archaeology, geophysics, geomorphology, and geotechnical engineering. The use of state-of-the-art animation allows the results of this research to come alive to the interested public. Thus, the heritage of the Red River and its place in American history are documented in an informative and entertaining medium.

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Sovereign Immunity and the Management of United States Naval Shipwrecks

Introduction

Over the last few years the Naval Historical Center has dealt with many policy issues involving U.S. Navy ship and aircraft wrecks and other government-owned wrecks that are entitled to sovereign immunity. This paper discusses the principle of sovereign immunity, addresses the extension of this principle to vessels of the former Government of the Confederacy, and clarifies the use of certain naval terms which are often misunderstood, such as "commission and decommission" and "stricken." However, I should add the disclaimer that I am an underwater archaeologist, not a lawyer. Therefore, the interpretations provided here are my own personal opinions based on my brief experience with these issues and do not necessarily represent those of the Department of the Navy.

The Department of the Navy retains custody of its ship and aircraft wrecks despite the passage of time and regardless of whether they are lost in U.S., foreign, or international waters. These wrecks are not abandoned but remain the property of the government until a specific formal action is taken to dispose of them and, thus, are immune from the law of salvage without authorization from the appropriate Navy authorities. This immunity is founded in long-existing, historic principles of maritime law. These properties are not considered "abandoned" in the Abandoned Shipwreck Act of 1987 (43 U.S.C. 2101-2106) and did not transfer to the states with adoption of the Act.

Navy custody of its wrecks is based on the property clause of the U.S. Constitution, Articles 95 and 96 of the United Nations Convention on the Law of the Sea (1982), and established principles of international maritime law. These laws establish that right, title, or ownership of federal property is not lost to the government due to the passage of time, or by neglect or inaction. Ultimately, abandonment of government-owned ships and aircraft occurs only through congressional action.

The principal law establishing ownership within United States' territorial waters is the property clause of the United States Constitution, Article IV, Section 3, Clause 2, which provides that only Congress and those persons authorized by Congress can legally dispose of United States property pursuant to the appropriate regulations.

The sovereign immunity provisions of admiralty law are well-established, founded in early principles of maritime law. In the United States, cases have supported this doctrine and established significant legal precedents in *Hatteras Inc. v. the USS Hatteras, her engines, etc. in rem and the United States of America, in personam* (1984 A.M.C. 1094, *aff'd*, 698 F.2d 1215, 5th Cir., [1982]) and *U.S. v. Richard Steinmetz* (763 F. Supp. 1293, 1294, [D.N.J. 1991]; *aff'd*, 973 F.2nd 212, [3d Cir. 1992] *cert. denied*, 113 S. Ct. 1578 [1993]), also known as the "Alabama bell case." The former is the most frequently cited legal precedent supporting the government's policy. It involved a claim against the wreck of the USS *Hatteras* and its associated artifacts by a private salvage company. The Court, citing numerous cases and well-established precedents, determined that neither the maritime nor the common law doctrine of abandonment was applicable, and stated, "It is well settled that title to property of the United States cannot be divested by negligence, delay, laches, mistake or unauthorized actions by subordinate officials" (1984 A.M.C. 1098).

Likewise, in *United States v. Steinmetz*, which considered ownership of the bell of the CSS *Alabama*, the wreck of the CSS *Alabama* was not considered abandoned by the mere passage of time. The court applied the doctrine of sovereign immunity to property formerly owned by the Government of the Confederacy and held that the United States rightfully succeeded to the property of the former. In so doing, the Court recognized that, in spite of the rhetoric used during the Civil War to describe Confederate

raiders as pirates and the citizens of the rebelling states as traitors, the Union government had in its prosecution of the war dealt with the Confederacy as a sovereign nation, although an adversarial one (Poser and Varon 1995). This case also interpreted United States' ownership as unaffected by the passage of time or by failing to salvage the property.

Sovereign rights on the high seas are affirmed in Articles 95 and 96 of *The Law of the Sea Convention* (1982). These provide a legal basis for the sovereign immunity of sunken warships and government vessels on the high seas. Article 95 states, "Warships on the high seas have complete immunity from the jurisdiction of any State other than the flag States," and Article 96 continues, "Ships owned or operated by a State and used only on government noncommercial service shall, on the high seas have complete immunity from the jurisdiction of any State other than the flag State."

At present, there is no multilateral treaty governing the treatment of sunken warships and military aircraft. In the absence of such a treaty, the governments of France, Germany, Japan, The Russian Federation, The United Kingdom, Northern Ireland, and the United States issued a joint statement in September 1995 to be used as guidance when dealing with issues related to sunken state vessels and aircraft (Department of State [DOS] 1995). States with ownership of title are referred to as the "flag states," while those States with foreign-owned sunken vessels located in their waters and subject to their jurisdiction are identified as the "coastal states." The six nations acknowledge the property rights of the flag states over their vessels, that the sunken vessels under their jurisdiction are "historical artifacts of special importance and entitled to special protections," and acknowledge that "these ships and aircraft may be the last resting places of many sailors and airmen who died in the service of their nations." It is accepted that disturbance of a ship or aircraft wreck site is a destructive process and that these sites hold a special significance for scientific discovery. Thus, any proposed recovery or excavation must provide a research design, site surveys, minimal site disturbance consistent with research requirements, adequate financial resources, preparation of professional reports, and a comprehensive conservation plan.

A coastal state does not acquire ownership of sunken warships even though the wrecks are "located on or embedded in land or the seabed over which it exercises sovereignty or jurisdiction." The coastal state does control access to those vessels and their associated artifacts that lie within their territorial or contiguous zones. The contiguous zone can extend a maximum of 24 miles beyond the territorial sea. The 1995 joint statement allows that most governments will honor requests from the sovereign states to allow visits to their sunken vessels and aircraft. Seaward of the contiguous zone, access to the submerged state vessels is subject only to flag state control.

The joint statement provides that salvage, or attempted salvage, of state vessels and their associated artifacts is prohibited, wherever located, without the express permission of the sovereign flag state. The only exception is "opposing belligerents" during the period of their conflict. In addition, vessels and aircraft containing human remains deserve special respect as war graves and are not to be disturbed; the flag state may use all lawful means to prevent disturbance or salvage.

For United States' wrecks within foreign territorial waters, this statement implies that protection or scientific investigation depends upon cooperation between the flag and coastal states. Management of the CSS *Alabama* is one example of such international cooperation. The CSS *Alabama* is the property of the United States, but the excavation of the site is carried out under the laws of the Republic of France (Dudley 1995).

Confederate Property and the Doctrine of Succession

The CSS *Alabama* and approximately 320 other Confederate naval vessels represent a special category of shipwrecks entitled to sovereign immunity. Confederate naval vessels are cur-

rently placed under the Administrator of the General Services Administration (GSA), a responsibility the GSA inherited from the Treasury Department. A Joint Resolution of Congress, signed 21 June 1870, enabled the Secretary of the Treasury to collect, "any moneys, dues, and other interests lately in the possession of or due to the so-called Confederate States, or their agents, and now belonging to the United States..." (Forty-first Congress, Session II, Res. 75, 1870). On 2 June 1965, this was incorporated into 40 U.S.C. 310 so that the Administrator of GSA is responsible for these sunken vessels.

United States' ownership of Confederate property is also supported by legal precedent. The United States Supreme Court developed the doctrine of succession concerning Confederate property in an 1872 Supreme Court decision, *United States, Lyon, et al v. Huckabee* (83 U.S. 414 1872). In 1862, C. C. Huckabee, with three other persons, constructed an iron works in Alabama which they later sold to the Government of the Confederacy. The factory was captured by Union forces in March 1865, and in 1866 it was sold to Francis Lyon. Huckabee made a claim to regain the iron works, alleging that he and his partners were forced to sell the factory to the Confederacy. The court ruled that

> Power to acquire territory either by conquest or treaty is vested by the Constitution in the United States. Complete conquest, by whatever mode it may be perfected, carries with it all the rights of the former government, or in other words, the conqueror, by the completion of his conquest, becomes the absolute owner of the property conquered from the enemy, nation, or state (83 U.S. 414 1872:435).

This opinion was upheld in a number of subsequent cases. In *Williams v. Bruffy* (96 U.S. 176 1877:188), the Court made a similar statement: "...the Confederacy failed and in its failure its pretensions were dissipated, its armies scattered, and the whole fabric of its government broken in pieces. The very property it had amassed passed to the nation."

Under the powers of Congress and the resolution mentioned above, the victor went about divesting itself of captured Confederate property and disposing of the wreckage of war. Prior to the 1870 resolution, the Department of the Navy took responsibility for removing and salvaging many Confederate naval vessels, blockade runners, and harbor obstructions in southern ports such as that of Charleston, South Carolina (United States Government Printing Office [USGPO] 1903:355). The principle of succession was applied to the wrecks of Confederate warships sunk during hostilities with *Leathers v Salvor Wrecking etc., Co.* (15 Fed. Cas. 116, No. 8164 [S.D. Miss. 1875]). This case considered the wreck of the steamboat *Natchez*, a vessel pressed into Confederate service and burned and sunk during that service. In this case, the Confederate Government compensated the owner, Leathers, for his loss. The Court stated that, because the owner had been fully compensated for his loss by the Government of the Confederacy, "... whatever was left of her hull and machinery belonged to that government, and, by consequence, became the property of the United States" (15 Fed. Cas. 116, No. 8164 1875:116). As was mentioned by the plaintiff in *Steinmetz v United States*, the Court did not rule on the issue of whether the wreckers acting under the full authority of the federal government would have been sufficient justification by itself for the transfer of title.

In a similar vein, the United States was recognized as the successor to the Confederate government under international law. In a case concerning the Confederate warship *Rappahannock, The Beactrice otherwise The Rappahannock* (36 L.J. Adm. 9 1866), the British Admiralty Court recognized U.S. ownership of title, but subject to the prior owner's lien upon the vessel for the remainder of its purchase price. In another case, the former USS *Harriet Lane*, which was captured by Confederate forces and later sold, was returned to United States Navy custody after negotiations with the government of Spain (Trexler 1931:109-123).

Title Lost, Transferred, or Divested

Government title can be lost, transferred, or given up. Under the rules of international law, government vessels and aircraft can be lost by capture during battle (before sinking), such as the Russian cruiser *Admiral Nakhimov* which sank one hour after being captured on 28 May 1905 by the Japanese Imperial Navy (29 Japanese Ann. Int'l L. 1986:185-187; Strati 1995:238). A second method is by international agreement or treaty, such as the Treaty of Peace with Japan, signed 8 September 1951, which provides in Chapter V, Article 14(a)2(I) that each of the Allied Powers "shall have the right to seize, retain, liquidate or otherwise dispose of all property, rights and interests" of Japan, "which on the first coming into force of the present Treaty were subject to its [the Allied Powers] jurisdiction" (DOS 1951). Another example is the United States' ships sunk during the Atomic Bomb test at Bikini and Kwajalein Atoll, the title to which was transferred to the Government of the Marshall Islands by international agreement in accord with Article 177 of the Compact of Free Association. Thirdly, an express act of abandonment, gift, or sale by the United States Congress can divest the government's title to property, such as was done with the War of 1812 ships *Hamilton* and *Scourge*. The procedures for abandonment of sunken United States warships and aircraft located outside the territory of the United States are set forth in 40 U.S.C. & 512 (1987 supplement V) and its implementing regulation 41 CFR Part 101-45 (1994).

In the case of transferring the *Hamilton* and the *Scourge* from the United States to the Royal Ontario Museum, the Secretary of the Navy W. Graham Claytor, Jr., used his authority under U.S. law (10 U.S.C. 7308) and the acquiescence of the United States Congress, as required by law, to donate the wrecks, provided that there was respectful treatment of any human remains that might be recovered. It was stipulated that the crew members' remains would be returned to the Navy and sent to the Armed Forces Institute of Pathology (Claytor 1979).

Terminology

The term "capture" indicates those cases in which the act of taking control immediately transfers the full legal ownership of that which is taken. By the act of capture, a vessel in the military service of an adversary becomes the property of the captor's government and title is immediately vested in the captor's government. It is unnecessary to send a captured public vessel into port for adjudication or to comply with the various formalities required when the case has to be prepared for a prize court (USGPO 1924:36; Smith 1959:126-127; Colombos 1967:801). Thus, a British gunboat captured during the War of 1812 could be used immediately in the United States fleet and, if sunk, would belong to the United States. Examples of acquisition by capture can be found in most naval wars in which the United States has been involved, including the American Revolution, the War of 1812, and the Civil War. Over the course of the Civil War, both the Confederacy and the Union captured and then deployed their respective prizes as warships. As a result of World War I and World War II, the United States received a number of German and Japanese naval vessels as war prizes.

Ships subject to capture during a conflict can be placed into four categories: (1) enemy warships, troopships, and other enemy vessels employed in the public service; (2) all ships, enemy or neutral, which take a direct part in hostilities on the enemy side; (3) "fleet auxiliaries," enemy or neutral, such as colliers and similar vessels, wholly engaged at the time in the direct service of the enemy or neutral, which take a direct part in hostilities on the enemy side; (4) "fleet auxiliaries," enemy or neutral, such as colliers and similar vessels, wholly engaged at the time in the direct service of the enemy armed forces (Smith 1959:126-127).

The terms "commissioned," "decommissioned," and "stricken" often create confusion but in fact have no relevance to title. Commissioning and decommissioning a ship refers only to making a ship a command or terminating that

command. A commission is the fixed period of time in which a warship, with its full complement of officers and men, is allocated to particular duties anywhere in the world. After a ship is commissioned, she continues in that state until she returns to her home, or other port, to pay off, at which time her company is dispersed. At the end of a commission, a ship may recommission immediately with a new complement, may remain temporarily out of commission during a major dockyard refit, or if at the end of her active life may be laid up in reserve, or pending sale, or breaking up (Kemp 1976:118). A ship without a commission still remains government property under jurisdiction of the Navy, but it is simply no longer a command. For obvious reasons, Navy small craft, such as yard vessels, never receive a commission.

The term "stricken" frequently appears in Navy records in reference to the disposition of a ship or aircraft. Some individuals have inferred abandonment from the use of this term. Although a ship may "strike its colors in battle" to signify its surrender, the term "stricken" as in the Navy records refers to removing the aircraft or ship from active duty status. Logically, the last status reported for an aircraft or ship that is lost or missing is "stricken." A 1945 Navy memorandum lists six conditions under which "stricken" can be written into the record of an aircraft: lost or missing, damaged beyond economical repair, salvaged for essential equipment or parts, disposed of outside the United States pursuant to the policies of the Integrated Aeronautic Program, disposed of outside the United States as directed by the Commanding Naval Officer, or transferred from Navy custody (Gates 1945). More recently "stricken" is defined in OPNAV INSTRUCTION 5442.8 of 18 April 1995 as "The official action that removes an aircraft from the inventory and commensurate reporting responsibilities" (Chief of Naval Operations 1995:7). An aircraft or a vessel that is listed as "stricken" can, at a later date, be put back into active service.

There are several important reasons that continued United States' government ownership of its sunken warships and aircraft is important. These are listed in the Navy's policy fact sheet *Sunken Naval Vessels & Naval Aircraft Wreck Sites* (Naval Historical Center 1995) and include compliance with federal preservation laws, protection of war graves, dangers to the public from ordnance and explosives, and the recognition that these wrecks represent valuable historic properties that are in the public trust.

Human Remains

Where human remains are concerned, United States Navy policy has been clear for some time:

> salvors should not presume that sunken U.S. warships have been abandoned by the United States. Permission must be granted from the United States to salvage sunken U.S. warships, and as a matter of policy, the United States Government does not grant such permission with respect to ships that contain the remains of deceased service men... (DOS 1986; UNESCO 1994).

This is not a new policy, as the Navy's involvement with the USS *Tecumseh* illustrates. *Tecumseh* was lost in 1864 during the battle of Mobile Bay with 93 men on board. In 1873, *Tecumseh* was sold for salvage by the Department of the Treasury to James E. Slaughter of Mobile for $50 (West 1995:27). After the purchase, Slaughter let it be known that he intended to use explosives to blast the wreck into salvageable pieces to recover iron and possibly the ship's safe. In 1876, the relatives of the men lost on the *Tecumseh* petitioned Congress to stop this salvage. Congress quickly passed Joint Resolution No. 23 on August 15, 1876, directing the Secretary of the Treasury to return the $50, with 6 percent interest, to Slaughter and empowered the Secretary of the Navy to assume control and protection of the *Tecumseh*. Congress stipulated that any salvage must provide for the removal and proper burial of the remains of the crew. Another example from the Civil War concerns the remains of the crew of the USS *Tulip*. A boiler explosion sent the *Tulip* and most of her crew to the bottom of the Chesapeake Bay. Only a few bodies were recovered, and these were buried on shore within site of the disaster. Cor-

respondence in Navy files dating to at least three periods in 1929, 1951, and 1967 show continued Navy concern over the remains of both the crew members buried ashore and those carried down with the ship (Ellicott 1929; Heffernan 1951; [Eller] 1969). The Navy refused a 1967 request from a diving club for salvage rights to the *Tulip,* primarily on the basis of "nondesecration of crew members entombed in sunken naval vessels." Other considerations were ordnance still on board and damage to the historic and archaeological integrity of the site.

Conclusions

The refusal of permission to the salvage of the *Tulip* shows that as early as 1967, the Navy considered such wrecks to be war graves and of historic significance. The Navy staff involved were from the Naval Historical Center and the Navy JAG, Admiralty Division. The individuals in these Navy branches foresaw the importance of sunken ships and aircraft for interpreting the history of the United States and its Navy. Today, the Navy recognizes that it has under its jurisdiction some of the most significant historical properties within the United States. Many, if not all, of the Navy's sunken warships are eligible for listing on the National Register of Historic Places, for these are reminders of the actions and events that forged the nation. These sunken vessels and aircraft also represent the courageous actions of those Americans who have earned a permanent place in United States history and are the final resting place for many who sacrificed their lives for their country. Sovereign immune status is a key concept and doctrine for all those who seek to protect a nation's naval heritage, whether U.S. or foreign, from willful destruction and wrongful taking. It is also the *raison d' etre* for the Navy's policy concerning its ship and aircraft wrecks.

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The Nautical Archaeology of Lake Champlain: Research from 1980 to 1995

Introduction

Lake Champlain, a freshwater body located between the states of New York and Vermont, is among the most historically significant waterways in the interior of North America. Relatively modest in its dimensions when compared with the Great Lakes to the west, the lake measures 120 mi. (193 km) in length from its southern headwaters at Whitehall, New York, to its northern outlet into Quebec's Richelieu River, while its maximum breadth, at Burlington, Vermont, is a span of 12 mi. (19.3 km). Champlain's significance can be attributed to its location between the upper Hudson River and Canada's St. Lawrence River, for in the era before railroads and highways these waterways together served as the prime military and commercial transportation route between New York and Canada.

The written history of Lake Champlain begins only in 1609, when French explorer Samuel de Champlain entered from the north by canoe, escorted by Algonquins on a raiding expedition against their Iroquois foes. For the next 200 years of the lake's history, the region was a sparsely inhabited battleground between competing nations of Native Americans and Europeans. The decades between 1689 and 1760 saw four major wars between France and England; during the fourth contest, the French and Indian War, British forces seized the Champlain Valley from the French in 1759 and then conquered all of Canada in 1760.

Peace was short-lived. In 1775 dissatisfied colonists rose up in rebellion against their rulers in England, and during the following eight years of the American Revolution the lake served as an invasion route. Three decades after the Revolution, the third and final major war to affect Champlain Valley, the War of 1812, again saw the United States battling Britain on the shores and waters of the lake. Each of these wars saw the construction of opposing flotillas of naval vessels, flotillas that ultimately decided the outcome of decisive military campaigns.

The close of the Revolution in 1783 brought a wave of settlers into the region, the majority of them from New York and the New England states. The opening of the Champlain Canal in 1823 linked the Hudson River to the lake by a navigable waterway, providing entrepreneurs with direct access to outside markets and signaling the beginning of an era of growth and prosperity. For the next 50 years Lake Champlain served as the principal transportation route for regional commerce, and sailing ships, steamers, canal boats, and ferries all plied the lake's waters in great numbers.

The railroad came to the Champlain Valley in the late 1840s, and by the final quarter of the 19th century overtook watercraft as the dominant form of transportation. Even as Lake Champlain's merchant fleet passed into history, a new class of vessel appeared on the scene: pleasure craft propelled by sails or by the newly invented gasoline-powered internal combustion engine. The 20th century can be characterized as the century of recreational boating on the lake.

The four major eras of maritime activity, the prehistoric, military, commercial, and recreational eras, saw Lake Champlain being employed for different purposes, and with markedly different types of watercraft. Fortunately for archaeologists, the cold, dark waters contain scores of wrecks from each era, vessels lost due to fire, collisions, storms, battles, and the effects of rot on oak and pine timbers. The lake is a vast museum of inland watercraft design and construction, and of the waterborne military, commercial, and recreational activities of the past four centuries.

The preserving qualities of the lake and its diverse history have long been recognized by local inhabitants, with the result that numerous wrecks have been salvaged by being pulled onto the shore. The salvagers were often well intentioned, but with few exceptions the wooden hulls they raised soon deteriorated beyond recognition.

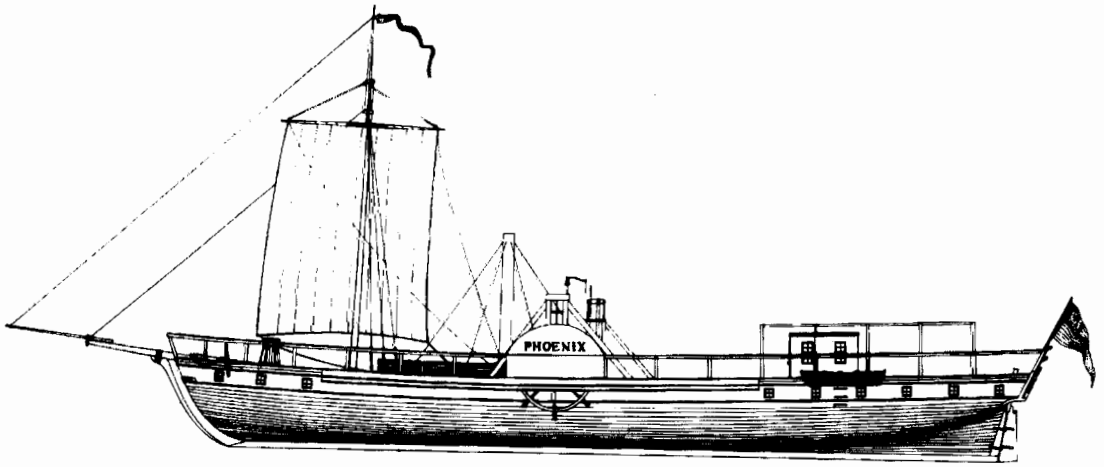

FIGURE 1. A reconstructed view of the Lake Champlain steamer *Phoenix* (1815-1819).

One of the rare successful salvage operations took place in 1935 when Colonel Lorenzo Hagglund recovered the intact hull, guns, and fittings of the Revolutionary War gunboat *Philadelphia*. Hagglund kept them together as a collection, out of the weather, and upon his death in 1960 donated the warship to the Smithsonian Institution (Lundeberg 1995).

While the lake's potential as an archaeological laboratory has long been recognized, no organization existed to locate and conduct research on its shipwrecks until 1980. The catalyst for the formation of such an organization appeared in September of 1978, when sport divers located the charred hull of the *Phoenix*, the second steamer to operate on the waters of Lake Champlain (Figure 1). *Phoenix* was built in 1815 and sank after catching fire and burning to the waterline in 1819; to the best of our knowledge it is the earliest example of a steam-propelled vessel yet discovered. The importance of this site encouraged regional historians, archaeologists, and divers to join forces and found the nonprofit Champlain Maritime Society (CMS) in 1980.

The Society's inaugural project, begun in August 1980, was a comprehensive study of the *Phoenix*, with the goal of preparing a plan of the wreck and a report on the history of the steamer (Davison 1981). The *Phoenix* investigation set the pattern for subsequent work on Champlain's shipwrecks, with hulls being recorded in detail on the bottom of the lake with minimal disturbance. Between 1980 and 1987 members of the CMS, working in concert with state and federal preservation officials, conducted numerous surveys and shipwreck studies over the length and breadth of the lake (Cohn 1984; Fischer 1985; Crisman 1986; Crisman and Cohn 1994).

The need for a permanent facility for lake research and education became increasingly apparent by the mid 1980s and led to the formation of the Lake Champlain Maritime Museum (LCMM) at Basin Harbor, Vermont, in 1986 (the LCMM and the CMS merged in 1987). Since its formation, the maritime museum has been at the forefront of lake research, sponsoring an ongoing program of electronic and diver surveys, preliminary shipwreck recording, and full-scale excavation and recording operations that involve the recovery and conservation of artifacts. The pace of research picked up in 1991 when the Institute of Nautical Archaeology (INA) at Texas A&M University and the University of Vermont joined the LCMM in sponsoring annual archaeological field schools on wrecks beneath the lake. Since 1991 a dozen master's theses or doctoral dissertations have been written, or are being prepared, on lake surveys and excavations.

Research on Lake Champlain Wrecks

In the decade and a half of archaeological research since 1980, examples of nearly every type of craft ever employed on the lake have been found. Approximately 10 percent of the lake bottom has been surveyed by divers, sonars, and magnetometers; the remains of over 100 ships, boats, and barges have been located; and over half of these wrecks have undergone preliminary inspection with basic documentation. Twelve wrecks have undergone intensive study, with detailed recording of their design and construction, and limited or complete excavation to expose hull features and artifacts. This work has begun to reveal patterns in ship design, construction, and maritime activity on the lake. The following is a summary of the work between 1980 and 1995, highlighting some of the more significant discoveries.

The remains of three vessels from the French and Indian War naval campaigns of 1759 and 1760 were discovered during a CMS survey of the waters below Fort Ticonderoga in 1983. One of the finds, the British 16-gun sloop *Boscawen*, was excavated in 1984 and 1985 by the CMS and the Fort Ticonderoga Museum. *Boscawen* was abandoned after the war, yet the surviving 70-ft.-long (21.33 m) hull contained a surprising number of artifacts, including munitions and weapons (Carter 1995); a variety of entrenching tools; personal effects such as shoes, buttons, coins, eating utensils, glass, ceramics, and wooden containers (Erwin 1994); and a substantial number of rigging items, including blocks, rope, dead eyes, parrell trucks, and iron hooks and thimbles. The presence of many still-useful items of equipment in the bilges of the sloop suggests that the post-war British garrison at Ticonderoga had little regard for government property. The hull of the *Boscawen* proved to be solidly built of treenail-fastened white oak and white pine timbers, but the workmanship was rough, reflecting the hasty construction of the vessel in 1759 (Krueger et al. 1985; Crisman 1986, 1988).

Perhaps the most significant Revolutionary War-era discovery made in recent years occurred in 1983 when a CMS-sponsored survey of the lake below the fortress of Mount Independence yielded ordnance and other materials dating to 1776-1777. The threat of damage by looters led

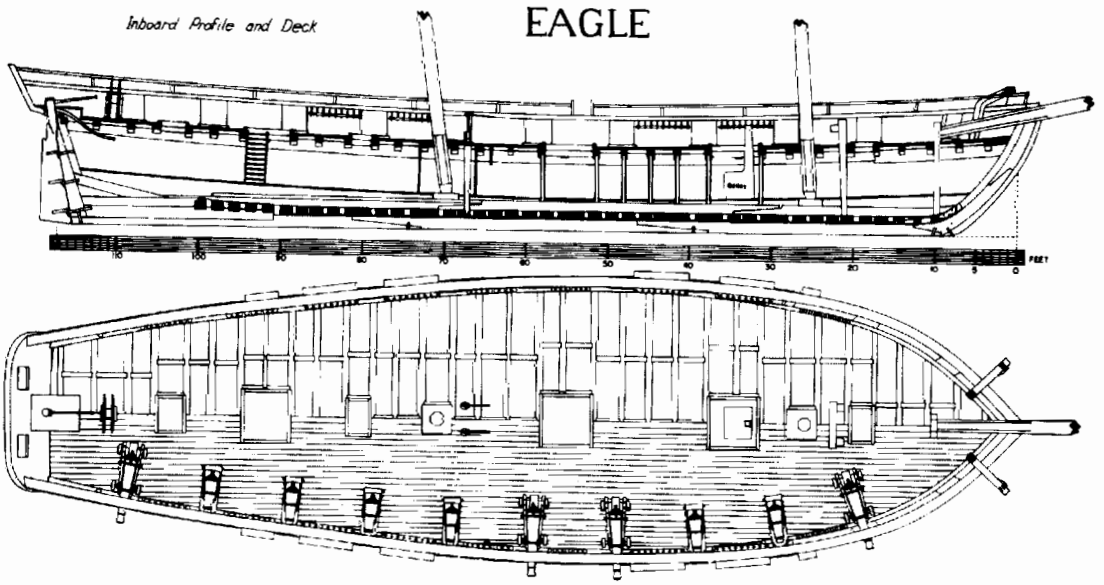

FIGURE 2. The reconstructed interior profile of the U.S. Navy brig *Eagle*, built in 19 days during the War of 1812.

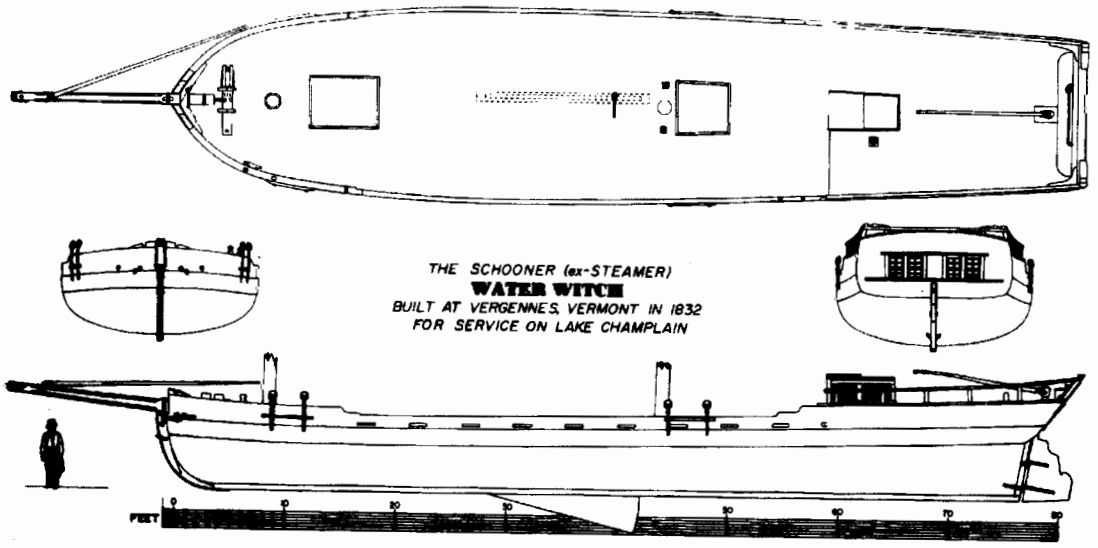

FIGURE 3. The Lake Champlain schooner Water Witch, drawn from measurements of the existing hull.

the State of Vermont to authorize a large-scale survey operation at Mount Independence in 1993 and 1994. The joint LCMM-INA operation resulted in the recovery and conservation of a 12-pounder iron cannon; round, bar, grape, swivel and musket shot; 8-in. mortar bombs; bayonets; a complete musket; and entrenching tools, shoes, bottles, and other paraphernalia, much of which was probably tossed in the water during the hasty British retreat from the upper lake in the fall of 1777. Also located and studied during the 1983 and 1993 surveys were 21 timber-and-stone caissons used to anchor a floating bridge between Mount Independence and Fort Ticonderoga in 1777 (Crisman 1993, 1995b; Cohn 1995).

The third and final major conflict to engulf the Champlain Valley, the War of 1812, left archaeological evidence in the form of warship hulls abandoned near the head of the lake at Whitehall, New York. A CMS study of the 1812 squadron began in 1981 by recording the wreck of the 17-gun schooner *Ticonderoga*, which had been raised from the lake in 1958 and placed on display behind a local museum. *Ticonderoga* was laid down as a commercial steamer in early 1814, but was commandeered by the U.S. Navy and converted over to a sailing warship before launching (Crisman 1983). A survey near Whitehall in 1981 resulted in the discovery of three more 1812-era hulls: the U.S. Navy 20-gun brig *Eagle*, the captured Royal Navy 16-gun brig *Linnet*, and a U.S. Navy 2-gun gunboat. The *Eagle*'s hull was recorded in 1982 and 1983, permitting a complete reconstruction of the vessel on paper, and revealing some of the shortcuts used by Navy builders to complete the 120-ft.-long (36.5 m) warship in just 19 days (Figure 2) (Crisman 1987, 1991b; Cassavoy and Crisman 1988). During the summer of 1995, a Texas A&M-University of Vermont field school completed the archaeological study of the *Linnet* and U.S. Navy gunboat hulls (Crisman 1995a).

By far the greatest number of wrecks found in the past 15 years date to the 19th century heyday of commercial navigation on Lake Champlain. The wreck of the lake's second steamboat, the *Phoenix*, mentioned above, remains one of the earliest and more significant finds; despite the charred condition of the hull, much has been learned about early steamer design and construction practices and about everyday life aboard the vessel (Hadden 1995). The remains of nine more of the lake's sidewheel steamers have been located and inspected.

Between 1993 and 1994, one of the later steamships wrecks, the *Champlain II*, was intensively recorded during a Texas A&M-University of Vermont field school. This steamer was built in 1868 to serve as a ferry for rail cars, and sank in July of 1875 when a morphine-addicted pilot ran *Champlain II* onto a mountainside and broke the hull in two. Documentation revealed innovations in lake steamer assembly practices during the later 19th century, including a relatively shallow keel, multiple internal stringers to provide longitudinal reinforcement, and wider frame spacing at the ends of the hull to resist hogging (Baldwin 1994; Cohn et al. 1994).

The well-preserved hulls of two lake sailers, the lake-bound merchant vessels that transported cargoes between ports along the lake's Vermont and New York shores, have been found and studied in recent years. The first of these is the schooner *Water Witch*, constructed as a small steamer in 1832, converted to sail in 1836, and sunk in 1866 with a load of iron ore. The wreck was located in 86 ft. (26.2 m) of water by Canadian divers in 1977, and studied by the LCMM and INA in 1990 and 1993. *Water Witch* was found to be nearly intact, missing only the mainmast and a few spars; during the two-week 1993 study the lines of the schooner were taken, revealing a graceful but shallow-hulled craft built along the lines of a sailer rather than a steamer (Figure 3) (Crisman and Cohn 1993a; Crisman 1993). A schooner called *Sarah Ellen*, built in 1849 and sunk in 1860, was discovered beneath 300 ft. (91.44 m) of water in the central lake in 1989. Remotely-operated vehicle surveys of the wreck in 1989 and 1992 revealed that the mainmast was still standing, and the name and home port painted on the stern were still legible (Crisman and Cohn 1993a, 1994).

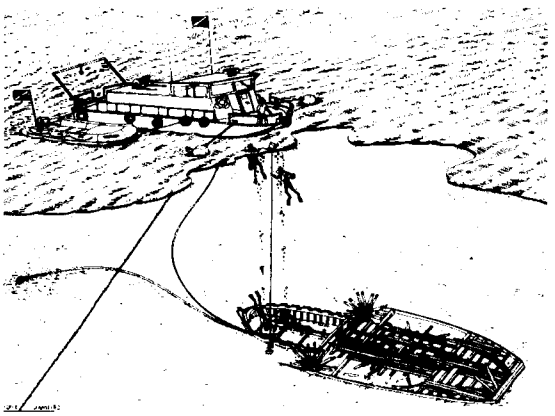

FIGURE 4. The wreck of the horse-powered ferry on the bottom of Lake Champlain.

A second class of 19th-century sailing craft that frequented Lake Champlain, the sailing canal boat, has been identified and defined by the discovery of four wrecks. Two of the wrecks, both sunk in Burlington Bay, Vermont, are of the 88-ft.-long (26.8 m) sailing canal schooners *General Butler* and *O.J. Walker*; the other two, sunk at Isle Lamotte and Burlington Bay, were shorter, around 79 ft. (24 m) in length, and were sloop-rigged. As the name implies, sailing canal boats were capable of navigating by sail (with the aid of a centerboard and masts that stepped on deck), yet were sufficiently shallow and narrow to be towed through the confined channel of the Champlain Canal by mule teams. These hybrid craft were very common during the second and third quarters of the 19th century (Cohn and True 1992; Cozzi 1992, 1993).

The remains of one of the more unusual types of vessels to operate on the lake in the 19th century were discovered during a sonar survey of Burlington Bay in 1983 (Figure 4). The nearly complete wreck proved to be a horse-propelled ferry, one of about 10 "horse boats" that carried people and their possessions across the lake between the late 1820s and the early 1860s. The 63-ft.-long (19.2 m) sidewheel ferry was propelled by two horses that walked in place upon a large, horizontal treadwheel mounted beneath the deck. The wreck was intensively studied between 1989 and 1993, and a full set of reconstruction plans has been prepared. Horse boats were employed throughout the United States, but the Burlington Bay wreck is still the only example to undergo archaeological investigation (Crisman 1991a, 1992; Crisman and Cohn 1993b, 1997).

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The Continental Gondola *Philadelphia*: A New Look at America's Oldest Surviving Warship

Introduction

On 30 July 1776, the Continental gondola *Philadelphia* was launched from the American shipyard at Skenesborough (now Whitehall), New York, into the waters of Lake Champlain. Construction of the *Philadelphia* and its sisterships was ordered on 17 June 1776, when the Continental Congress instructed General Philip Schuyler, commander of the Northern department, . . . "to build, with all expedition, as many gallies and armed vessels as . . . shall be sufficient to make us indisputably masters of the lakes Champlain and George" (Morgan 1970, 5:589). Congress's order came with the realization that the American attempt to take Quebec and neutralize British Canada in the first year of the Revolutionary War had failed. Schuyler, anticipating the possible need for vessels to aid in the retreat of the army, had already begun preparations in late May for the construction of gondolas by sending carpenters from Fort George to Skenesborough (Morgan 1970, 5:317).

Schuyler's foresight, and the subsequent letters of Generals Benedict Arnold and John Sullivan to George Washington, prompted Congress's Marine Committee to order additional shipwrights to Skenesborough in mid-June. At that time, Schuyler over-optimistically predicted that once more carpenters arrived it would be possible to build five gondolas a week (Force 1848, 1:629). However, only two gondolas had been sent to Fort Ticonderoga by 15 July. This fact prompted General Horatio Gates, commander of the Northern Army, to complain that the 60 carpenters at work at Skenesborough "must be very ill-attended to, or very ignorant of their business, not to do more work" (Force 1848, 1:454). Gates had already written to Arnold expressing his wish that he take charge of the building program at Skenesborough (Morgan 1970, 5:1115).

In late July, both the shipbuilding program and command of the fleet fell to the more experienced Arnold, who then instructed the nearly 200 ship and house carpenters at Skenesborough to turn their attention to the construction of larger galleys. Meanwhile, Arnold's British counterpart, Sir Guy Carleton, Governor General of Canada and the British Commander, was assembling vessels at St. Jean on the Richelieu River in preparation for a thrust southward down Lake Champlain designed to cut off New England.

When the British invasion of Lake Champlain began, Arnold anchored his fleet at Valcour Island near the New York shore. On 11 October 1776, the battle commenced. The Americans fought skillfully and determinedly, but the superior firepower of the British squadron proved decisive. One hour after the battle ended, the badly damaged *Philadelphia* sank. Arnold and most of his men escaped in a daring nighttime retreat by rowing their ships between the British fleet and shore. By the end of the three-day engagement, only four of the original 17 ships that formed the American fleet returned to the shelter of Fort Ticonderoga.

Many historians point to the naval contest for Lake Champlain in 1776 as the foundation for British commander John Burgoyne's decisive defeat the following year. Had Arnold not forced the British to lose a campaign season by entering into a lengthy shipbuilding race, the American army would not have had time to build the strength necessary for victory at Saratoga. The sacrifice of the *Philadelphia* and other vessels in Arnold's fleet thus served its purpose when Burgoyne surrendered his entire army to Horatio Gates on 17 October 1777.

The gunboat *Philadelphia* remained at the bottom of Lake Champlain until 1935, when Colonel Lorenzo Hagglund raised it, placed the hull on a barge, and created a floating exhibit that toured the Hudson River and Lake Champlain for many years. In 1961, *Philadel-*

phia went to the Smithsonian Institution where it became a central exhibit at the National Museum of American History.

Both *Philadelphia* and its role in the naval engagement of 1776 have been the subject of several professional papers and are mentioned in historical texts. Plans of the vessel were produced by the Smithsonian Institution (Hoffman 1981), but a comprehensive analysis of this vessel and crew has never been completed. Fortunately, a wealth of information is available in contemporary written and graphic records.

The *Philadelphia* was the fifth of eight gunboats that formed part of Arnold's command. Presumably, the name was chosen to honor the 52 Philadelphia shipwrights who had arrived at Skenesborough just five days prior to its completion (Schuyler 1776). The vessel was constructed in approximately three weeks, a remarkable feat considering the host of problems that Schuyler and Arnold faced. *Philadelphia*'s builders complained of the necessity of having to stand in line each morning waiting to sharpen their axes on the few grindstones available to them. Woodcutters protested that the soldiers who "went into the woods to help them . . . would sit down by the trees instead of working" (Force 1848, 1:582). By the time of *Philadelphia*'s construction, it was necessary for axe-men to travel up to 12 miles to secure the oak crooks needed for the 78 knees of each gunboat. Numerous letters were sent to the northern colonies requesting additional carpenters, felling axes, blacksmith tools, and more often than not, a barrel of rum to make the mosquito-ridden camp slightly more comfortable. Eventually, more carpenters, grindstones, and axes found their way to Skenesborough. The rum also arrived, but not without a directive ordering the work to continue on Sundays (Morgan 1970, 5:680).

Benedict Arnold arrived at the Skenesborough shipyard on 23 July, just three days short of the planned launching of *Philadelphia*. He delayed the launch and ordered that a gun platform should be installed in the stern of the vessel for the installation of a mortar to complement the other three cannons (Schuyler 1776; Force 1848, 1:679). The *Philadelphia* was likely the gondola that military engineer, Jeduthan Baldwin, described on 1 August:

> . . . at Sunset one howet [howitzer] was fired on board a large Gundalow by way of experiment, the Shell brok in the air, one 13 inch Bomb was also thrown from the same Gundelow on bord of which were about 20 men, when the Bomb went of[f] the Morter Split & the upper part went above 20 feet high in the Air over the mens heads into the water & hurt no man. the piece that blowd of[f] weighd near a ton, I was nigh & saw the men fall when the morter burst, & it was a great wonder no man was kild (Baldwin 1971:64-65).

The *Philadelphia* has several square openings cut into its inner planking in the aft end of the vessel, suggesting that Arnold's mortar platform was removed following the mishap. To trim the vessel, a number of stones were then placed under the quarterdeck to counteract the weight of the 12-pounder bow gun. Presumably, the idea of arming the gondolas with mortars was given up when the only other large mortar available to the Americans also blew apart during a test firing on Mount Independence the next morning (Baldwin 1971:65).

Crew

With the fortuitous discovery of *Philadelphia*'s original payroll in 1973, the names of the 44-man crew became known (Lundeberg 1995:46). The *Philadelphia*'s captain, Benjamin Rue, was a member of the First Regiment of the Pennsylvania Line. Prior to his appointment to *Philadelphia*, Ensign Rue served with Generals Montgomery and Arnold in Canada. At age 21, Rue took command of *Philadelphia* on 1 August 1776, one day after the gondola arrived at Mount Independence for masting, rigging, and arming.

In July, the call for seamen and marines to man the fleet was sent out to the maritime seaports. It soon became apparent that it would be difficult to lure experienced seamen from the healthier and potentially more profitable privateering fleets. Consequently, Congress was forced to order drafts from the Northern army stationed at Fort Ticonderoga (Wayne 1963:101). *Philadelphia* completed its muster with a few

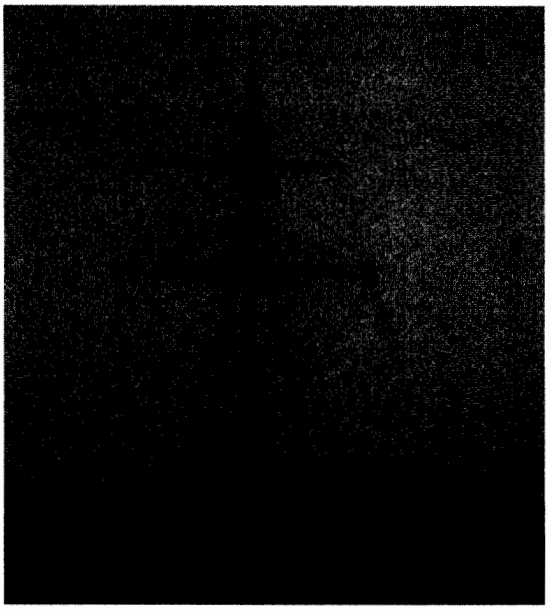

FIGURE 1. The *Philadelphia II* maneuvering under sweeps. (Photo courtesy Lake Champlain Maritime Museum.)

additional drafts from Massachusetts and Maine.

Arnold described the drafts from the regiments as a "wretched motley Crew," the marines "the Refuse of every Regiment, and the Seamen, few of them, ever wet with Salt Water" (Morgan 1972, 6:884) This statement may have been true for most of the men drafted from units at Ticonderoga, but many of *Philadelphia*'s crew very likely had a great deal of inland water experience, judging from their hometowns. Maine, Massachusetts, and especially New Hampshire relied extensively on inland and tidal watercraft similar to Arnold's flat-bottomed gondolas. The indigenous Pitscataqua and Merrimac River gundalows and the Durham boat had long been used in these regions for the transport of bulk cargoes such as marsh hay and timber. These flat-bottomed craft of similar size and construction used the same means of propulsion as did the *Philadelphia*: sweeps and/or square sails set upon a single mast.

The historical record also preserves clues to what happened to *Philadelphia*'s crew following its sinking. At least 35 of the 44 men boarded the galley *Washington*. Subsequently, they were made prisoners of the British when *Washington*'s captain, General Waterbury, was forced to surrender to an overwhelming British force on 13 October. However, Baldwin's journal (1978:81) records that Captain Rue and 16 of his men escaped and came in through the woods to Ticonderoga. Rue and his followers were able to leave the galley in a bateau and flee it to shore just before Waterbury struck his colors.

Nine members of *Philadelphia*'s crew are missing from the historical record. Presumably, these men were killed in the battle on the 11th, or they may have boarded a vessel other than the galley *Washington*. It is likely that those wounded may have been carried aboard the fleet's hospital sloop (*Enterprise*) which returned safely to Ticonderoga.

The Philadelphia II

According to Richard Steffy (1994:229-230), "the ultimate research vehicle [for nautical archaeology] is a full-size, faithfully duplicated copy of [an] original ship . . . since they have no parallel for studying construction techniques and ship handling." With this idea in mind, and the desire to "demonstrate a cost-effective and historically sound alternative to raising fragile, historic shipwrecks" (Cohn 1995:61), the Lake Champlain Maritime Museum began construction of a full-sized *Philadelphia* working replica in 1989. Detailed plans provided by the Smithsonian Institution assured an accurate reproduction that could be used to evaluate how *Philadelphia* was built, manned, sailed, and propelled by sweeps (Figure 1).

Construction of the *Philadelphia II* began as soon as a combined boat shed and exhibition hall were erected on the museum grounds. Like the builders at Skenesborough, the Lake Champlain Maritime Museum also had difficulties in securing timber for the replica. Since much of the countryside of Vermont and New York had been heavily deforested by the late 1800s, it was necessary to scour the countryside for scattered stands of second-growth trees (Cohn 1995:68). Once this was accomplished with the

help of local farmers, the museum had the advantages of modern milling equipment and above all, time.

Construction of the *Philadelphia II* required the best part of three years, since the museum had only three shipwrights. Intentionally, their work was often interrupted by the educational program that accompanied the project. As part of that program, however, they also relied on, and received, the help of numerous volunteers, and even school children.

In 1990, the museum's shipwrights added the stem, sternpost, and frames to the new *Philadelphia*'s flat bottom (Cohn 1995:70). After nine months of framing work, the 48-ft., 11-in. keelson was installed by joining two scarfed white oak timbers to the replica's floors with 10 iron bolts. During that second season, the museum also constructed a blacksmith shop and forge so that the gondola's ironwork could be manufactured on-site in a traditional manner.

Planking of the vessel took place in 1991; the process required nine weeks and was accomplished by planking inside and outside simultaneously. The services of an expert caulker were secured to teach the modern boatbuilders the almost lost art of properly caulking a wooden vessel (Cohn 1995:72). With the final addition of the decks and rudder, the hull was completed and ready to be rigged. The standing and running rigging had been spliced and wormed, parcelled, and served in the traditional manner; ash blocks with lignum vitae sheaves had been fashioned; and the mast, yards, and boom had been shaped from white pine.

With the aid of a local power company truck, the newly fashioned mast was stepped into the hull and the final rigging completed. One dozen ash oars, each 21 ft. long, for propelling and maneuvering the new *Philadelphia* were placed aboard. On 18 August 1991, the new *Philadelphia* was launched into the waters of Basin Harbor to the cheers of 4,000 spectators (Cohn 1995:77). As Art Cohn, director of the project, stated, "The career of the *Philadelphia II* as a floating history exhibit had begun."

Evaluating the Replica

Since 1991 there have been many opportunities to put *Philadelphia II* through its "sea trials." During the summers of 1992 and 1993, the museum maintained a busy tour schedule that sent the new *Philadelphia* to many of the same historic places its namesake visited in 1776, including Whitehall (the former Skenesborough), Fort Ticonderoga, and Valcour Island (Cohn 1995:77-80). Unlike the original, the new *Philadelphia* also visited the site of the 1776 British shipyard at St. Jean, Quebec.

As expected, the *Philadelphia* type is primarily a rowing vessel. Appropriate for the no-lateral-resistance hull, the square rig is designed for only running before the wind in the relatively smooth water of the lake (Roger Taylor 1995, pers. comm.). According to Roger Taylor, captain of the new *Philadelphia*, sailing the new vessel with a fair wind was "a treat" (Cohn 1995:84). *Philadelphia II* can make 3 or 4 knots easily, but 4 was about maximum. As an experiment, the crew brought the vessel up as close to the wind as they could, approximately 90 or 100 degrees from the true wind. *Philadelphia II* forged ahead very slowly and made about as much leeway as headway (Roger Taylor 1995, pers. comm.) In practice, it was found that if a course of 120 degrees off the true wind was steered, the gondola made good a course approximately 150 degrees off the true wind. If she was sailed any closer, its performance decreased because the leeway increased so much.

The gondola type has very high initial stability with its wide, flat bottom, beam, and great weight; however, it has also proven to be unmaneuverable at times. *Philadelphia II*, with its heavy, shallow hull and with considerable windage in its rig, is very vulnerable to the wind when maneuvering under oars (Cohn 1995:82). In fact, the crew found it difficult to make progress sweeping against even a gentle breeze. If the wind was of any real strength the boat would travel with it, regardless of the direction the vessel was pointed (Cohn 1995:78). On a

calm day, however, the 12 oars skillfully applied would propel the vessel forward at a sustained speed of 2 1/2 knots (Roger Taylor 1995, pers. comm.).

Taylor concluded that one reason why Arnold fought his gondolas from moorings was that he realized how unmaneuverable they were, under oars, sail, or both. Essentially, the *Philadelphia* and its sisterships were floating gun platforms. The uncomplicated design, however, was ideally suited to the Colonials' immediate need of a gunboat that could be quickly assembled with only a minimum of men and materials.

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The Story of HMS *Linnet*, a Brig from the War of 1812

Introduction

During a survey of the Poultney River on 23 July 1981, the hull remains of the *Linnet* were discovered by Art Cohn and Kevin Crisman. Although searching at the time for the American brig *Eagle,* archaeological evidence, based in part on timber measurements and identification of all other similar vessels in the area, confirmed the identification of the British brig *Linnet.* The first large warship built in the shipbuilding race on Lake Champlain during the War of 1812, the *Linnet* had an interesting, albeit short, career in this war. To date she is the only known existing Royal navy hull from the British squadron on the lake. This ship fought in the Battle of Plattsburgh Bay and was the last great British warship to surrender on Lake Champlain. A great variety of factors led to the construction of *Linnet,* beginning with the British navy's ill state of preparedness in 1812.

The War of 1812

In the fall of 1813, word of American shipbuilding activity in the south reached Ile-aux-Noix, Canada. Captain Daniel Pring, head of the growing naval establishment on Lake Champlain, began to request new vessels in addition to men to power them. On 7 November 1813, after much bartering between Pring and Canadian Governor General Prevost, William Simons, a shipwright of Kingston, Ontario, was given the contract to build one brig—*Linnet,* to be launched and completed by May 1 (Figure 1). The British government agreed to supply spikes, bolts, iron work, lodging, and rations for Simons's crew. The shipbuilding race began, although for the British it was off to a slow start. It would have occurred much more quickly had a dockyard at Ile-aux-Noix previously existed. They lacked everything—all iron, timber, and supplies had to be shipped to the island. In the winter of 1813-1814, before Simons began construction on the brig, the dockyard was built.

Very slowly, reinforcements arrived from the Navy, and Pring's fleet was built up. In fact, rumors of American shipbuilding activity caused the British to hurry the building of *Linnet* (first named *Niagara*). Finally launched in April 1814 and battle ready in May, *Linnet* was 85 ft. in length (Lewis 1995:18), 82 ft. 6 in. on deck, with a beam of 27 ft. and a depth of hold of 6 ft. 8 in. Probably resembling the ship depicted in Chapelle (1949), most sources also indicate she carried 16 long 12-pounders and would have been about 350 tons burthen with a complement of around 120 men.

Early action as Pring's flagship included the harassment of local residents on the New York and Vermont sides of the lake. In May of 1814, she accompanied sloops and gunboats for an unsuccessful attack on the American fortification at the mouth of Otter Creek. After the emergence of the American fleet on the lake in late May, *Linnet* was kept in Canada for the remainder of the summer. The last time *Linnet* sailed up the lake was on 11 September 1814, in the company of the Royal frigate and new flagship *Confiance*, the sloops *Chub*, *Fin*, and *Icicle*, and 13 gunboats, all bound for Plattsburgh Bay to attack the awaiting American naval squadron. The British lost that battle, one which became the turning point in the war and helped finalize the peace treaty in Ghent later that year. The

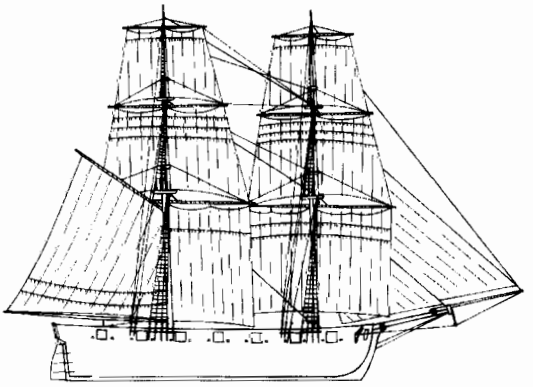

FIGURE 1. Theoretical rigging model of *Linnet.*

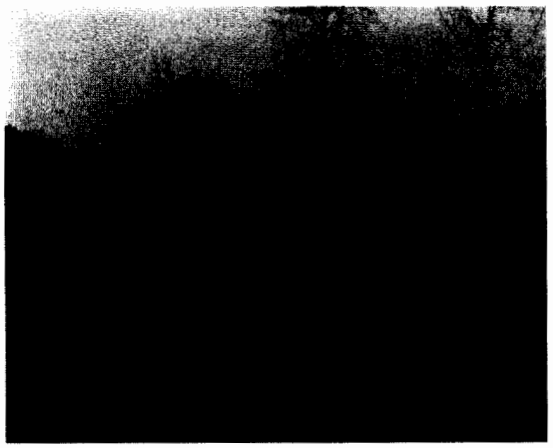

FIGURE 2. View of *Linnet*'s stern after the 1949 raising. (New York State Archives.)

Portsmouth court martial in 1815 blamed the lack of army support for the loss and exonerated nearly all the British naval officers.

Although many factors contributed to the loss of this battle and eventually the war, the actions of Pring and *Linnet* were not among them. *Linnet*'s assignment was to take position at the northernmost line of battle and, together with *Chub*, to fire upon the American brig *Eagle*. This they did, for over two hours. As a matter of fact, *Linnet* was the only ship to hold position as British Commander Downie had ordered, and did the job so well that Captain Robert Henley of the *Eagle* described the fire as "raking and most destructive" (Crisman 1987:70). Henley eventually cut *Eagle*'s bower anchor and, giving up his position, sailed past the American flagship *Saratoga* to a new position out of reach of *Linnet*'s guns. After *Confiance* surrendered, Pring kept up the fight for an additional 15 minutes before succumbing to the guns of the *Saratoga*. With 20 men killed and 30 wounded during the engagement (Clark 1904:71), *Linnet* was the last great British warship to surrender that day or ever on Lake Champlain. The two-hour-and-twenty-minute battle was over, and American dominance was ensured.

U.S. Navy Prize: 1814-1825

After the battle, *Linnet* became U.S. Navy property and was in desperate need of repair. It was riddled with shot—30 to 50 holes—most of which probably came from the guns of the *Saratoga* in the last 15 minutes of battle (Crisman 1987:79). In early October, *Linnet* was moved south to Whitehall to be put in ordinary with the rest of the squadron. In relatively short time, naval presence on the lake dissipated, and equipment and vessels were either placed in storage or auctioned off to help pay the war debt. By 1820, shipping activity had increased in Whitehall and the ragtag fleet was blocking passage of commercial vessels, so they were moved to an area known locally as East Bay, actually the mouth of the Poultney River. *Linnet* sank at anchor along the New York bank of the river around 1825 and remained there for 124 years, attacked only by local firewood seekers, rot, and ice.

Archaeology/Anthropology

1825 - 1949

In the fall of 1949, Whitehall, New York, was not the easiest place to make a living. One long-time resident, knowing, as did most of the other local farmers, about the wrecks in East Bay, came up with an idea to raise some money. Not owning the proper equipment, he approached neighboring farmers, Steve and Tony Galick, with his idea. So, very quietly and "overnight," according to Tony Galick's nephew, a small group of farmers hooked two steel cables around some of the main timbers in one of the ships, and with horses and three tractors dragged it to the Vermont side of the river (Figure 2). In the process of doing so, the forward section of the hull broke off and the ship spun around so that the bow now faced down the Poultney River, unlike the rest of the former U.S. Naval fleet on the New York side. When asked why they did it, the Galicks echoed a sentiment recorded in the local paper—"just for fun!" According to the Galicks, the area between the ribs was filled with cannonballs. Their neighbor sold the shot for "two dollars a pop" (Bill Galick 1995, pers. comm.).

According to the *Whitehall Times*, the ship was misidentified as from the Revolutionary War and, oddly enough, of French construction. Two 9-pounder cannon and over 350 cannon balls filled with gunpowder were removed. Over 300 people stopped by the Galick farm to look over the relics. Among the visitors was a furniture dealer from Rutland, Vermont, who was interested in buying timber with which to make special furniture. This transaction never occurred. Also present were various representatives from Fort Ticonderoga. One of the 9-pounder cannon and a split mortar were sold by three local families to Fort Ticonderoga. Another cannon, according to the paper, 1,200 pounds and 6.5 ft. long, was acquired by Fort Mount Hope and later became property of Fort Ticonderoga. All three were unserviceable and used as ballast in 1814. Also removed were 38 bar shot and 6 "exploding bombs" (*Whitehall Times* October 1949). The majority of artifacts, however, are probably in private collections in the local area.

1995 Field School

From 11 July through 31 July 1995, the Lake Champlain Nautical Archaeology Field School conducted excavations on the hulls of the *Linnet* and the U.S. gunboat *Allen*. The main objective in the *Linnet* excavation was to record timber measurements so an accurate reconstruction of this vessel could be made through line drawings and construction plans. Approximately 160 hours of dive time were spent recording features of the hull during the three-week period, with approximately 65 percent of the remains successfully excavated. We focused on the keel/keelson arrangement, frames, and mast step, and searched for the bow and stern sections. Few artifacts were expected, and few were found. Among them were iron spikes, nails, lead musket balls, copper buttons, and grape, bird, and canister shot. The canister and one grapeshot were donated by the Galick family of Whitehall, New York.

FIGURE 3. Split mortar (ballast) recovered in 1949. (New York State Archives.)

During the first week, the shores were made ready for the team. Modern litter was cleared, and an appropriate work area was created out of the surrounding shrubbery, including space for the crew, data processing, equipment storage, and a safe access ramp into the site. The dredge and hooka units were set up. The site was examined, and dredging began to clean up what was then simply called the "Vermont side" of the *Linnet* (later determined to be the starboard side of the vessel). A third of the floors on this side of the hull were in such shallow water that their tops extended above the surface of the river adjacent to the shore.

The total length of the existing hull is approximately 58 ft. and, although originally well built, it is in a poor state of preservation. Although an extensive river bank and bottom search was carried out, complete bow and stern sections were not located. When questioned about the missing forward section of the hull, the Galicks replied that part of it floated away downriver. Most of the missing 25 ft. and other detached hull timbers, however, ended up at Mount Hope, displayed under a rotting shed as remnants of Benedict Arnold's fleet.

Hull Details

The keelson averaged 6 to 8 1/2 in. sided and 11 1/4 to 12 1/2 in. molded. We determined that the keel had broken off in the forward section of the hull, splintering the garboard strake.

The overburden was so deep at this end and the bank erosion rate so high that a cofferdam was constructed around the last few frames to keep the sediment from settling in over the excavated timbers. Water depth here was approximately 9 ft. The last few forward feet of the keelson consisted of a 3-ft.-long flat scarf, the only scarf found. The keelson also had slightly unusual construction, noticed in 1982—it was cut out along the bottom to fit over frame sections for every frame except those immediately surrounding the mast step.

A 14-ft. section of the keel with stern deadwood was located about 8 ft. upriver from the main part of the hull. All frames from this section are missing and are probably some of those on display at Mount Hope. When removing this section from the water to confirm measurements, it was discovered that the wood floated more easily than was expected of oak, and the possibility of a softwood construction was initially suggested.

The frames on the starboard side were completely uncovered and excavated between every other frame. No ceiling planking was located intact, although some was evident in photographs taken of the remains in 1949. A total of 23 floor timbers were excavated on the starboard side, including futtocks for the three floors at the forwardmost end of the hull. On average the frames were sided to 7 to 9 in. and molded 9 to 10 in. A midships frame was not identified during the excavation; there was no noticeable difference in measurements between any of the frame sections. Furthermore, no evidence of lateral fastenings was found in the floor sections or in the excavated futtocks.

It was soon realized that the initial goal of excavating the port side would not be fulfilled. The overburden there was even deeper than the starboard side and consisted of fine, thick clay which made dredging a more difficult and lengthy process. An additional three weeks was estimated to mirror the starboard side in excavation, so we decided to concentrate on just one section from the port side, between Frames 1 and 2 (aft). While exploring the port section, a chock (or filler piece) was discovered fastened to the top of the frame by a treenail.

Although the *Linnet* was a brig, evidence for only one mast remained. Recorded in detail, the mast was located about a third of the way forward of the stern of the ship. Most likely intended for the mainmast, it measures approximately 3 ft. long by 1 ft. wide. Constructed of oak with a rectangular hole in the center for the mast, the step is laterally supported by iron bars on each side and connected to the keelson by six iron drift bolts.

At the conclusion of the field season, remaining field members surveyed the timbers on display at Mount Hope. These were in very poor condition, having been subjected to the extremes of New England seasons for 46 years under the protection of a mere bark-and-scrap-wood shelter. Many timbers had the consistency of a wet sponge and literally fell apart in our hands. In three days a total of 3 floors, 8 possible futtocks, and 14 miscellaneous timbers and planks were recorded and put in safe storage, away from the elements, in a replica blockhouse on the property. The sign above the shelter inaccurately indicates that the timbers are from a Colonial gunboat, possibly one of Benedict Arnold's fleet. Believed to have originated from the broken bow, after the lines are drawn and a preliminary construction for *Linnet* is suggested, it is hoped that some of these timbers will fit into the site plan.

In addition to these timbers, we also located the two trunion-less cannon and split mortar, carried in 1814 as ballast, that were salvaged in 1949 and sold to Fort Ticonderoga. These are still on display on the fort's property, although again implied as being from the Revolutionary War. The mortar's bore measures 13 in. and the construction is cast iron—not bronze as some locals suggested (Figure 3). Both cannon are on display just outside the main fort entrance in a line-up of other cannon. They are 6 ft. 1/2 in. long and fired 9-pounder shot.

Conclusion

The current picture of the *Linnet* is still that of a complicated puzzle with pieces scattered over two states and three primary locations. Prior to the 1981 rediscovery and correct identification, knowledge of the wrecks in East Bay has been passed down through about seven generations of Whitehall and vicinity residents. Several elders who stopped by the excavation recalled times of playing on the hulls as children. Locals have fished over them, chopped up the timbers for firewood, and sold pieces as local history for education and profit. These people have also developed colorful folklore surrounding the hulls and have continued a story of *Linnet* for 156 years. The *Linnet* served as a variety of different things for different groups of people—a beginning to a British threat, a U.S. Navy prize, an inconvenience, a mysterious wreck for generations of children to play on, the subject matter of local folklore, one farmer's fall income, a tourist attraction, educational display, and most recently, thesis material. For myself, it is the search for the history of this ship that is so fascinating—the first large British warship built on Lake Champlain during the War of 1812.

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The Steamboat Wrecks of Lake Champlain

Throughout the 19th century the waters of Lake Champlain teemed with a variety of commercial watercraft. The history of steam on Lake Champlain began with the building of the small steamer *Vermont* in 1809, the second successful steamboat in commercial operation, and continued well into the 20th century until the steamer *Ticonderoga* was retired from service in 1954 to be displayed at the Shelburne Museum in Shelburne, Vermont. Because the history of steam navigation on Lake Champlain spanned over 144 years, nearly the entire history of steam navigation, and because the cold, dark waters of the lake help to ensure the preservation of many wooden vessels, the lake has become an ideal laboratory for the study of inland water transportation, and steam transportation in particular. Archaeological investigations of the submerged cultural resources of the lake have located and documented numerous steamboat wrecks, and three vessels have been the subject of more detailed study. These wrecks, although a small sample, demonstrate both the wide range of variation and several clear trends in steamboat design and construction.

The earliest steam vessel to ply Lake Champlain waters was the *Vermont*, launched in 1809, only two years after Robert Fulton had gained fame with his successful Hudson River steam passenger service (Ross 1930:24). The vessel, built by Burlington, Vermont, businessman John Winans, was a flat-bottomed, stab-sided vessel, 120 ft. in length, 20 ft. in beam, with a 20-horsepower engine turning a pair of side paddlewheels, largely similar in shape and configuration to Fulton's *North River*. The vessel's side lever, bell crank engine was prone to breakdown, eventually causing her demise. The *Vermont* sank in the Richelieu River, at the northern outlet of Lake Champlain, in October 1815, when the crankshaft violently disconnected, breaking through the bottom of the hull. The vessel filled and sank within minutes.

The remains of the vessel were discovered and raised from the Richelieu River in 1953 by Lorenzo Hagglund, who also raised the Revolutionary War gunboat *Philadelphia*. The attempt to do something equally educational with the remains of the *Vermont*, as had been achieved with the *Philadelphia*, ended in tragic failure. The remains were never conserved or cared for in any way and eventually disintegrated. Some details of construction can be gleaned from photographs of the raised remains, which show the relatively flat floor timbers of the vessel, the regular spacing of the single floors, the iron fasteners, and the large longitudinal stiffening timbers.

The second successful commercial steamboat on the lake was also the subject of the first full-scale archaeological investigation of a wreck in Lake Champlain. The *Phoenix* was built in Vergennes, Vermont, in the spring of 1815 by the Lake Champlain Steamboat Company (Ross 1930:31). The vessel was 146 ft. in length and was elegantly furnished for passenger travel up and down the length of the lake. The *Phoenix* came to a violent end on the night of 5 September 1819 when a fire broke out in the galley. The quickly spreading flames panicked both crew and passengers, and in the haste to abandon the vessel, the captain and 11 passengers were left aboard the flaming wreck. While the captain and four others were eventually found clinging to some of the furniture that had been tossed overboard for flotation, six people died in the disaster. Although the fire was officially attributed to a candle left burning in the galley by a crew member, there was ample speculation that it was deliberately set by bitter rival sailing interests.

Discovered by divers in deep water off Colchester Point in 1978, the remains of the *Phoenix* rest on a sloping bottom at depths between 60 to 110 ft. A team of divers from the Lake Champlain Maritime Museum recorded and mapped the bottom of the hull (for the vessel had burned to the waterline) in 1980, and as a

result the wreck became part of Lake Champlain's Underwater Historic Preserve System administered by the State of Vermont.

The study of the hull remains showed a hull built entirely of white oak and iron fastened throughout (Crisman 1986:30). The overall shape of the hull differed from the *Vermont*. The *Phoenix* had a rounded bottom, was proportionally broader, and had a deeper draft. The hull structure had been designed to compensate for the weight of the heavy steeple engine machinery, and the builder had endeavored to make the hull as stiff as possible. Construction features included a series of three 10-in.-square longitudinal strengthening timbers, including a keelson, with four shorter longitudinal timbers acting as engine mounts. The engine machinery was located forward one-third of the length of the ship from the bow. Frames were constructed in pairs to further strengthen the bottom of the hull.

The 1820s and 1830s were characterized by the development of new vessel types, advances in steam technology, and the rapid expansion of maritime commerce on the lake as a result of the opening of the Champlain Canal linking the Hudson River and Lake Champlain in 1823. While many steamers were built on the lake during this period, only one has been the subject of a detailed archaeological recording.

The *Water Witch*, built in 1832, was originally constructed as a steamboat but was later converted to a schooner (Cohn and Crisman 1993). The vessel was smaller than most of the lake steamers of her day, measuring only 80 ft. in length, 17 ft. in beam, and no more than 8 ft. in depth of hold. *Water Witch* was designed with a single (main) deck and was powered by a single 40-horsepower engine. The vessel worked both as a tow-boat and in opposition to rival companies line boats until the year 1835. During that year, the Champlain Transportation Company (CTC) finally gained supremacy in steam transportation on the lake. In order to consolidate their primacy, they bought out several rival companies, boats, among them the *Water Witch*. The small *Water Witch* was converted to a commercial schooner and was sold.

The vessel had a lengthy career as a commercial sailor until 1866 when she went down in a gale off Diamond Island, midway down the lake. The vessel was hauling iron ore between two lake ports for its owner Thomas Mock, who captained the vessel and lived aboard with his wife, two children, and an infant. The sudden storm occurred on 27 April 1866, and Captain Mock, his family, and crew were swept from the deck into the 40-degree lake where they were later picked up by a passing sloop. Tragically, their infant daughter Roa perished.

The remains of the *Water Witch* were discovered in September 1977 in the deep waters just south of Diamond Island, to the west of the mouth of Otter Creek. A group of Canadian divers were exploring the lake bottom by planing board. In the course of their exploration a diver was pulled into the upright side of the *Water Witch*.

The hull was examined by archaeologists from the Lake Champlain Maritime Museum in 1990 and again in 1993 (Cohn and Crisman 1993). Primarily iron-fastened, the vessel measured 83 ft. in length from the stem rabbet to the after edge of the taffrail, 80 ft. on deck, and 18 ft. in breadth at its widest point. Although a shallow hull, with near-vertical sides amidships, the shape is relatively graceful with an elegant transom stern. The *Water Witch* is nearly indistinguishable in size and configuration from other lake schooners of the day, with few traces of steamer origins. The vessel was much smaller than the majority of lake steamers, and although comparable in size to at least two other steam vessels, the *Mac Donough* and the *Washington*, these steamers were considered inferior boats in all aspects. Thus, we can designate the *Water Witch* as an average sailing vessel, but an undersized and atypical steamer.

Some of the other, larger, more typical lake steamers now rest in a graveyard of wrecks in the waters just off the CTC shipyard on Shelburne Bay, south of Burlington. The shipyard was established by the company in 1820 and has remained in use until the present day. Traditionally when steamers were taken out of

use by the company, they were taken to the shipyard where they would be stripped of their valuable machinery and dismantled. As steam technology passed from supremacy, the waters off the yard became littered with the remains of vessels.

In 1983, Lake Champlain Maritime Museum divers made a survey of the western shore of the bay to try to locate 12 wrecks identified in a drawing, thought to date to the 1880s, of the shipyard property (Chase 1985). During the survey, the remains of four steamers, designated Wrecks A through D, were located, measured, and assigned tentative identification.

The researchers believe Wreck B to be the remains of the steamer *Franklin*. The *Franklin* was built in 1827, of similar vintage as the *Water Witch*, but much larger, measuring 162 ft. in length, 22 ft. in breadth, and 9 ft. depth of hold (Ross 1930:53). The single-engine vessel also had the distinction of being the first built on Lake Champlain with the boilers located out on the guards instead of in the hold of the vessel. This improvement reduced worry regarding "the danger which attends the explosion of a boiler within the boat."

The preserved length of the remains is 135 ft. 6 in., and the preserved breadth 23 ft. One very interesting construction feature is the pattern of the frames. According to the survey, Frames 1 through 18 on the wreck are single frames. Then the pattern changes to pairs for Frames 19 through 36, and then back to single frames for the remainder of the wreck, Frames 37 through 86. Clearly the double frames are meant to provide added strength to the portion of the hull intended to bear the weight of the engine machinery.

Wreck C is believed to be the *Burlington*, built in 1837 and retired from service in 1854. This vessel was the pride of the CTC's fleet for many years, serving as a passenger line boat (Ross 1930:63). The *Burlington* was repeatedly lauded for her elegant appointments, and Captain Richard W. Sherman (who had also been the captain of the *Phoenix*) was a celebrated figure.

The remains have paired frames throughout, with a large central keelson and six longitudinal timbers on the port side and four remaining on the starboard side. A portion of the sternpost and some deadwood were also noted. These construction features again represent the builder's way of strengthening the bottom of the hull, while providing longitudinal stiffness in the narrow, shallow hull.

The third vessel surveyed at the Shelburne Shipyard site, Wreck D, is believed to be the CTC steamer *Canada*. Built in 1853, the vessel measured 260 ft. in length, 33 1/2 ft. in breadth, and 10 ft. depth of hold (Ross 1930:93). On this wreck the survey noted paired frames, a central keelson flanked by large engine mount timbers, two further stringers on the starboard side, and only one further stringer on the port side. One of the major differences in construction that the survey noted was that, unlike the other wrecks where longitudinal timbers paralleled each other, longitudinal timbers on the *Canada* appear to taper in toward the keelson at both the bow and stern.

The identification of Wreck A proved to be the most problematic. The vessel is believed by researchers to be the remains of either the *Francis Saltus* or the *A. Williams*. The *Francis Saltus* was built in 1844 and measured 185 ft. in length, 26 ft. in breadth, and 8 3/4 ft. depth of hold (Ross 1930:75). The vessel ran in opposition to the famed *Burlington*, with a loss of profitability to both, until 1848 when the CTC bought out its competition. In the midst of legal, and sometimes illegal, battles for her control, in 1856 the steamer was beached and stripped at the shipyard site. Another vessel was said to have been sunk directly behind the *Saltus* to prevent her from being removed from the harbor. Photographs of the *Saltus* show that the vessel had a single walking beam engine situated in the center of the hull amidships. Her two boilers were placed abaft the engine and out on the guards, at the side of the hull.

The *A. Williams* was built in 1870 and measured 132 ft. in length, 22 ft. in beam, and 7 1/2 ft. depth of hold (Ross 1930:135). The vessel was purchased by the CTC shortly after her construction and was used for ferry and local service as she was much smaller than the

typical CTC line boats. The *Williams* served for 20 years until retired to the shipyard in 1893. The *Williams* also had a single walking beam engine, centrally placed slightly aft of amidships, but had only one boiler, centrally placed forward of the engine.

The archaeological survey revealed remains measuring 125 ft. in length. The vessel has a large center keelson flanked by two large stringers. These three central longitudinal members formed the engine mount. Eight other smaller longitudinal members were also recorded, five on the port side and three on the starboard. Fasteners for two more timbers were noted on the starboard side, indicating that the vessel had a total of six longitudinal strengthening members on each side of the keelson.

The simple drawings from the survey show a rather random pattern of framing, with some paired and some single frames. Similarly, the room and space appear to be somewhat erratic. This discrepancy may be due to the deteriorated condition of the remains or the fact that the investigations of the wrecks were intended only as a preliminary survey.

Although the mountings for a centrally located, single engine were visible, no evidence of boiler placement was recorded. It is therefore difficult to determine to which of the two vessels the remains belong. However, the remains are more likely to be those of the earlier vessel, the *Francis Saltus*, as the construction of the vessel shows none of the progression of strengthening of the central portion of the hull, or of tapering of the stringers in toward the keelson.

The *Champlain II* was the subject of the third full-scale recording of a steam vessel in Lake Champlain (Baldwin 1994). Originally named *Oakes Ames*, the vessel was built in 1868 for the specific purpose of transferring railroad cars between the Rutland Railroad terminus at Burlington, Vermont, and the Montreal and Plattsburgh Railroad Terminus at Plattsburgh, New York. The steamer was built to carry 12 to 14 fully laden rail freight cars across the lake at a time. Eventually a consolidation of railroad property ended her service, and she was sold to the CTC for conversion to a passenger steamer in 1873.

The vessel was wrecked on 16 July 1875 when her pilot, allegedly high on morphine, drove her onto the rocky New York shore at the southern end of Split Rock Mountain. The wreck, whose position remained well known, was recorded by the Lake Champlain Maritime Museum and students from Texas A&M in the summers of 1993 and 1994.

The recording of the vessel yielded several construction features which then seemed unique, but when seen in perspective with the other Lake Champlain steamboat wrecks appear to be part of a logical progression of construction styles. Namely, the framing pattern of the remains appeared unique. The *Champlain II* had single frames the length of the keel, but of extreme moulded dimension, 16 in. by 4 in. sided. The spacing of the single frames also changed along the length of the hull. Amidships the frames were on 12-in. centers, while toward the bow and toward the stern the frames were on 24- to 26-in. centers. The vessel was stiffened longitudinally by a central keelson and three stringers, two to each side of the keelson, and another at the turn of the bilge. Like those of the 1853 *Canada*, the stringers all taper in toward the keelson, and are eventually fayed into the keelson just forward of the sternpost.

While such construction of the frames can now be seen to be part of a progressive evolution, the engine mounts of the *Champlain II* were quite different from any seen before. The *Champlain II* had two walking beam engines, placed on either side of the hull rather than in the center, this placement enabling rail cars she was originally intended to carry to run on tracks down the center of the hull.

To confirm the progression of construction features on Lake Champlain steamboats, the steamer *Adirondack* was also recorded in the summer of 1994. Built in 1867, the *Adirondack* was a night-line passenger vessel for the CTC. The *Adirondack*'s career was cut short by the completion of a railroad along the west side of the lake, thereby ending the need for night-line steamers. She was retired in 1875 and subse-

quently abandoned near the CTC's Shelburne Shipyard. The *Adirondack* rests in the shallow water of Shelburne Bay, just to the south of the Shelburne Shipyard, in waters now the property of the Lake Champlain Yacht Club.

With the exception of the centrally located engine mounts, the framing plan and longitudinal stiffening timbers on the *Adirondack* follow the same pattern as the *Champlain II*, with closely spaced single frames amidships under the engine mounts, and more widely spaced single frames toward the bow and stern. The longitudinal timbers also taper in toward the keelson in the area of the bow and the area of the stern.

A final confirmation of this framing pattern as a standard Lake Champlain construction technique came from a brief survey of the steamer *Reindeer*. Built for the Grand Isle Steamboat Company in 1882 for operation between Burlington and St. Albans, Vermont, this vessel was one of the very few steamers not owned at one time or another by the CTC.

The remains of the *Reindeer* now lie in shallow water at South Bay, near Whitehall at the southern end of the lake. Due to extremely low water this past summer, the remains were partially exposed and therefore easy to survey. Although the remains were in a deteriorated state, the survey revealed that the vessel was framed along the same pattern as both the *Champlain II* and *Adirondack*, with single frames on 10- to 12-in. centers amidships, and 24 to 26 in. forward and after the engine mount area.

By examining the construction of these steamboat wrecks, we can see a progression in design and construction from the earliest steam-powered vessels on Lake Champlain. In addition to a rapid increase in size during the early steam period, we can see a continual effort to modify and improve hull design and construction to deal with the problems of engine weight and longitudinal stability and strength. The three vessels, *Champlain*, *Adirondack*, and *Reindeer* all exhibit a framing pattern that we have not been able to attribute to any vessels outside Lake Champlain. It is certainly a regional, or at least a local, construction type, but sufficient comparative evidence from other regions has not been found.

In a broader context, these steamers also reflect the structure of the steam-carrying trade on the lake, dominated from an early period by the CTC and concentrated on north-south traffic. (The *Champlain,* ex-*Oakes Ames*, was an oddity, as it was a large, heavily constructed vessel built for short cross-lake voyages.) Those vessels, which were not built for the CTC, were often built as direct competition. Or, as may be the case with *Water Witch,* the builder had the intent of being enough of a threat to the company to force them to buy the vessel to maintain the company's primacy in the steam trade of Lake Champlain.

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The Lake Champlain Sailing Canal Boat

Introduction

In October of 1823 the Champlain Canal officially opened, and the first vessel to move through was greeted with formal celebrations at each town it passed. The celebrated vessel, named *Gleaner*, had been built in St. Albans, Vermont, during the summer in anticipation of the new waterway's opening. *Gleaner* sailed south, up Lake Champlain, entered the canal at Whitehall, New York, and was towed to Waterford. From there it sailed down the Hudson River to New York City, where a poet penned a couplet dubbing the craft the "Barque of the Mountains" (Canfield 1868). *Gleaner* was a new kind of vessel, one that could sail on Lake Champlain and the Hudson, and yet fit within the confines of New York's canals. It had a mast that could be quickly removed and stowed on board for the trip through the canal so that the vessel could pass beneath bridges that spanned the waterway. It was the first Lake Champlain sailing canal boat, and as with many early inland watercraft, the historical record lacks details concerning construction and operation. Archaeological research over the past 15 years has provided a clearer picture of this forgotten class of vessels.

Historical Background

During the Jeffersonian embargo and the War of 1812, forwarding companies set up business at Whitehall, New York, to deliver Champlain Valley products overland to Albany but had little effect on lake trade carried north through the Richelieu River to Quebec. The canal opened a flood of trade to the south as these forwarding companies collected goods delivered by lake sailing craft and transshipped cargos into towed canal boats for the trip to Albany where goods destined for New York City were loaded into Hudson River sloops. This new trade route led to the construction of many traditional craft like the lake sloop and new vessel types such as towed and sailed canal boats.

Lake Champlain sailing canal boats can be broken into three classes (Cohn and True 1992) corresponding to the periods 1823-1840, 1841-1857, and 1858-1867. The earliest class is defined by experimental design and construction. They ranged from narrower, shallower versions of lake sailing craft to those built with radically new construction methods. William Annesley, an Irish architect, sold seven patents for sailing canal boats based on his system of frameless construction (Cohn and True 1992). This class featured vessels with easily unstepped masts, centerboards, a capacity around 40 tons, and dimensions up to 80 ft. in length, with a beam of 13 1/2 ft. and a depth of hold between 3 1/2 and 4 ft.

In 1841 Burlington, Vermont, merchants Timothy Follet and John Bradley founded Merchants' Line and sent the canal sloop *R.M. Johnson* through the canal, proving the superiority of sailing canal boats that could carry goods from Burlington to New York City without transshipment over the method used by the Whitehall forwarding companies. This was significant as Burlington had become the foremost collection point for Vermont's perishable farm products such as cheese and butter (Nading Hill 1987). These products did not stand up well to handling or delays while cargos were transferred from lake to canal craft. The success of Merchants' Line led to a building boom for boats of the second class, which are characterized by standardized size, form, and construction, as illustrated by enrollment records (U. S. National Archives) and a set of boat drafts that belonged to a Burlington boat builder (Spear Family Papers 1840-1852).

An enlargement of the New York canal system in the mid 1850s produced a third class of sailing canal boats that were around 88 ft. long, with a beam of 14 1/2 ft., a 6-ft. depth of hold, and a capacity of 65 tons. Schooner rigs came into increasing use to minimize crew size by splitting the sail area between two masts. His-

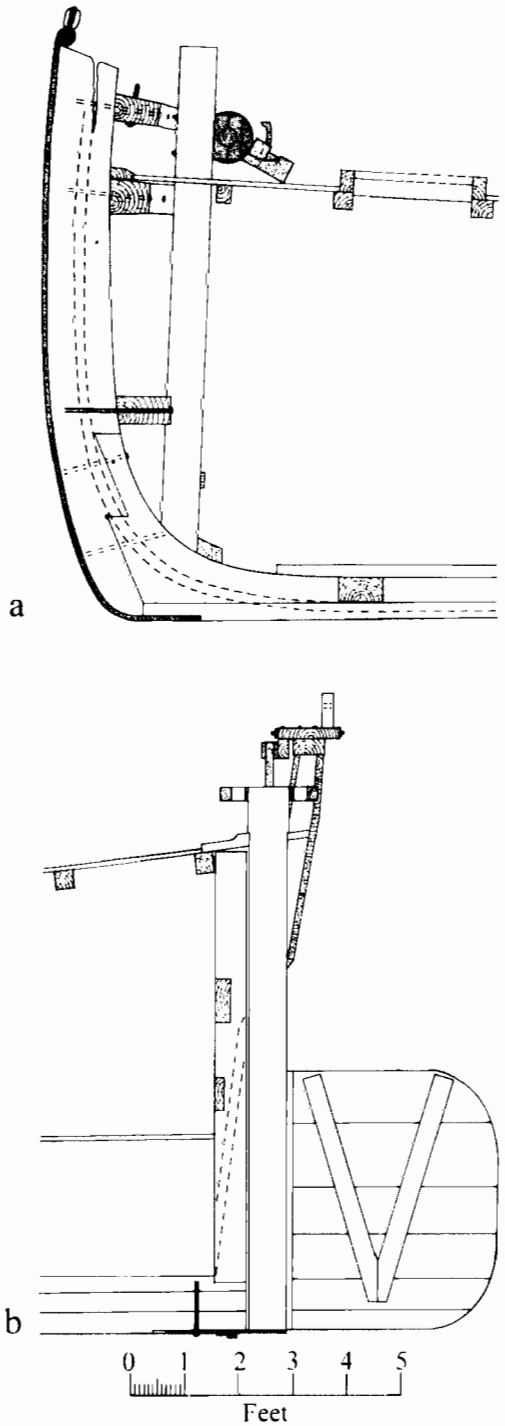

FIGURE 1. Centerline profile of *General Butler*'s a) stem and b) stern. Dashed lines denote rabbet and fastenings which are not directly on the centerline.

torical information on all three classes is limited, as they did not attract a great deal of print unless they were the first of the season to enter a port or suffered an accident with loss of life (Barranco 1993). It has fallen to archaeology to provide details describing the form and construction of these vessels.

The Lake Champlain Sailing Canal Boat in the Archaeological Record

Four archaeological examples of Lake Champlain sailing canal boats have been discovered and surveyed during the last decade and a half. Research on a recognized vessel of this class began with the discovery of the 1858-1867 class canal schooner *General Butler* off the Burlington breakwater in 1980 (Cohn and Crisman 1984a). The 14-year-old *General Butler* sank in 1876 under dramatic circumstances caused by a winter storm and the failure of the vessel's steering gear (Cohn 1985). The Champlain Maritime Society (CMS), a non-profit group interested in the lake's maritime history, investigated the remains over 10 summer days in 1981 and again in 1982. Permits for data and artifact retrieval for this and other sailing canal boat projects were provided by the Vermont Division for Historic Preservation (VDHP). CMS concluded that the vessel was lightly built and intended only to navigate inland waters (Cohn and Crisman 1984a). This work focused attention on a sloop-rigged wreck discovered in 1978 off Isle La Motte (Théorêt 1980) which was not initially recognized as a sailing canal craft. CMS surveys of the Isle La Motte sloop in 1982 and 1983 determined that the still unidentified vessel is of the 1841-1857 class (Cohn and Crisman 1984b, 1985). A second canal schooner of the 1858-1867 class named *O.J. Walker* was discovered in 1984. The Lake Champlain Maritime Museum (LCMM), the successor to CMS, carried out week-long investigations on these remains in 1988 and 1989. This site is remarkable for its well-preserved rigging equipment, including both masts and booms, along with several rigging blocks. In 1987 another canal sloop of the 1841-1857 class was discovered off North

Beach in Burlington. This site is unique in that the shallow remains are broken up, as opposed to the other vessels which are remarkably intact.

Archaeological investigations during the 1980s focused on recording the remains of the intact vessels above the mud line. With this largely complete, attention turned to reconstructing them on paper. With the reconstruction suffering from a lack information concerning their structures beneath the sediments, it became necessary to inspect the bottom of one of these craft. The Isle La Motte sloop and *General Butler* were rejected as candidates for excavation, as cargos of building stone and sediments within their holds prevented uncovering a complete hull section. *O.J. Walker* was dismissed due to a deck cargo of bricks, and a collapsing after cabin trunk, which argued against penetration of the hold. The North Beach wreck, however, contained no cargo, and its collapsed sides allowed the bottom available for inspection. A four-week Texas A&M University and University of Vermont field school in the summer of 1992 revealed that it is an example of a frameless construction technique by which thick planks are edge-fastened by iron drift bolts to build up the vessel's sides (Cozzi 1993), which makes it unique among the four archaeological examples.

In 1993, concern over the installation of an out fall pipe close to the *General Butler* led to a two-week LCMM project to set up silt monitoring stations and to excavate a trench amidships exposing a portion of the vessel's floor from the centerline to the starboard side. In 1995, LCMM returned to *General Butler* to conclude the siltation survey and to excavate the interior of the vessel's bow. Also in 1995, the VDHP requested a re-evaluation of *O.J. Walker* for inclusion in Vermont's underwater preserve, which presented the opportunity to examine portions of its hull below the mud line. As penetration of this site had already been deemed unwise, the research design focused on excavating outside the vessel. Results from the 1990s together with past project data point to several common features of Lake Champlain sailing canal boats.

Characteristics of Lake Champlain Sailing Canal Boats

Lake Champlain sailing canal boats have chine-constructed canal boat hulls with flat bottoms and vertical sides for most of their length. *General Butler* and *O.J. Walker* have floors and futtocks that meet at chine logs, which is a type of chine construction (Cozzi 1994) but differs from the North Beach wreck. Builders added bluff bows and either transom or scow sterns to these boxlike cargo holds. The keel does not project far, if at all, beneath the hull planking. *General Butler* has a keel plank with maximum molded and sided dimensions of 4 3/4 in. and 15 1/2 in. respectively. The North Beach wreck has an internal keel composed of 12-in.-square timbers, except at the stern where it is greatly reduced to permit water to flow over the rudder, and at the point where the centerboard passes through the keel where the sided dimension is 16 in. Stems butt against the keel's forward end in some manner, rather than being joined by a scarf. The stems of *General Butler* (Figure 1a) and *O.J. Walker* butt against the forward end of keel planks. On the North Beach wreck the forward end of the keel is formed from a branched timber creating a 16-in.-long surface that abuts the stem. All three of the stem-to-keel joints are reinforced by aprons. Sternposts are set plumb (Figure 1b) and do not rake astern. Framing is small in dimension and broadly spaced, as for example on *General Butler,* which has 5-in.-square floor timbers and roughly 4-in.-square futtocks with an average room and space of 2 ft.

Sailing canal boats are outfitted with either sloop or schooner rigs. Their masts are stepped on deck in tabernacles formed from two stanchions that rise from the vessel's floor and protrude through the deck by some 2 1/2 ft. A thick plank between the stanchion's forward edges above deck completes a three-sided box, while the after portion is left open to permit the mast to be lowered in this direction. A 2-in. iron pin placed athwartship through the stanchions and several inches above deck level provides the pivot point through the mast heel. Iron bands

around the tabernacle secure the mast, along with shrouds running to three sets of deadeyes on either side of the vessel, and a forestay at the stem head. The masts were raised and lowered from the bow by a windlass that also deployed the vessel's centerboard. The centerboard pivoted beneath the hull up to 8 ft. to prevent the flat-bottomed vessel from slipping to leeward. Centerboards and their trunks are built up from several broad, thick planks that are edge-fastened by iron drift bolts.

At some point the long, narrow hull form presented problems with hogging, and both canal schooners have hogging trusses installed on the port and starboard sides. These trusses consist of three timbers in a queen truss arrangement fastened over ceiling planking and into futtocks. A 3x10-in. top timber is placed below the clamp amidships for a run of 15 ft. Two diagonal timbers run from the ends of the top timber down toward the chine log. The truss is held in tension by vertical iron tie rods at the joint of the top timber and the diagonals. The tie rods are presumably anchored into the chine log. The North Beach wreck's edge-fastened construction technique turned each side into a virtual "Wall of Timber" which prevented hogging (Cozzi 1993), while the Isle La Motte sloop has no anti-hogging device. The canal schooners are 8 to 9 ft. longer than the canal sloops, and it may be this added length that necessitated the trusses.

The canal schooners were wheel-steered, unlike the Isle La Motte sloop which has a tiller. *O.J. Walker* has a well-preserved, shin-cracker wheel, aptly named for its tiller-mounted device that could easily strike an inattentive steersman's leg. The apparatus consists of a wheel and drum on an axle which is supported by two stanchions set on the tiller. A rope and tackle ran from the device to the bulwarks and back, and as the wheel turned, the drum would take up rope on one side of the tiller and release it on the other, moving the barn door rudder. *General Butler* had an apparatus that did not require a tiller. Instead, a now-missing wheel and axle transferred movement by gears and a vertical shaft to a 1-ft. 10-in. diameter gear still in place atop the rudderpost. The wheel's axle was supported at its after end by a wooden and iron composite block still mounted on the stern rail (Figure 1b). Fastenings on the deck indicate that an A-frame, which is no longer present, supported the forward end of the wheel's axle.

Sailing canal boats shared other features and practices, including bulwarks construction, bilge pump placement, cargo types, as well as deck and hold arrangements for cargo, boat equipment, and personal items. The forward bulwarks are constructed from frame tops that extend above deck level and are planked over, and capped with a rail, providing a sturdy point of attachment for towing cleats along the port and starboard sides. The remaining bulwarks consist of thick planks that are drift bolted through the waterway into wales. Bilge pumps are located at the sides of the vessel near the ends of the cargo hold and not along the centerline. Sailing canal boats carried a variety of Champlain Valley cargos including lumber, ash, wheat, cheese, butter, iron ore, building stone, and bricks. On return voyages from the Hudson Valley, cargos ranged from fresh fruit to manufactured goods, but the most prevalent cargo was coal. In addition to one or two companion hatches at the bow and a cabin hatch at the stern, sailing canal boats have anywhere from two to four cargo hatches. The interior of the bow served as an equipment storage locker containing rigging items, kerosene lamps, tools, mule harnesses, and paint supplies. The stern was reserved as living space for the captain and crew. The stern cabin was formed from a large hatch opening that was capped by a short trunk and roof. Cabins were painted white and had four windows at the stern and perhaps more in the cabin trunk. They could be finished with partitioning, flooring, cupboards, and bunks, and always contained a cook stove. Life on board *General Butler* is reflected by glass, ceramic, and metallic finds, such as bottles of bitters and spring water, stoneware, imported whiteware, and cast-iron pots. Along with necessities of life were objects kept for pleasure, such as a trumpet found on *O.J. Walker* and a model boat from *General Butler*.

Conclusions

The lightly constructed, chine-built hulls of Lake Champlain sailing canal boats permitted economy through the use of less skilled carpenters for the majority of their construction. The use of chine logs and frameless sides predates that reported for towed canal boats, suggesting that sailing canal boat hulls were not simply copies of the towed variety. Sailing canal boats utilized the latest technology for further economies, and techniques originating on the lake later spread to other areas. In 1832, the U.S. Navy built a schooner named *Experiment* following Annesley's scheme (Maloney 1974) some nine years after the first sailing canal boat of this type was completed. The frameless construction found at North Beach became common to canal boat building throughout New York, and this fastening method was later required for certain timbers on ocean vessels (Cozzi 1994). Locally available iron also led to the early use of turnbuckles and tie rods. Orson S. Spear, the Champlain Valley's premier boat builder, employed ship drafts as early as 1840. Wire rope, made famous with the erection of the Brooklyn Bridge in 1886, is evident on the standing rigging of *O.J. Walker* which was built in 1862 and sank in 1895. The wheel steering devices on *General Butler* and *O.J. Walker* are similar to mid-19th-century patents for steering apparatus.

After the Civil War, sailing canal boats lost their hold on lake commerce to steam-powered transportation. The railroad came to Burlington in 1849, and rails on the New York side of Lake Champlain were completed between Montreal, Canada, and Albany, New York, by 1875. The first screw-propelled steamboat built on Lake Champlain, *James H. Hooker*, appeared in 1846, permitting towed boats to ply lake trade. Vessel enrollment documents from the mid 1870s note that masts and rigging were removed from sailing canal boats, making them strictly towed craft, and indicating that steam technology on water was taking over. The Lake Champlain sailing canal boat is an example of appropriate technology well suited to conditions present in the Champlain Valley between 1840 and 1875. The study of four archaeological examples of these craft has expanded understanding of a long-forgotten class of inland transportation.

ACKNOWLEDGMENTS

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"Gallies are Unquestionably the Best Description of Vessels for the Northern Parts of this Lake": The Excavation and Study of the U.S.N. Row Galley *Allen* on Lake Champlain

Introduction

When New York shipwright Noah Brown arrived in the Lake Champlain Valley during the winter of 1813-1814, he was greeted by an anxious U.S. Navy Master Commandant Thomas Macdonough. More than a year had passed since the fledgling United States government had declared war on Great Britain over the issues of free trade and the impressment of American sailors. Unfortunately, the U.S. Navy was still largely in a state of disorganization and neglect (Crisman 1987:3-5). By February 1814, Brown and his shipwrights at Vergennes, Vermont, were engaged in an arms race with the British at Isle-aux-Noix, Canada; the prize was control of Lake Champlain (Figure 1). This strategic waterway was the key to supplying American efforts to invade Canada, as well as the key of British plans to split New England from the rest of the United States. Numerous reports from Canada suggested that the British intended to increase their naval force and overrun the lake by early spring. Macdonough, who could ill afford this latter outcome in his effort to beat the British onto the open lake, adopted the use of a variety of small war-craft, particularly row galleys.

Macdonough found row galleys to be "unquestionably the best description of vessels" for the rivers, inlets, and shoal waters of Lake Champlain (U. S. National Archives 1814). Galleys boasted a number of advantages for lake service: they could be quickly built and were relatively inexpensive; they had a shallow draught which allowed them to travel almost anywhere; their low freeboard made them difficult to hit from a distance; and they were capable of being operated by sails or sweeps. U.S. Navy Secretary William Jones trusted Macdonough's judgment and authorized him to build a small squadron of these vessels.

Jones specified that the Champlain galleys were to be built according to a set of plans approved in October 1813 by the Chief Naval Constructor at the Washington, D.C., shipyard, William Doughty. The vessels were 75 ft. long, 15 ft. in beam, and drew no more than 22 in. of water (Figure 2). Each mounted a long 24-pounder in the stern and a 42-pounder carronade in the bow. The design was similar to the galleys of Commodore Joshua Barney's Chesapeake Bay flotilla built earlier that year.

In less than two months, Brown built and armed a total of six row galleys: *Allen, Borer, Burrows, Centipede, Nettle*, and *Viper*. *Allen* was launched into the Otter Creek below the falls at Vergennes in late April 1814. It was immediately called upon to help protect Fort Cassin, a makeshift American battery at the river's outlet into Lake Champlain. At this time, *Allen* was manned by 40 officers and seamen under the command of Sailing Master William S. Robbins.

Allen cruised the lake for smugglers during the spring and fall of 1814, and assisted Macdonough's fleet in its victory over the British at Plattsburgh Bay on 11 September. When the war ended in December 1814, the Navy's squadron was put in ordinary at Whitehall, New York. *Allen* was recommissioned for patrol duty on the lake roughly two years later under the provisions of the Rush-Bagot Agreement. When the Navy Department closed the Whitehall station in 1825-1826, the galleys were sold. Situated out of the way in the Poultney River—about a mile and a quarter northeast of Whitehall—the exposed portions of *Allen*'s hull were removed by salvagers; the submerged portions remained well preserved.

Whitehall Project 1995

It was believed that Macdonough's row galleys had been mass produced from a copy of

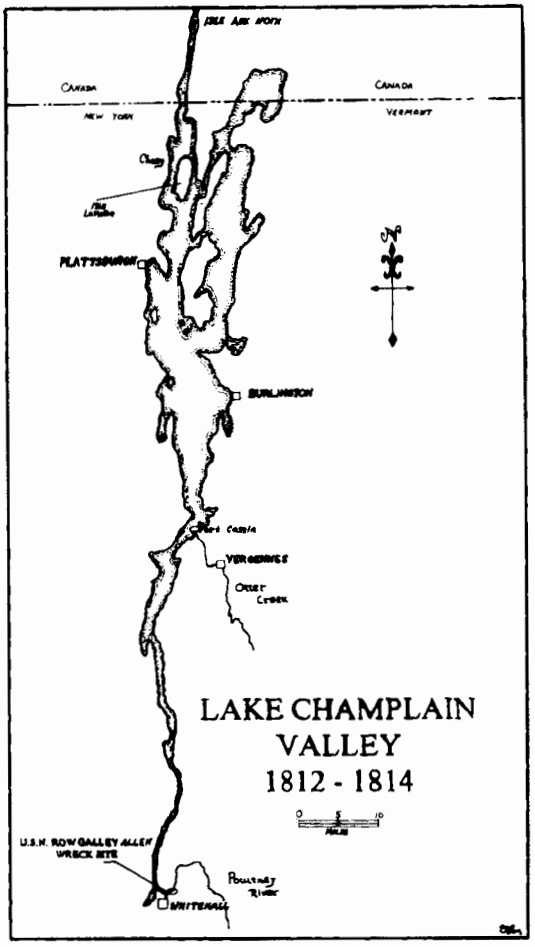

FIGURE 1. A map of Lake Champlain, 1812-1814.

Doughty's 1813 plan (Warren 1984:65). Physical evidence to confirm this theory, however, did not exist, as there were no known examples of a War of 1812 galley available for study on Lake Champlain. This changed in August of 1981 when Dr. Kevin Crisman, Arthur Cohn, and Ken Cameron discovered the remains of a vessel—thought to be *Allen*—in the Poultney River. The wreck was situated adjacent to the New York side of the river, downstream from the remains of the U.S. brig *Eagle* and the British brig *Linnet*. Approximately 50 percent of the original hull was determined to be intact. This included the keel (roughly 70 ft. in length) and the keelson (67 ft. in length), portions of the stem and sternpost assemblies, and most of the starboard side. A full-scale investigation of the wreck promised to yield a considerable amount of new information on early naval life and the design and construction of War of 1812 vessels on Lake Champlain. It was further concluded that it would be possible to reconstruct the hull's shape and appearance from the existing remains in the form of line drawings and construction plans.

Excavation of *Allen* took place during the summer of 1995 in the form of a joint field school between Texas A&M University and the University of Vermont. The data needed to complete the analysis of the hull (thereby permitting its reconstruction) were gathered in a timely manner. Archaeologists competed against the clock much like Brown and his men in 1814. A new type of enemy—known as the zebra mussel—was threatening to invade the Poultney River. These tiny mollusks were recently introduced into Lake Champlain where they have begun to form colonies on wooden shipwrecks, thus obscuring the details of their design and construction. Five main objectives were defined for the 1995 project: (1) to gather sufficient information to develop a complete site plan; (2) to complete the documentation of the keel, keelson, and stem and sternpost assemblies; (3) to record the construction and shape of frame sections at as many points as possible; (4) to conduct an intensive study of the vessel's starboard side, including its ceiling planking; and (5) to map and record the vessel's ballast arrangement in the stern on both sides of the keelson and remove samples for conservation.

The following is a summary of only a portion of the data collected that summer. This information has been organized for the reader from the keel up, the typical order of construction for 19th-century wooden vessels. Special consideration has been given to the hull features that suggest Brown deviated from Doughty's 1813 plan and employed certain shortcuts in an effort to hasten *Allen*'s completion.

Preliminary Analysis of *Allen*'s Hull Construction

Keel

Allen's keel was estimated to be between 68 ft. and 70 ft. in length and probably consisted of two timbers flat-scarfed together. Analysis of the keel was restricted to a 5-ft. section exposed in the bow, a 3-ft. section in the stern, and measurements of its top surface taken at 15 frame positions. Its dimensions ranged from 6 in. moulded and 4 in. sided in the bow to 10 in. moulded and 10 1/2 in. sided at 25 ft. along the baseline and tapering to 3 in. moulded and 3 in. sided in the stern. Samples of wood from the keel could be obtained only forward of amidships. The forward keel timber was fashioned from white oak.

A rabbet was cut along the top of the keel to fit the outer planking. Its two grooves ran from stem to stern approximately 1/2 in. down from the top of the keel. The rabbet had two 40-degree angles roughly 1 to 1 1/2 in. deep. It started just forward of the after end of the apron and could be recorded six frames aft, at which point it was difficult to discern due to the outer planking.

The lack of a protective timber, or "false keel," on the underside of *Allen*'s keel suggested that the vessel was not expected to survive much longer than its service in 1814. Galleys were designed for shallow-water use and could even run ashore to deploy troops and supplies. Such activities would have made covering the bottom surface of the keel essential to its longevity.

Stem and Stern Assemblies

The stem was flat-scarfed to the keel and measured 2 ft. 7 1/2 in. in length, and extended up from the horizontal plane of the keel at approximately a 58-degree angle. At its widest point the stem was 4 in. moulded and 6 in. sided. The keel extended about 10 in. forward of the stem's base. The lower edge of the stem was considerably worn and deteriorated. This suggested that the space was not intended to hold an outer timber. Instead, the stem's original dimensions would have filled that space. However, wood samples taken during the excavation disagree with this theory. They showed the existence of three different wood types: the section of the stem closest to the forward end of the keel was fashioned from red oak; the timber fastened between this outer stem, or "false stem," and the apron was of American elm; and the apron itself was of white ash.

Two plugs, or "stopwaters," were found in the scarf seam where the stem and keel were attached. The apron was attached to the top of the stem with four 3/4-in.-diameter iron through

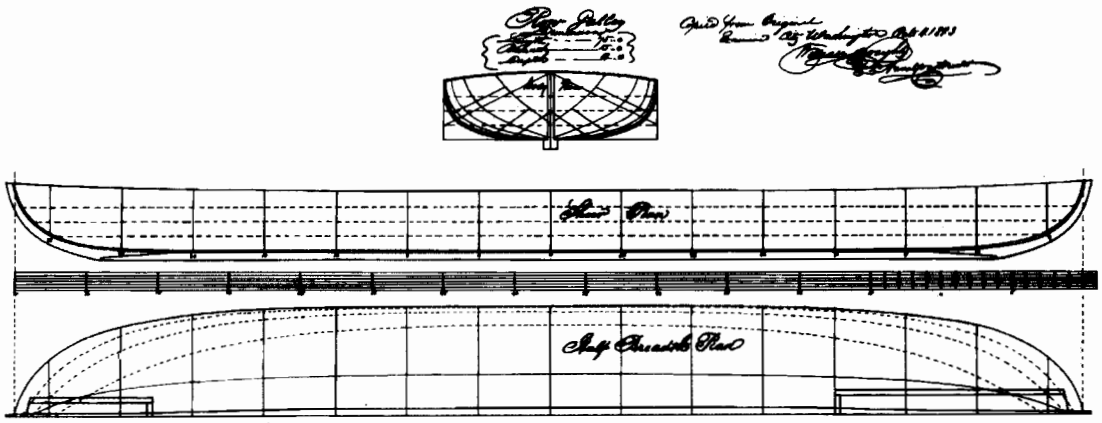

FIGURE 2. Plans for a USN row galley approved by William Doughty, October 1813. (United States Archives, Washington, D.C..)

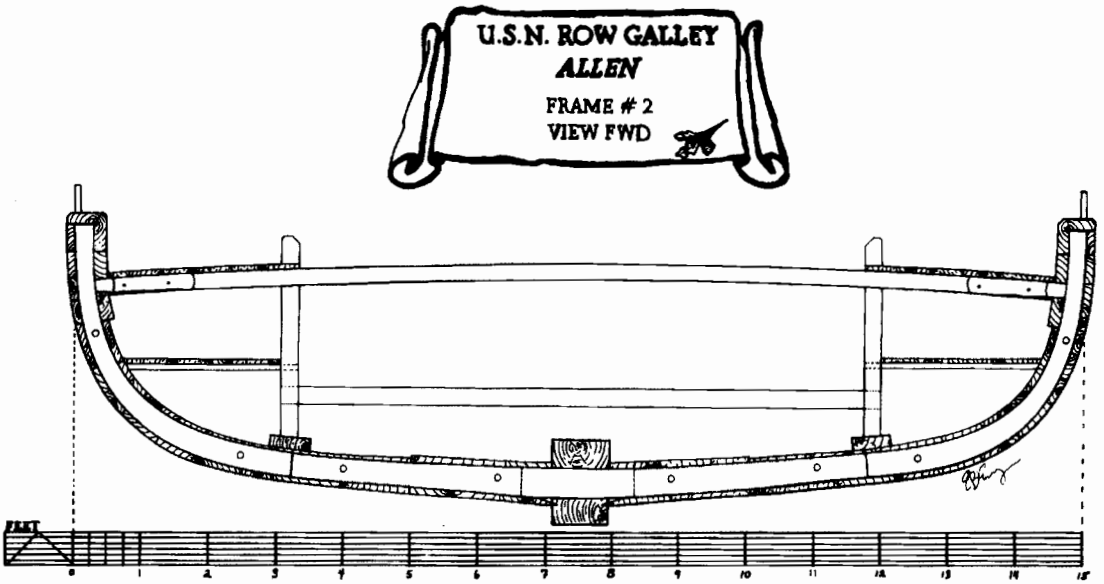

FIGURE 3. A reconstructed midships section of the USN row galley *Allen* .

bolts. The overall length of the apron was 5 ft. 6 in. Its dimensions varied from 3 1/2 to 10 in. moulded by 3 1/2 to 5 in. sided.

Allen's stern bore little resemblance to that of Doughty's design. Doughty showed a double-ended galley with its rudder hung from a curved sternpost. *Allen* had a straight sternpost which was fastened to the top of the keel by a long, flat scarf and secured to the keelson and Frame 23 by means of two 3/4-in.-diameter iron drift bolts. An iron eye bolt with a 1 1/2-in.-diameter hole was driven into the after-end of the outer sternpost; this makeshift gudgeon was a fast and easy way to hang the rudder. It would have also enabled the gun crews to quickly un-ship the rudder prior to using the long 24-pounder mounted in the stern.

Keelson

Consisting of two timbers flat-scarfed together 24 ft. aft of the stem, the galley's keelson was nearly intact. Although the forward end was considerably deteriorated, the overall length of the keelson was 67 ft. 3 in., and it was accessible for documentation at all points. It measured 1 1/2 in. moulded by 1 in. sided in the bow and 4 1/2 in. moulded by 5 7/8 in. sided in the stern, with an average dimension of 4 in. moulded by 7 in. sided. The top surface had stanchion mortises as well as two mast steps. The first mast step was located 13 ft. 9 in. from the forward end of the keelson. It was 6 in. long, 5 in. wide, and 3 3/4 in. deep. The second mast step was located 45 ft., 5 in. from the forward end and was 10 in. long, 4 3/4 in. wide, and 4 1/4 in. deep.

At 51 ft. abaft of the stem, a series of planks extended transversely across the top of the keelson; they averaged 4 in. in width and their lengths varied (depending on the extent of decomposition) from 4 to 8 in. This transverse decking, or planking, was above the level of the ceiling, and was perhaps intended to provide seamen with a surface to walk on that was not cluttered with ballast.

An unusual drift bolt pattern along the keelson provided evidence that may help confirm the existence of two keel timbers. At the stem, amidships, and the stern were a series of three 3/4-in. drift bolts that had been driven through the keelson and keel within a foot of each other. This provided additional rigidity to *Allen*'s backbone at these potential weak sites. Similar drift

bolt patterns were found at 20 ft. 4 in. from the stem and at 30 ft. 10 in. One of these locations coincided with the keelson scarf, and the bolts clearly were intended to secure the scarf. The second grouping of drift bolts may define the location of the keel scarf.

Excavation of the Starboard Ceiling and Frames

One of the primary objectives of the 1995 fieldwork was to excavate *Allen*'s starboard ceiling and frames which were buried beneath the Poultney River's heavy clay banks. A grid was constructed during the first week of the project and placed over the wreck. This structure was 20 ft. long by 5 ft. and was installed between the after edge of Frame K and the forward edge of Frame 4. This structure was divided into 5-ft.-square excavation units. Transversely, the grid extended from the starboard edge of the keelson to nearly the top of the existing starboard frames. The units within the grid were numbered consecutively from 1 to 4, with Unit 1 closest to the bow and Unit 4 closest to the stern. A second grid (10 ft. long) was installed but left unexcavated.

The ceiling on the starboard side was generally well preserved, and some strakes spanned more than 14 ft. Their widths ranged between 7 in. and 15 in., and thicknesses between 3/4 in. and 1 in. The ceiling planking was attached to the vessel's frames with iron T-head nails. Some notable features found on these planks included small wooden battens extending laterally from the starboard edge of the keelson toward the bulwarks. These battens were 17 in. long and 2 in. wide. They were fastened to the ceiling with three T-head nails about 2 1/2 in. apart. Three pairs of battens were found on the starboard side with an average spacing of 5 ft. It is possible that these battens were designed to hold in place bulwarks in the hull's storage areas. Samples of the ceiling and battens were removed for documentation on shore while divers continued to record the frames underneath.

Irregularities existed in *Allen*'s frame construction and composition. The frames appeared to have been assembled with little regard for size and spacing, and they varied in moulded and sided dimensions from 3 1/2 in. moulded by 5 in. sided to 5 1/2 in. moulded by 7 in. sided. On average they were spaced along the keelson every 2 1/2 ft. *Allen*'s shipwrights were building in a hurry and may have allowed considerable leeway for error. For example, one starboard futtock was attached to the wrong side of its respective floor timber (it did not follow the pattern of the other frames forward of amidships), drift bolts missed frames and simply passed through the keel and keelson, there were no limber holes cut into the underside of the frames, and some frames may have been produced from unseasoned wood. One frame in particular was abnormally large and soft. It was the largest frame in the entire vessel (4 in. moulded by 8 in. sided) and was fashioned from white pine, an unusually weak wood choice for a floor timber.

Excavation and Documentation of the Ballast

The collection of pig iron ballast found in *Allen*'s stern area suggested that it was being used to counterbalance a large weight in the bow. This was unusual because ballast was typically placed on either side of the keelson along most of its length. This kept the vessel trim in the water and added stability to the hull. When *Allen* was patrolling Lake Champlain during the latter part of its career, it mounted a long 12-pounder on its bow. The weight of this gun would have required sufficient ballast in the galley's stern to float the vessel on an even keel.

It was not until the end of the second week of work that sufficient debris had been removed to allow for the mapping of the ballast, all of which was recorded and measured in situ. Ranging in size from 7 in. long by 3 in. wide to 32 in. long by 3 3/4 in. wide, the 16 pieces on the starboard side of the keelson were tagged and removed. These pieces were taken to the Lake Champlain Maritime Museum and conserved. They have not yet been weighed.

Preliminary Reconstruction of *Allen*

Allen's starboard side was best preserved and thus yielded the most information during the 1995 excavation. The missing portions of the hull were reconstructed based on comparisons with other contemporary vessels of a similar class and information obtained through historical documentation. The assembly of *Allen*'s frames was consistent with traditional 19th-century shipbuilding techniques. Floor timbers and futtocks were fastened together to form a U-shaped frame secured between the keelson and keel with iron bolts. From stem to stern, the first 22 frames had their futtocks fastened to the after face of their respective floor timbers, and the next 23 frames had the opposite orientation. *Allen*'s midship area consisted of six frames of roughly the same dimensions and shape. In long, shallow hulls this was commonly called a "dead flat."

Allen's hull shape was considerably different from the galley depicted in Doughty's plan. Doughty showed a series of sections with a full turn of the bilge, while *Allen* had a more pronounced deadrise (Figures 2 and 3). Macdonough needed his galleys to be somewhat sail-worthy, and the sharper angle of *Allen*'s hull would have enabled it to cut through the water easier and provided better lateral resistance. Doughty's galley, on the other hand, was more barge-like. It would have supported its guns well but sailed miserably.

Conclusion

Archaeological analysis of *Allen* has revealed a wealth of information about row galley construction on Lake Champlain during the War of 1812. The vessel's significance is vast. It is the only known example of a vessel built by Noah Brown that is available for study. With further analysis of the hull and artifacts, we will eventually have a better understanding of life aboard a Champlain row galley, and the ability to identify certain construction features unique to Noah Brown-built vessels. At the least, *Allen*'s rapid construction represents an impressive accomplishment. Although some hull features suggest a live-fast, die-young, leave-a-good-looking-corpse attitude, they also serve as an example of Brown's shipbuilding genius: simple, strong, and serviceable vessels produced in short periods of time.

ACKNOWLEDGMENTS

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Interim Report of Casks Excavated From the Millecoquins' Shipwreck

Introduction

The Millecoquins' Shipwreck is a late 1830s Great Lakes trading vessel. The wreck lies near the mouth of the Millecoquins River, west of Naubinway, Michigan (Figure 1). The ship measures 62 ft. overall and has a beam of 17 ft. 5 in. (Figure 2). The vessel's construction is entirely of white oak, except for a poplar bulkhead and pine interior cabinetry (Cantelas 1993:13).

In 1991, East Carolina University's Program in Maritime History and Nautical Archaeology excavated the vessel's bow and stern sections. Excavations uncovered remains of personal effects, general stores, and two casks. Probing revealed the cargo area was fully laden. The abundance of material, combined with a lack of time, limited research from continuing into the vessel's midsection (Cantelas 1993:13, 15).

The Program in Maritime History and Nautical Archaeology conducted a second field season in 1994. This season focused on excavating the starboard midsection, between previously excavated bow and stern sections (Figure 2). Staff and students recovered 24 casks, exposed the framing pattern, and recovered numerous artifacts from an aft cabinet (Figures 2 and 3).

Twenty-three tierces and one kilderkin were recovered. Though most of the casks were empty, a few held well-preserved fish remains. Markings existed on many of the empty casks; however, a few casks remained enigmatic, with no markings or contents.

The 1991 season produced only two complete tierces from the vessel's bow area. Miscellaneous cask heads and staves were also recovered at this time. The remaining casks were excavated in the 1994 season. The casks were dispersed throughout the starboard side, with a majority recovered between 27 ft. and 35 ft. aft of the bow. Most of the casks appear to be in situ; however, some had undergone shifting or floating during the vessel's grounding and subsequent burial.

The casks were relatively the same size. The staves ranged from 27 in. to 31 in. in length with a width of 2 in. to 5 in. The staves were 1/4 to 3/4 in. thick. The casks contained between 15 to 19 staves with capacities of at least 32 imperial gallons. Calculating the capacity was general at best, since most of the casks were crushed or altered from their original shapes. This modified the booge circumference, thus changing capacity. The casks on average appeared to be tierces, except for two which were comparable to kilderkins (Coble 1995, pers. comm.). Tierces measure 6 gallons more than barrels, while kilderkins are equal to half a barrel (Thomas 1963:98).

The casks were made of five different wood species: hemlock, white oak, white pine, beech, and elm. Hemlock was the predominant wood species for stave construction, found in 16 casks (Figure 3). The second most prevalent wood species was white pine, found in five casks, while white oak was used for three casks. Beech and elm were not utilized for stave construction.

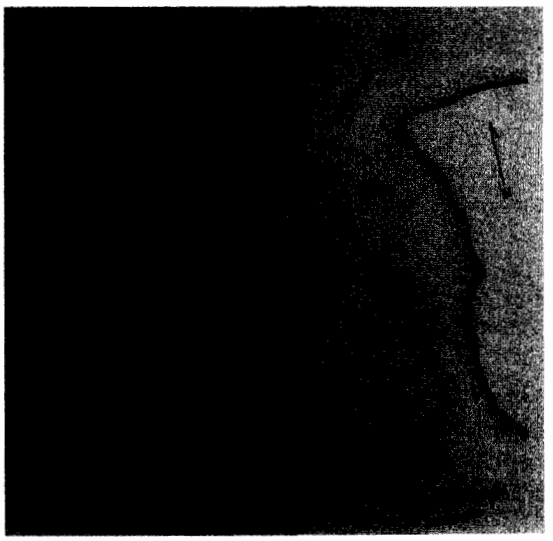

FIGURE 1. Map of the State of Michigan, showing the wreck's location (Cantelas 1993:13).

FIGURE 2. Site plan of the Millecoquins wreck, generated in 1993 (Cantelas 1993:14).

The heads consisted of all five wood species. White pine and beech were each found in six casks, white oak was found in five, while elm and hemlock were each found in four. Ash hoop construction was found for 23 casks, while the remaining three used white oak.

Wood species for cask construction on the Millecoquins Wreck fell into two main groups: white pine and white oak versus hemlock. The white pine and white oak casks had white pine and white oak heads, while the hemlock-staved casks had elm, beech, hemlock, and white oak heads.

The dichotomy of wood species was also apparent in the casks' placement within the hold. The hemlock casks were centrally located in the ship's hold, while the pine and oak casks were found fore and aft of the salt casks. Some mixing does exist, but was likely due to subsequent shifting or floating.

The dichotomy of wood species was also found according to cask contents. Fish remains were found in four of the pine and oak casks. The remaining pine and oak casks were empty, possibly due to spilling. Research found that the hemlock casks, though empty at the time of excavation, had carried salt. The soluble saline contents were rinsed out through the numerous ground water springs located under the vessel.

Markings

No marks, inscriptions, or paint were found on the staves; only the heads retained evidence of markings. The hemlock casks were most prevalently and consistently marked. All but one hemlock cask had a number between 270 and 320 inscribed on the head. Nine hemlock casks also had JM ALLEN INSPECTOR painted on the head. Other markings included the words SYRACUSE, SALINA, RICHMOND, the name J. COON, and the initials B&D.

Of the five white pine casks, three had no markings, one had the initials A&S painted, and one had P& no-33 painted on it. Of the three white oak casks, two had no markings and one had the initials B&D painted on the head.

Several of the heads had incised scratches. The scratches were typically in the form of an X or double X. Some heads had only elliptical or moon-shaped markings; others had only straight lines. These markings probably represented coopers' or makers' marks.

Contents

The Millecoquins casks were divided into three groups according to content: salt, fish, and empty. The largest group was the hemlock or salt barrels, comprising 16 casks. The second group was comprised of four fish casks, and the last group included five empty casks.

The salt casks were a puzzle upon excavation as the casks did not contain any saline remains. Liquids were eliminated because the casks' construction elements were not consistent with known tight cooperage. For example, tight casks were made from good-quality hardwoods and had a bung to pour and drain the liquid, two elements the salt casks lack.

Additional commodities were excluded due to a lack of evidence. The site's excellent preservation would have left some form of remains such as bone, seeds, or pits, etc. Spilling was eliminated because most of the casks had intact heads, preventing large-scale seepage. Dunnage was still packed around the casks, further preventing the contents from leaking. The lack of evidence and the casks' construction then led research to focus on water-soluble goods such as salt and sugar. Ships' manifests from the District of Michlimackinac and inventories at Fort Wilkins pinpointed three likely candidates: salt, sugar, and soap. Markings on the casks' heads

provided the decisive clue. The hemlock casks had JM ALLEN INSPECTOR and/or SALINA or SYRACUSE painted on the head.

Salt production was a major industry for early 19th-century Syracuse. An 1851 report from the Secretary of the Treasury specifically indicated salt was shipped from Salina and Liverpool (both suburbs of Syracuse) to Syracuse, then out to the port of Oswego on Lake Ontario. From there salt was shipped to various ports in Canada and the United States (Andrews 1851:76). Research at the New York State archives revealed J. M. Allen was the salt inspector between 1836 and 1839 (Register of Bonds).

Statistics relating to saline interests described how each cask should be marked after inspection. The statistics stated that when the cask passed inspection, the company that produced the salt was to brand or mark the cask with the surname of the inspector, initials of Christian name, the word INSPECTOR, and weight prescribed by the inspector (Garirigues 1881:36).

The statistics also described the casks' construction. The staves were to be between 30 1/2 to 31 1/2 in. long and 1/2 to 7/16 in. thick and no wider than 4 in. Each cask should hold between 280 and 320 pounds, and each packer should make a hole 7/8 in. in diameter in the head for inspection (Garrigues 1881:29, 40). The preceding information accurately described the casks excavated at Millecoquins. The casks were similar in length, thickness, and width, and had a sample hole and corresponding markings.

Four casks contained extant fish remains. Two possible types of casked fish were found on the Millecoquins site. The first type had larger bones with a pink flesh; the second had smaller bones with a dark grey flesh. Initial estimates suggested the latter fish were white fish, a species common to the Great Lakes. The fish remains are currently being analyzed for species.

The casks holding the fish with pinkish flesh were found aft of the salt casks and were therefore inaccessible to immediate loading and unloading. This suggests the two casks were loaded early in the vessel's trip. Unfortunately, neither cask had any markings to help indicate the vessels' origin. The other two fish casks were found forward of the salt casks, near the bow. Again, the casks lacked distinctive markings.

None of the casks conformed to statutes laid by either Canada or Michigan. The statutes for Michigan stated each cask should be marked with a no. 1 or no. 2, denoting quality. The head should have the denomination of fish, inspector's initials and surname, county inspected in, the word MICHIGAN, and year inspected (Bagg 1838:141).

Statutes for the Canadian fishing trade were given in greater detail in the Parks Canada Research Bulletin No. 208, "Bulk Packaging in British North America, 1758-1867: A Guide to the Identification and Reproduction of Casks." Specifications for Lower Canada in the 1820s stated that each cask should have the type of fish, the town where inspected, the word INSPECTED, the inspector's Christian surname and initials, and the year and month inspected. Upper Canada in 1840 specified each cask should be marked with No. 1 or No. 2, species, inspector's Christian initial and surname, district where inspected, and UPPER CANADA. Each district in Canada throughout the 19th century had similar statutes (Burns 1983:18).

The only similarity between the excavated casks and specifications of the statutes related to size. For instance, in 1829 Nova Scotia maintained that salmon, herring, and gaspereau (drum) should be packed in casks 27 in. long and mackerel in casks 28 1/2 in. long. In 1849, herring and alewives should be packed in casks 27 in. long and contain 26-27 gallons, while

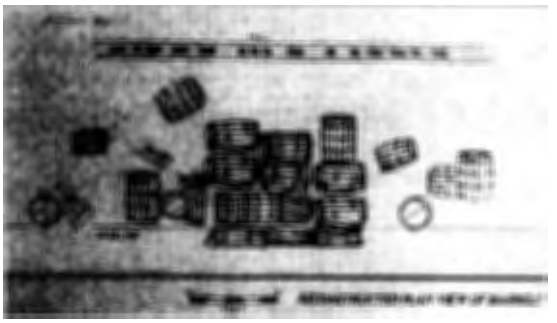

FIGURE 3. Site plan of the casks recovered in the 1994 season.

mackerel and salmon casks should be 28 in. long and contain 28-29 gallons (Burns 1983:13-16). Again, each district had similar specifications for cask construction.

There are several possibilities for the absence of markings. White fish could be packed under different regulations because it did not need to be pickled. The previous regulations were for pickled fish such as salmon, herring, and cod, but the statutes did not account for unsalted fish.

Another possibility is that the fish were being taken directly to market and could therefore have bypassed inspection. Canadian districts exempted uninspected fish for immediate consumption if brought directly to market in casks by fishermen (Burns 1983:15). These possibilities, however, did not explain the fish found aft of the salt casks, where they were not easily accessible for market.

The remaining casks were empty and lacked distinguishing markings. These casks were likely empty when the vessel grounded, as they were found scattered throughout the hold. Also, many of the empty casks were found lying horizontal, allowing for spillage, and were not protected by dunnage or surrounding casks. They were built similarly to the fish casks, utilizing the same wood and hoop configurations.

Conclusion

The Millecoquins wreck carried two types of casks, hemlock salt casks and white pine or white oak fish casks. The salt casks were easily recognized by their wood species use. The salt casks had hemlock staves with hemlock, beech, elm, or white oak head pieces.

Each cask had a number between 270 and 320 inscribed in the head. Many had JM ALLEN INSPECTOR and the cities SYRACUSE or SALINA painted on the head. The in situ casks had dunnage still packed around them, indicating they were full at the time of wrecking. The construction was typical of stated salt cask manufacture. The staves measured 28 in. to 31 in. in length and their heads measured 17 in. 18 in. in diameter. They had no bungs, but each had a sample hole bored in the head.

The fish casks' staves and heads were made of white oak or white pine. The casks had few markings on their heads and no markings on the staves. The absence of markings was surprising because statutes indicated inspected casks should have a list of information painted on the heads. These included the word INSPECTED, inspector's name, date and where inspected, and fish quality and denomination.

The fish casks were found primarily fore and aft of the salt casks. As only the upright casks had fish remains, it was likely the vertical position protected the contents. As they were similar in construction, the horizontally lying empty casks likely carried corresponding goods.

Further historical and laboratory analysis should provide researchers with a clearer understanding of the Great Lakes salt and fishing industries. Shipments of salt and fish were typical, necessary commodities for the daily functioning of villages, ports, and forts. The Millecoquins wreck provided a first-hand account of how these commodities were shipped, stowed, and traded. The remarkably intact vessel was a rare opportunity to study early 19th-century Great Lakes trade.

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Project Croatan: Volunteers Seize the Day

Introduction

Most archaeological projects involve archival research, elaborate planning, a search for funding, selection of team members, gathering of equipment, and site searches and surveys. Then sometimes a project drops in your lap. You either do it now with what you have or lose the opportunity to do anything. Such an endeavor was Project Croatan, a wreck survey done on a shoestring with volunteers in a matter of weeks, before souvenir hunters or the sea claimed it once more.

Background and Site Description

The waters off Virginia are a graveyard for countless ships sunk by acts of war or nature. Many of the ships are known, but others went down unseen and alone during the age of sail. From time to time, the same sort of storms that sank many of these ships washes up portions of their remains.

On 20 November 1994 Hurricane Gordon's massive waves washed up an inverted 42-ft. bow section of a wooden vessel into the surf line at Croatan Beach about a quarter mile south of Virginia Beach, Virginia. Director Fielding Tyler and Education Director Ann Dearman of the Life-Saving Museum of Virginia photographed the remains (Figure 1). They also found a 47-ft.-long probable keelson consisting of three 1-ft.-square timbers fastened together, as well as other disarticulated pieces washed ashore in the same general area. On 9 December the authors, visiting Tidewater maritime museums for their periodical MAHSNEWS, visited the Life-Saving Museum and met Tyler, who described the wreck. The next week the authors reported to members of the Maritime Archaeological and Historical Society (MAHS—an organization devoted to preserving America's maritime heritage). It was agreed that they would contact NOAA's John Broadwater (archaeologist in charge of the *Monitor* Project and working out of the Tidewater area) about the possibility of using MAHS volunteers to survey the wreck under his direction. Fortuitously, Broadwater is an advisor to both MAHS and the Life-Saving Museum.

Tyler believed that the remains would be washed back to sea or vandalized, so he arranged for the Air National Guard civil engineers to right the wreck and move it with a Caterpillar tractor to a point higher up on the beach at Rudee Inlet. The keelson section was washed back out to sea by a storm before it could be moved.

Julie Pouliot, co-author of *Shipwrecks on the Virginia Coast* and the museum's Administrator and Registrar, put together a list of possible shipwrecks based on research into Life-Saving and Coast Guard records, laying out an area from the North Carolina border to the mouth of Chesapeake Bay with two dozen more likely wreck candidates as well as a number of other recorded wrecks in the area. MAHS Education Director Tom Berkey further annotated this list with size and origin information plus a few other candidates. The overall list was based on probable tonnage (200 to 700) and the likely period of the wreck (1850-1910), assumed from its general appearance. It is recognized that there are many unrecorded wrecks which might also account for the remains.

Broadwater agreed to serve as Project Archaeologist to oversee a wreck survey during the weekend of 21-22 January 1995. Overall direction was provided by the Life-Saving Museum of Virginia—the trustees of the wreck. A dozen MAHS volunteers traveled to Virginia Beach and stayed with friends to minimize expense.

The Survey

The objectives of the survey were to record the wreck's dimensions and diagnostics, deploy a dive team to find and recover, if possible, the keelson that had washed back out to sea, and examine disarticulated pieces. We also hoped to

record any unique characteristics that might add to the knowledge of shipbuilding, characterize the wreck by size, origin, date, and type, and, if possible, name the wreck.

The team laid a baseline atop the three-timber keelson and triangulated positions of the forward remains of the 15 surviving frames and other significant hull parts (Figure 2). Sufficient ceiling was missing to allow many of the frames to be plotted as they passed between the keel and the keelson. Most of the hull aft of Frame 15 (30 ft. aft of the zero point on the baseline) was missing except the keelson and keel, which ended at about 42 ft.

In addition to exterior and ceiling plank measurements made by the team, J. "COZ" Cozzi of Texas A & M University measured frame curvature at Frames 3, 5, 8, 11, and 15 with a "Cozziometer"—an updated (digital electronic) version of the bevel gauge goniometer. Additionally, two local TV stations covered the project and made their coverage the feature presentation of their evening newscasts, providing welcome publicity for the techniques of nautical archaeology.

The team plotted one-to-one tracings of the starboard hull interior and exterior planks. Ceiling planks were plotted from bow to Frame 10 and exposed exterior planks from bow to Frame 5, including location of treenails and the few metal fasteners. Wood samples were taken from the keel, keelson, floor, ceiling, and exterior planking for further examination.

A dive team was ready to search for the probable keelson that had washed back out to sea some weeks before, but weather conditions precluded the search. The "Odd Pieces" that had washed up in the same area during the same storm were examined but could not be positively related to the wreck and were not considered further in the project.

Component Measurements

The keel, keelson, 15 frames, and the exterior and ceiling planks to a height of about 6 ft. above the base of the keel survive. The widest remaining portion of the ship is 22 ft. The

FIGURE 1. Fielding Tyler examines the Croatan wreck

single-timbered keel is 12 in. wide and 16 3/4 in. thick at Frame 15, and ends with a keel scarf joint beginning at 38 ft. and ending at 42-plus ft. from the bow. The keelson's three timbers are untapered, about 13 1/2 in. wide and about 12 in. thick. The only scarf joint is on Keelson 1 beginning at 19 ft. and ending at 23 1/2 ft. There are five mortises cut into Keelson 3. Four are about 3 in. wide x 12 in. long x 3 in. deep, beginning at 13 ft. aft and at 6-ft. intervals thereafter. These are likely seats for lower deck stanchions. The top rider keelson ends in a large unraked rectangular mortise, probably a mast step, 8 in. wide x 6 1/2 in. deep x unknown in. long (the aft end of the keelson was abraded).

The section that washed out to sea was 47 ft. long and consisted of three timbers each 14 in. wide and about 12 in. thick fashioned together with metal pins. Two of the timbers had flat scarf joints about 4 to 5 ft. long. In all these features, the piece resembled the wreck's keelson. We judge, therefore, that it is probably from the original wreck, and thus the original keel/keelson was probably no less than 90 ft. long.

The garboard strake is 12 1/2 in. by 4 3/4 in.; exterior planks average 3 5/8 in. by 14 in. and ceiling planks 3 1/4 in. by 12 in. Planks tapered in width toward the bow to accommodate hull narrowing and also narrowed in thickness toward the bow.

Frames 1 through 15 survive. They are all uncanted (square) double frames consisting of a floor timber aft attached to butted first futtocks

forward. Arrangement appears regular, with all floor timbers being the aftmost sister of the pair, and first futtocks butting to the forward frame sister at about 5 ft. from the keel. Frame interval is 22 in. for the first four frames and 28 in. thereafter.

Diagnostics

Timbers and Planking

The keel has no shoe or rabbet. The keelson has two riders but no sisters and no apparent deadwood. The scarf joint has no stopwater. The uppermost keelson displays imprints in the forward 4 ft. of four apron seats, as well as a tenon cut into the most forward portion. The keelson shows circular saw markings of approximately 4-ft. radius in the forward port area.

Frames are paired and untapered with butt joints to first futtocks. The ends are evenly worn away and pitted with worm holes in the upper portion, indicating that the missing upper portion of the hull was a victim of exposure and age and not the recent storm.

The garboard strake is unrabbeted. Exterior strakes are carvel-planked. Ceiling planks extend to the keelson. The forward ends of bilge stringers and most ceiling planks are split sawn for about half their length, resembling wooden clothespins in longitudinal cross section, no doubt to facilitate bending the planks to fit increasing curvature toward the bow. This may be a distinctive diagnostic in ceiling planks and bilge stringers, helping to narrow the provenance of the wreck. Planking is in good condition without worm holes. No spars or spar remnants survived.

Fasteners

Five kinds of fasteners are evident. Numerous small nail holes over the entire surviving outer hull, closely spaced but in no discernible pattern, indicate the hull had been copper- or Muntz metal-sheathed, probably several times, and

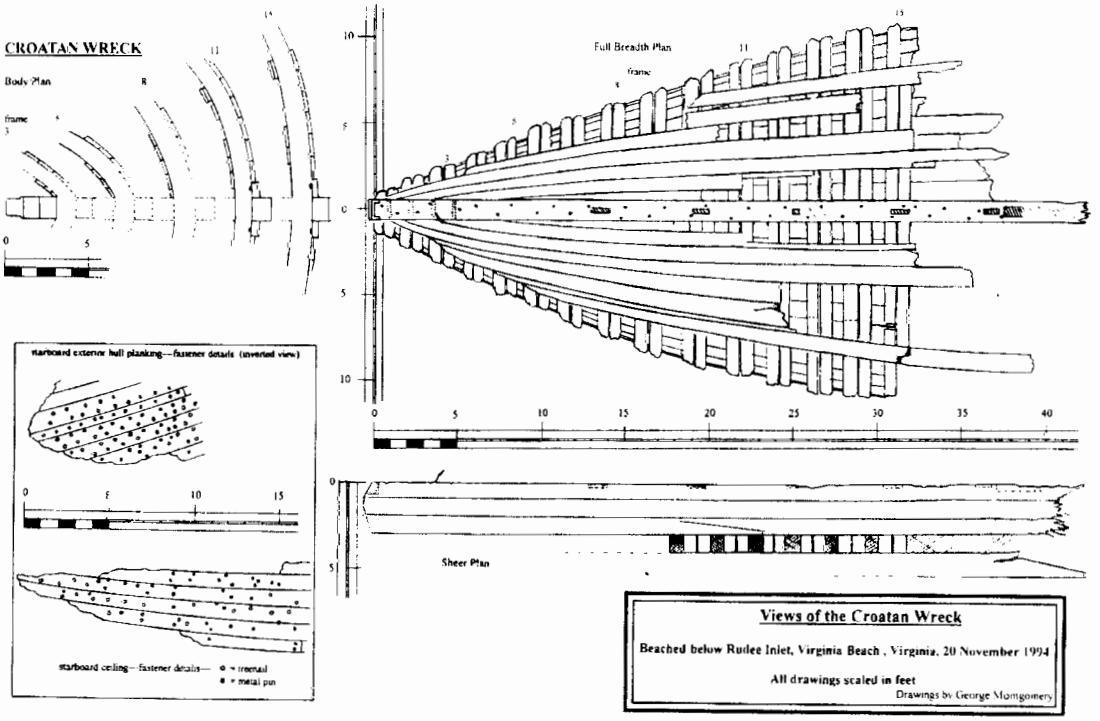

FIGURE 2. Scale drawings of the Croatan wreck

therefore likely had more than a decade of usage prior to foundering. A few copper nails but no sheathing survived.

Treenails are the fastener of choice. They are found in regular but inexact patterns (approximately one per plank per frame) attaching both floor and ceiling planks to the frames as well as being rarely used to connect keelson timbers and frame pairs. Treenails are 1 in. in diameter, with longitudinal striations (characteristic of die-cutting) with an octagonal cross section, and all exposed ends are split with wedges aligned athwartships.

Iron driftbolts are used to join keelson riders, sister frame members, and frames to the keel. They are used sparingly elsewhere, apparently at points where extra strength was required, such as at the turn of the bilge. Iron driftbolts with washers are occasionally found, but clench rings and rivets are not evident.

Bronze driftbolts are less common, used in the ceiling and stringers at irregular intervals. A couple have collars, but most are now missing. The driftbolts are less than an inch in diameter, but are so eroded that exact measurement was not possible.

Other Diagnostics

Limber holes are evident in the floor and first futtock timbers. Two probable shipwright markings were found on the interior port side, one on a frame, and the other on the top rider keelson. Two chocks, both below Keelson 1 on the center line, fill the space between Frames 13 and 14 and Frames 9 and 10. There is a gap of 2 in. at the bottom of the chocks to allow water passage. The function of the chocks is unclear. No artifacts or ballast remains were present.

Sizing the Ship—Tonnage or Cargo Capacity

Dimension-to-Tonnage Ratio

Several wreck identification aids were consulted. The most useful relationship was the formula found in the *Record of American and Foreign Shipping* (American Shipmasters Association 1878):

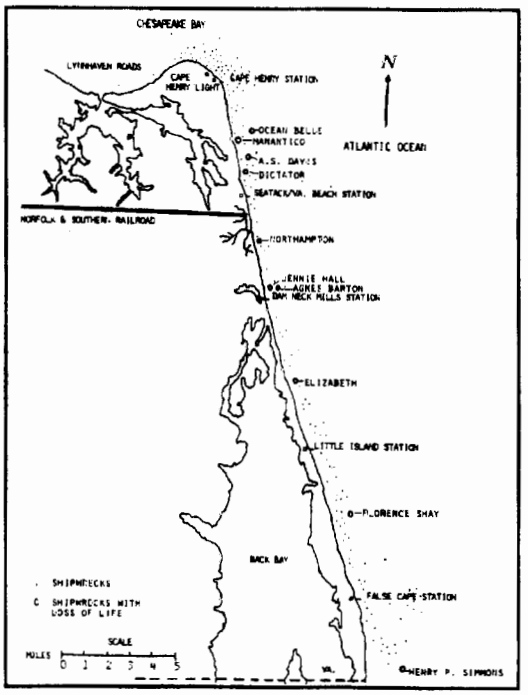

FIGURE 3. Recorded shipwrecks off Virginia Beach, 1874-1915 (Julie Pouliot).

length (main deck) X breadth (widest) X depth (hold) X.0075 = tonnage

Although we did not have a complete ship, we extrapolated from our measurements to derive the following probable dimensions.

Depth of hold: Curvature of the 6-ft.-high (from bottom of keel) bow section shown in the body plan cross sections indicates that only the lower bottom portion, well under the waterline, survives. By continuing this curvature in conformance with hulls of the period, we estimate that the draft would have been from 8 to 12 ft. and freeboard another 10 ft., and a depth of hold of about 10 to 15 ft., say 12.5 ft.

Width: At 22 ft., the widest extant cross section of hull shows no indication of lessening curvature. Not only would the hull widen considerably before any tumblehome, but it also ends well forward of maximum apparent width.

This appears to be a beamy ship. Beam is estimated at between 30-40 ft., say 35 ft.

Length: About 40 ft. remain with the keelson broken off at the first evident mast step. Because this mast step appears to be well forward of the mast position of a typical single-masted ship of our estimated width, it is likely that at least two and probably three masts were installed. Comparing normal foremast placement, we then arrive at a minimum length of main deck of 110 ft.—perhaps over 150 ft. if all masts reached the keelson. We split the difference at 130 ft.

Tonnage: Following the formula and taking mean dimension estimates, we calculate a rough tonnage of the original wreck as follows:

130' (length) X 35' (breadth) X 12.5' (depth of hold) X .0075=426 tons

Components as Tonnage Indicators

We used an 1878 American source providing *Rules for the Classification of Wooden Vessels* that equated sizes of ship timbers, planks, and fasteners to tonnage. We augmented this with the similar *Lloyd's Register* for features surviving in the wreck but not cited in the American source (Lloyd's 1889). There is a likelihood that any moderately sized ocean-going vessel plying American waters in the latter part of the last century would comply with the general component dimensions these publications prescribed for its tonnage so that it could be certified and insured.

Table 1 plots source dimensions against tonnage (from Rules unless annotated with "L" for *Lloyd's*) for ship features that were available for our measurement. The shaded individual boxes show the findings for the Croatan wreck. Measurements are in inches rounded to nearest tenth unless otherwise indicated and interpolated if the indicated tonnage was not provided.

We speculate on the original ship's size using this table as follows:

Planking Size: At Frame 15 exterior planks averaged 15 in. by 3 1/2 in. or equivalent to 400- to 800-ton ships, while ceiling planks averaged 13 in. by 3 in., more suitable for ships of 300 to 500 tons.

Fasteners: Metal driftpins are consistent in size with a ship of 500 to 600 tons. Treenails at 1-in. diameter, however, are more suitable for a 100-ton ship.

Timber Size: These features all approximate 1-ft. in cross section, indicating a ship of moderate size, two- or three-masted, probably not larger. Sided and molded dimensions, if squared, (9 in. x 12 in. = 108 in.) track nicely with 10 1/2-in. futtock or double floor size allotted to a ship of 400 tons.

Timber and Space (or frame interval): After the first five frames, this measurement is consistent in this forward portion of the wreck. It consists of frame pairs each 9 in. thick followed by a space of 10 in. for an interval of 28 in., equating again to a ship of 400 tons.

Sizing by component dimensions yields, with fastener exception, a ship of around 400 tons.

Wreck Location

To try to identify the wreck, we considered where it was found and the locations where similar candidates foundered. Ocean storms can move wrecks many miles along the coast, particularly if they float once freed from the bottom (Bright 1993). All in all, however, the odds of a match favor ships lost near a reappearing wreck. The map from Pouliot's book (Figure 3) has been annotated to show wrecks lost from the North Carolina border to the mouth of Chesapeake Bay based on Life Saving Service and Coast Guard records. The most likely wrecks based on size and location are named. Without much worm damage, it is unlikely that the Croatan wreck lay uncovered on the bottom for an extensive period.

Conclusions

Based on the above information, we believe that the Croatan wreck can be described as follows:

TABLE 1
COMPONENT DIMENSIONS AS TONNAGE INDICATORS

SHIP FEATURES TONS	100	200	300	400	500	600	700	800	900
Keel	10x11	11x12	12x13	12x14	13x15	14x16	14x17	14x18	14.5x18
Scarf of keel (feet) L	4.25	4.75	5.2	5.5	6	6	6	6.3	6.3
Keelson and riders	10x11	11x22	12x24	12x28	13x30	14x32	14x36	15x38	15.5x40
Scarf of keelson with riders (feet) L	4.25	4.75	5.2	5.5	6	6	6	6.3	6.3
Floor timbers	8x10	9x11	9x11	9.5x12	10x12.5	10.5x13	10.5x13.5	11x14	11x14
First futtocks sided & molded sq'red L	6.5	7.8	9.3	10.5	12	12.3	12.5	12.8	13
Double floors sided & molded sq'red L	6.5	7.8	9.3	10.5	12	12.3	12.5	12.8	13
Timber & space (frame interval) L	19	21.5	24.5	27.3	30	30.5	31.3	31.8	32.5
Ceiling on flat of floor	2	2.5	3	3	3	3.5	3.5	3.5	4
Planks - garboard to wales	2.5	3	3	3.5	3.5	3.5	3.5	3.5	4
Keelson bolts (thru keel at floor) L	.8	.9	1	1.1	1.1	1.1	1.2	1.2	1.3
Bilge & limber butt bolts L	.6	.7	.8	.8	.9	.9	.9	1	1
Hardwood treenails L	1	1.1	1.1	1.3	1.4	1.4	1.4	1.4	1.4

• about 130 ft. long (main deck), about 35 ft. in beam, with a depth of hold of about 12.5 ft., based on extrapolation of the surviving hull

• about 400 tons in capacity, based on the table and the above estimated dimensions; a 3-masted schooner, based on size, beamy hull, the position of the mast step, and comments on a draft of this report from knowledgeable reviewers. This type was the most common American coaster of the period.

• built in America, based on construction methods and reviewers' comments

• covered with bottom sediment shortly after foundering, eroded to its current height over a long period, and refloated and beached at Croatan for the first time since her original sinking, based on the excellent condition of the hull surface and the smooth erosion and location of worm holes only on the upper surfaces.

From the Pouliot/Berkey list of some two dozen candidates, we have preliminarily selected the *Jennie Hall*, a 3-masted schooner, net tonnage 391, built in Columbia Falls, Maine, in 1883. While *Jennie Hall* is the only candidate that fits our wreck for "right" size, type, and location, it is recognized that the wreck could have come from any number of unrecorded sinkings along the coast.

A unique aspect of this project was that it involved not a penny of public funds. The volunteers paid their own way and used their own equipment, transport, and lodging. The professionals did not even use publicly funded or academic "time" as the survey was completed on the weekend when they volunteered their services.

The Life-Saving Museum has assumed custody of the Croatan wreck. It is too large to be incorporated into regular museum exhibits, and it cannot be protected at Rudee Inlet. Perhaps a portion of the bow can be detached and moved to the museum grounds to serve as a teaching tool in shipbuilding techniques. The remainder might be of a size that could be moved to one of the local military installations for protection and later study. Readers with suggestions concerning appropriate methods of further identification, display, curation, or uses for the wreck are invited to contact the Life-Saving Museum of Virginia, P.O. Box 24, Virginia Beach, Virginia 23458.

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Building Bridges in the Badger State: Partnerships in Wisconsin Underwater Archaeology

There is an old Russian folk tale that tells of a hungry man living in a poor village. The man possesses nothing but a soup kettle. One day he hits upon the idea of asking his neighbors to join him in cooking up a large pot of stone soup. He goes to his first neighbor to beg a turnip, saying, "I am making stone soup: here I have the soup kettle, and water, and here I have a stone; all we need now is a little turnip." Obtaining this, he proceeds to the next neighbor, and the next, where in a similar manner he gathers potatoes, carrots, onions, seasonings, stew meat. When he finally has collected enough for the stone soup, he throws out the stone, and they all settle down to their first decent meal in a long while.

When the State Historical Society of Wisconsin embarked on development of an underwater archaeology program, I was provided with a 20th-century American equivalent to the soup kettle in the story: a desk and a telephone. Since 1988, I have begged operational funding, equipment, volunteers, temporary staff, boats, trucks, lab and office space, services, and sometimes just simple cooperation from government agencies, universities, businesses, non-profit organizations, and individuals. What began as a means of expediency, "just until we get the money to do this ourselves," has evolved into a stable network of alliances and ongoing efforts. For Wisconsin's underwater archaeology program, partnerships and outreach have not been simply compartmentalized activities but the process by which most everything gets done.

The Wisconsin state underwater archaeology program works in four principal areas: (1) resource survey and inventory, (2) public information and education, (3) resource management and administration, and (4) preservation and stewardship. With a full-time staff of one, assisted by one limited-term or seasonal employee, it is quite easy for work to become entirely focused onto a single objective, any of which could demand the full-time attention of a large staff. Therefore, it is critical that program efforts be balanced between these four objectives, and if possible, contribute to all the program objectives simultaneously.

Partnerships begin close to home: in fact, just across the hall. Making common cause with my parent programs, the Office of the State Archaeologist, and the State Historic Preservation Office (SHPO), was a critical but occasionally overlooked first step. Becoming an active, contributing, and highly visible part of the overall agency mission has provided the program with the stability and in-house support to survive some very serious state budget cuts and even progress modestly in terms of funding, equipment, and lab space.

As the underwater program was initially charged with field survey and resource inventory responsibilities, partnerships with university marine research programs were the first established by the fledgling state underwater archaeology program, and these partnerships continue to be vitally important. Working principally with the University of Wisconsin Sea Grant Institute and the East Carolina University Program in Maritime History and Nautical Archaeology, a series of joint underwater field schools has been undertaken, providing the state with essential field data on underwater archaeological resources, as well as the personnel, equipment, and funding to conduct this work when the program's own assets were at their lowest level.

These surveys have also involved scores of diver volunteers, dive shops and charters, local historical societies, schools, marinas, local businesses, government agencies, and members of the public. These local partnerships provide vital expertise, services, equipment, and even cash to the overall endeavor.

Over nine field seasons, these joint projects have investigated over 70 shipwrecks and other underwater archaeological sites, completing National Register of Historic Places level documen-

tation of approximately 30 sites, and listing 12 sites on the Register with more to come. Along the way, the projects have actively involved communities and individuals in studying and understanding their heritage; provided intensive, hands-on training opportunities for over 50 diver volunteers and undergraduate and graduate nautical archaeology students; published detailed technical reports and popular articles; attracted public and media attention to the significance and fragility of Wisconsin's underwater archaeological heritage; and "shown the flag" in almost every corner of the state (Cooper 1989, 1991; Jensen 1994; Cooper and Jensen 1995).

As the underwater archaeology program sought to apply its research results to resource management and preservation objectives, the next series of partnerships involved some of Wisconsin's principal land and water management agencies, including the Wisconsin Department of Natural Resources (DNR), the Board of Commissioners of Public Lands, the National Park Service (NPS), and the U.S. Army Corps of Engineers (USACE). Here, finding common cause was occasionally more difficult, paradoxically, as a result of the Wisconsin SHPO's other successes in archaeology and historic preservation, particularly National Historic Preservation Act (NHPA) Section 106 compliance. Apart from the NPS, where cultural resources are a familiar and longtime part of the agency mission, some agencies were naturally leery of anything that appeared to bind them to new, unfunded management responsibilities, responsibilities that could turn into real mandates and regulatory disputes through pressure from the SHPO and others. While the active participation of major land and water management agencies in preservation programs is vital, as is a solid interagency administrative framework to guide future cooperative efforts, these "agency partnerships" often go unseen and unappreciated by preservationists and the general public alike.

With hard work and persistence, combined with cultural resource advocates working on the inside of agencies, progress has been made on many submerged cultural resource issues, and joint projects have been launched including: (1) cooperative field surveys and formalized agreements for joint submerged cultural resources management at the Apostle Islands National Lakeshore; (2) start-up funding for cultural resources marine law enforcement, including quarter-time assignment of a DNR marine investigator; (3) development of interagency permitting procedures for underwater archaeology and marine salvage; (4) development of specialized submerged cultural resource law enforcement guidelines, training, and data-sharing procedures with the DNR; (5) USACE funding for an Upper Mississippi River shipwreck inventory, publication of a brochure on Mississippi River maritime resources, publication of a special maritime issue of *Wisconsin Archeologist* (Berwick 1992; Cooper 1992; Jensen 1992; Watts 1992); and (6) more rigorous application of NHPA Section 106 and 110 activities to underwater archaeological resources, resulting in the review of hundreds of marine construction projects, a series of USACE-mandated underwater surveys, and the avoidance or mitigation of impacts to significant underwater archaeological resources. In one unusual case, a major city park exhibit has been developed around the remains of a Great Lakes schooner encountered during harbor dredging activities (Tidewater Atlantic Research 1993).

As field surveys continued, and many of the details of establishing a new government program were being slowly worked out with partner-agencies, the underwater program also turned its attention to the many individuals, non-profit organizations, and businesses which make up the Wisconsin sport diving, preservation, archaeology, and local history communities. Here partnerships are more fluid, but ultimately, these are the means for accomplishing much of the real work of public archaeology, education, and preservation.

Partnerships evolved not only from common goals but from both old and new friendships. As a former dive club officer and a participant in local history projects, I had the advantage of personal contacts and friendships around the Wisconsin diving community, as well as among local historians and community members. Being a "local boy" has greased the skids on more

than one occasion and has tempered the natural community suspicion toward government types sallying out from the state capital with new ideas and wild eyes.

Key figures helped pave the way, and through their knowledge, the conferral of their blessings, and their not-inconsiderable community status, the new program was not only secured but was substantially advanced. Influential sport diving leaders and shipwreck preservation advocates provided essential support and eased many of the dive community's fears regarding new preservation legislation and funding for a state underwater archaeology program. Key legislative and agency proponents, with both personal interest and a full measure of statehouse savvy, helped make sure these grassroots ideas became a reality. A maritime historian provided not only critical support to the initiative but generously shared a lifetime of research which makes up the backbone of the state's submerged cultural resource inventory. A host of other individuals, far too many to name, all have made vital contributions to this evolution.

Over time, individual support has coalesced into group support and partnerships. Divers, volunteers, and preservationists have formed the Wisconsin Underwater Archeology Association (WUAA), the state's principal underwater archaeological avocational group. A body of key experts has been assembled on the Wisconsin Submerged Cultural Resources Council (SCRC), the state's official public advisory board, bringing together expertise and ideas within public interest groups and partner-agencies. Other institutional partnerships have been important as well. The Wisconsin Trust for Historic Preservation, with support from WUAA, has been a vital advocate in the state legislature, providing visibility and support for underwater archaeology and shipwreck preservation. Similarly, the Wisconsin Maritime Museum has provided advocacy and support, and is an important partner in developing curation and collections policies for underwater archaeological objects.

As our partnerships grow, work with WUAA and other sport diver groups is an increasingly large part of our program's efforts. Currently, the WUAA/SHSW partnership is focused on joint resource surveys and diver education and training. Every year, WUAA and the SHSW are engaged in field investigations around the state, surveying not only historic shipwrecks but also non-shipwreck resources such as inundated terrestrial sites, quarries, logging booms, and prehistoric fish weirs (Aerts 1994; Barton 1995). WUAA and the SHSW also jointly sponsor regular meetings, special lectures, tours, and training.

A new addition to the partnership is a professional dive instruction facility, where a series of research diver training classes is being developed, jointly taught by WUAA and SHSW. The advantages to this arrangement have become immediately apparent as the classes have significantly benefited from the use of regular facilities, the far broader reach of dive shop advertising networks (our last class attracted participants from as far away as Georgia and Arkansas), and the expertise of a large cadre of professional diving instructors to handle the problems of in-water class safety and instructor liability. Not only are the classes truly enjoyable for both students and instructors, they also provide a modest return for WUAA to put back into their own projects or into training development. Due to the classes' continued success, we are looking at expanding their focus to provide a variety of specialized topics, and we are examining other dive instruction facilities to provide more around-the-state training locations.

Other initiatives in progress include on-site stewardship and preservation. Working with local divers, partner-agencies, and the SCRC, we are developing improved shipwreck interpretive materials, aids to access, and active site monitoring. Ultimately, we hope to turn these activities over to local stewardship groups, and the archaeological resources themselves will likely be grouped into designated state underwater preserve areas, based on models first established by Michigan, Vermont, and Florida. While Wisconsin is reluctant to officially designate an area as a state preserve without proper state funding and broad-based, active local support groups, with the current outlook for government budgets, this

ideal is less than fully attainable. Working with partners and the resources at hand, and hoping for more stable future funding, we are proposing to develop one or more pilot preserve areas, with locally sponsored moorings and stewardship projects. We are also developing a series of interpretive materials including waterproof visitor's guides, brochures, and a World Wide Web site featuring Wisconsin shipwrecks.

So far, I have reviewed many of the benefits that Wisconsin has reaped from partnerships. However, the readers need to address the problems as well. Thankfully, the benefits can vastly outweigh the problems, as long as one goes into a partnership with open eyes and the right attitude. A partnership challenges you to expand on common ground and produce a shared accomplishment. A partner is an ally, but that is not the same as paid staff. Partnership activities usually happen on other people's schedules, in accordance with their priorities and wishes, and forcing this can seriously jeopardize the relationship. Often, ideas and objectives will only partially overlap, and compromise, or "agreeing to disagree," is an important reality. Another reality is that you are building bridges with people, not just with institutions. This means that you need to establish friendships and relationships that go beyond professional roles.

This personalized nature of partnerships has its downfalls. First, there is the reality that people come and go. A key player in a community, agency, or organization can disappear very quickly, causing the partial or total collapse of an important partnership "bridge." In the best of times, there are very real limitations to the number of personal relationships that can be actively maintained. I tend to work with a small, handpicked team, which unfortunately can create a sense of being excluded among those not actively involved. Anyone working in community outreach can tell you how sensitive community members are to perceived favoritism; how outreach must mesh with community hierarchies; and how even well-balanced efforts can fall afoul of internal community rivalries and jealousies. The maintenance of such networks can also be psychologically draining, as even a simple social interaction can revert into local politicking or just "talking shop."

It is very easy to get spread too thin in partnerships, and to spend more time in developing and nourishing partnerships than in getting anything accomplished. There is a very difficult balance between process and product. Some objectives which require a specific product on a timetable are best accomplished through use of internal staff and funds. Other activities, such as diver field training projects which combine research and educational objectives, may sacrifice some efficiency, but for a great return in public involvement.

Regardless of future public funding levels, underwater archaeology and submerged cultural resources management are gaining much from partnerships. In the interests of fostering more partnerships, and in accomplishing more with our existing partners, I place a great priority on acquiring additional underwater archaeology program staff, not to replace partners, but so preserves, stewardship, public education, and volunteer programs may all receive more of the focused attention that they deserve. Perhaps as partnership and program support broadens, government fiscal exigencies may be partially overcome.

There is no doubt in my mind that the strategy of partnerships in Wisconsin has paid larger dividends than could ever have been accomplished by individual efforts. Our partnerships have built upon diverse contributions and strengths, and the results have been greatly multiplied, often multifaceted community accomplishments. The results and benefits from these efforts are proudly shared by our numerous partners.

The results of the Wisconsin experience are, of course, not unique. Many states have developed active and productive public archaeology partnerships many without the benefit of core staff and funding. Each state is a laboratory, each experimenting with different cultural resource partnerships, policies, and programs. All differ by their individual emphases, histories, and personalities. But by candidly assessing and sharing our own program experiences as objective

case studies, we may uncover productive new directions and ideas derived from this collective knowledge.

In the meantime, I am confident that Wisconsin underwater archaeologists will be walking the village streets with a soup kettle, knocking on doors, for many years to come.

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