THE LAKE CHAMPLAIN SAILING CANAL BOAT

A Dissertation

by

JOSEPH ROBERT COZZI

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

August 2000

Major Subject: Anthropology
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Approved as to style and content by:

Kevin J. Crisman
(Chair of Committee)

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August 2000

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ABSTRACT

The Lake Champlain Sailing Canal Boat. (August 2000)

Joseph Robert Cozzi, B.A.. University of Maine at Orono;
M.A.. University of Maine at Orono
Chair of Advisory Committee: Dr. Kevin J. Crisman

The nineteenth century witnessed profound developments in North American inland vessel construction. The story of the steamboat is familiar, but other vessels have not received adequate attention. In particular, canal boats are poorly understood in many respects. Only recently have historians and archaeologists come to discover that sailing canal boats were used extensively on Lake Champlain.

The first half of this dissertation provides an historical context for the development of North American inland watercraft and specifically sailing canal boats associated with the Champlain Valley. The second half presents archaeological data from investigations of four sailing canal boat sites conducted over 15 years. Historical and archaeological data from these investigations are presented here to provide descriptions and drawings of the design, construction, and general appearance of these unique vessels. This study concludes that boat builders developed the sailing canal boat from existing types of inland watercraft and developed innovative construction techniques to produce lightly-framed vessels that were well-suited to canal and lake transportation, and which played a significant role in the economic development of the Champlain Valley in the mid-nineteenth century.
DEDICATION

For Hera

With All My Love
ACKNOWLEDGMENTS

The historical archaeology study of Lake Champlain sailing canal boats is the product of hard work on the part of many individuals and institutions. It is my very great honor to acknowledge their efforts in providing such valuable assistance as: financial and logistical support, information, time, elbow grease, common sense, a sympathetic ear, and comradery in the face of adversity.

Several institutions have supported sailing canal boat research. The Vermont Division for Historic Preservation (VTDHP) has provided leadership in protecting valuable submerged archaeological sites. Eric Gilbertson, Giovanna Peebles, and David Skinas deserve special recognition. The Lake Champlain Maritime Museum (LCMM) and its predecessor the Champlain Maritime Society (CMS) have sponsored, organized, and staged every sailing canal boat project, providing money, personnel, and public education concerning these boats. The Institute of Nautical Archaeology (INA) at Texas A&M University (TAMU) provided funds and equipment for fieldwork from 1991 until 1995. Special thanks are due Ray Siegfried II. Texas A&M University and the University of Vermont (UVM) sponsored summer field schools in underwater archaeological field methods in 1991 and 1992. Waterfront Diving Center (WDC) in Burlington, Vermont, took care of our diving logistical needs like we were paying customers at the finest resort. We thank Jon Eddy for this kind treatment. The U.S. Coast Guard and the U.S. Navy Reserve provided staging areas for projects in 1991 and 1992.

The archaeological fieldwork was carried out by a dedicated staff of volunteers and students. They spent hours underwater and went home at night and stayed up late recopying notes, just to get up early the next day and repeat this grind that was so essential to excavating and recording the hulls of sailing canal boats. Captain Fred Fayette deserves special recognition for providing a wonderful work platform in the R/V Neptune and for running a tight ship. Our dive masters deserve special thanks for keeping us all working safely. Thanks to Arthur Cohn, William A. Bayreuther, III, John V. Butler, Dave Andrews, David Robinson, Erick Tichonuk, and Pat Beck. The field crews consisted of:


North Beach Wreck Crew: Dave Andrews, Elizabeth (Robinson) Baldwin, Pat Beck, John Bratten, Toby Brown, Ned Chase, Arthur B. Cohn, Kevin J. Crisman, Lisa Denis, Tina Erwin, Jennifer Faul, Alan
Flanigan, Tommy Hailey, Curtis Hite, Hera Konstantinou, Scott McLaughlin, Ron Plouffe, David S. Robinson, Tray Siegfried, and Erick Tichonuk


O. J. Walker Crew: Dave Andrews, A. Peter Barranco, Bruce Beauregard, Pat Beck, Ed Bell, John Bratten, Dan Brown, Dave Burnor, John V. Butler, Charlie Chiodo, Larry Clark, Ray Clautier, Arthur B. Cohn, R. Scott Cooper, Kevin J. Crisman, Jon Eddy, Anne (Erwin) Cohn, Fred Fayette, Bryce Howells, Linda Jackson, Paul Johnston, Mike Lalime, Daniel LaRoche, Marc Maheux, Scott McLaughlin, David C. Skinas, Eric Tichonuk, Heidi S. Trotman, Joe Vicere, and John Warren

Cumberland Bay Canal Sloop Crew: Dave Andrews, Arthur B. Cohn, Kevin J. Crisman, Fred Fayette, Pierre LaRocque, and Scott McLaughlin

Two people deserve additional recognition. Arthur B. Cohn and Dr. Kevin J. Crisman have provided me with wonderful research opportunities for which I cannot thank them enough. After working for them, you expect that all projects should run as well and as smoothly as theirs. Further recognition is due Cohn, who as the director of LCMM, continues to be a powerful driving force behind sailing canal boat research. He will not be happy until standing on the deck of a sailing canal boat replica. He has pulled together talented crews and placed them at the disposal of sailing canal boat research. When I asked Crisman for a term paper topic in 1990 he gave me a couple of field notebooks
and said see what you can do with these. I hope this study does some justice to the amount of guidance that they have provided for me.

I wish to extend my thanks to several TAMU programs for providing me with financial assistance in the form of grants and fellowships. I learned a great deal working under Dr. Frederick M. Hocker as the J. Richard Steffy Ship Reconstruction Lab Assistant in 1991. I am grateful for a University Academic Excellence Award in 1992. I was honored as a Mr. & Mrs. J. Brown Cook Graduate Fellow in 1992 and a Marion Miner Brown Graduate Fellow in New World Archaeology in 1993. I was fortunate to receive a College of Liberal Arts Dissertation Grant in 1994. I am indebted to the University Graduate School Mini Grant Program for money to complete fieldwork and historical research in 1995.

I thank my committee for helping me get through every hoop along the way. Dr. Kevin J. Crisman gets more done than any person I know. Dr. Frederick M. Hocker is one of the most brilliant persons I have ever met. I am in awe of professor emeritus J. Richard Steffy. Dr. James C. Bradford scares me with his breadth of knowledge.

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Patty, Dan, Buster & Hooch provided a refuge in which to write. Emily Detoro kept me going in the final days of manuscript preparation.

My colleagues at the Archaeology Institute of the University of West Florida have helped me immeasurably. Dr. Judy Bense allowed me time to continue writing. Dr. Elizabeth Benchley keeps finding ways to pay me. Thanks to Dr. John Bratten for covering for me and especially for his work on the artifact catalog for General Butler. Mr. John Phillips made possible the retrieval of information from a database of sailing canal boats. Lee-O-tech McKenzie helped prepare images for illustrations.

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CHAPTER I

INTRODUCTION

The Lake Champlain sailing canal boat is an example of a vernacular watercraft that can be most easily visualized as a hybrid between a towed canal boat and an inland sailing vessel. This simple description, however, does not convey the important role sailing canal boats played in both Champlain Valley commerce and inland boat building during the middle years of the nineteenth century. Long forgotten and occasionally misinterpreted by historians, sailing canal boats have been put into clearer focus by recently-located, archaeologically-studied remains and associated historical research.

This dissertation examines the sailing canal boats of Lake Champlain from their first appearance in 1823 through their evolution into a standardized form to their decline following the Civil War. The primary focus will be on the construction and rigging of these unique vessels. A secondary study will focus on the people who built and used them during the commercial development of the lake following the opening of the Champlain Canal. The historical context for the sailing canal boat’s origins and its development also will be provided. In addition, archaeological information gathered through fieldwork will be discussed and interpreted. Together, these pieces of the puzzle will illustrate characteristics of the Lake Champlain sailing canal boats that allow them to become so successful and to influence other boat and ship builders of the time.

This comprehensive historical-archaeological study of Lake Champlain’s sailing canal boats examines the construction of sailing canal boat hulls and compares them to other vessels to determine why for a 25-year period they were the most appropriate means for carrying freight on Lake Champlain and through the Champlain Canal. Reconstructions of the hulls under discussion and their rigging are provided to illustrate general appearance. This dissertation seeks to analyze and interpret these boats and the role they played in the economic development of the Champlain Valley in the nineteenth century.

Historical Background

Late in the fall of 1823 a new type of sailing vessel left its home port in northern Lake Champlain. From St. Albans, Vermont to Whitehall, New York, the boat traveled as an ordinary sailing vessel. When it reached Whitehall, however, it made history by being the first sailing vessel to be transformed into a canal boat for the inaugural passage to the Hudson River through the brand new

This dissertation follows the format of the Nautical Archaeology Series of monographs published by Texas A&M University.
Champlain Canal. Upon reaching the Hudson, the boat was again rigged as a sailing vessel for the final leg of the journey to New York City.

The vessel was greeted with cheers and gunfire salutes, and heralded as the first of what would soon be a popular class of boats carrying raw materials and finished goods between the Champlain Valley and the Hudson River Valley. Traditional sailing boats and steam vessels could carry goods on the lake only. Upon arrival at the canal they would transfer their cargo to towed canal boats. The new type of vessel, however, could make the entire journey quickly and efficiently.

The Champlain Canal was completed on September 10, 1823. It cut through Washington and Saratoga Counties in New York state, ranging from Whitehall to Waterford, New York. Crossed by many bridges, the canal was shallow, narrow and stepped with long, slender locks. Its size and shape dictated the length, breadth, draft and depth of canal boats. The new type of sailing vessel was reconfigured to clear bridges by having its masts and other rigging easily removable. The small boat could be towed through the waterway by mules. Upon completion of the canal trip, the mast was stepped and sail spread for the remainder of the voyage.

Sailing canal boats like the one above were built in small numbers at first, but between 1840 and 1865 when Champlain Valley merchants needed to ship items to New York in the shortest time possible, and with the least amount of handling, the sailing canal boats captured the bulk of the freight transported on the lake. Following the Civil War, sailing canal boat operators witnessed the slow demise of their livelihood as their hold on freight forwarding was lost to steam-powered transportation on land and water. Rail shipment became common on the eastern shore of the lake in the 1850s, and by 1875 there was a rail connection between New York and Montreal on the west side of the lake. The first propeller-driven steam tug boat made its appearance on the lake in 1846. These steam tugs could tow as many as 60 unrigged canal boats at a time on the lake whereas paddle-driven steamboats were relegated to towing a few lumber rafts or canal boats.

The Lake Champlain sailing canal boat was an appropriate technology for the Champlain Valley economy in the mid-nineteenth century. Steam transportation on land and water supplanted these unique hybrid vessels largely due to the commercial vitality the sailing canal boats had helped to create. More reliable technology and new commercial opportunities warranted investment in steam communication that had been prohibitively expensive a few years earlier. By the turn of the century only a few Lake Champlain sailing canal boats survived as a reminder to their former glory.

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Archaeological Context

The first remains of a Lake Champlain sailing canal boat were found in 1978 in waters off Isle La Motte in northern Lake Champlain, although they were not recognized as anything more than a commercial sailing vessel at that time. In 1980 the discovery of another boat in 40 feet (13 m) of water just off the Burlington breakwater, identified as General Butler, revealed a canal boat hull outfitted for two masts. The wreck also had a centerboard that could be lowered beneath the hull or raised within a trunk inside the hold. When deployed, this device provided resistance from slipping to leeward when sailing on a wind coming from the vessel's beam. When the centerboard was raised the craft had a very shallow draft suitable for canal travel. This combination of canal boat and sailing features identified General Butler as a Lake Champlain sailing canal boat.

The features on General Butler led to a re-examination of the Isle La Motte wreck. Subsequent discovery of a centerboard and a single mast on deck indicated that it also was a sailing canal boat, although of a slightly different design. A third sailing canal boat wreck was investigated during a survey of Burlington Bay in 1984. The well-preserved hull bore a striking resemblance to General Butler and was later identified as the canal schooner O. J. Walker. This vessel has extensive rigging remains revealing that it carried fore-and-aft sails on its two masts. These sunken vessels indicate that Lake Champlain sailing canal boats were manufactured according to several different designs and were rigged as sloops or schooners. Differences in hull dimensions also reflect the enlargement of the Champlain Canal over time.

The initial fieldwork on these sailing canal boats was conducted by Arthur Cohn, currently director of the Lake Champlain Maritime Museum (LCMM), and Kevin Crisman, currently an associate professor of New World Seafaring in the Nautical Archaeology Program at Texas A&M University (TAMU). Their field investigations in the 1980s focused on surveying the remains as they lay exposed on the lake floor. Their research led them to conclude that:

On the General Butler we have a situation unusual in nautical archaeology: the construction and layout of the upper part of the hull is known in detail, while practically nothing is known of the hull below the waterline. From what we have examined, it is evident that the Butler was a lightly-built vessel, intended only for navigating inland waterways.

Continued work on the General Butler in a methodical way will no doubt answer many of the questions that remain about the design and construction of this significant Lake Champlain vessel. The General Butler will continue to provide us with technical details of mid-19th century lake shipbuilding, while both raising and answering questions about Lake Champlain's economic and maritime history.2

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These statements, while specific to General Butler, applied equally well to the state of knowledge concerning both O. J. Walker and the Isle La Motte sloop.

Field investigations for this dissertation conducted during the 1990s have focused on the remains beneath the mudline for both General Butler and O. J. Walker as well as a recently discovered sailing canal boat site located offshore from North Beach in Burlington, Vermont. A preliminary reconstruction of O. J. Walker’s lines was completed in 1991 at the J. Richard Steffy Ship Laboratory at TAMU. The drawing is based on field recording completed in 1989 by LCMM and on O. J. Walker’s dimensions (length, breadth, and depth of hold) as indicated on enrollment documents located at the National Archives. This initial reconstruction assumed that the vessel had a rounded bilge. The reconstruction indicated that building such a vessel would have required framing timbers with radical bends to construct a bilge between the vessel’s flat floor and vertical sides. These timbers would have been difficult to locate and expensive to purchase in the timber-depleted Champlain Valley of the mid-nineteenth century. The reconstruction, therefore, suggested that O. J. Walker and other sailing canal boats were built by some alternate construction method, which could only be verified by inspecting the bottom of these boats.

Cohn suggested examining the collapsed remains of a sailing canal boat located offshore from North Beach in Burlington to answer questions concerning how these vessels were built below the waterline. The North Beach wreck was surveyed in 1991. Exposure of the vessel’s bottom revealed a new form of hull construction which was documented by subsequent archaeological excavations in 1992 and 1993.

Opportunities arose in 1993 and 1995 to dig test pits within the hold of General Butler. During the first season a trench was placed across the starboard side at the forward end of the centerboard trunk. In the second campaign LCMM undertook excavations in General Butler’s starboard bow. That same year a reassessment of O. J. Walker as a candidate for Vermont’s underwater preserve program provided a chance to examine the starboard side of the vessel’s bottom. These investigations provided ample material to answer architectural questions and to complete reconstructions of a typical schooner-rigged sailing canal boat.

The complete body of fieldwork conducted in the 1980s and 1990s, together with associated historical research, indicate that Lake Champlain sailing canal boats were flat bottom boats which were chine-built in one form or another. In this type of construction the bottom and sides of the vessel are flat when viewed in cross section and meet in an angle or chine, usually with a chine log at the corner. This differs from construction seen in ocean-going wooden sailing vessels where paired square frames ran along the floor of the boat making a rounded turn at the bilge and continuing up the side to at least deck level. Research on Lake Champlain sailing canal boats provides an earlier date for chine-log construction than has been previously reported.
Lake Champlain sailing canal boats developed over time in response to a variety of technological, economic, political and social circumstances. The lines of their hulls and their chine construction demonstrate a desire to maximize cargo capacity within the dimensions necessitated by the canal system. Their construction also reflected an attempt to save money by the use of less expensive building techniques and materials.

The work on the North Beach wreck documented an entirely new method of chine construction distinct from that recorded on General Butler and O. J. Walker. The North Beach wreck represents a vessel built with a modern form of edge fastening between thick planking strakes that eliminated the need for most of the traditional athwartship framing timbers. The sides of the North Beach vessel were built from thick planks known as balks which were fastened with iron drift pins driven through their widths. Iron edge fastening became a standard practice not only for canal boat construction, but also for certain composite-timber structures of ocean-going ships, especially where longitudinal stiffness was a concern. The North Beach wreck remains are currently the earliest reported example of iron edge fastening of a hull and indicate the advanced state of boat building in the Champlain Valley and its influence on American ship building in general. Historical research spurred on by this discovery has since located a patent for this hull construction method and a photograph of a Champlain Canal boat being built in this manner.

Historical research has supplied additional information concerning the size, form, and construction of sailing canal boats as well as who owned these boats and how they were used. Arthur Cohn and Kevin Crisman, working with lake historians Morris Glen and A. Peter Barranco, have uncovered a variety of materials that provide details about sailing canal boats. Their work identified the remains of General Butler and O. J. Walker and supplies us with some of the life history of these two vessels. Other documents related to sailing canal boats include a list of sailing vessels on Lake Champlain compiled from vessel enrollment documents at the National Archives and from various library and company collections. This list, together with further work in the National Archives for this dissertation, has produced a data base for sailing canal boats from information found on merchant vessel enrollments. These documents asked for information on the origin of a boat, its port of call, owners' name(s) and residence, the type of vessel, as well as some of its characteristics. These data provide

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3 J. Deming, "Abstract of the specification of a patent for an improvement in the manner of constructing Ships and Vessels of every description, either for the purposes of War or Commerce," in *Journal of the Franklin Institute*, ed. T. P. Jones, pp. 132-34.

some basis for drawing conclusions concerning who owned and operated these boats and where they were most likely to be found around the lake.

A set of papers belonging to the Spear family of Burlington and Shelburne, Vermont constitutes a historical resource of great significance related to sailing canal boats. This collection contains documents associated with Orson S. Spear who was a prominent boat builder. The papers include a set of three boat drafts for sailing canal boats and a collection of contracts and receipts for sailing canal boat building and repair. These provide a fascinating glimpse into the daily activities of boat building and provide first-hand evidence in addition to archaeological recording of sunken hulls for the form and construction of Lake Champlain sailing canal boats.

A final historical resource is photography. Photographs taken in the late-nineteenth and early-twentieth centuries depict a few remaining sailing canal boats still at work on the lake. From these photographs we can glean a great deal of information regarding the general appearance and rigging of these vessels. We can also compare them to photographs of other types of lake craft to determine if similarities exist.

As an example of a distinct and overlooked class of inland North American watercraft, the remains of sailing canal boats in Lake Champlain are significant artifacts and archaeological records. Their importance is supported by the unique history of these vessels, especially the central role they played in the commercial development of the Champlain Valley. Their reconstructions are presented here for the first time to provide the most up-to-date and complete view of these forgotten craft. All that is lacking is information on how these vessels handled on the lake and through the canal. This can only be obtained through construction of a replica which could be put through sailing trials. It is hoped that the reconstructions presented here will provide the basis for just such an experiment.
CHAPTER II

NORTH AMERICAN INLAND WATER TRANSPORTATION UNTIL 1823

Watercraft played an essential role in transporting people and goods between North America's coastal settlements and its expanding frontier. The push to settle the vast area west of the Appalachian Mountains gave rise to a new, distinct style of inland watercraft. These vessels reflected the conditions presented by inland travel. They also were built with new techniques that spread throughout the inland boat building community and even to the builders of ocean-going ships.

Native American and European boats were used at first, but eventually European-style boats built from native materials dominated inland transport.¹ The new watercraft and inland building traditions that emerged can be grouped into two broad categories. The first is scow-built craft, which exhibit some form of chine construction where the bottom and sides of the vessel meet at an angle, usually 90 degrees. The second group is made up of molded vessels, which have a rounded transition from the bottom to the side, usually accomplished with paired, square frames. The uniquely-American inland watercraft that developed provided the foundation for revolutionary nineteenth-century inland vessels distinct from ocean-going ships of the Atlantic Coast.

Prior to colonization, Native Americans employed various watercraft including rafts and boats made from reeds, skins and wood, as well as bark, dugout and plank canoes.² Europeans arriving in the Western Hemisphere used their own small ships and boats to explore bays and larger rivers, but turned to local small craft to investigate the interior land mass via tributary waterways. In northeast North America the bark canoe carried French explorers in their unsuccessful quest for an all-water route to the Far East. The lack of a continuous waterway meant that people, goods, and vessels had to move overland between navigable portions of lakes, rivers and streams, and the light-weight canoe was ideally suited to this task. The practice of carrying a small watercraft around a break in the network of navigable waters was called "portage."

French explorer Samuel de Champlain used canoes in 1609 to explore south of Quebec and had to portage the Richelieu River's rapids to travel upon the lake that bears his name.³ Six years later, while relying solely on canoes, he became the first European to trek beyond the Ottawa River and onto the


Great Lakes. Jesuits and traders used lightweight birch-bark canoes almost exclusively as they followed the trail blazed by the explorer, bringing with them religion and supplies and carrying out pelts during the early commercial expansion of New France.

In 1609 Henry Hudson approached the Champlain Valley from a southerly direction, traveling up the river named for him in the ship Half Moon to within 75 miles (120.7 km) of Champlain's southernmost reach. Hudson did not use small craft to venture farther into the interior, but Dutch settlers following in his wake soon did. English settlement of the Atlantic coast in 1620 supplied the final side of a triangle of colonial expansion with Lake Champlain at the center. Several colonial wars emphasized the importance of Lake Champlain as a water highway between what is today Canada and the United States. Waves of settlers replaced fur traders and soldiers and made new demands on the watercraft.

Initially, Europeans used Native American small watercraft like the canoe and the pirogue. They simply built larger versions to meet their needs. There is a limit to how large a bark canoe can be made, but pirogues are especially well-suited to enlargement. Pirogues are thought to be of West Indian origin and were found on the Ohio and Mississippi Rivers and on Lake Champlain during the period of settlement. In their simplest form they consist of a dugout canoe with planks attached to extend the freeboard. Later, the type was increased in size by splitting the canoe and inserting planks in the floor of the vessel as well. They were propelled by oars, poles, and sails, with the larger ones carrying two masts.

When Europeans needed larger watercraft to carry heavier cargo they turned to European or eastern models and adapted them to conditions found on inland waterways. In the 1680s the French introduced a simple, efficient, and low-cost boat called a bateau, which has a flat bottom with vertical sides that curve in to meet at its pointed ends. The French used oars, setting poles, and square sails to propel their small bateaux that drew very little water, making them useful on almost any stream.

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8Baldwin. The Keelboat Age, p. 40; Chapelle. The National Watercraft Collection, 16.

basic plank-on-frame construction made bateaux relatively easy to build from available timber and a supply of iron nails. These versatile watercraft continued in use on North American lakes and rivers into the middle decades of the twentieth century.  

The English and Americans also used bateaux (Fig. 1), but of a slightly different design from the French. Americans expanded the size of the bateaux during the eighteenth century until they had created a large version known as a gunelow. One of Benedict Arnold’s gunelows named Philadelphia was sunk during the battle of Valcour Island. Philadelphia was raised by a salvage diver in 1935 and is displayed in the Smithsonian Institution.

Charles Carroll provides a contemporary description of an American lake bateau from 1776. He describes the bateau as “thirty-six feet in length and eight feet wide; they draw about a foot of water when loaded, carry between thirty and forty men and are rowed by the soldiers. They have a mast fixed in them to which a square sail or blanket is fastened but these sails are of no use unless with the wind abaft or nearly so.”

In addition to their wartime use bateaux provided a means for moving settlers and supplies to the frontier by rivers and streams. Connecticut River bateaux of the late eighteenth century were called pole boats due to their chief means of propulsion. They also employed sails from time to time. Documentary sources record their use as far west as the Illinois territory, and archaeological examples of early bateaux are known from Quebec City in Canada, Lake George in New York, and the James River of Virginia. By the nineteenth century several variations on the basic bateau had arisen. Small

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Figure 1. Lake Champlain Maritime Museum bateau replica. Reproduced with permission of the Lake Champlain Maritime Museum.
bateaux were called skiffs, while Allegheny skiffs and Mackinaw skiffs were names for larger bateaux.\textsuperscript{17} Great Lakes lumbermen of the twentieth century referred to their bateaux as pointers due to their extremely sharp ends.\textsuperscript{18}

Settlement and defense of the frontier led to the development of several other boat types which could move large quantities of soldiers and supplies or entire families together with possessions needed to begin a new life away from the eastern seaboard. Some of the types include "small craft, known as Durham boats, arks, Kentucky boats, keel-boats, and flats, according to the region and service in which they were employed."\textsuperscript{19} To these names can be added barges, broadhorns, Mackinaw boats, Mohawk boats, New Orleans boats, Ohio packet-boats, Schenectady boats, and Susquehanna boats.\textsuperscript{20} Each was an adaptation of a basic boat type to a particular set of environmental and economic conditions.\textsuperscript{21}

Despite the plethora of names, two broad classes of vessels emerged based upon their basic construction. One category exhibits chine construction where the bottom and sides of the vessel can be thought of as discreet components that meet at an angle. Chine-constructed vessels resembled early river scows and, therefore, are often referred to as "scow-built." A picture of New York in 1717 illustrates a scow ferry with a flat bottom, vertical sides, and raked ends.\textsuperscript{22}

A second class of inland vessel had a more boat-like hull with centerline timbers, uninterrupted athwartship frames, and a round bow and stern or, in some cases, a transom stern. Scow-built vessels were called flats or flatboats, while more boat-like craft were termed keelboats. These two classes provided the models for most inland boats, except for large sailing and steam vessels on the Great Lakes. Here conditions of deep, broad, and often furious waters required vessels built like ocean-going ships, which trace their origins to the first sailing ships built on the upper lakes, like the Griffon built for French explorer Robert Cavalier, Sieur de La Salle in 1679.\textsuperscript{23}

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\textsuperscript{17}Baldwin. The Keelboat Age, p. 42; Dunbar. A History of Travel in America, p. 281.


\textsuperscript{20}Baldwin. The Keelboat Age, pp. 47, 50; Dunbar. A History of Travel in America, pp. 282, 284, 287.

\textsuperscript{21}R. Bissell. The Monongahela, p. 52.

\textsuperscript{22}Chapelle. American Small Sailing Craft, pp. 17, 29, 32.

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Flatboats

Settlers in the Connecticut River Valley used vessels called flatboats to travel up- and downstream in the late eighteenth century. Their range upstream was increased by canal projects carried out between 1791 and 1829, allowing flatboats to travel farther upstream to serve the river’s hinterlands in Vermont and New Hampshire. Connecticut flatboats had flat bottoms, straight sides, shallowly-raked ends, and a small stern cabin for protection from the elements. They were built with open holds but had a walkway along each side. Very little is written about their construction except that they were easy to build using some form of chine construction. Flatboat size varied, but a boat 72 feet (22 m) in length and 11 feet, 6 inches (3.5 m) in breadth could carry a 30-ton cargo on 2 feet (61 cm) of water. 24

Flatboats were propelled downstream by the flow of the waterway and steered by a long oar called a “sweep.” In areas lacking in current, crew members used wooden poles with iron tips on one end and a padded leather rest called a “button” on the other end to move the vessel back into the current or toward shore or a dock. Crew members placed the button against their shoulder and set the pole’s iron tip in the river bottom and then trod along walkways to push the boat in the desired direction of travel. This technique of propulsion with setting poles is the same as that used with bateaux. Flatboats were also propelled by square sails set on a single mast. Connecticut River boatmen employed a main sail which was about 20 feet (6.1 m) long on each side and extended out beyond the vessel’s sides. An 8-foot (2.4-m) wide top sail was often used and on occasions of extremely light wind a third sail could be placed above the top sail.

On both up- and downstream trips “swift-water-men” or oxen located on shore used long ropes to pull boats around rapids or through eddies when setting poles or a sail were inadequate. 25 At one location upstream progress could only be accomplished with the assistance of a windlass located on shore. 26 Flatboats ventured as far as Barre, Vermont, which served as a collection point for timber drawn from eastern Vermont. 27

Flatboats made their appearance in the west on the Ohio River just prior to 1780. Their size varied according to the amount they carried and the course they took. Like their eastern counterparts, they had flat bottoms, vertical sides, and raked ends. They were, however, usually housed over from stem to stern, occasionally with the bow left open. They ranged from 20 to 100 feet (6.1-30.5 m) long, 10

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26Hemenway, *The Vermont Historical Gazetteer*, vol. V, pp. 21, 39, 305.

to 20 feet (3.6.1 m) wide, drew from 1 foot to 2 feet, 6 inches (30.5-76.2 cm) fully loaded, and had 3 to 4 feet (0.9 -1.2 m) of freeboard. By the end of the eighteenth century the United States government, through contracts with builders, had standardized flatboat size to between 45 and 50 feet (13.7-15.2 m) in length and 12 to 14 feet (3.7-4.3 m) in width. It was a size adopted from this time on in the private sector.28

During the early settlement of the Ohio River Valley, flatboats served as floating fortresses. Heavy hardwood construction and thick planking, especially above the waterline, together with a sturdy enclosure provided protection against armed attack. Once the area became more settled and peaceful, builders set up open space in the bow for livestock, laundry drying, and for children to play. Flatboats on western rivers were a one-way-trip means of conveyance as they took settlers and their possessions to a new home. Upon reaching their destination they were broken up to provide building material for houses.29

Distinct names for watercraft in different regions often reflected only a change in size or the destination of the particular vessel rather than any difference in design. Susquehanna boats were arks used on the Susquehanna River, while New Orleans boats were large Mississippi flatboats destined for New Orleans. A broadhorn was a large flatboat that was steered by additional sweeps that resembled horns extending from the vessel's sides. Smaller flatboats bound for Kentucky or southern Ohio were called Kentucky boats.30 Once a particular name was associated with a boat, it would become permanent. A boat built in Kingston, Ontario in 1801 for use on the St. Lawrence River was called a Kentucky boat by local merchants.31

The name ark referred to flatboats that originated on either the Delaware, Juniata, or Susquehanna Rivers late in the eighteenth century. The term also suggests an immense vessel and was used to describe the largest of flatboats. Ohio and Mississippi River arks ranged from 75 to 100 feet (22.9-30.5 m) in length.32 Although some had V-shaped ends rather than raked ends, they were built and operated similar to flatboats.


29Dunbar, A History of Travel in America, pp. 284-86.

30Baldwin, The Keelboat Age on Western Waters, p. 47; Dunbar, A History of Travel in America, p. 286.


32Dunbar, A History of Travel in America, pp. 39. 282-84, 295 illus. 84; Baldwin, The Keelboat Age, p. 206. n. 10.
The Mackinaw boat was a hybrid between a flatboat and a skiff, with a flat bottom, vertical sides, a square or raked stern, and a pointed bow. It reached 50 to 60 feet (15.2-18.3 m) in length, 12 feet (3.7 m) in breadth with an open cargo hold.\textsuperscript{33} Mackinaw boats used on the Mississippi River retained this basic form into the 1870s.\textsuperscript{34}

Flatboats and bateaux shared a bottom-based construction technique. In this building tradition the bottom of the vessel was laid out first and can be thought of as a discreet component of construction.\textsuperscript{35} It consisted of planking of uniform thickness run either fore-and-aft or athwartship. Vessels with athwartship planking are referred to as “cross-planked.”\textsuperscript{36} The builder then installed some form of framing to provide the means for attaching side planking at an angle to form a chine. On flatboats this was a 90-degree angle as opposed to bateaux whose sides often angled up and slightly outward.

While bateaux were framed with standing knees, flatboat framing took one of three forms. Some flatboats used standing knees, which is a fairly sturdy form of construction. Other flatboats, used on calm waters, were simply and inexpensively framed with straight floor timbers and futtocks (which are also called side frames) that overlapped at the chine and were fastened together at that point. The third form of flatboat construction utilized square timbers of substantial dimensions running fore-and-aft along each side of the vessel’s bottom. These timbers are called chine logs.

Archaeological examples of flatboats are rare, but a scow ferry found near Mount Independence, Vermont, is believed to date from the Revolutionary War. On this flatboat, the bottom is cross-planked, while framing timbers, called stringers, run fore-and-aft. The vessel has two strakes of side planking that run fore-and-aft and are attached to side frames. The two outboard stringers of the bottom are notched to fit over the side frames and serve as chine logs. Without other archaeological examples of early inland flatboats little more can be said except that they were relatively easy and the least expensive boats to build.\textsuperscript{37}

\textsuperscript{33}Baldwin, \textit{The Keelboat Age}, p. 50.

\textsuperscript{34}P. O’Neil, \textit{The Rivermen}, pp. 10-11.

\textsuperscript{35}F. M. Hocker, “The Development of a Bottom-Based Shipbuilding Tradition in Northwestern Europe and the New World” (unpublished manuscript), pp. 20-26, 223-25; Chapelle, \textit{American Small Sailing Craft}, p. 46.

\textsuperscript{36}Chapelle, \textit{American Small Sailing Craft}, pp. 36, 46-48, 52-53, 81-82, 100, 133-34.

\textsuperscript{37}Bissell, \textit{The Monongahela}, p. 52.
Keelboats

The keelboat and craft derived from it such as barges, Ohio packet-boats, Mohawk boats, and Durham boats differed significantly in terms of construction and form from flatboats. The keelboat took its name from its distinctive centerline timber, when "[s]ome person unknown, at an indeterminate time before 1800, nailed a long beam about four inches square lengthwise to the bottom of a bateau to hold the boat on its course when it was being towed and to absorb the shock of contact with rocks and logs." After their initial conversion from bateaux, keelboats became more boat-like in appearance. They developed full, rounded bows and centerline timbers, including a shallow keel. They could have a chine or rounded bilge.

Most keelboats were 40 to 80 feet (12.2-24.4 m) long, 7 to 10 feet (2.1-3 m) wide, and drew 2 feet (61 cm) or less of water when fully loaded. They usually had a cabin amidship and always had a cleated walkway along both sides. They were steered by one or two sweeps and propelled by 4 to 12 rowers seated in the bow by poling and, only on rare occasions, by a square sail. Keelboats were the only inland river boats to make regular trips upstream out west, even if it required the use of a form of Spanish windlass called a "cordelle." Keelboats were employed on every navigable waterway in North America. On some rivers they completely monopolized trade.

Keelboats, like flatboats, came with a variety of names. Barges were keelboats of greater width and more substantial construction. This limited them to the deeper water of the lower Mississippi and Ohio Rivers. They had extremely full ends, were up to 20 feet (6.1 m) in beam with a draft of 3 to 4 feet (0.9-1.2 m), and carried on average 40 tons. They commonly sported either square, fore-and-aft, or hermaphrodite rigs, and were rudder steered. A cabin located in the stern provided protection, as did a deck in the bow. Cleated walkways ran along either side of an open hold, which was covered with a tarp after cargo had been stowed. Barges reached 120 feet (36.6 m) in length and could carry 170 tons. Smaller barges were employed on the Missouri River, which had numerous shallows created by accumulated mud and sand.


40 Baldwin, The Keelboat Age, pp. 42-45; Dunbar, A History of Travel in America, pp. 281-82.


Ohio packet-boats were another variety of large keelboat, ranging in length from 75 to 100 feet (22.9-30.5 m) with a beam of 15 to 20 feet (4.6-6.1 m). They had a stern passenger cabin and were propelled by the most expedient means, often being towed from shore by gangs of men. These boats specialized in rapid transportation of passengers and express freight.\textsuperscript{43} The earliest known example of a packet-boat dates to 1786 on the Monongahela River.\textsuperscript{44}

Several types of keelboats were used on New York's Mohawk River and have been described by a contemporary, who toured through this area in 1807,\textsuperscript{45} and by a historian.\textsuperscript{46} The descriptions and illustrations in these works were analyzed by Robert Hager, who produced reconstructions of three types: Mohawk boats, Schenectady boats and Durham boats.\textsuperscript{47} As these reconstructions are based partially on illustrations, they must be viewed with some caution. The original accounts, however, are the most detailed observations of inland North American watercraft in use prior to 1820.

Mohawk boats were shallow-drafted keelboats without a cabin and worked the Mohawk River Valley.\textsuperscript{48} They ranged from 18 to 50 feet (5.4-15.2 m) in length, with an average length of 32 feet (9.7 m), a width of 6 feet, 6 inches (2.0 m), and a depth of 3 feet (91.4 cm) in the hold. They had a slightly rocker keel plank but no keelson. The keel is referred to as a keel plank because it is much greater in sided dimension than it is molded. Adapted from earlier military bateaux, the Mohawk boat has broader floors and straight, almost vertical sides, making it an efficient cargo carrier. It was propelled by oars, poles and sails. Hager's reconstruction illustrates a mast stepped through a hole in a rowing thwart down to the vessel's floor. Large Mohawk boats traveled between Schenectady and Little Falls, New York, until improvements in 1804 allowed them to reach the Oswego River. Smaller boats were portaged to

\textsuperscript{43}Dunbar, A History of Travel in America, p. 287.

\textsuperscript{44}Bissell, The Monongahela, p. 57.

\textsuperscript{45}C. Schultz, Travels on an inland voyage through the states of New-York, Pennsylvania, Virginia, Ohio, Kentucky, and Tennessee, and through the territories of Indiana, Louisiana, Mississippi and New-Orleans; performed in the years 1807 and 1808: including a tour of nearly six thousand miles.


\textsuperscript{47}Hager, Mohawk River Boats. figs. 4, 17, 19. Hager's reconstructions are based primarily on two contemporaneous illustrations, which can be seen in Greene, History of the Mohawk Valley. p. 1208; F. D. Larkin, New York State Canals, A Short History, p. 13.

\textsuperscript{48}Dunbar, A History of Travel in America, p. 282; Glazebrook, A History of Transportation in Canada, p. 67.
Lake Ontario, and then coasted to the Niagara River where another portage was required to reach Lake Erie.49

Schenectady boats originated at the Binnie-kill boat yards in Schenectady, New York, although they were employed as far away as Canada.50 These boats averaged 50 feet (15.2 m) in length, 8 feet (2.4 m) in breadth, and 3 feet, 6 inches (1.1 m) deep in the hold. They differed from Mohawk boats in several important respects including greater length, which required thicker planks for the keel as well as for their keelson, a feature that Mohawk boats lacked. Their sides retained the rounded shape found on early bateaux, but they had a V-shaped stern.

Hager’s reconstruction shows a mast stepped on the forward deck in a tabernacle. The tabernacle consists of two stanchions rising from the vessel’s floor up through the deck.51 The bottom of the mast, called the mast heel, was secured between the two stanchions and could be raised and lowered easily. Hager illustrates an iron pin running through the stanchions and mast heel that served as a pivot point. The ability to quickly lower a mast is found on river boats that frequently passed beneath bridges. The Piscataqua River gundelow has a stub mast which supports a long, counter-weighted spar with a triangular sail known as a leg-of-mutton rig.52 These boats were in use on New Hampshire’s Piscataqua River by 1800, if not earlier.

The Durham boat was similar to the Mohawk and Schenectady boats, but was used over a greater geographic area. Their origin is attributed to Pennsylvania iron producer Robert Durham, who first used them on the Delaware River in the second quarter of the eighteenth century.53 They were 60 feet (18.3 m) long, 8 feet (2.4 m) wide, and, when fully loaded with a 15-ton cargo, drew only 1 foot, 8 inches (50.8 cm) of water with scant freeboard. They were either double-enders with extremely sharp ends or, in the case of the Mohawk River variety as reconstructed by Hager, had a sharp bow and a V-shaped transom stern. Durham boats had decks fore and aft and cleated walkways along both sides. They were propelled by oars, poles, and sails and were the only boats regularly taken onto lakes. They had flat bottoms with vertical sides. Hager reconstructs them with a rounded turn of the bilge, but they were also chine-built. Their centerline timbers had greater molded and sided dimension than the shorter


51Hager, Mohawk River Boats. pp. 69-75, fig. 17; Schultz, Travels on an inland voyage. p. 6.


Schenectady and Mohawk boats.⁵⁴ Durham boats were introduced into Canada around 1809 and were used extensively on Canadian and American rivers prior to 1820.⁵⁵

In summary, despite the variation of names, there were essentially two types of inland watercraft by 1800 carrying people and cargo in North America. One type was some form of scow, while the other was a variation of the keelboat. Both types were flat-bottomed and could be chine-built. They were propelled by poles, oars, and sails wherever rivers, streams, and short portages provided access to the continent’s interior. Very rarely did they cross large bodies of water and, if found on lakes, they skirted the shore.

During the nineteenth century inland transportation was revolutionized by manmade waterways, new technologies of propulsion, and new building materials. The existence of an active inland North American boat building tradition helped create new hull forms and construction methods. For example, when boats were needed for use on canals, existing river boats were pressed into service and gradually adapted to the canal.⁵⁶ The same can be said for lake vessels, and for this discussion we next look at inland navigation on Lake Champlain.

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CHAPTER III

LAKE CHAMPLAIN AS AN EARLY WATER HIGHWAY

The vast size of the North American continent permitted peaceful relations between rival colonists until the final decade of the seventeenth century, when European conflict spilled over into the New World. Warfare broke out regularly during the eighteenth century, with the English gaining control of North America following the French and Indian War (1755-1763), only to see some of their colonies become independent in the American Revolution (1775-1783). Throughout this period Lake Champlain served as an important water highway for transporting people and materials between the St. Lawrence and Hudson River Valleys. This water highway was broken by short portages. To the north of the lake there were the Chambly Rapids of the Richelieu River, while to the south, between Champlain and the Hudson River, there was the “Great Carrying Place”\(^1\) at Fort Edward and a smaller portage at Fort Miller.

Soldiers passing through the Champlain Valley made note of the lush forests and fertile soil and returned to settle, especially following the Revolutionary War. The population of the Champlain Valley expanded creating the need for a wide variety of watercraft. By 1820 several steamboats and dozens of sloops made regular voyages around the lake. Plattsburgh, New York, and Burlington, Vermont, both at the northern end of the lake, together with Whitehall, New York, at the southern end of the lake, became centers of settlement and transportation.

The waters of Lake Champlain (Fig. 2) flow north for 126 miles (202.8 km) from Whitehall, New York, to the Richelieu River in Canada. Only a quarter of a mile (0.4 km) wide at the southern end, it begins to spread out and reaches a maximum width of 12 miles (19.3 km) just above Burlington, Vermont. The most shallow channel is 20 feet (6.1 m) deep, providing ample water for navigation, while the lake gets up to 399 feet (121.6 m) deep. Two-thirds of the lake’s 567 square mile (1468.5 sq km) surface area, including the large northern islands, fall within the state of Vermont.

Figure 2. The Champlain Valley as a pathway between Canada and New York.
Settlement, Timber, and Transportation

For early settlers, Lake Champlain unified the two shores. Travel by land, especially along the
New York side, was rugged. An assortment of bateaux, oar-propelled floats, and sailing scows made it
easier to cross the lake. From the mid-seventeenth century until 1760 the French built canoes, bateaux,
and a variety of flat-bottomed river vessels at St. Jean on the Richelieu River to carry furs, supplies, and
soldiers on Lake Champlain. Swedish naturalist Peter Kalm described the lake’s first European-style
sailing vessel as a yacht, which made regular trips between Fort Frederic and St. Jean in the 1740s. By
1745 they had established a lumber camp on Isle La Motte, improved the Chambly Rapids on the
Richelieu River, and a naval architect and boat builder named Le Vasseur was sending mast timber out
of the lake for the French king. The French erected a sawmill farther south on the lake and built sailing
vessels to protect their timber and mast trade from the English.

English settlers arrived in the valley after 1760 and continued to cut mast timber, to which they
added oak staves and potash to the products that they sent to Quebec. William Gilliland was a
merchant from Albany, New York, who made the arduous journey to the lake by bateau in 1765 and

2G. E. Cone. “Studies in the Development of Transportation in the Champlain Valley to 1876”
(M.A. thesis, University of Vermont, 1945), pp. 13-14; R. N. Hill. “Two Centuries of Ferryboating on
Lake Champlain,” in Lake Champlain Ferryboats, ed. J. P. Williams, p. 7.

Nineteenth-Century America, p. 115; J. H. French, Gazetteer of the State of New York, p. 300. n. 3; C.
Development of Transportation in the Champlain Valley to 1876,” pp. 17-18: Smith, History of Essex
County, pp. 333, 327; Hemenway, The Vermont Historical Gazetteer, vol. V, p. 528; H. N. Muller, “The
Commercial History of the Lake Champlain-Richelieu River Route. 1760-1815” (Ph.D. dissertation,

4T. H. Canfield, “Discovery, Navigation and Navigators of Lake Champlain,” in The Vermont
Historical Gazetteer, ed. A. M. Hemenway, p. 659; A. Lépine. “A wreck believed to be a French
bateau sunk during action in 1760 off Isle-aux-Noix in the Richelieu River, Quebec, Canada.” IJNA

290; P. S. Palmer. History of Lake Champlain, 1609-1814, p. 49.

Lumber Trade Between Canada and the United States, p. 91; M. L. Porter. Plattsburgh, p. 68.

7H. P. Smith, History of Essex County, pp. 378, 382; Canfield, The Vermont Historical
Gazetteer, p. 667 n. 1; J. Kreuger, A. Cohn, K. Crisman, and H. Miksch. “The Fort Ticonderoga King’s
Shipyard Excavation.” The Bulletin of the Fort Ticonderoga Museum 14, no. 6 (Fall 1985): 335-436.

established a settlement on the Bouquet River in Essex County, New York. In 1761 Major Philip K. Skene established a settlement on Wood Creek at the southern end of Lake Champlain, which was first called Skenesborough and later became Whitehall, New York. By 1770 Skene built and operated a sloop to conduct trade with Canada and later built one or two schooners, giving him a monopoly on trade until the American Revolution.

Early Champlain Valley settlers cleared the land for farming and in the process produced a supply of timber and forest products that could be traded. Until the Industrial Revolution almost all human endeavors relied on timber as a fuel, a building material, and for other products like pine masts for naval vessels. When a nation ran out of timber, as England had, a crisis ensued. The British began harvesting white pine masts in New England in 1634 and relied on this supply in case their primary Baltic source was cut off in wartime. Philip Skene and William Gilliland were awarded land grants, which reserved for the crown “all White or other Sort of Pine Trees fit for Masts of the Growth of Twenty-four Inches Diameter and upwards, at Twelve Inches from the Earth.” Cutting and shipping mast timber became a full-time endeavor for some settlers, as logs had to be hauled to staging areas and prepared as spars, and then transported by the lake and the Richelieu River to Québec where agents of the British government accepted them for the Royal Navy.

Champlain Valley merchants developed their first business associations with markets along the St. Lawrence River, as Norway pine spars, hand-hewn oak timbers and staves became the most valued items in a Canadian trade that also included potash, wheat, and livestock. Timber cost 6 to 8 cents per

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cubic foot to bring to the lake, and transportation to Canada cost 2½ cents, so that the 20 cents for pine and 40 cents for oak to be had in Quebec offered the possibility of substantial profits.\(^{18}\)

The first sawmills constructed in North America date to the 1620s and 1630s.\(^{19}\) Apart from the French mill captured at Ticonderoga, the first English mills in the Champlain Valley were built in 1766 with a noticeable increase in the 1780s when more settlers arrived.\(^{20}\) Ira Allen built the first sawmill near Burlington, Vermont, in 1786, after his brother Levi contracted with the English in Canada to supply square oak timber, white oak pipe staves, and white pine boards.\(^{21}\) Stephen Mallett, for whom Malletts Bay is named, is credited with sending the first raft of oak timber to Canada in 1794. The Allens, therefore, must have taken their timber out of the lake by boat. Two years after Mallett, John Thorp of Charlotte took a raft of Norway pine down the lake.\(^{22}\) Rafts could pass the Chambly Rapids on spring swells whereas bateaux had to be portaged and rafts were thus loaded with everything that might be traded in Canada.\(^{23}\)

Farmers spent the winter as lumbermen and carpenters, cutting timber and preparing rafts made of logs and squared timber. Beginning a raft with a course of logs, they added two courses of perpendicular timber bracing and fastened everything together with treenails. They built individual cribs of 25 feet (7.6 m) on a side, which were joined together into large rafts with up to four masts with square sails to run down the lake. These rafts had a capstan, an anchor, a warping cable, oars to steer individual cribs, a small boat or canoe to lighter goods and to take the anchor out for warping, a cabin, and a fireplace. Lumbermen sent individual cribs over the rapids, then reassembled the raft for the trip on the St. Lawrence River.\(^{24}\) Rafting gave farmers and lumbermen rudimentary carpentry skills and experience building and operating watercraft.


\(^{21}\)R. N. Hill, *Lake Champlain, Key to Liberty*, p. 164.


\(^{23}\)Smith, *History of Essex County*, p. 173.

These large rafts had room to transport other goods like potash and pearl ash, livestock, wool, fish, cheese, grain, flour, distilled spirits, and tobacco, which were exchanged for salt, fish, iron, tobacco, and merchandise. Customs records for Québec in 1788 show that the province exported to England goods worth £94,870, of which the largest item was 200,400 bushels of wheat worth £40,000, followed by lumber worth £12,500 and 9,900 barrels of flour worth £11,000. This market and available water transportation are what attracted commodities from the Champlain Valley.

**Other Products and Water Transportation**

Masts and oak timber were valuable trade items that Valley residents could easily exploit and transport. New Yorkers and Vermont’s “Connecticut Yankees” were also intent on farming and developing the region’s rich iron reserves. These enterprises needed not only watercraft, but merchants, storehouses, and docks to carry out this trade.

The process of clearing the land for farming produced ashes to trade with Canada. Farmers took ashes from log burning and fireplaces, poured water through them to leached out lye, and then refined them in a heated cast-iron kettle to produce “black salts” of potash and pearl ash through crystallization at the base of the cauldron. Potash was essential to glass making and in the production of fuller’s soap for use in the woolen-textile industry, and therefore could be exchanged in Canada for cash, even when this trade was prohibited by statute. Three asheries in Essex, New York produced between 200 and 300 tons of potash each year prior to the War of 1812. The level of trade in ash can also be inferred from commentaries on timber depletion.

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Farmers planted grains such as corn, rye, barley, and buckwheat, as well as root crops such as potatoes. Wheat, however, brought between $2.00 and $2.25 per bushel and produced harvests comparable to those raised in western New York decades later.\textsuperscript{32} Wheat harvests in the Champlain Valley would remain at high levels until 1829, when a wheat midge destroyed production and accelerated the move to livestock raising.

Bulky grains were not perfectly suited to the limited transportation network of the late eighteenth and early nineteenth centuries. Champlain Valley residents, therefore, began building gristmills and distilleries to reduce the grain to a more easily transported form or fed the grain to pigs and cattle which could be driven to market.\textsuperscript{33} Winter ice and snow provided another outlet for farm goods as sleighs pulled by teams of horses often took to the lake just five days after the last steamboat of the season.\textsuperscript{34} Canada, Troy, New York, and Boston, Massachusetts were markets for goods transported this way.\textsuperscript{35}

The Champlain Valley’s rich deposits of iron ore could not be shipped out in large quantities either, so early iron works mainly met local needs by manufacturing hollow ware, plows, stoves, and potash kettles.\textsuperscript{36} Forges and furnaces had a great impact on the valley’s economy by spurring on lumbering to provide charcoal and farming to supply iron workers with food, both of which encouraged immigration.\textsuperscript{37} Iron may have been worked as early as the 1770s in Vermont. By 1792, several forges had been built in Vermont, some obtaining their ore from Crown Point, New York.\textsuperscript{38} Judge Zephaniah Platt erected the first iron works on the New York shore in 1798.\textsuperscript{39} The first blast furnace in northern

\textsuperscript{32} S. Swift, \textit{Statistical and Historical Account of the County of Addison, Vermont}. pp. 94-97.

\textsuperscript{33} Heaton, \textit{The Story of Vermont}. p. 149; Hurd, \textit{History of Clinton and Franklin Counties}. pp. 294-95.

\textsuperscript{34} Watson, \textit{The Military and Civil History of the County of Essex}. p. 432.

\textsuperscript{35} Swift, \textit{Statistical and Historical Account of the County of Addison}, pp. 94-95; H. P. Smith, ed., \textit{History of Addison County}. p. 672.


\textsuperscript{38} Rolando, \textit{200 Years of Soot and Sweat}. pp. 10, 59; Canfield, \textit{The Vermont Historical Gazetteer}. p. 682.

\textsuperscript{39} Hurd, \textit{History of Clinton and Franklin Counties}. p. 149.
New York was located near Plattsburgh in 1809, presumably set up by Alfred Keith, who was in the business with the Saxe family that operated Saxe’s Landing (later Chazy Landing), from which they shipped and received goods in their own boats.

Early iron works were located near sources of iron ore, water power, and transportation, like that of Captain Rufus Barney, who in 1799 utilized bog ore in Swanton, Vermont, near the lowest falls of the Missiquoi River and just up stream from Lake Champlain. If Barney or other early Vermont iron producers needed a secondary sore, it commonly came from across the lake. Iron stock also traveled across the lake, as in the case of William D. Ross’s Bouquet River, New York, rolling mill that sent nail plates, at $8.00 per hundredweight, to a factory in Fair Haven, Vermont. People also traveled across the lake, like Platt Rogers who lived in Basin Harbor, Vermont, and mined an ore bed in New York. and Liberty Newman of Shoreham, Vermont, who built an iron works at Ticonderoga, New York in 1801. The flow of iron ore and people across Lake Champlain once again indicates the lake’s unifying effect.

Some attempts were made at transporting bulky items out of the Champlain Valley. Levi Highbey (also spelled Higby) and George Throop, with financial support from Charles Kane of Schenectady, began manufacturing anchors weighing between 300 and 1,500 pounds (136.2-681.0 kg) at Willsboro Falls in Essex County, New York, in 1801. The anchors went by boat to Whitehall, New York, by cart to Fort Edward, New York, and then in bateau to Troy, New York. Highbey and Throop also produced mill cranks, gristmill machinery, and later, iron hardware for steamboats. Their anchors had to compete with those from iron works much closer to Troy and Albany. In the 1790s Ephraim Griswold set up a forge in Fort Ann in Washington County, New York, to manufacture chains and anchors.

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40 Rolando, 200 Years of Soot and Sweat, pp. 13-14.
41 Aldrich, History of Franklin and Grand Isle Counties, p. 405.
42 Rolando, 200 Years of Soot and Sweat, p. 87.
44 Rolando, 200 Years of Soot and Sweat, p. 59.
Winslow C. Watson, writing in 1869, repeats an unattributed, yet often repeated, statement that "[n]o decked vessel...navigated lake Champlain seventy years ago. The insignificant commerce which at that period existed upon its waters, was conducted in cutters, piraguas, and bateaux. Few wharves had then been constructed." This picture changed after 1800, however, when it became clear that the Champlain Valley could supply New York with lumber, iron, farm products, and other goods. This would require transportation and Lake Champlain offered the easiest route to market. Nowhere is this story better exemplified than in the development of trade and navigation in Burlington, Vermont.

**Burlington, Vermont**

The development of Burlington, Vermont, into a leading city in trade and boat building had a great impact on the type and number of vessels built on the lake around 1800. Ethan, Ira, Hemam, and Zinri Allen, together with Remember Baker, received a land grant from New Hampshire in 1763 and cut roads through the woods leading to Lake Champlain at Burlington. Ira Allen practiced lumbering and set up an iron works, which produced among other things, anchors. Late eighteenth-century observers report that Burlington was a busy port with boats coming and going daily. This began in 1772 when Ira Allen and Remember Baker built the schooner Liberty on the Winooski River and conducted trade with Canada until the vessel was seized for military use during the Revolutionary War.

Following the war several people came to Burlington who had a profound effect on trade and boat building in the Champlain Valley. Job Boynton arrived in 1780 and, with his eldest sons, Jed and Elijah, built several vessels and commanded them on the lake. In 1788, Connecticut sea captain Benjamin Boardman arrived and brought with him a New London boat builder named Daniel Wilcox.

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Two years later, Boardman and Wilcox built a 30-ton sloop based on the "fast sailing" hulls that Wilcox had built on the Connecticut coast for use in the West Indies trade. The sloop was immediately recognized as exceptional. Wilcox built more for other clients, including Gideon King, who also settled in the town of Burlington in 1788.

Gideon King and Jed Boynton built two 8-ton cutters, which they ran between Burlington, Vermont, and Essex and Plattsburgh, New York. In 1790, they retrieved two schooners from St. Jean, Canada, and used these to trade between Burlington and St. Jean. Early in the nineteenth century, King became known as "Gid King, the admiral of the Lake" due to his ownership of, or investment in, just about every sailing vessel on the lake. King was among those who admired Wilcox's sloop and ordered one for himself in 1793, which was named Dolphin. Job Boynton did the same and named his Wilcox boat the Burlington Packet. Both vessels were 25 tons and built in Burlington. In 1794 Wilcox built one or two boats in St. Albans, Vermont, but in 1795 he returned to build a 30-ton sloop, named Lady Washington for Russell Jones.

Thomas Hawley Canfield, chronicler of Lake Champlain navigation, interviewed aging boat captains to compile a list of 29 merchant vessels built on the lake between 1790 and 1815 (Appendix B). Despite minor discrepancies in dates between Canfield's list and primary source documents, Canfield's list provides an idea of the number and size of boats on the lake and indicates the dominant position of Gideon King in the shipping business. It also supports the premise that most early lake sloops were of the Wilcox design. Nine of the vessels on Canfield's list were built by Wilcox and fifteen others by Richard Eggleson of Essex, New York, who had adopted Wilcox's design. Of the remaining six boats on the list, three were by Richard Fittock and three others are by unidentified individuals. Fittock built vessels for Gideon King and Job Boynton, both of whom were impressed by the Wilcox boats, and may well have insisted on this design. Fittock is described as a master builder and had the opportunity to inspect Wilcox's vessels, as he owned a tavern and warehouse on waterfront, and

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51Hill, *Lake Champlain*, p. 211; Canfield, *The Vermont Historical Gazetteer*, pp. 668-69; Crockett, *Lake Champlain*, p. 291. Crockett's account of navigation appears to have been taken from Canfield, places King in partnership with Jed Boynton's father Job.

52Muller, "The Commercial History of the Lake Champlain-Richelieu River Route," p. 158.


conveyed cargo with his scow lighter Old Lion.62 Even if Fittock built on a different model, the prevalence of the Wilcox model is clear. Wilcox's precise design, however, is not known, although Canfield describes them as "clipper style" and unlike the heavy Dutch sloops on the Hudson River.63

Another two dozen sloops along with a few cutters and schooners, not listed by Canfield, engaged in trade on the lake prior to 1823.64 Information concerning where these vessels were built is lacking, but other towns began building boats as trade increased. Richard Eggleston was a prolific boat builder in Essex, New York, who built the sloop Euretta in 1810 for Essex store owner and nail plate producer William D. Ross. Following the War of 1812, Eggleston built close to 10 vessels of greater than 150 tons, and during his career set over 100 commercial vessels afloat. He also built 250 military row galleys or bateaux.65

Concluding Remarks

Vermont became part of the United States in 1791. Five years later, Jay's Treaty opened trade with Canada, resulting in a boom period that saw Burlington, Vermont, and Plattsburgh, Essex, and Whitehall, New York, lead a vigorous lake trade.66 Boat building was undertaken to facilitate trade directed at markets in Quebec and Montreal, with goods from lake ports taken to St. Jean, Canada, where they would be transshipped and taken either by way of the Richelieu River or by overland routes. Some trade did flow south to Whitehall, New York, and several vessels were built at the southern end of the lake in response to this traffic. From Skene's day, Whitehall traded primarily with markets to the north, although some trade was conducted overland with Troy, Lansingburgh, and Albany, New York, for items that could not be had in Canada.67 In 1806, a company was incorporated with $150,000 and built the 60-mile (96.6-km) long Waterford and Whitehall Turnpike, passing through Fort Miller. Fort

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63Canfield, The Vermont Historical Gazetteer, p. 668.


65Smith, History of Essex County, pp. 546-49.


67The Delaware and Hudson Company, A Century of Progress, p. 705.
Edward and Fort Ann, and operated as a toll road. Even Jefferson’s Embargo in 1808 and the Non-Intercourse Act that followed the next year were unable to stop the flow of goods between the Champlain Valley and Canada, and only forced this trade into illicit avenues conducted by smugglers working under the cover of darkness. The years 1808 to 1811 saw prices for commodities hit all-time highs, with only a few commodities dropping off, and those due to the change in the valley economy from pure forest exploitation to a mix of agricultural and nascent industrial pursuits.

The War of 1812 and English control of the northern lake forced trade to the south. Gideon King and others went to Whitehall to set up forwarding companies, build boats, and establish connections with business interests in Troy, New York. Richard Hart operated the toll road between Troy and Whitehall, New York, and the firm of Hart & Bird at Whitehall obtained the contract to transport government stores from Troy to Whitehall. They operated in conjunction with King, whose sloops took troops and supplies down the lake. King also loaded private goods and passengers at Whitehall for transportation down the lake. The success of the association between the two made Hart wealthy enough to retire in 1815, giving King control of the shipping on the lake.

Trade in the Champlain Valley after the early settlement years depended almost exclusively on Lake Champlain as an early water highway. No matter who was in control of the region, trade was irrepressible. When the French controlled Canada, British trade goods were exchanged for French furs. When the British controlled Canada, New Yorkers and Vermonters rafted lumber, ashes, and flour for British merchandise. The Champlain Valley drained physically and economically into the St. Lawrence River Valley.

During and after the War of 1812, when trade relations between the Champlain Valley and Canada had worn thin, trade to the south seemed an obvious next step. With relationships between merchants in Troy and Albany, New York, already established through the toll road of 1806, the time was ripe for New York to capture the Champlain Valley trade from the tide of the St. Lawrence. Into the breech stepped De Witt Clinton with a plan for a man-made outlet to the south. Clinton was a New Yorker who wanted to be governor of that state. He championed an old idea of building a canal linking the Champlain Valley with the Hudson Valley. This would provide cheap and plentiful transportation

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68 Johnson, History of Washington Co., p. 70.


70 Canfield, The Vermont Historical Gazetteer, p. 681.

for the heavy, bulky commodities that the Champlain Valley had to offer. It would also greatly enhance passenger travel between New York and Montréal by eliminating a stage route in New York. The fight for a canal was difficult, but in the end was successful and transformed life in the Champlain Valley.
CHAPTER IV

NEW YORK'S CANALS: ERIE AND CHAMPLAIN

Since antiquity merchants have used water to float their goods to market whenever possible. Water routes provide a low maintenance, level surface ready for use by a suitable vessel. With few exceptions, water travel has always been cheaper than overland transport, which requires building and maintaining roads at great expense, and demands greater output of energy to move materials to their destination. The weight which can be pulled on water is 66 times greater than the weight that can be transported on land at an equivalent horsepower and pace.¹ Navigable lakes and rivers, however, are not always conveniently located to allow exploitation of natural resources. Canals were one answer to this problem. They provided a means of extending and linking natural waterways, permitting access to raw materials, and allowing finished products to be shipped to market.² Canals, however, can require substantial and continuous investments of capital. In England, canal technology for a moderate cost provided an inland transportation network essential to industrialization between 1760 and 1830.³ Late-eighteenth and early-nineteenth century Americans, especially New Yorkers, believed the same could be accomplished in the United States. The same people who dreamed of a New York canal system connecting eastern cities with western settlements also advocated the creation of a waterway between the Hudson River Valley and New York’s northeastern frontier: Lake Champlain.

Early Canals in the United States

The American canal movement was largely based upon European examples. The early settlers of New York brought with them a knowledge of Dutch and English canals, and understood how trade and commerce via inland waterways was essential to economic prosperity in the old country.⁴ Throughout the eighteenth century American advocates of canal building toured European canals and came to appreciate their effect on the well-being of the economy.⁵ American engineers studied the


²C. Hadfield. World Canals. p. 58.


canals of the Dutch, the French, and in particular, the English. European canal engineers also came to the United States to supervise the construction of early canals and to train Americans in this science. The construction of the Bridgewater Canal by James Brindley in the 1760s set off a canal boom in England and started Americans thinking about how artificial waterways could help them open western territories to settlement and trade.

In the last two decades of the eighteenth century Americans improved river navigation along the Potomac and James Rivers and built a few short canals. In 1803, the Middlesex Canal opened in Massachusetts providing an artificial waterway between the Merrimac River and the port of Boston over a course of almost 28 miles (45.1 km). This provided cheap transportation, waterpower for industries along its route, and a five-fold increase in land value.

George Washington, an early canal supporter, and New York’s Governor George Clinton examined that state’s northern waterways in 1783 and 1784 and reported on the potential value of canals, which eventually led to the first efforts to link the Hudson River with both Lake Champlain and western New York. Elkanah Watson and General Philip Schuyler, who had both toured European canals, were the guiding forces of this movement. Watson was the public promoter, speaking in favor of canals at every opportunity, while Schuyler, who was a member of the New York senate, worked behind the scenes, gaining legislative support. On March 30, 1792, the Northern Inland Lock Navigation Company and the Western Inland Lock Navigation Company were formed to provide water communication from the Hudson River to the Champlain and Mohawk Valleys respectively.

The northern project was ill-fated from the start, as the sale of company stock was slow until Schuyler purchased shares. Even then, only two-thirds of the potential 1,000 shares were ever sold, and the actual number of stockholders was a mere 169. Further appeals by Schuyler in both New York and Vermont did not result in any other financial support from either private investors or state governments. Poorly financed, the company also suffered from the lack of a full-time, trained canal engineer. Schuyler served as president and took on the superintendency when his primary candidate, English canal

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engineer William Weston, could not break free of commitments to the Schuylkill and Susquehanna Canal Company.\textsuperscript{13}

The first two years of work consisted solely of surveying. In 1794 some progress was made in clearing Wood Creek and construction began for a canal channel and lift locks between Whitehall, New York, and the lake. Weston, who examined the project, reported favorably on the proposed corridor of the canal that year, although he recommended that the wooden locks be replaced by more-durable brick construction. By the time Weston was available in 1796 money and support for the project had dried up, and the following year marked the end of the company's efforts.\textsuperscript{14}

\textbf{The Erie Canal}

Twenty years after the failure of the Watson-Schuyler projects, construction began on a new and far more successful venture: the Erie Canal (Fig. 3). This was to become the premier canal built during the early-nineteenth century when a canal mania swept through United States.\textsuperscript{15} The Erie Canal served as the model for later large-scale canals\textsuperscript{16} and was a training ground for the engineers who would supervise the construction of other canals.\textsuperscript{17} The Erie was a long time in the making, but once complete, it transformed New York State into the Empire State. Known also as the Grand Canal, it diverted the trade of the Old Northwest which had previously gone by river to Montreal or New Orleans\textsuperscript{18} and brought years of prosperity to New York.

Like most canal efforts, the Erie began in a storm of controversy and politics. Agitation for a canal connecting the Hudson River with Lake Erie and beyond had continued after the limited success of the Western Inland Lock Navigation Company. By 1808, the New York legislature responded to the public discussion of a canal with funds for a survey to determine which of two routes would be preferable.\textsuperscript{19} New York State representatives went to Washington, D. C. to see if money could be

\textsuperscript{13}O'Hara, "Erie's Junior Partner," p. 40.

\textsuperscript{14}H. P. Smith, ed., \textit{History of Essex County}. p. 267.

\textsuperscript{15}Shaw, \textit{Erie Water West}. p. 418.

\textsuperscript{16}Shaw, \textit{Canals for a Nation}, p. 49.

\textsuperscript{17}Shaw, \textit{Canals for a Nation}. pp. 38, 162, 255 n. 8.

\textsuperscript{18}G. P. deT. Glazebrook, \textit{A History of Transportation in Canada}. p. x.

\textsuperscript{19}O'Hara, "Erie's Junior Partner." p. 59.
obtained from the federal government to assist in a canal project, only to find that the jealousy of other states blocked President Madison and U.S. Secretary of the Treasury Albert Gallatin from providing any real assistance. The canal debate continued until the beginning of the War of 1812, which effectively put a stop to the canal effort. By 1814, the canal seemed all but dead.

The end of the war breathed new life into the canal, however, by creating an atmosphere of nationalism, which gubernatorial candidate De Witt Clinton made the theme of his successful campaign in 1816. Clinton, the politician who most identified with construction of a canal, had opposition on several fronts. The southern counties of New York felt they would not benefit from the canal. New York City and the towns along the Hudson River feared that they would be taxed too heavily to pay for it. The Holland Land Company balked several times in selling land along a proposed route. Some canal proponents did not like Clinton's proposed route, preferring, instead a course through the Oswego Valley to Lake Ontario. Martin van Buren led a faction within the Republican Party, known as the "Bucktails," that opposed Clinton on almost every issue. Only when project financing was based on the state's credit rather than on the credit of a canal company did Van Buren throw his support behind the canal. This maneuver allowed anti-Clintonians to support the canal, but still oppose their traditional enemy. With sufficient political support in place the state went forward with more surveys, which once again returned favorable reports.

By 1817 New York had passed a canal bill, which charged five canal commissioners with constructing a route between the Hudson River and Lake Champlain and linking the Mohawk River with the Seneca River. New York's canals were run by a Canal Board made up of five appointed canal commissioners, together with the commissioners of the Canal Fund, who were six high-ranking state office holders. The fund commissioners managed financial affairs, while the canal commissioners took

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21Shaw, Erie Water West, pp. 50-55; O'Hara, "Erie's Junior Partner." p. 65.

22Shaw, Canals for a Nation, pp. 33-36.

23Shaw, Erie Water West, pp. 61-62.

24Shaw, Erie Water West, p. 71.
care of building and maintaining the canal. De Witt Clinton was elected President by the canal commissioners.

The idea of funding the project through private investment and the sale of shares was abandoned as too difficult to manage. The support of anti-Clintonian Republicans was secured by funding the canal through loans of up to $400,000 per year taken out upon the credit of the state. With money in hand, work commenced amidst July 4 ceremonies in 1817 in Rome, New York. Newly-elected Governor Clinton began the easiest portion of the route first, building on the successful work accomplished by the Western Inland Lock Navigation Company in the central Mohawk River Valley.

When it was finally completed in 1825, the canal was 363 miles (584.2 km) long and overcame 675 feet, 6 inches (205.9 m) of elevation change with 83 locks, which measured 90 feet (27.4 m) long and 15 feet (4.6 m) wide. The canal prism was 40 feet (12.2 m) wide on top, 28 feet (8.5 m) wide on bottom, and 4 feet (1.2 m) deep. This waterway required the construction of 18 aqueducts and 600 bridges as it crossed 32 streams. It was a marvel of engineering and a testament to the efforts of those who built it.

The Erie Canal helped populate western New York and served as both a conduit for emigration to the west and a pathway for raw materials and produce from the west, especially western New York in the first decades of canal operation, to flow to the Hudson River. By the 1830s the canal had transformed upstate New York from wilderness to farmland, and was a principal outlet for products from the west. By the mid-1850s western states sent over three times more goods through the canal than did New York residents. It was so successful that New Yorkers began asking for a larger canal to

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combat the constant delays caused by boats awaiting lockage from one level to the next. In 1834 the canal commissioners call for enlargement and a law was passed the next year. The enlargement became mired in political debates that lasted well into the 1840s. Approximately half of the estimated funds for this work were under contract by the early 1840s. Construction took place only during the winter, when ice closed the canal, and the project was, therefore, not completed until 1862.

The enlarged canal was shorter by 12.5 miles (20.1 km) and had 11 fewer locks. The locks were increased to 110 feet (33.5 m) in length and 18 feet (5.5 m) in width. The canal prism was made 70 feet (21.3 m) wide at the top, 56 feet (17.1 m) wide at the bottom, with a depth of 7 feet (2.1 m). The larger canal took boats of 220 tons burden, or nearly three times the cargo capacity allowed by the original Erie Canal.

The Erie Canal was the first great American canal, with an increase in volume of goods shipped and value of tolls paid between 1825 and 1850. After 1850 toll rates decreased and were abolished altogether in 1882, yet volume shipped continued to increased into the 1880s. The Erie was, without a doubt, the most successful of the American canals. There was, however, another notable New York canal, and it linked the Champlain Valley to markets in New York: the Champlain Canal.

The Champlain Canal

Lake Champlain had served as the principal route of communication between Canada and the eastern seaboard since the early-seventeenth century, and canal promoters were quick to recognize the potential of an uninterrupted waterway between the upper Hudson River and the lake. The origins of

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33 F. D. Larkin. New York State Canals, A Short History. p. 31.

34 Shaw. Erie Water West. pp. 305-06.


the Champlain Canal along this route, like those of the Erie Canal, can be found in the inland lock navigation companies of the 1790s. Washington County, New York, straddles two great drainage basins, the northern end of the Hudson River watershed, and the southern end of the St. Lawrence watershed.\textsuperscript{40} The country between the two had partial water communication by means of Wood Creek. Native Americans and early settlers used canoes and bateaux along this route and carried their watercraft and goods overland at the Fort Edward and Fort Miller portages.\textsuperscript{41}

New York's canal commissioners concluded in 1812 and 1817 that a canal between Lake Champlain and the Hudson River was of "national importance."\textsuperscript{42} As justification for this conclusion they noted that the vast timber and iron ore resources of the Champlain Valley could thereby find their way to markets in New York in exchange for salt and gypsum from along the Erie route. These industries were vital to the economies of the region, and a canal would ensure continued growth and vitality.

The original 1817 plan called for a prism 30 feet (9.1 m) wide at the top, 20 feet (6.1 m) wide at the bottom, and 3 feet (91.4 cm) deep, while the locks were to be 75 feet (22.9 m) long and 10 feet (3.1 m) wide,\textsuperscript{43} reflecting the size of boats in use at that time. These dimensions were increased in 1819 to the size of the Erie Canal to placate lumber interests who favored large timber rafts and to avoid transshipping goods traveling between the canals from boats of one size to those of a smaller size. The only difference between the two canals was that the Champlain locks were 14 feet (4.3 m) wide, or a foot (30.5 cm) narrower than those on the Erie Canal. The canal was projected to cost $871,000, but enlargement brought the total to nearly $1,000,000.\textsuperscript{44}

Construction of the Champlain Canal was authorized by New York's legislature on April 15, 1817.\textsuperscript{45} The first contract was awarded to Burlington, Vermont, freight forwarder Ezra Smith.\textsuperscript{46} Like

\textsuperscript{40}W. L. Stone, \textit{Washington County, New York, Its History to the Close of the Nineteenth Century}, p. 6.

\textsuperscript{41}O'Hara, "Erie's Junior Partner," pp. 2, 5.


\textsuperscript{43}Whitford, \textit{History of the Canal System of the State of New York}, p. 979.

\textsuperscript{44}O'Hara, "Erie's Junior Partner," pp. 79-80.


many other businessmen Smith recognized the benefits of a canal that connected the lake to New York markets and contracted to help construct the waterway. Labor for building the canal was also drawn from people who would come to depend upon it for their livelihoods, such as farmers living along the canal.47

Construction along the 64 miles (103 km) of the canal’s route took five years to complete.48 The canal’s southern terminus began at the junction with the Erie Canal near Cohoes, New York, some nine miles (14.5 km) north of Albany, New York which had a vast canal basin on the Hudson River. From this junction the Champlain Canal crossed the Mohawk River and proceeded to Waterford, New York, where there was another outlet to the Hudson by means of sloop locks.49 From Waterford the main canal ran north along the west bank of the Hudson River passing through many small towns in Saratoga County, New York. It then crossed the Hudson River just north of Schuylerville and continued north through Washington County, New York, and into Fort Miller and Fort Edward. From the latter town it crossed a ridge at the canal’s summit and followed improved sections of Wood Creek or ran in a canal channel, passing through a few more Washington County towns and ending in Whitehall, New York. Towns with the words “basin” or “landing” in their name owe their origins to the canal, in the same way that many newly-created Erie Canal towns end with the word “port.”50

Construction progress was immediate and considerable under chief engineer James Geddes and Canal Commissioner Samuel Young. By the end of 1818 some 12 miles (19.3 km) of excavation were completed between Fort Edward and Whitehall, New York.51 Water was admitted to this northern section and a number of boats journeyed to Fort Edward on November 24, 1819.52

In 1820 canal construction focused on completing the section of canal leading to Waterford. A dam to supply water at the summit level was also begun, but storm damage delayed completion of the Fort Edward dam until 1822.53 By 1821 the canal was complete to one mile (1.6 km) south of Stillwater.


50Sheriff, *The Artificial River.*, p. 64.


New York, and the remaining 10 miles (16.1 km) to Waterford were completed in 1822. A second dam located on the Hudson River was 1,100 feet (335.3 m) long and 28 feet (8.5 m) high and provided sufficient water for sloops and canal boats to navigate between Waterford and West Troy, New York. The canal could have been completed in 1822, but a funding shortfall delayed this until the following year.

The canal had insufficient water at the summit level, especially in drought years, which closed the canal for part of the navigation season. A dam built north of Fort Edward brought water from the Hudson to ease this problem. The Fort Edward dam was a stopgap measure. A feeder canal subsequently built at Glens Falls and in operation by 1839 solved most water supply problems.

The last work to be undertaken was at the south end of the Champlain Canal. The decision about where to place the channel was delayed until the east end of Erie Canal was determined. There was concern that boats passing between the canals would be subjected to the hazardous navigation of the Hudson around Waterford, New York. The canal commissioners finally decided upon two separate routes, one that crossed directly to the Erie Canal and the other emptied into the Hudson. The latter route allowed Hudson River sloops to visit Waterford and provided an alternative route for canal boats to reach the Hudson when the junction to the Erie Canal was blocked by excessive traffic.

The canal was completed from Lake Champlain to Waterford on November 19, 1822. Small celebrations greeted a number of boats that arrived from the lake at this time. There were still problems that would have to be solved after the waterway officially opened, including the canalization of a stretch of the Hudson River between Fort Edward and Fort Miller, New York, which was winding and hazardous to rafts.

On September 10, 1823, the lake was connected by canal all the way to the Erie Canal and navigation was opened. The connection to the Hudson River through Troy, however, would have to

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wait a couple of months, as freshets on two occasions carried away parts of a dam. The Champlain Canal officially opened on October 8, amid great celebrations. The first vessels from the Champlain Valley stopped at Troy and Albany, New York, before journeying to New York City. In New York City seafood was taken on as cargo to symbolize the journey to the sea.

The completed Champlain Canal had 17 locks and was 64 miles (103 km) long. It was comprised of 46 miles (74 km) of man-made channel and 12 miles (19.3 km) of river navigation along the Hudson River, with another six miles (9.7 km) along Wood Creek. Ten boats utilized the incomplete canal in 1821. During the abbreviated first season of navigation in 1823, more than 100 boats went through the canal from September until the ice came in November. Unquestionably, the Champlain Canal was an immediate success.

After the canal opened along its entire route, improvements were made to sections which were difficult to navigate, such as the rivers. More artificial channel and locks were built until river navigation was all but avoided. Locks originally built from timber required rebuilding with masonry soon after the canal opened. This work took twenty years to complete. Once the Glens Falls Feeder was completed it required improvement to make it navigable by canal boats in 1839. The locks at Glens Falls were made 100 feet (30.5 m) long by 15 feet (4.6 m) wide and could accommodate larger boats. At Whitehall, protective walls were built along the tow path to prevent flood waters from Wood Creek damaging the canal and its locks. A pier was also built to assist boats entering the canal when the lake level was high.

The dream of a contiguous, navigable water route between the St. Lawrence and the Hudson was finally realized in 1843 when the Chambly Canal opened on the Richelieu River. It was not until the construction of the St.-Ours Lock in 1849, however, that boats of any size could travel from the St. Lawrence to Lake Champlain. The 12 miles (19.3 km) of Chambly Canal and the single lock at St.-Ours Lock did not connect with the Champlain Canal until 1855.

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Ours extended navigation on the Richelieu River north from St. Jean for 60 miles (96.6 km) to the St. Lawrence River at Sorel. From this point, Montreal is about 45 miles (72.4 km) to the south and Quebec is a little over 100 miles (160.9 km) to the northeast.

The Champlain Canal operated under the same Canal Board as the Erie Canal, but did not develop in size as rapidly as its western counterpart.66 The opening of the St.-Ours Lock on the Richelieu River and Canadian plans to increase the size of canals on the St. Lawrence, led to considerable discussion in the New York legislature about creating a ship canal, but no concrete plans were developed.67 By 1859, 11 of the 25 Champlain locks had been rebuilt to a length of 100 feet (30.5 m) and a width of 15 feet (4.6 m).68 The remaining locks were finished by 1862, permitting boats of a larger size to pass through the entire canal. By 1871, the entire Champlain Canal was deepened to 5 feet (1.5 m) of water, and six years later, in 1877, all 23 locks had been enlarged to 110 feet (33.5 m) long and 18 feet (5.5 m) wide. No other improvements occurred until the state developed a plan for a Barge Canal System in the early twentieth century.70

The Champlain Canal was the most important man-made connection in the all-water route from New York to Canada. From New York City the Hudson River extends 156 miles (251 km) up to Albany, New York, where the New York canals begin. From Albany it is 76 miles (122.3 km) to Whitehall, New York, at Lake Champlain's southern end (64 miles (103 km) via the Champlain Canal).71 From Whitehall there is 157 miles (252.7 km) of navigable water on Lake Champlain and the Richelieu River to St. Jean, which is 24 miles (38.6 km) north of the United States and Canadian border. The Canadian improvements extend the waterway to Sorel on the St. Lawrence, with Montréal to the southwest and Québec to the northeast. Navigation along the canals closed most years from December until April, although it stayed open much longer on the broad lake, and occasionally remained open the entire year.72

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Lake Champlain, together with the Champlain Canal, the Chambly Canal and the St.-Ours Lock provided an efficient, safe route for trade, commerce, and passenger service. This all-water route was the first direct connection between Montreal and New York. Together with Canadian canals on the St. Lawrence River and the Welland Canal between Lakes Ontario and Erie this system provided an all-water alternative to the Erie Canal for Great Lakes' products.

The completion of New York's first canals created powerful new avenues of commerce, and diverted the previous flow of waterborne trade in the Champlain Valley. A new era of commercial prosperity was poised to take off not just in New York, but also in Vermont which benefitted from the canal even though it did not participate in its financing. The canal infused existing extraction industries with new life, and made possible a new array of agricultural, industrial, and commercial pursuits, all of which relied on the new and inexpensive all-water route to New York markets.
CHAPTER V

COMMERCIAL DEVELOPMENT AND TRANSPORTATION IN THE CHAMPLAIN VALLEY

The lack of an adequate means of transportation hindered economic development in the Champlain Valley during the late eighteenth and early nineteenth centuries. The opening of the Champlain Canal had a profound effect on every aspect of life in the region, and the canal's contribution to the valley's economic growth cannot be overstated. The canal changed the direction of trade, and improved access to markets also altered the intensity and nature of the economic activity. Lumbering, iron working, and farming were radically transformed from mere subsistence activities to large-scale operations that sent the majority of their products out of the valley. The canal provided cheap water transportation that also stimulated quarrying of the valley's stone resources. The population of almost every lake town increased as new enterprises created a demand for labor. Lake towns became collection and distribution points for trade with an extensive hinterland. Population increases in the Champlain Valley led to a greater demand for merchandise from markets on the Hudson. Champlain Canal toll revenues reflect increases in trade.

A vast array of products poured out of the Champlain Valley including agricultural items such as apples, cheese, hay, and potatoes, as well as manufactured goods and building materials such as bar iron, bricks, tanned leather, nails, door and window sashes and cut stone. These were exchanged for merchandise of every description, as well as bulk cargo such as coal, flour, gypsum, and salt. The heightened level of trade in both directions required new facilities and businesses to conduct this

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4 J. H. French, Gazetteer of the State of New York, p. 57.; Amrhein, "Burlington," p. 125. Annual canal toll receipts grew from $26,000 in 1823, $46,200 in 1824, and $73,615 in 1825, to almost $200,000 by 1866.

commerce. What was originally an insignificant local trade carried out with a few sloops, bateaux, and rafts, soon became a bustling commerce requiring hundreds of large boats including sloops, schooners, steamboats, and canal boats. Towns such as Burlington, Vermont, and Plattsburgh, New York, became the leading centers of this commerce, but every lake town took advantage of opportunities presented by the canal. All around the lake merchants and mechanics built stores, wharves, warehouses, boat yards, and boats, because now it was possible to transport items in great quantities through what some people sometimes referred to as the “ditch.”

Lake Commerce Turns South

The completed canal cut the journey to New York to less than two weeks. With horses and mules able to pull 3 to 8 times as much weight over canals as they could over turnpikes, freight rates dropped by two-thirds to $10 per ton. This made trade to the south easy, inexpensive and preferable. Referring to the opening of the canal, lake historian Ralph Nading Hill said “it was as if some great force had suddenly tipped the lake to the south, emptying into Whitehall the goods that had always gone to St. Jean.” Nineteenth-century historian Henry P. Smith described the dramatic turn-around in trade as taking place in a single day when, “Lake Champlain became a commercial highway, whose blue waters were thickly dotted by white sails and puffing steamers from the opening of navigation to its close.” As early as 1822 merchants from the Connecticut River Valley and Canada complained about New York City merchandise reaching the Champlain Valley as return cargo for lumber flowing down the Champlain Canal. Only now did the average Vermonter feel a political connection to the United States.

Despite Hill’s hyperbole, Canadian trade did not completely stop after 1823. Burlington, Vermont, retained its status as a port of entry and continued to welcome Canadian banknotes at its

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8. R. N. Hill, Lake Champlain, Key to Liberty, p. 207.


Trade between the United States and Canada was the most significant foreign commerce of each country throughout the nineteenth century. Trade between the Champlain Valley and Canada continued, especially after 1849 when the final improvements to the Richelieu River permitted canal boats to move freely between Lake Champlain and the St. Lawrence River. The direction of trade, however, was exactly the opposite of the pre-canal days. The Canadian canals attempted to divert western trade from the Erie Canal. Instead, they provided a further conduit for western goods to reach New York via the Champlain Canal. Many Great Lakes products favored the lower tolls and speedier passage of the Champlain route to Hudson River markets over the Erie Canal.

Commercial Expansion and Population in the Champlain Valley

Lower transportation costs made possible the exploitation of valuable resources such as lumber, iron, stone, and agricultural lands. Inexpensive rates for freight and passenger traffic led old and new settlers along New York's and Vermont's rivers, streams, and lake shores to establish many new enterprises, such as sawmills, iron works, stone quarries, farms, mercantile businesses, and transportation lines.

Contemporary observers and historians have noted that the Champlain Canal not only turned the tide of trade but, in keeping with the canal advocate's predictions, ushered in a great commercial expansion, as well. Vermont's governor, Cornelius P. Van Ness, in his 1824 inaugural address recognized that a "new era" in business enterprise had already begun with the new waterway. Nathan Hoskins wrote in 1830 that, "[t]he amount of business has increased exceedingly upon Lake Champlain, since the opening of the northern canal." Henry P. Smith wrote with the benefit of 50 years of

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12 Hill, Lake Champlain. p. 214.


17 N. Hoskins, A History of the State of Vermont. From its Discovery and Settlement to the Close of the Year MDCCCXXX [1830], pp. 272-73.
hindsight that, "[it] seemed that a new era of commercial history had begun." The commerce of the valley and its towns increased significantly as Lake Champlain became a greater water highway with Lake Champlain and the canals at either end providing better connections to markets in New York, Montréal, and Boston, as well as the expanding western frontier.

Development of Champlain Valley resources required sufficient population to carry out new and expanded commercial activities. The canal provided an easy means for people to reach the area. European immigrants traveling between New York and Canada made their way through the Champlain Valley on their way out west, with some staying in the valley. More immigrants came to the valley from the south, like the Sewall Cutting family, who came to Westport, New York, in 1823. Dr. Sewall Sylvester Cutting, the son of Sewall Cutting, wrote an account of the journey, stating that his family.

"left New York about November first, ascending the Hudson on a sloop bound for Troy. My father's merchandise was here transferred to two canal boats, and on one of these boats my oldest brother, William, and myself took passage for Whitehall, my father and mother and the younger children going thither by stage. At Whitehall we took the sloop Saratoga, and sailing at 8 P.M., with a strong south wind, reached our destination at Westport, Nov. 13, 1823, at two o'clock in the morning."

This story was repeated all over the Champlain Valley as significant increases in population occurred throughout each town and county on the lake and along the canal.

The most dramatic population increase was in Burlington, Vermont, which went from 2,111 people in 1820 to 7,585 in 1850. Burlington became the most populous town in Vermont by 1840, and the most populous town on the lake in the following decade. Census data indicate the leading role played by Burlington's residents in trade and commerce.

18 Smith, History of Addison County. p. 124.


Lumber

The first product to be carried through the Champlain Canal was lumber. In 1821, the British placed a higher duty on timber at Québec that came from the Champlain Valley, which, together with the new canal, put an end to timber shipments to the north. Peter Comstock, who became one of the principal passenger and freight handlers on the Champlain Canal, took the first raft of timber through the canal to the Hudson. As the flow of Champlain Valley lumber shifted toward New York markets, production increased. Immense rafts promptly packed the new waterway. These rafts were made up of cribs built 75 to 80 feet (22.86–24.38 m) long and 13 feet (3.96 m) wide to match the canal locks. In the 1830s, boats replaced rafts as the means of transporting lumber when the Canal Board established higher tolls for rafts because they damaged canal banks.

For many, lumbering became a full-time vocation as opposed to a wintertime subsidy. The number of sawmills on the New York lake shore more than doubled between 1820 and 1835. The number of saws in operation along the Ausable River doubled again between 1840 and 1845. This level of activity helped New York pass Maine as the country’s leading lumber producer in 1850. Albany, New York, led the nation in lumber distribution. New York, however, used more lumber than it produced and made up the difference, in part, with western pine shipped through the Erie Canal.

Watercraft shipped 65% of all of New York’s timber via the Champlain Canal in 1834. Saw mills moved from the Hudson to the Champlain Valley. The demand at New York’s lumber markets was so strong that Canadians rafted Ottawa Valley timber up the Richelieu River for shipment through

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26 Lower, The North American Assault, p. 94.
33 O’Hara, “Erie’s Junior Partner,” pp. 224-25; C. Johnson, History of Washington Co., New York, p. 320. In 1834, 106,188,270 feet (32,366,578.3 m) of lumber, 990,950 cubic feet (280,480.2 steres) of timber, 140,000 barrel staves, and 6,030 cords of firewood reached the Hudson River from the Champlain Valley.
Lake Champlain and the Champlain Canal. By 1835, deforestation around the lake shore was widespread and lumber production leveled off, but the manufacture of wooden items such as barrel staves, carriages, wagons, sleighs, doors, sashes, blinds, tubs, pails, and paper continued to expand.54

The increase in the lumber trade led to dramatic technological changes in milling.55 American sawmills sought to supplant European mills through mass production with the introduction of gang saws (multiple parallel blades) around 1835, and circular saws were in general use by 1840.56 The first circular saws manufactured in the United States were made in New York around 1814. By the 1860s they were used, as well as manufactured, throughout the Champlain Valley.57

Norway pines had already been heavily depleted when the Champlain Canal opened, but the primeval forest was basically intact.58 Heavy cutting in the Adirondack Mountains and in western Vermont, however, took its toll. By mid-century, red cedar were almost gone and white pine and other woods had to be sought farther from the lake.59 Finally, all that remained were second and third growth forests.

Just as Champlain Valley forests were being depleted, a fresh supply of lumber arrived from Canada. The first boat load of Canadian lumber arrived in Burlington, Vermont, in 1850.60 By the 1870s, Burlington had developed extensive lumber milling operations resulting in the harbor being

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"choked" by lumber boats and barges as the city became the third largest lumber port in the United States.  

By the 1880s, Burlington was receiving 100,000,000 board feet of lumber each year.  

Canadian lumber also passed directly through the lake and canal on its way to Hudson River markets. In 1850, nearly twice as much Canadian lumber found its way from the shores of Lake Ontario to the Hudson by the Champlain Canal as did through the Erie Canal. Despite its longer distance, the Champlain route could be traveled more quickly and with fewer tolls than the path through the Oswego and Erie Canals. After the St.-Ours Lock opened on the Richelieu River in 1849, American boats frequently visited Canadian lumber ports. Canadian boats were banned by statute from passing through the Champlain Canal. This allowed American boats to carry all lumber, excluding that which came by Canadian boats to Burlington, Vermont, for milling or transhipment. Lumber in excess of 15,000,000 board feet passed through the Champlain Canal to the Hudson in 1849, increasing to 42,000,000 board feet in 1850, and doubling the following year. Square timber shipments increased proportionally reaching 1,660,000 feet in 1850.

Iron

New York's canals transformed iron mining and production to a greater extent than the lumber industry. New York's and Vermont's lake counties had rich, high-quality, as-yet-untapped iron deposits. In addition, there were streams with falls to power trip hammers, making these counties ideal for iron mining and iron making operations. This industry contributed significantly to the region's prosperity. Iron production spurred by cheap water transportation sent ripples throughout the valley's economy as the industry lured new laborers and their families into the Champlain Valley seeking employment not only in the iron works, but also in lumbering operations that supplied these works with charcoal and even on farms that provided the food needed for additional iron workers.

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With the opening of the Champlain Canal, iron works were built throughout the region, but Clinton and Essex counties in New York became the primary iron producing areas, with Essex-forged iron among the best and most-desired in the country.\(^4\) The Irondale Iron Works forge built in 1828 six miles (9.7 km) inland from the lake near Putnam, New York, produced iron of such high quality that in 1829 the Federal Government ordered it shipped to Pittsburgh to be used in the production of steel.\(^5\) Rutland County, Vermont, was the center of that state's iron production, with Lake Champlain and the Champlain Canal as the main outlet to market.\(^6\) Canal tolls that favored New York iron over "foreign" iron which included iron from Vermont, allowed New York to overcome Vermont's early lead in the iron industry.

Cheap transportation was crucial to the iron industry. This is illustrated by the history of the Adirondacks Iron Works, which was located in the far interior of New York State.\(^7\) Poor roads made it impossible to reach Lake Champlain easily. Despite a higher price per ton at market due to the exceptional quality of its production, the enterprise ran at a loss due to high transportation costs. Iron was heavy and required plank roads for transport to wharves on Lake Champlain. The existing roads leading to the Adirondacks were constantly in poor condition.\(^8\)

In addition to transportation issues, trade policies determined the success or failure of Champlain Valley iron businesses. Protective tariffs in 1824, 1828, and 1842, ushered in periods of prosperity, but the free-trade policies that followed had the opposite effect. Protectionism returned as the Civil War neared, however, and iron prices doubled.\(^9\) Due to this policy, northern New York became one of the ten principal iron-producing regions of the United States. By 1860, New York was producing over 20% of the country's $11,000,000 worth of iron manufactures.\(^10\)


\(^{60}\)Rolando, 200 Years of Soot and Sweat, pp. 11-12, 86-86, 93-98; A. M. Hemenway, The Vermont Historical Gazetteer, vol. IV, p. 1023.


\(^{54}\)Clark, A History of Manufactures, pp. 498, 504.
Iron producers had to be resourceful in transporting their products. They constructed their own plank roads, built wharves, and owned and operated canal boats. Companies and individual canal boat operators distributed ore to forges all around the lake. Afterwards, they loaded the products of those forges for delivery to iron works farther down the line. Champlain iron destined for Hudson River steel works or those in Pittsburgh, Pennsylvania went through the canal. Throughout the nineteenth century the transportation of iron ore and iron products to the canal was a bustling business for the lake’s iron producers.

Coal was a common return cargo for canal boats carrying iron up the lake. Anthracite coal was picked up at the north end of the Delaware & Hudson Canal in Rondout, New York. Alternatively, it could be found at coal dealers in Troy, New York, in several canal towns, and at lake towns like Burlington, Vermont.

**Other Products of the Champlain Valley**

Lumber and iron production were the leading Champlain Valley industries during this period. New York’s canals, however, influenced every occupation. From minerals to maple syrup, goods now could be sold in a much larger market. Vermont and New York quarried and manufactured stone once the canal provided cheap transportation. Copperas (used in pigments and inks) was manufactured from sulfur of iron found in large beds at Stratford and Shrewsbury, Vermont. Refined plumbago (black lead for the production of crucibles used in iron casting) was mined around Ticonderoga, New York, beginning in 1832. Vermont eventually supplied half the country’s marble, which was quarried around the state then shipped to towns like Burlington, Swanton, and Vergennes, Vermont, to be cut and finished into building stone, bridge piers, steps, sidewalks, mantels and tiles. It was then sent up the lake

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and out the canal to market. New York businesses processed hyperstene rock and Potsdam and Keeseville sandstone, which was used for building, flagging, and glass manufacture.\textsuperscript{62}

Farming pursuits altered dramatically with the opening of the Champlain Canal. Flour was imported into the valley from western New York, so farmers turned from growing wheat and other grains to producing corn, hay, livestock, dairy products, wool, fruits, and maple sugar.\textsuperscript{63} Livestock raising produced draft animals like Morgan horses, as well as cattle and sheep from European stocks, which were herded to market, skinned and tanned into leather, or shorn for wool.\textsuperscript{64}

Sheep farming, like iron production, benefitted from both the Champlain Canal and tariff policies.\textsuperscript{65} New York and Vermont farmers imported Spanish Merino sheep to enhance local flocks and increase wool prices.\textsuperscript{66} By 1825 sheep farming was the primary source of a farmer's cash, as wool remained profitable despite price fluctuations.\textsuperscript{67} Addison County, Vermont, led the nation in sheep and wool produced per capita.\textsuperscript{68}

Winslow C. Watson, a contemporary historian, wrote his observations of the Champlain Valley in 1868:

"The commerce of Lake Champlain is now large and every year augments. The lumber, the ore, and iron fabrics of the north, combined with the grain and flour of the west, and the coal and merchandise from the south constitute a vast trade. To their domestic resources may be added the productions of Canada, which seek a market by this avenue, and the goods chiefly bonded that pass into the dominion from American ports, and much of which is returned under fresh entries, all swelling this immense internal commerce. Numerous Canadian vessels, designed for the navigation of the St. Lawrence, and readily distinguishable from American craft by their peculiar structure and appearance, reach the waters of Champlain by the Chamblee [sic] canal. Vessels from the upper lakes are occasionally observed in our harbors. A large class of the population contiguous to the lake is connected with its navigation. This occupation


\textsuperscript{64}Heaton, \textit{The Story of Vermont}, pp. 152-53.

\textsuperscript{66}Hoskins, \textit{A History of the State of Vermont}, p. 268.

\textsuperscript{67}Johnson, \textit{History of Washington Co.}, pp. 71, 74.

\textsuperscript{68}Swift, \textit{Statistical and Historical Account of the County of Addison}, pp. 98, 104.
forms an admirable school for the acquisition of nautical skill and experience, and creates a bold and expert body of mariners." 69

Watson, relying on information from the local customs collector, observed that large numbers of steamers, ships and canal boats passed through the region. 70 A total of 1,021 vessels on customs' rolls in 1868 gives a good indication of the tremendous growth since the early days.

The Champlain Canal created a great deal of wealth and almost all business ownership and capital was local. Some out-of-state capital came into the valley's iron industry towards the end of the nineteenth century, but this was the rare exception to the rule. Most boat lines, for example, operated as a simple local partnership, and most valley industries like lumber mills, iron works, or marble quarries were enterprises under the personal direction of their local owner. Despite the proliferation of new markets opened by the canal, and later by the railroads, business operations in the Champlain Valley remained in local hands. It was not until the twentieth century and the transformation of the pulp-paper industry that a modern business organization emerged. 71

The Champlain Canal brought sweeping changes to towns in northern New York and western Vermont, including economic prosperity to many lake and canal towns. Goods and merchandise poured in and out of the Champlain Valley on a daily basis. Forest products could be seen stacked up on wharves awaiting loading onto boats and manufactured items from New York City could be seen on store shelves in every town. What often went unnoticed or undescribed were the vessels that cleared the shores and stocked the shelves. Another aspect of change wrought by the canal was the development of specialized watercraft.

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70 Watson, The Military and Civil History of the County of Essex, p. 488.

CHAPTER VI

"THE BARQUE OF THE MOUNTAINS"

The creation of canals sparked a revolution in inland boat building that was not seen following simple river navigation improvements. Connecticut River navigation projects included locks to admit flatboats and bateaux, but vessel construction did not fundamentally change, except that boats were built of a size to permit them to pass through the locks. This was also true for vessels on other early navigation projects in New Orleans, Virginia, and North Carolina.¹

The date of construction for the first American canal boat is not known but was sometime around 1803 when the Middlesex Canal opened in Massachusetts. In the 1820s and 1830s, with the opening of the New York canals and the subsequent "Canal Mania" that spread throughout the country, existing river boat designs were pressed into service on the new waterways. Boat builders adapted existing watercraft to the canal, mainly by increasing their cargo capacity within the confines of the canal locks and channel prisms. This produced an array of vessel types, which by the middle of the nineteenth century had coalesced into about a half dozen types, although there was still great variability between boats on different canal systems.²

The term canal boat conjures up images of a long, narrow, full hull. Dimensions were limited by the size of the canal structures. For the length and breadth of a vessel were fixed by the size of the canal's locks. A canal boat could be no longer than the lock when its mitered doors were open, because these doors opened inward at the downstream end of the lock. The canal's channel at the bottom was twice the width of the locks to allow two boats to pass each other on the canal. Finally, the depth of the canal channel limited the vessel's depth of hold, because a fully-loaded boat had to draw less water than was in the canal. Construction also altered over time in response to demands for economy and the introduction of new techniques and materials.

Sailing canal boats appeared in several locations at the same time as their unrigged cousins. The sailing variety were found where a large body of navigable water, like a lake, joined a canal system or where other forms of propulsion were not a viable option. Sailing canal boats were developed to their fullest potential on Lake Champlain, and for more than 25 years were the principal method of shipping freight on the lake.

²T. S. Hahn and E. L. Kemp, Canal Terminology of the United States, p. 19.
A Variety of Canal Boats

Construction of the Middlesex Canal in Massachusetts between 1793 and 1803 served as a model for New York's canals and was home to the first distinct American canal boats. The elimination of shoals and rapids and the creation of long, level runs with tow paths meant that builders could produce deeper hull forms with superstructures that covered almost the entire vessel. They no longer required a walkway on either side of the deck like earlier poled river boats, because they were towed by animals who followed a path on the shore. New York's early canal boat builders were experienced at producing keelboats, especially Durham boats, and flatboats like the scow, as well as lake sailing craft. These provided the basis from which to develop the canal boat.

The first purpose-built canal boat for the Erie Canal was Chief Engineer, launched on October 22, 1819 in Rome, New York. It was 61 feet (18.6 m) in length, 7 feet, 6 inches (2.3 m) in breadth, and 4 feet (1.2 m) deep in the hold. It was partially based on a model of an English canal boat. This has led some to conclude that American canal boats are derived from European models. American canal boats, however, and specifically Erie and Champlain canal boats, were based on previously existing local boats that had similar length and breadth, but shallower draft. Chief Engineer's narrow breadth represents an attempt to send two boats through the locks at the same time, rather than duplicating the English narrow boat. Chief Engineer was a canal "packet" built to carry passengers, and its slender shape insured rapid journeys along the canal.

As mentioned before, canal boat size was limited by the dimensions of the canal's channel and lift locks. New York canal engineers initially decided on locks 90 feet (27.4 m) in length and 15 feet (4.6 m) in width, with a canal channel 4 feet (1.2 m) deep, 40 feet (12.2 m) wide at the top and 28 feet (8.5 m) wide at the bottom. These dimensions allowed boats to pass one another on the canal. The inward swing of downstream miter gates required boats to be about 10 feet (3.1 m) shorter than the locks themselves.

Early canal boat builders did not always take full advantage of the canal's capacity, with some boats only 40 feet (12.2 m) in length. At first, builders thought only in terms of the river boats they knew. In addition, canals frequently suffered water shortages that grounded larger boats, so smaller

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3R. E. Shaw, Canals for a Nation, the Canal Era in the United States, 1790-1860, p. 14; H. S. Drago, Canal Days in America, the History and Romance of Old Towpaths and Waterways, p. 21.

4S. Dunbar, A History of Travel in America, p. 606, fig. 182.


vessels were preferred. After a few years of smooth canal operation and experimentation with hull forms, builders began to make full use of the space allowed by the locks, channel, and the space between the water and any overhead obstructions, such as bridges. From about 1840 onward, canal boats were built with minimal clearances, and hulls became much more box-like and efficient.

There was no standardization of size or design among the first canal boats. Chief Engineer
reflects the size of many early canal boats. Some Erie Canal boats, however, were built much larger, as in the case of Yankee Enterprize built in 1820 at 76 feet (23.2 m) in length, and Montezuma built the same year at a length of 76 feet (23.2 m) and a breadth of 14 feet (4.3 m). According to the New York state engineer, Erie canal boats used from 1819 until 1830 were 61 feet (18.6 m) long, 7 feet (2.1 m) wide, and 3 feet. 6 inches (1.1 m) deep, with a capacity of 30 tons. By 1830 Erie Canal boats had increased to an average of 75 feet (22.9 m) long, 12 feet (3.7 m) wide, and 3 feet, 6 inches (1.1 m) deep, with a capacity of 75 tons. By 1835, the volume of goods transported by canal boats of this size so overtaxed the Erie's capacity that the state began to enlarge the canal system. Thus, by 1850 the average canal boat was 90 feet (27.4 m) long, 15 feet (4.6 m) wide, and 3 feet. 6 inches (1.1 m) deep, with a capacity of 100 tons. A further enlargement completed in 1862 pushed boats to 98 feet (29.9 m) long, 17 feet, 6 inches (5.3 m) wide, and 6 feet (1.8 m) deep, with a capacity between 210 and 240 tons.

Champlain Canal enlargements and canal boat size lagged slightly behind those on the Erie Canal.

With minor exceptions, canals in other states mirrored those in New York. Most divisions of the Pennsylvania Main Line Canal and other Pennsylvania state-owned canals, together with canals in Ohio, Indiana, and Illinois, had locks identical in size to New York's. Some variations occurred in Pennsylvania's private canals, such as the Union Canal with locks 75 feet (22.9 m) in length, 8 feet, 6 inches (2.6 m) in width and the Susquehanna & Tidewater Canal with locks 170 feet (51.8 m) in length

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8 Dunbar, A History of Travel, p. 848.


10 N. Greene, History of the Mohawk Valley, Gateway to the West, 1614-1925, p. 1282.

11 F. D. Larkin, New York State Canals, p. 31; Shaw, Canals for a Nation, p. 45; Greene, History of the Mohawk Valley, p. 1282.

12 McCullough and Leuba, The Pennsylvania Main Line Canal, pp. 36, 43, 52; Shaw, Canals for a Nation, pp. 129, 139, 144, 181.
and 17 feet (5.2 m) in width. The latter was able to handle two boats at a time, each 65 feet (19.8 m) in length, 16 feet (4.9 m) in width, 8 feet (2.4 m) deep, with 150 tons capacity.\textsuperscript{13}

Early canal boat descriptions and illustrations indicate that New York's freight and packet boats were quite similar and resembled keelboats.\textsuperscript{14} Each had a cabin that ran practically the entire length of the vessel with small forward and after decks. The cabin extended from gunwale to gunwale. Consequently, there were no walkways along the sides, which had been an integral characteristic of keelboats.

Packets were a form of rapid canal transport for passengers and express mail. Their hulls were usually 80 feet (24.4 m) in length and 14 feet (4.3 m) in breadth.\textsuperscript{15} They were drawn by two or more horses and traveled around four miles per hour, the maximum speed allowed on canals. Packets developed sleeker lines than freight boats because speed was essential to their operation. The interior was divided into separate living quarters for male and female passengers, as well as for crew. A number of windows along the boat's side lit the interior space. Packets on the Erie and Champlain canals had 10 windows per side.\textsuperscript{16} These boats began running on the Champlain Canal in 1825, with companies offering Champlain Valley residents passage to the Hudson River or to Buffalo, New York.\textsuperscript{17} The completion of a railroad in 1848 ended packet service on the Champlain Canal.\textsuperscript{18}

Early freight boats were referred to as "line boats." They were part of a fleet owned by a company or line that had relationships with other transportation companies and offered customers the opportunity to travel and/or ship goods with one company or "line" from point of origin to final

\textsuperscript{13} W. E. Shank, The Amazing Pennsylvania Canals, pp. 11, 26, 51, 57, 64, 71.


\textsuperscript{17} O'Hara, "Erie's Junior Partner," pp. 170, 174.

\textsuperscript{18} The Delaware and Hudson Company, A Century of Progress, History of the Delaware and Hudson Company, 1823-1923, p. 678.
destination. This meant that merchants did not have to travel with their goods, but entrusted their care to the line company and its agents. Line boats were intended to carry both freight and passengers. *Chief Engineer* had two cabins 14 feet (4.3 m) in length, located at either end of the vessel with a deck between, a typical layout for line boats. A second type had a single, full-length cabin with a divided interior for passenger and freight stowage. Line boats had fewer windows than packets and featured hatchways amidship that opened up the side and top of the cabin for loading cargo in barrels, boxes or bushel baskets. They traveled slower than packets, but charged less fare. Packets and freighters are among the most frequently illustrated canal boats.

Another early Erie Canal boat was the scow. Scows were used to a limited extent on calm sections of the Mohawk and Hudson Rivers prior to the canal. Afterward, they became the favorite vessel of farm families. Scows had flat bottoms, vertical sides and raked ends. Their breadth was easily altered to fit the new waterway and their chine construction maximized cargo capacity. A few illustrations of these boats exist, but scows did not capture the sketch artist’s attention to the degree that packets and line boats did. Nonetheless, they did catch on with those interested in moving low-fare bulk goods that did not need protection from the elements, such as coal, gravel, sand, and stone.

Other Erie Canal boats developed from these early types in response to a particular freight or a specific use. These canal boats continued in operation until the end of the canal period. Occasionally, they were captured in photographs and examined for the 1880 census report on shipbuilding. One such boat, derived from the line boat, was the bullhead. Bullheads retained a full-length cabin, but one

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that rose only 2 or 3 feet (61-91.4 cm) above the side of the vessel, presenting a lower profile than earlier line boats. The design provided maximum protection for such goods as grain and flour.  

The general-purpose canal boat of the mid-nineteenth century was the "laker." The name indicates that it was towed by steamboats on the Great Lakes as well as Lake Champlain. This is the boat that comes to mind when one thinks of the term "canal boat." Laker hulls had full, round ends, flat bottoms, vertical sides, with a slightly rounded bilge. They were steered by a large "barn door" rudder, but after the Civil War some form of wheel steering often replaced the simple tiller.

Lakers did not have full-length cabins like bullheads. Instead, they had a continuous deck with watertight hatches for bulk cargo and two low-profile cabins fore and aft for crew and towing animals. Champlain Canal lakers did not need a mule house because the canal's short length did not warrant the expense of keeping mules on the boat. Instead, boat owners rented mules along the way. Western freight boats had three cabins. One in the stern for the owner's family, one forward for the crew, and a mule house amidship. The laker's deck layout originated on Pennsylvania's Schuylkill Canal around 1830, where large hatches were needed for coal.

Canal boats on the Erie and Champlain canals were towed back and forth along sheltered waters. For this reason, they were lightly constructed in comparison to ocean-going vessels. Even lakers were built in this manner, and when caught on open water in a fierce storm, they were often cut free so they would not jeopardize the tow boat. Consequently many lakers ended up on the bottom of a lake.

New York canal boats were built in great numbers from the outset. Seventy-three boats attended a July 4, 1820 celebration along the Erie Canal in Syracuse, New York. In 1843 an inventory of New York canal boats recorded a total of 2,126 vessels: 40 packets, 389 line boats, 379 lakers, 118 bullheads, 327 decked scows and 873 open scows. By 1847 the number of boats had nearly doubled to 4,191 vessels: 62 packets, 621 line boats, and 3,508 freight boats. The number of scows decreased in

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30Drago, Canal Days in America, p. 29.


32McHugh, A Canalboat Primer, p. 7.

33McHugh, A Canalboat Primer, pp 7-9.
1846 when the Canal Board mandated a round bow for canal boats and set up higher tolls for scows.\textsuperscript{34} This was done to keep the canal open following collisions, because sharp-cornered scows frequently holed other boats, causing them to sink and obstruct the channel.\textsuperscript{35}

While developments on the Erie Canal no doubt influenced those on the Champlain Canal, it must be remembered that canal construction began at the same time, and that the Champlain Canal opened first. This means the first boats used along the Champlain Canal between 1819 and 1822 were not directly influenced by those on the Erie line because they could not reach the Champlain Canal until late in the year 1823. Instead, Champlain Valley boat builders looked to other models.

The Champlain Canal was an immediate success with over 100 boats used on the canal during its abbreviated inaugural season. The previous system of lake forwarding to and from Whitehall, New York, was aided greatly by the new transportation system. Freight costs between Whitehall and Troy, New York were reduced, creating a demand for lake sloops and canal boats. Local boat yards turned out a variety of watercraft to handle the increased volume of goods that passed over the lake and through the canal. Freight forwards were quick to build fleets of canal boats that were towed by horses and mules. By 1833, the number of canal boats registered north of Glens Falls, New York, was 232, increasing to 450 a decade later.\textsuperscript{36}

The number of sailing vessels on Lake Champlain also increased because of the canal. From 1825 to 1836, it was not unusual to see 20 boats in a lake port, and there were estimated to be 125 sloops sailing the lake, chiefly due to the lumber trade.\textsuperscript{37} If this number is accurate, it represents an increase of four fold from the 29 vessels listed by Thomas Canfield as having been built between 1790 and 1814. Local merchants were quick to realize the potential for profits. Eagerly awaiting the canal's first full year of operation in 1824, merchants Asa Eddy and Ezra Smith advertised the "New Line of sloops" in Whitehall, New York, which could forward freight to canal boats for distribution throughout New York.\textsuperscript{38} They offered clients the benefits of a single line company that transported freight in its own sloops and canal boats.


\textsuperscript{35}McHugh, \textit{A Canalboat Primer}, p. 13.


\textsuperscript{37}H. P. Smith, \textit{History of Essex County}, pp. 262, 547.

\textsuperscript{38}"New Line of Sloops on Lake Champlain in Connexion [sic] with the Troy and Erie Line of Sloops." Henry Stevens Papers.
In 1824 the Erie line boat Eclipse delivered a cargo of salt to Plattsburgh, New York, and a
decade later this 1,000 bushel delivery had increased to 123,000 bushels.\textsuperscript{39} The number of Erie boats in
the Champlain Valley bringing in this cargo may have had some influence on later Champlain boats. A
few vessels built in the Champlain Valley in the 1850s are described as having Durham bows.\textsuperscript{40}

Most early Champlain Canal boats were relegated to use in the canal and did not venture out
onto the lake. One reason for this was the competition between steamboat lines for lake traffic
following the opening of the canal. Stiff competition among a limited number of steamers did not
provide the opportunity for standard canal boats to catch a tow to lake ports.\textsuperscript{41} A few canal boats
operated from lake ports, but it is unclear if they were towed or whether they were sailing canal boats.\textsuperscript{42}
Steamboats began towing timber rafts on Lake Champlain as early as 1827, and canal boats were also
towed, but when and how many is not clear.\textsuperscript{43} Regular towing of several standard canal boats at one
time came with the introduction of propeller-driven steam tugs in 1845.\textsuperscript{44}

Champlain Canal boats arose in the same manner as Erie Canal boats. Local watercraft, like
the scows and sloops that predated the canal, and early New England canal boats are probable
influences. In the early years, canalmen employed whatever vessel could be used. Eventually, definite
types emerged including line boats, packets, and scows. Differences in the canals led to some variation
in boats, as Champlain Canal lake boats had no need of a mules house in the bow. Sailing canal boats were
developed side-by-side with towed canal boats and post-1823 lake sailing vessels and, therefore, were
derived from the same models. Before considering sailing canal boats, however, we should take a brief
look at traditional lake sailing vessels to provide a basis for comparison and because this is the most
likely model for the Lake Champlain sailing canal boat.

\textsuperscript{39}O'Hara, "Erie's Junior Partner," p. 306.

\textsuperscript{40}Enrollment documents for the canal boat Atlantic, dated July 17, 1865, the canal sloops H. Truman, dated July 28, 1866, and Elisha Ashley, dated May 29, 1857, Record Group 241, Civil Reference Branch, United States Archives.

\textsuperscript{41}O'Hara, "Erie's Junior Partner," p. 215.


\textsuperscript{44}C. H. Royce, Bessboro: A History of Westport, Essex Co., N. Y., p. 444.
Lake Sailing Vessels

Some of the best information regarding vessels of all types (lake sailing vessels, sailing canal boats, towed canal boats, and steamboats) employed on Lake Champlain comes from merchant vessel enrollment documents held in the National Archives of the United States. Vessels that traveled outside the United States were required to file papers whenever a boat was built or its documents were surrendered.45 Filing necessitated listing the vessel's owner(s), owner's residence, vessel type, vessel name, home port, master's name, town where built, year when built, enrollment number and date, reason for enrollment, location of enrollment, official conducting the enrollment, number of decks and masts, length, breadth, depth of hold, tonnage, rigging, bow construction, stern construction, type of head, date of documentation, official's signature, and official's title. In addition, the documents often bear miscellaneous notations such as whether the rig had been altered. Data from these enrollment papers were analyzed for this study and provide a glimpse into the ownership and operation of these vessels as well as providing information and their size rigging. As lake sailing vessels visited St. Jean in Canada their owners were required to enroll these vessels.

A preliminary list of Lake Champlain merchant sailing vessels compiled by Kevin Crisman incorporated data from enrollment documents as well as other primary sources.46 Enrollment documents for the period from 1823 until 1844 are not preserved in the National Archives because they were either not forwarded by local customs officials or were destroyed by fire in the nineteenth century. The other sources consulted by Crisman, therefore, provide the majority of historical information available for merchant sailing vessels built just after the Champlain Canal opened. This list includes sloops and schooners that were relegated to sailing on Lake Champlain as well as sailing canal boats that could sail the lake and also pass through the Champlain Canal.

For this study the National Archives were consulted again, but this time both sailing and non-sailing vessels were tabulated to glean how many vessels of each type were used at any given time. A total of 296 merchant vessel enrollment documents were examined for the ports of Burlington, Vermont, and Plattsburgh, New York, beginning with the earliest records which date to 1844 and stopping in 1865. The latter date was chosen, because it marks the ascendancy of the towed canal boat on Lake Champlain.

45New papers were required of vessels that traded outside the country for a variety of reasons including: changed ownership, enrollment papers lost, vessel moved into or out of a customs district, abandonment, burning, and sinking.

46K. J. Crisman, "Nineteenth-Century Lake Champlain Sailing Merchant Vessels: A Preliminary List" (unpublished manuscript). Other primary sources for this list include papers of the Champlain Transportation Company; Henry Stevens Papers; and U.S. Bureau of Statistics, Merchant Vessels of the United States.
Data from the various historical sources indicate that vessel dimensions did not change as a result of the increased trade brought about by the canal. Builders around the lake continued to make sloops and schooners in the same manner and of the same size to which they were accustomed. The average length of lake sailing vessels was 71 feet, 2 inches (21.7 m), with an average breadth of 19 feet, 5 inches (5.9 m), giving them an average length to breadth ratio of 3.7:1. Specifically, lake sloops average 61 feet (18.6 m) in length and 19 feet, 3 inches (5.9 m) in breadth, with a length to breadth ratio of 3.2:1. Lake schooners average 84 feet, ¾ inches (25.6 m) in length and 19 feet 8¼ (6 m) inches in breadth, with a length to breadth ratio of 4.3:1. When it came time to build sailing vessels that could also fit into the Champlain Canal the boat builders of the Champlain Valley already had experience building vessels of the requisite length. They only had to alter the breadth and depth of hold to meet the restrictions of canal transit.

From the Plattsburgh, New York, and Burlington, Vermont, enrollment documents together with the other historical sources, several other things become clear concerning sailing vessels. In the 1820s and 1830s lake sailing vessels were built and operated on a par with other types of vessels. During this period records for 20 lake sailing vessels survive in comparison with documentation for approximately 50 other vessels. From 1840 until 1865, however, the records indicate that lake sailing vessels were outnumbered by other classes of vessels by a margin of 321 to 19. Steam vessels had been introduced to the lake in 1809 and from the 1820s on several were in operation making runs between Whitehall, New York, and St. Jean, Canada, with stops at important lakeside towns such as Burlington, Vermont, and Plattsburgh, New York. Once the Champlain Canal opened towed and sailed canal boats were also used on Lake Champlain. Sailing canal boats account for most of the vessels enrolled between 1840 and 1865.

The documentation also points out some interesting aspects of lake sailing vessel ownership. Lake sailing vessels were originally owned by businessmen alone or in conjunction with the vessel’s master. These businessmen were associated with a freight forwarding company, a specific enterprise such as a nail factory, but in other cases the boat appears to have been just a speculative venture unrelated to their other business pursuits. The vessel’s sailing masters are known as “lakemen,” because they spend their entire career navigating the lake and often times the canals as well. Older boats routinely became the sole property of their sailing master or another lakeman. Lake sailing vessels were built and owned primarily by people living in the northern lake where sail was an economical alternative to steam technology. Many features of lake sailing vessels and their operation were shared with another class of vessels known as sailing canal boats which appeared with the opening of the Champlain Canal in 1823.
Sailing Canal Boats

Sailing canal boats have escaped the attention of canal historians and have been the subject of misinterpretation by some lake historians.\textsuperscript{47} Like their towed cousins, the origin of the first sailing canal boats requires some examination before it can be determined with any precision. Durham boats with sails were among the first vessels to use the Erie Canal. The earlier Middlesex Canal also had canal boats that sailed, but the precise date of their appearance is unclear.\textsuperscript{48} For the first account of a vessel that was built expressly to fit within the confines of a canal, as well as to sail on open water, we have to turn to Lake Champlain and the Champlain Canal.

Even before the Champlain Canal was complete, boats began to pass through the improved portions. Timber rafts journeyed from Whitehall to Troy, New York once earlier portages were replaced with water routes. Enterprising businessmen, sensing what the canal meant for lake commerce, began constructing specialized vessels to gain a share of shipping along this new trade route. According to Ralph Nading Hill, the canal revolution "was nowhere more apparent than in the springing-up of home-grown shipyards for the construction of boats designed to fit the locks."\textsuperscript{49}

In 1823, a Vermont hatter named Nehemiah W. Kingman saw an opportunity to establish a grocery and provisions store in St. Albans, Vermont.\textsuperscript{50} Merchandise would soon be easily brought up from New York and St. Albans was well positioned to serve as a collection and distribution point for northern Vermont, being located a short distance from St. Albans Bay and surrounded by farming communities. Kingman, together with merchants Julius Hoyt and John Taylor, therefore, ordered the construction of a vessel in the summer of 1823. They named the completed boat \textit{Gleaner}, and promptly loaded it with wheat and potash for New York.\textsuperscript{51} It would be the first vessel to pass through the entire length of the Champlain Canal.\textsuperscript{52}


\textsuperscript{48} Shaw, \textit{Canals for a Nation}, p. 15.

\textsuperscript{49} Hill, \textit{Lake Champlain}, p. 208.

\textsuperscript{50} A. B. Cohn et al., "The Archaeological Reconstruction of the Lake Champlain Canal Schooner \textit{General Butler} (VT-CH-590) Burlington, Chittenden County, Vermont" (unpublished manuscript), p. 25.


\textsuperscript{52} J. Hayward, \textit{Gazetteer of Vermont}, p. 110.
Under the command of Captain William Burton, *Gleaner* departed St. Albans in early September and made its way up the lake to Whitehall, New York. The final lock was completed on September 10, and *Gleaner* passed into the Hudson River, crossing to Troy, New York, where it was greeted by throngs of admirers. Celebrations were organized at Troy, Albany, Hudson, Poughkeepsie, and New York City. A prominent New York poet, known by the sobriquet “the Boston Barb,” wrote a verse that referred to *Gleaner* as the “Barque of the Mountains.” The vessel discharged its cargo and took on merchandise, including seafood to mark its passage from the mountains to the sea. Cannon fire saluted *Gleaner* all along its return voyage. After arriving in St. Albans, Hoyt, Kingman, and Taylor planned future enterprises for their boat.53

How was *Gleaner* able to sail on Lake Champlain, enter the canal, and be towed to the Hudson River and then sail once more down to New York City? *Gleaner* apparently performed well on the lake and river through variable weather conditions and was capable of negotiating the canal and its locks. Although poetically dubbed a barque, it carried a sloop rig. It was 60 feet (18.3 m) in length on deck with a breadth of 13 feet, 6 inches (4.1 m) and a draft of 3 feet, 6 inches (1.1 m).54

*Gleaner*'s breadth allowed just enough space for the boat to fit between the lift lock walls. While its draft was appropriate for the shallow channel. It fell 20 feet (6.1 m) short of the maximum allowable length, which gave the vessel a length-to-breadth ratio of 4.4:1. This is similar to other lake sailing craft and well below the maximum allowed by the locks of around 6:1. *Gleaner* was probably shallower than sailing craft confined to the lake, although shallowness of draft is a common characteristic of Lake Champlain watercraft. To create *Gleaner*, its builders may have only slightly altered the existing lake sloop design. In fact, retention of the lake sloop’s bowsprit may explain *Gleaner*'s short length relative to the canal locks. Later sailing canal boats did not have bowsprits.

*Gleaner* was not the first boat on the canal nor does it seem to have been the first sailing canal boat built on the lake. As soon as improvements between Whitehall and Fort Edward, New York, linked the Champlain and Hudson valleys in 1819, timber rafts and small boats began carrying goods by a rough but all-water route.55 On November 19, 1822, the canal was navigable for canal boats from Lake Champlain to Waterford, New York, and several new craft from northern New York and western Vermont arrived in Whitehall, New York, including one carrying a 15-ton load of Swanton marble.56 At least some of these boats made the lake passage by sail as early steamboats were not capable of towing

more than one or two other boats. Unfortunately, accounts describing these early passages of boats are not as detailed as those for Gleaner.57

Sailing canal boats were built for over 60 years, especially by merchants in the northern half of the lake, and by those who lived in ports not regularly serviced by sloops or steamboats. Throughout this time the vessels underwent considerable change. Sailing canal boat development can be broken down into three broad classes,58 each signaling a shift in lake commerce or a physical change in the canal itself. The first class originated in 1823 with the opening of the canal. These boats are noted for randomness of design and smaller size. A second class arose around 1841. During this time, demand for sailing canal boats gave rise to the first line companies, which led to standardized construction practices. A third class is dated to 1862 when the New York canal enlargement allowed vessels of a larger size. Another canal enlargement in 1877 brought about still larger sailing canal boats. By this time, however, these watercraft were being replaced on the lake by standard canal boats towed by steam tugs and only a handful of large sailing canal boats were ever built.

Class of 1823

This early period of sailing canal boat construction is characterized by the lack of a standardized design. The boats were built by a wide variety of people from established boat builders to farmers, ordinary carpenters, or enterprising businessmen.59 Sailing canal boats were rigged with one or two masts and can be referred to as canal sloops or canal schooners. Merchant vessel enrollment documents refer to them as “rigged lake and canal boats,” “lake and canal boats,” and sometimes by the shorthand “L&C boats.” They carried a fore-and-aft rig. In only one instance is a square sail known to have been used.60 They sailed primarily from the northern ports of the lake, although they began to be built and owned in southern lake ports from the mid 1850s onward.61

Some builders took the lake sloop for their model, while others may have chosen to build scows. Sailing scows are known from the shallow waters of the upper Hudson River from at least the

57Lansingburgh Gazette, November 26 and December 3, 1822.


60Enrollment document for the canal schooner Emma, dated May 15, 1865, Record Group 41. Civil Reference Branch, United States Archives.

War of 1812. They were also used on Lake Champlain immediately after the canal was built, and were probably used prior to the canal as well. The earliest sailing canal boats failed to make maximum use of space allowed within the canal locks, but within a few years of the canal’s opening builders launched boats around 75 feet (22.9 m) in length, 13 feet, 6 inches (4.1 m) in breadth, a 4 feet (1.2-m) deep at 40 tons. (Appendices B and D)

Construction techniques also differed depending on the chosen model. Those built like traditional lake sailing craft were framed then planked, and may have had a rounded turn of the bilge or may have been chine-built. Scows were built by one chine-built method or another.

Regardless of the differences, all sailing canal boat hulls had certain characteristics in common with each other and were similar to towed canal boats. They had to fit within the confines of the Champlain Canal. Their hulls resembled the laker with a sailing rig added, and their masts were stepped on deck so that they could be lowered for passage through the canal with its many bridges.

Another common feature of sailing canal boats was a centerboard that could be lowered beneath the shallow hull to provide lateral resistance when sailing on the wind. This practice dates to at least 1834 when the lake sloop Lafayette was built. British Revolutionary War officer John Schank, who proposed drop keels for British naval vessels, directed the boat yard at St. Jean, Canada, and may have brought this technology to the lake. Conversely, he may have formulated his ideas after seeing examples on the lake. Detachable keels and centerboards were also used on Hudson River sloops.

Another means of dealing with the problem of slipping to leeward is to use leeboards. Lake Champlain boat owner Gideon King had a periauger outfitted with a leeboard and they had been used on some colonial sailing scows. Leeboards, however, extend beyond the sides of a vessel and are less desirable for canal boats which already suffer from restricted breadth. No evidence exists at present for the use of leeboards or detachable keels on Lake Champlain sailing canal boats.

Several early sailing canal boats were built following the design of an innovative naval architect named William Annesley, whose boats represented a radical departure from traditional boat building.

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techniques practiced at the time. This was a frameless construction method that saved on compass timber and offered more space in the hold. Champlain Valley boat builders tended to be conservative and resisted his design, but Annesley did manage to sell seven patents on the lake for sailing canal boats.

Annesley's idea was well ahead of its time, and was essentially the method for producing modern laminate vessels. His method called for erecting molds and covering them with planks running fore-and-aft. He used iron clamps and screws on the inside of the vessel to secure the first course of planks to molds. He placed a second course of planks perpendicular to the first, running transversely from gunwale to gunwale. These and subsequent planking layers were secured with wooden, iron, or copper fasteners from the outside. He set a third course of planks parallel to the first, and a fourth course run parallel to the second. Annesley then applied sheathing paper dipped in hot tar over the entire exterior of the hull, and finished off with a final course of fore-and-aft planking.

Annesley's design was used to construct several sailing and steam vessels on the lakes and rivers of New York. The United States Navy commissioned the Annesley-designed schooner Experiment in 1832 and, although the vessel performed no worse than any other new schooner, it received poor reviews and no others were built. Annesley-designed sailing canal boats on Lake Champlain include the canal sloops William Annesley and Governor Clinton owned by Matthew Saxe who ran a wharf and store in Chazy, New York, and Captain Jehaziel Sherman's canal sloop Ethan Allen.

As in the case of lake sailing vessels, historical documents, especially merchant vessel enrollment papers, provide a great deal of information concerning sailing canal boat size (Appendices B, C, and D), features, ownership, and operation. They were built and kept in greater numbers in the

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northern part of the lake, reflecting the lack of steam transportation in this area. The peak years for building sailing canal boats were the 1840s and 1850s. Sailing canal boats had only one deck and carried one or two masts. The fore-and-aft rig was preferred, and sloops out-numbered schooners for many years. Their length, breadth, depth of hold, and tonnage represented something approaching the maximum allowed by the canal's dimensions. Several bow and stern types are mentioned but the most common descriptions for the ends of vessels are the terms "moulded" [sic] and "scow." After the scow bow was outlawed by the Canal Board by 1846, scow sterns remained in use on sailing canal boats. The combination of a molded bow and a scow stern was as common as a molded bow and molded stern.

From documents that survive, one trend that is evident for this first class of sailing canal boats is a rapid increase in length. The sailing canal boats Argo, Gleaner, Maria, Rainbow, and Royal Oak, built in the first decade after the canal was open, were less than 70 feet (21.3 m) in length. Other canal sloops and schooners constructed in the first 10 years of canal operation were approximately 75 feet (22.9 m) in length. Later, boat builders produced vessels 78 or 79 feet (22.8-24.1 m) long. Other vessel dimensions remained constant throughout the 1823 class with vessel breadth averaging 13 feet, 6 inches (4.1 m) and depth of hold around 4 feet (1.2 m).

There is no doubt that the Champlain Canal radically altered the state of navigation and commerce on Lake Champlain. In 1800, only a handful of sloops and cutters carried goods on the lake. By 1826, there were 378 vessels plying the lake,\textsuperscript{73} including lake sloops, lake schooners, canal boats, steamboats, and sailing canal boats. The number of sailing canal boats continued to grow until the tremendous increase in the lake's commercial navigation led to the next class of sailing canal boat.

Jacob Halstead's schooner Troy was built and sank in 1825.\textsuperscript{74} Details unfortunately, of its size and form are lacking, therefore, it is unknown whether it was a lake sailing vessel or a sailing canal boat. Captain George Rushlow reports that a sloop-rigged canal boat named Troy was built in the 1820s.\textsuperscript{75} The remains of Troy have been sought by archaeologists but not yet found. If located, Troy will provide a fascinating glimpse of one of these early boat types.

\textsuperscript{73}N. Hoskins, \textit{A History of the State of Vermont, From Its Discovery and Settlement to the Close of the Year MDCCXXXX (1830)}, p. 273.

\textsuperscript{74}Royce, \textit{Bessboro}, p. 344.

\textsuperscript{75}Rushlow, \textit{Plattsburgh Republican}, October 20, 1894.
Class of 1841

Historian Thomas Canfield describes the 1841 voyage of Richard M. Johnson as a watershed event in lake commerce. On June 1 this sailing canal boat, commanded by Orson S. Spear, became the first sailing canal boat to operate as part of a line service on the lake. The vessel, owned by the "Merchants’ Lake Boat Line," left Burlington, Vermont, bound for Albany, New York. Merchants’ Line was founded by Burlington merchants Timothy Follett and John Bradley to load freight anywhere on the lake and take it all the way to its destination under one company and without transhipment to other vessels. Once the idea of a sailing canal boat line was implemented, other merchants began shipping freight using this newly-popular technique. Some of these firms include Nichols, Burton & Chittenden of St. Albans and the "New York and Canada Line" formed by W. H. Wilkins of Burlington, Vermont.

The formation of sailing canal boat lines created a demand for boats of standard size and rigging. Merchants’ Line eventually operated 40 canal sloops including John Bradley, M. Bradley, E. K. Bussing, J. S. Bussing, Eagle, Empire, P. T. Hearst, A. B. Kingsland, J. D. Kingsland, Isaac Nye, Oregon, and Valcour. Boat builders now had customers ordering the same size boat over and over again as their businesses expanded. This led to standardization of size as indicated by vessel’s dimensions listed in merchant vessel enrollment documents (Appendices B and C). No change occurred in the vessel’s length, width, or depth of hold, but tonnage figures indicate slightly larger vessels, suggesting that builders maximized cargo capacity by producing more box-like hulls. Building for line companies also led to standardized construction practices. Although the historical record does not document this, three canal sloops of this era preserved in the archaeological record do reflect standardization in construction.

The sloop rig reigned supreme for sailing canal boats of the 1841 class. Of the 100 sailing canal boats listed in Appendices B, C, and D for this class, 96 hulls were rigged as sloops. This represents a marked increase over known examples of the 1823 class, where canal sloops held a 27 to 15 margin over canal schooners.

After 1841 the use of sailing canal boats began to spread south with the increased demand for shipment of perishable farm products like butter and cheese as well as manufactured goods. The system of transhipment at Whitehall sufficed for conveying durable items, but delays of three days or

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76 Canfield, The Vermont Historical Gazetteer pp. 683-84.
78 Cohn and True, Vermont History 60. no. 1 (Winter 1992): 39; Canfield, The Vermont Historical Gazetteer pp. 683-84.
longer” awaiting an available towed canal boat and rough handling during transhipment in both
Whitehall and Troy, New York, ruined perishable or fragile goods and upset the merchants shipping and
receiving these items.80 Timothy Follett and John Bradley set up their new sailing canal boat line to
handle these problems. Their business idea was so successful it overtook the previously dominant
Northern Line and Northern Transportation Line for a period of 25 years.

Sailing canal boat lines set up offices in Burlington, Vermont, and New York City. They
maintained relationships with merchants throughout the lake, and along the routes to New York City,
Montreal, and the Great Lakes.81 The business of these line companies grew until 1876, when a
continuous rail connection on the western shore of the lake provided another means of transporting
goods directly to market.82 In the meantime, sailing canal boats had their heyday.

Follett & Bradley was a leading wholesale firm in Burlington and the principal owners were
well established in the business community.83 Follett, who handled the daily business operations,
practiced law and represented Burlington in the legislature from 1830 until 1832,84 but had interests in
lake commerce dating back to his investment in the lake sloop Fair Trader in 1813.85 He entered into a
partnership with Henry Mayo in 1823 under the name of Mayo & Follett. They purchased Burlington’s
first wharf, known later as the South Wharf.86 Mayo & Follett conducted a canal forwarding business
with the canal boat Vermont, as well as the lake sloop Hercules.87 Follett opened the Merchant Line of

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80 R. P. Bellico, Sails and Steam in the Mountains, A Maritime and Military History of Lake
George and Lake Champlain, p. 239.


82 Canfield. The Vermont Historical Gazetteer p. 684; O’Hara. “Erie’s Junior Partner. pp. 144-
46. 162-65.


84 Cohn et al., “The Archaeological Reconstruction of the Lake Champlain Canal Schooner


Henry Stevens Papers, State of Vermont Archives.

Port of Burlington. Vermont: Site and Situation, A Study in Historical Geography” (M.A. thesis,
University of Vermont, 1972), pp. 32, 36-37. figs. 6, 12.

245; Crisman. “Nineteenth-Century Lake Champlain Sailing Merchant Vessels.”
canal boats in Port Kent, New York, in 1833 and dissolved his partnership with Mayo, who became a steamboat captain the next year. Follett entered into partnership with John Bradley in 1835. Their firm built the "Stone Store" opposite the South Wharf and controlled most of the wholesale business of Burlington together with the firm of J. & J. H. Peck. Follett & Bradley were well poised to found a sailing canal boat line because they had relationships with line companies in Whitehall, Troy, and Albany, New York, and the vessels, which were then known as "longboats," already existed.

What sparked sailing canal boat lines into existence was not a new type of vessel, but demand for a vessel that had been around for awhile. The volume of trade on the lake overtaxed the Champlain Canal much as it did on the Erie Canal, but enlargement took longer on the northern canal. Sailing canal boats provided a means of dealing with an overtaxed canal at the same time that farmers needed to get perishable dairy products to market more quickly than the existing system would allow. Once this ability to supply rapid transportation from the lake to New York markets was demonstrated, many more producers availed themselves of the Merchants' Line. Whatever the precise origin of the idea, the voyage of Richard M. Johnson was the first step toward a sailing canal boat line.

In the four years following Richard M. Johnson's inaugural trip, the Merchants' Line revolutionized the carrying trade on the lake through the use of sailing canal boats. Goods loaded at Follett & Bradley's wharf sailed to Whitehall, New York, where the sailing canalers transformed, lowering masts and raising their centerboards, and then immediately entered the canal for the trip through to Troy, Albany, and New York City. They unloaded without transhipment at any point along the route and could return just as quickly with merchandise to their dock, again without transhipping freight. Transhipment not only took time and labor, but it also put perishable farm products in jeopardy. Butter and cheese could ill afford to wait around the docks at either end of the canal. Additional handling only risked damage due to jostling.

Not only did sailing canal boats corner the market for all perishable and fragile goods, they also became the preferred mode of transportation for more durable goods. Follett & Bradley carried on

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89Canfield, The Vermont Historical Gazetteer p. 706.


91Canfield, The Vermont Historical Gazetteer p. 684.


93O'Hara, "Erie's Junior Partner." p. 165.
extensive shipping of lumber and other bulk cargos. Indeed, demand for their services were so great that they often ran out of boats and had to contract with other boat owners to carry their freight. In a short time, sailing canal boats put an end to the forwarding companies that had used traditional lake sailing craft.

Follett & Bradley, who had created sailing canal boat lines, were part of the next revolution in transportation that would replace these vessels. In 1845, Timothy Follett became president of the Rutland and Burlington Railroad Company, which completed a line in 1849 that ended at Follett's South Wharf. In 1847, John Bradley received a charter from the legislature for a steam towboat company to tow standard canal boats and barges. That same year, Follett retired and was replaced in the Merchants' Line by Thomas Canfield, who managed the majority of the firm's business. Canfield contracted with Rutland & Burlington Railroad in 1851 to build four barges for transshipping rail freight between Burlington, Vermont, and Rouses Point, New York. Management of the wholesale business and its sailing canal boats soon fell solely to Thomas Canfield. In 1852 the firm became Thomas H. Canfield & Company, and though it was moving to a system of railways linked by towed boats, sailing canal boats still managed to thrive as the final class came into being.

Class of 1862

Around 1862, enlargement of the locks and channel of the Champlain Canal created a third class of sailing canal boats that were longer, broader, and deeper in the hold. They were on average 85.5 feet (26.1 m) in length, 14.5 feet (4.4 m) in breadth, 6 feet (1.8 m) deep in the hold, with a burden

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95 O'Hara, “Erie’s Junior Partner.” p. 166.


97 Canfield, *The Vermont Historical Gazetteer* p. 684.


of 66 tons.\textsuperscript{102} Merchant vessel enrollment documents indicate that these boats were built in significant numbers, supporting the idea that they played a great role in lake commerce (Appendices B, C, and D). The documents also show that they did not burst onto the scene in 1862, but rather developed over a number of years.

Sailing canal boats larger than the 1841 class size were built as early as 1855 for use on those portions of the canal that had already been improved. The canal sloop \textit{G. H. Taylor}, for example, built in Fort Edward, New York, in 1855 was 86.3 feet (26.3 m) in length, 13.5 feet (4.1 m) in breadth, 4.6 feet (1.4 m) deep in the hold, with a burden of 43.68 tons.\textsuperscript{103} Only its length is larger than the earlier class, however, reflecting its use on the Glens Falls Feeder, which had longer locks. The canal sloop \textit{Rope}, built in Whitehall, New York, in 1857, was 88 feet (26.8 m) in length, 14.4 feet (4.4 m) in breadth, 5.4 feet (1.6 m) deep in the hold, with a burden of 63 tons.\textsuperscript{104} It was definitely larger in all of its dimensions and, therefore, representative of the 1862 class. The same can be said for the canal sloop \textit{J. W. Ingalls}, built in Whitehall, New York, in 1859. It was 87.6 feet (26.7 m) in length, 14.7 feet (4.5 m) in breadth, 6.6 feet (2 m) deep in the hold, with a burden of 68.18 tons.\textsuperscript{105}

While these larger boats were being built, other boats were still being constructed based on the earlier dimensions. The canal sloop \textit{Sam}, built in Whitehall, New York, in 1855, was 77 feet (23.5 m) in length, 13.5 feet (4.1 m) in breadth, 4.4 feet (1.3 m) deep in the hold, with a burden of 45.92 tons.\textsuperscript{106} The canal sloop \textit{P. L. Gilbert}, built in Burlington, Vermont, in 1858, was 77.5 feet (23.6 m) in length, 13.1 feet (4 m) in breadth, 4.8 feet (1.5 m) deep in the hold, with a burden of 47.71 tons.\textsuperscript{107} Standard

\textsuperscript{102}Enrollment documents for various sailing canal boats, dated 1855 to 1866. Record Group 241. Civil Reference Branch. United States Archives. Customs collectors changed from measuring vessels in feet and inches to feet and tenths of feet in the mid 1850s.


\textsuperscript{104}Enrollment document for the canal sloop \textit{Rope}, dated October 4, 1866. Record Group 241. Civil Reference Branch. United States Archives.


towed canal boats built in the late 1850s reflect this same trend. Some were built larger than the standard size of the 1841 class, while others were not.\textsuperscript{108} By 1862 all vessels under construction were of the larger dimensions. For example, the canal sloop Bertha was built in Whitehall, New York, at 87.6 feet (26.7 m) in length, 14.7 feet (4.5 m) in breadth, 7.3 feet (2.2 m) deep in the hold, with a burden of 78.77 tons. Other canal sloops of this class include H. C. Hall, built in Whitehall, New York, at 85.6 feet (26.1 m) in length, 14.6 feet (4.5 m) in breadth, 7.2 feet (2.2 m) deep in the hole with a burden of 80.47 tons, and O. W. Owen, built in Orwell, Vermont, at 86 feet (26.2 m) in length, 14.3 feet (4.4 m) in breadth, 6.75 feet (2.1 m) deep in the hold, with a burden of 72.93 tons.\textsuperscript{109} By this date the larger class of sailing canal boats was firmly established, reflecting the enlargement of the Champlain Canal over its entire length.

Along with the larger size came other changes in the sailing canal boat. After 1862 more schooner rigs appeared, although the sloop rig still dominated the class. Of the 103 sailing canal boats of the 1862 class whose documentation survive, 20 were rigged as schooners. This was in part due to the increased size of the vessel. The schooner rig yielded economy through reduced crew size to manipulate smaller individual sails which, however, added up to the same or greater sail area than sloop-rigged vessels. This kept wages down, which in turn allowed boats to charge cheaper freight rates and better compete with alternative transportation.\textsuperscript{110} Many boats of the 1862 size, however, carried sloop rigs, so size alone did not require the change to two masts. Several canal schooners were captured in photographs, some under sail, while others are at dockside with gaffs and sails lowered against their booms.\textsuperscript{111} Most appear to be rigged similar to Hudson River schooners.\textsuperscript{112}

\textsuperscript{108}Enrollment documents for the canal boats Banner, Virgil Smith, Asia, and Plymouth, dated 1866. Record Group 241, Civil Reference Branch, United States Archives.

\textsuperscript{109}Enrollment documents for the canal sloops Bertha, dated July 3, 1866, H. C. Hall, dated April 28, 1866, and O. W. Owen, dated September 8, 1866. Record Group 241, Civil Reference Branch, United States Archives.

\textsuperscript{110}Cohn et al., "The Archaeological Reconstruction of the Lake Champlain Canal Schooner General Butler," p. 27.

\textsuperscript{111}"Canal schooner near Vergennes, Vt."

\textsuperscript{112}W. E. Verplanck and M. W. Collyer. The Sloops of the Hudson. p. 38.
A good example of a sailing canal boat from the 1862 class was the canal schooner *B. Noble*. The Hoskins and Ross boat yard of Essex, New York, built the vessel in 1863. It was named after Colonel Belden Noble who owned an Essex forge that could be reached by canal boat. The vessel’s original owners were also the boat yard’s owners, John and Wesley J. Hoskins and Henry H. Ross. They may have built the vessel hoping for a contract with Colonel Noble to carry ore and coal to the works and carry out iron products. Noble, Ross, and John Hoskins, were all active in community affairs and would have known each other.

The history of *B. Noble* is summarized here to give readers an idea of the busy and often difficult careers of this type of vessel. The canal schooner *B. Noble* was 86.3 feet (26.3 m) in length, 14.4 feet (4.4 m) in breadth, 6.5 feet (2 m) deep in the hold, with a burden of 66.04 gross tons. It was owned and operated by a variety of individuals and partners for 36 years. A year after it was built, E. H. and H. A. Putnam of Essex, New York, bought the vessel, and Captain W. R. Tefft of Westport, New York, ran the boat for a year before acquiring it outright. In 1872, Tefft sold the vessel to Dayton D. and David Bullis of Port Kent, New York, with Dayton D. Bullis serving as captain. In 1881, the Bullises sold the boat to Francis Colombo of Vergennes, Vermont, who acted as his own captain. Two years later Colombo sold out to Henry G. Fleury and James Jarvis, Jr. of Isle La Motte, and Fleury commanded the craft. In 1885, Dorus Goodsell bought out Jarvis’s share. Later that same year S. J. McNall of Plattsburgh, New York, became the sole owner and captain. In 1888, Oliver Murray of Rouses Point, New York, bought the boat and served as its master. Later that year John Berile of Rouses Point bought and commanded the vessel. The enrollment for *B. Noble* was surrendered in 1899, when the boat was abandoned.

Over its career *B. Noble* carried many different types of cargo including horseshoe nails, iron ore, lumber, rags, scrap iron, slate, and stone. It sank on two occasions, was run aground twice to prevent sinking in deep water, and was damaged at least three other times when caught in squalls. Captain Fleury drowned while running the boat. “The career of the *B. Noble* was not unique—her hard life was typical of that of the lake vessels of the past century,” according to Barranco.

A final increase in sailing canal boat size occurred in 1877 with another enlargement of the canal. Only five examples are known to have been built. They were about 10 feet (3.1 m) longer, a little

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over 3 feet (91.4 cm) broader, 1 foot (30.5 cm) deeper in the hold, and carried 40 more tons of cargo than the 1862 class of vessels. The canal schooner Dreadnaught was built in Ticonderoga, New York, in 1877, and was 96.5 feet (29.4 m) in length, 17.7 feet (5.4 m) in breadth, had a depth of 7.2 feet (2.2 m) in the hold, and a burden of 104.42 gross tons, or 99.20 net tons.\textsuperscript{117} Lakemen in the northern ports owned these largest of sailing canal boats, again because steam service still allowed them an opportunity to operate. Standard towed canal boats were also built at this larger size.\textsuperscript{118}

\textbf{Decline of Sailing Canal Boats}

Towed canal boats developed at the same time as sailing canal boats and had offered freight forwarders an alternative since the Champlain Canal opened in 1823. The lack of vessels to tow what merchant vessel enrollment documents referred to as “unrigged lake and canal boats” allowed sailing canal boat lines to become the dominant means of moving freight on Lake Champlain and through the Champlain Canal in the 1840s. This decade also witnessed the introduction of two new rivals that eventually took over the role played by sailing canal boats. Specially-designed steam tugboats and railroads came to the Champlain Valley as commerce continued to grow.

Since 1809 steam transportation on the water had always presented competition to sail on Lake Champlain with steamboats carrying passengers and express freight, and occasionally towing timber rafts or canal boats. In the 1820s and 1830s there were never enough steamboats to handle more than a fraction of the lake’s commercial needs. In the 1840s, however, line companies began to construct steam tugs to tow canal boats and to better compete with sailing canal boats.\textsuperscript{119} In 1846, the Northern Transportation Line built the first steam propeller on the lake in Whitehall, New York, and named it James H. Hooker, after one of the leaders in freight forwarding on the Champlain Canal. This vessel measured 135 feet (41.2 m) in length, 24 feet, 10 inches (7.6 m) in breadth, with a depth of hold of 8 feet, 3 inches (2.5 m), and rated at 258-63/95 tons.\textsuperscript{120} Propeller technology was new, and the vessel was

\textsuperscript{117}Enrollment documents for the canal schooners Dreadnaught, dated October 20, 1877, and Hiram Walker, dated June 18, 1895, Record Group 241, Civil Reference Branch, United States Archives.

\textsuperscript{118}Enrollment documents for the towed canal boats W. B. Fonda, dated August 13, 1880, Gayton Ballard, dated May 11, 1881, and William A.Crombie, dated June 8, 1881, Record Group 241, Civil Reference Branch, United States Archives.


\textsuperscript{120}Enrollment documents for propeller James H. Hooker, dated October 1, 1846, and May 27, 1865, Record Group 241, Civil Reference Branch, United States Archives.
outfitted with a sloop rig and a centerboard in case the propellers failed.\textsuperscript{121} Competition from \textit{James H. Hooker} and later boats of this type placed great pressure on sailing canal boat lines, especially for items that arrived at Lake Champlain by rail on one side and which were often destined for a rail connection on the opposite shore.

Freight forwarder and sailing canal boat owner John Bradley was one of the first to see the potential of combining canal boats and steam transportation on the lake. He, together with Nichols, Burton & Company of St. Albans, Vermont, and Charles F. Hammond, of Crown Point, New York, built the steam tug \textit{Ethan Allen} in 1847. They used it to tow lake boats, then sold it to the Vermont Central Railroad in 1849. The railway used the boat to haul passengers and freight between Alburgh, Vermont, and Rouses Point, New York, until a bridge was built between those points, at which time the boat passed to the Northern Transportation Line.\textsuperscript{122} \textit{James H. Hooker} and \textit{Ethan Allen} were the foundation of what became a successful steam tugboat line company.

In 1856 the Northern Transportation Line was reorganized as a stock company, to provide sound management and financing for a large company. That same year the line built the towboat \textit{Oliver Bascom},\textsuperscript{123} and later added other towboats including \textit{William Birkbeck} and \textit{Boston} by 1861,\textsuperscript{124} and \textit{Montreal} after the Civil War.\textsuperscript{125} By 1870 steam transportation was so firmly established that the company maintained their own boat yard in Whitehall, New York, under the direction of master carpenter George Neddo.\textsuperscript{126} The company could also operate the steamboat \textit{L. J. N. Stark} strictly as an express freight boat between New York and Montreal.\textsuperscript{127}

Other firms also offered the same services as the Northern Transportation Line. The Whitehall Transportation Company was chartered in 1865 and operated five propellers, towing canal boats between Montreal, Canada, and Whitehall, New York, by way of the Chambly Canal. In 1868 this company took over transportation for the Port Henry, New York, firm of S. H. & J. G. Witherbee, who

\textsuperscript{121}Royce, \textit{Bessboro}, p. 444.

\textsuperscript{122}Crockett, \textit{A History of Lake Champlain}, p. 308.

\textsuperscript{123}Canfield, \textit{The Vermont Historical Gazetteer} p. 684.

\textsuperscript{124}O’Hara, “Erie’s Junior Partner,” p. 142.


\textsuperscript{126}O’Hara, “Erie’s Junior Partner,” p. 142.

\textsuperscript{127}Cone, “Studies in the Development of Transportation in the Champlain Valley to 1876,” p. 60.
shipped 150 boat loads of iron and ore in one year. Henry G. Burleigh also operated a towboat line out of Whitehall beginning in the 1860s, after years of operation in Ticonderoga, New York.

After 1865 towed canal boats displaced their sailing cousins. On a customs house record of 600 vessels from about 1865 for the Champlain and Vermont districts are listed 10 steamboats, 15 schooners, and 575 sloops. Canal boats of all types were rated as sloops together with sailing craft restricted to lake travel. Thomas Canfield estimated that 25 of the 575 so-called sloops were sloop-rigged lake sailing vessels. He does not differentiate between sailing and towed canal boats, although he does state that, "sail-vessels formerly in use are gradually disappearing, yet the canal-boats are taking their place, being towed through the lake by steam tow-boats, and thence to New York, without change or transhipment." This suggests that towed canal boats were replacing sailing canal boats as well as traditional lake sailing vessels. The enrollment documents for Plattsburgh, New York, in 1866 confirm the shift from sailing to towed canal boats. That year 21 sailing canal boats were enrolled versus 70 towed canal boats. This trend continued throughout the remainder of the nineteenth century as steam tugs towed barges loaded with wood from ports on the St. Lawrence and Ottawa rivers, through the Chambly Canal to lumber mills and pulp paper mills on Lake Champlain.

Steam transportation on land offered stiff competition to sailing canal boat lines beginning in 1849 when the Rutland & Burlington Railroad and the Vermont Central Railroad arrived in Burlington, Vermont, and transported dairy products to the Boston market. These are the same goods that had initially given sailing canal boats an upper hand over traditional sailing vessels. The railroads initially had a positive impact on lake-borne commerce, as the rails brought in passengers for steamboats and opened up new markets for Champlain Valley products. Ironically, canals with their inexpensive rates for bulk shipping were the means by which most rail supplies were sent to build the railways that put an end first to sailing canal boat lines and eventually to all commercial use of the canal system. In Burlington, Vermont, sailing canal boat operators Bradley and Canfield carried the vast majority of the

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130Canfield, The Vermont Historical Gazetteer p. 705.
131Canfield, The Vermont Historical Gazetteer p. 705.
132Enrollment documents for Plattsburgh, New York, dated 1866, Record Group 241, Civil Reference Branch, United States Archives.
133R. N. Hill, Vermont Album, A Collection of Early Vermont Photographs, p. 44.
134Canfield, The Vermont Historical Gazetteer p. 684.
rails used on the Poulney, the Rutland & Castleton, the Rutland & Washington, and the Lake Champlain & Ogdenburgh railroads. When the line company fell to the sole ownership of Thomas Canfield, he used any boats available to get goods across the lake and to the rail connections, but sailing canal boats were becoming marginal even though this gave them a few more years of profitable operation. By 1875, the Delaware and Hudson Canal Company completed an all-rail route between New York City and Montreal, providing direct transportation of goods on land without the need for transhipment at any point. Steam transportation had accomplished on land what sailing canal boats had once provided by water.

This was the final blow for sailing canal boats. Merchant vessel enrollment documents in the 1870s reveal that many lakemen no longer found sailing canal boats economical to operate. A number of boats had their masts and rigging removed, turning them into standard towed canal boats. Records survive for 53 canal sloops that were turned into standard towed canal boats at this time (Appendices B and C). No canal schooner, however, is recorded as having been changed to a towed boat. In only one instance was it recorded that a towed canal boat was converted into a sailing canal boat. Boat owners wanted to forego the expense of a sailing rig that no longer offered a competitive advantage. In the years after the Civil War steam towboats on the lake had increased to the point where towed canal boats far outnumbered their sailing cousins.

The Lake Champlain sailing canal boat had begun as a slightly altered lake sloop or sailing scow that could negotiate the Champlain Canal, and, over time, developed into a class of vessels with standardized dimensions. Beginning with Nehemiah Kingman's ambitions for Gleaner and exploding with Follett & Bradley's Merchants' Lake Boat Line, this innovative, if humble, vessel revolutionized the way goods were transported on the lake and helped turn Burlington, Vermont, into the "Queen City" of the Northeast. Continuous rail lines from New York to Montreal, however, together with improved steam transportation on water, removed sailing canal boats from a leading role in transportation and pushed what boats remained on the lake into the fringe of lake commerce. Most, if not all, sailing canal boats were run by private owners and operators instead of lines companies for the last 25 years of the century. The final years of their usage saw them hauling low-paying, bulk cargos like stone, lumber, gravel, bricks, or coal, whenever there were not enough towed canal boats to do the

135O'Hara, "Erie's Junior Partner," p. 166.

136The Delaware and Hudson Company, A Century of Progress, p. 708.

job or in back waters still not regularly serviced by steamboats. It was the end of an important era in lake vessel development, one marked by builders who used innovative techniques to respond to trade opportunities and the unique physical circumstances of Lake Champlain and the Champlain Canal. For the best historical information concerning the form and construction of sailing canal boats, we will turn to one of the lake's most prolific and innovative boat builders, before looking at the archaeological examples of sailing canal boats.
CHAPTER VII

ORSON S. SPEAR: MASTER CARPENTER OF THE CHAMPLAIN VALLEY

One of the Champlain Valley's most important boat builders during the canal era was Orson Saxton Spear. Born in Shelburne, Vermont, on October 27, 1808, the same year that the lake's first steamboat was being built. Spear developed a reputation as a talented and meticulous boat builder and draftsman. In part, this was due to the fact that Spear apprenticed under some of the area's most prominent artisans and technicians. From an early age Spear demonstrated a capacity for mathematics and mechanical science. The Spear family lived near Shelburne Bay for many years and Orson Spear grew up amidst lake navigation and the construction of both buildings and boats. Spear had a long and varied career working with boats on lake Champlain and the Champlain Canal and became the chief architect of the standardized sailing canal boat in 1841.

In 1836 Orson Spear was hired as a surveyor by Vermont's surveyor-general, John Johnson. This was an important opportunity for Spear as Johnson was a talented, much sought-after surveyor who wrote manuscripts on bridge building, carpentry, hydraulics, mill construction, and iron making. Most importantly, Johnson trained young surveyors and mechanics, emphasizing both a strong theoretical and a broad practical background. In the building trades Johnson stressed the importance of a good design to precede construction. Orson Spear adapted these techniques to boat building and drafted out his boat plans carefully prior to constructing the vessels.

Orson Spear also learned many practical aspects of boat building by working under the direction of master carpenter Lavater S. White in Shelburne Bay, Vermont, as well as in Peter Comstock's boat yard in Whitehall, New York. White built several steamboats, including Winooski in

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1 C. L. Speare, The Speare Family From 1642, Genealogical Record of Certain Branches, p. 240.


1832 and Burlington in 1837. While working for White in 1836, Spear observed Burlington under construction and developed an appreciation for well-built vessels. Burlington was hailed by Thomas Canfield as "the paragon of steamers," and by Charles Dickens as superior to "any other in the world." Working for Comstock probably yielded keen insights concerning economies in boat building, as Comstock’s business acumen is well documented.

By 1840, if not earlier, Spear was supervising the building and repair of boats and was involved fully with the design and construction of the Merchants’ Line’s first canal sloop Richard M. Johnson, completed the following year. Spear also corresponded with boat builder John Stafford of Essex, New York, concerning the dimensions of Stafford’s sailing canal boat Erie. Spear wanted to be sure that Richard M. Johnson would fit through the canal. Stafford told Spear that the boat had to be 80 feet (24.4 m) or less in length (Erie was 79 feet, 8 inches [24.3 m]). He also told Spear that most boats were built 13 feet, 6 inches (4.1 m) in breadth, but that a recent refurbishment of the canal’s narrowest lock now permitted boats that were 2 to 3 inches (5.1-7.6 cm) broader in the beam. Finally, he warned Spear not to build in excess of 4 feet, 6 inches or 5 feet (1.4-1.5 m) for depth of the hold, to insure that the vessel would draw less than 4 feet (1.2 m) of water when fully loaded.

Orson Spear’s lines drawing for Richard M. Johnson survives (Fig. 4), along with two other drawings and numerous documents related to boat building and repair. These documents provide some of the best insights to the 1841 class of sailing canal boats. The merchant vessel enrollment document

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5 Canfield, The Vermont Historical Gazetteer. p. 707.

6 Canfield, The Vermont Historical Gazetteer. p. 703.


10 Lines drawings entitled “Capt. O. S. Spear, R. M. Johnson,” “Eagle & Empire 42/43 M.” and “Chine Boat, 1852,” Spear Family Papers.
Figure 4. *Richard M. Johnson*, by Orson S. Spear. Reproduced with permission of the Lake Champlain Maritime Museum.
for the Richard M. Johnson also survives. Together these documents provide a clear picture of the hull’s form. Richard M. Johnson was 79 feet, 6 inches (24.2 m) in length, 13 feet, 6 inches (4.1 m) in breadth, with a depth of hold of 4 feet, 9 inches (1.5 m), and a capacity of 47-49/95 tons. The vessel had a molded bow and stern and appears to have had a full entry, although the extreme bow does not survive in the drawing. The vessel had a long run on a flat bottom and a transom stern. It had nearly vertical sides that sloped outward only 3 inches (7.6 cm) over their height of 4 feet (1.2 m). The vessel’s pivoting centerboard is shown with a length of 14 feet, 9 inches (4.5 m), and a height of 4 feet (1.2 m). The centerboard slot in the keel is 3 inches (7.6 cm) wide. Just forward of the centerboard Spear shows a rectangular structure 6 feet (1.8 m) in length, obviously the mast tabernacle. This vessel was a true sailing canal boat and not merely a modified lake sloop. Its hull shape provided maximum cargo storage area within the limitations dictated by the canal, unlike Gleaner, which was nearly 20 feet (6.1 m) shorter in length.

Although Spear had no ambition to navigate the lake and canal as a career, he did want to see how the new vessel performed. So, on June 1, 1841, Captain Orson S. Spear left South Wharf in Burlington, Vermont, in command of Richard M. Johnson for his client Follett & Bradley’s Merchants’ Line. After sailing up the lake and passing through the canal, the vessel reached West Troy, New York, on June 8 and was towed to Albany, New York. Upon discharging the cargo, Spear took on a load of coal and merchandise and left for Burlington. Spear must have been satisfied as he kept this design for future reference. Follett & Bradley were also satisfied with the venture and ordered another boat from Spear in 1842.

After this auspicious beginning, Spear built and supervised work on a great many vessels for more than forty years. Between 1842 and 1853, Spear built a number of canal sloops, including: Eagle.

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13Early enrollment documents refer to a vessel’s capacity in tons and fractions of a ton with a denominator of 95. so 47-49/95 is 47 tons and 49 95ths of a ton. Later documents use a denominator of 100.

14Canfield. The Vermont Historical Gazetteer. p. 683.


Empire. J. D. Kingsland, A. B. Kingsland, M. Bradley, and John Bradley.17 These vessels were either built for Follett & Bradley or companies that did business with them. In the 1850s, Spear directed crews that repaired canal sloops and lake sailing vessels.18

In 1862 Spear turned his attention to the construction of the enlarged class of sailing canal boat and built the canal schooner O. J. Walker for Joseph H. Kirby of Burlington, Vermont.19 According to a 1935 Burlington Free Press article, Kirby and his father felled the oak used in the vessel's construction.20 Kirby used the vessel to haul gravel to Canada, a common cargo during his more than 50 years as a lakeman on O. J. Walker and other vessels. O. J. Walker was 86 feet, 8 inches (26.4 m) in length, 14 feet, 8 inches (4.5 m) in breadth, 6 feet, 6 inches (2 m) deep in the hold, with a burden of 78 tons.21 Spear's papers for that year include receipts for boat materials from the firm of Van Sicklin & Walker, which was partially owned by Obadiah Johnson Walker.22 No concrete evidence exists that Walker had invested in the vessel, but Kirby may have named it after the merchant in the hopes of transporting freight for the wholesale firm. There is evidence that Walker was involved in the boat's operation later in its career.

In addition to turning out a number of sailing canal boats, Orson Spear also built lake sailing boats and steamboats. In 1837 the master carpenter built the lake sloop Daniel Webster and, in 1854,

17Crisman, “Nineteenth-Century Lake Champlain Sailing Merchant Vessels;” Enrollment document for the canal sloop A. B. Kingsland, dated to May 1, 1847. Record Group 41, Civil Reference Branch, United States Archives.; Cohn, “The O.J. Walker, Historical Context,” p. 16. Cohn cites a contract dated December 13, 1853, from the Spear Family Papers. Spear contracted with the firm Knowlton and Hoffnagle, who wanted a vessel built along the line of Spear's J. D. Kingsland. This is probably the canal sloop Argus built in Burlington in 1854.


19Enrollment document for the canal schooner O. J. Walker, dated July 9, 1862. Record Group 41, Civil Reference Branch, United States Archives.


21Enrollment document for the canal schooner O. J. Walker, dated July 9, 1862. Record Group 41, Civil Reference Branch, United States Archives.

launched the lake sloop A. M. Clark. Both were built in Burlington for local merchants. In 1848 he traveled to Essex, New York, to build the steamboat Boquet.

By the Civil War, Spear was well established at Proctor’s boat yard on the Burlington shore at the head of Shelburne Bay. Here, in 1868, Spear built the steamboat Oakes Ames, which carried railway cars across the lake for the Rutland & Burlington Railroad. He also built the steamboat Grand Isle in 1869 at Essex, New York. For the remainder of his career, Spear continued to work at Proctor’s yard and is the only shipwright listed in an 1882 business directory for Chittenden County, Vermont. As late as 1885, he directed repairs of the steamboat Minnivaha on Lake George. Orson Spear died on June 16, 1890 at age 81.

In addition to the drafts of Richard M. Johnson, Spear’s papers contain lines drawings for several other sailing canal boats. One is for the sister boats Eagle and Empire, dated to the winter of 1842/1843 (Fig. 5). The other is entitled: “Chine Boat 1852” (Fig. 6). The Eagle and Empire drawing shows some modification when compared to the Richard M. Johnson. The new vessels differed very little in overall dimensions at 79 feet, 2 inches (24.1 m) in length, 13 feet, 4 inches (4.1 m) in breadth, and 4 feet (1.2 m) deep in the hold. They had the same flat bottom and nearly vertical sides, but had a finer entry and exit and a less-pronounced sheer.

The Eagle and Empire draft also contains much more information than that of Richard M. Johnson. The later drawing has more section lines illustrated, which indicate framing stations according to Spear’s annotation. Eagle and Empire had 43 frames and three cants, indicating light framing in comparison to ocean-going vessels. Nine framing stations, including the midship frame, required half frames, located on either side of the centerboard slot in the keel. Two dotted lines located between

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23Crisman, “Nineteenth-Century Lake Champlain Sailing Merchant Vessels.”

24Canfield. The Vermont Historical Gazetteer. p. 707.


29Speare, The Speare Family From 1642. p. 239.
Figure 5. *Eagle* and *Empire*, by Orson S. Spear. Reproduced with permission of the Lake Champlain Maritime Museum.
frames 19 and 20 and frames I and J represent the transition between the midship portion that made up the cargo hold and the molded stern at one end and the molded stern at the other end.  

The chine boat draft (Fig. 7) is more developed than the earlier drawings with a body plan showing a midship section and a section at the transom. The transom had four windows to light the interior of a stern cabin. Although Spear does not illustrate a cabin, this is a typical arrangement on all known sailing vessels on Lake Champlain. The plan does illustrate several construction features; the most significant are chine logs that ran 52 feet, 6 inches (16 m) along each side on the vessel’s floor. This hull was intended to be chine-built, where the bottom and sides meet at an angle rather than a rounded turn of the bilge. It is not known for certain if any vessel was built from this drawing. The earliest evidence for chine construction in canal boats prior to this 1852 drawing is an 1858 patent.  

Previously canal historians had assumed that this patent marked the origin of the technique.  

Spear’s plan shows how to join the ends of the floor timbers and futtocks to the chine log by mortise-and-tenon joinery. Floor timbers end in a shaped tenon, one side of which has a dove-tail, that fits into a similarly-sized mortise and locked in place by a wooden key. The futtocks (sometimes called “side frames” in chine-log construction) also fit into mortises shown in the upper face of the chine log, although no details of the join are provided.  

Orson Spear’s three surviving sets of lines drawings present a coherent picture of the standardized Lake Champlain sailing canal boat. The plans share certain characteristics yet differ in others. All three hulls have the same general appearance, but the lines of Eagle and Empire are finer than either Richard M. Johnson or the chine boat. Over time Spear raked his transoms farther aft, although he kept the sternpost vertical throughout. Each vessel had a pivoting centerboard.  

The similarity of hull form illustrated in these drawings strongly suggests that the earlier boats were also chine-built. The drawing of Richard M. Johnson illustrates framing stations in the molded stem and stern but not amidship. This is consistent with the chine boat plan. There is, however, no definitive representation of a chine log in either of the earlier drawings. Spear may have used standing knees to frame these vessels with flat bottoms and nearly vertical sides, a practice performed earlier on Champlain Valley watercraft such as bateaux and the Revolutionary War gundelows Philadelphia.  

Orson Spear’s plans are invaluable historical documents in regard to the design and construction of a unique class of inland watercraft. They are part of the legacy of the Champlain

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30Lines drawing entitled “Eagle & Empire 42/43 M.” Spear Family Papers.  


Figure 7. "Chine boat Nov 1852," by Orson S. Spear. Reproduced with permission of the Lake Champlain Maritime Museum.
Valley's leading builder of standardized sailing canal boats of the 1841 class. Spear's method of drawing out his designs on paper shows that at least one inland boat builder was keeping pace with shipwrights in the nation's leading seaports such as William Webb and Donald McKay who were also producing lines drawings. This is a testament to the skill and education Spear acquired from John Johnson and Lavater White.

Many unique aspects of sailing canal boats are not illustrated on Spear's drawings. For example, there is no deck plan showing the location of hatches. Masts or rigging are not shown and the drawings could just as easily have been used to build standard towed canal boats as the sailing variety. Only the illustration of a centerboard points to the use of sails with these plans. There is no hint concerning how the vessel's interior space was divided between cargo hold, crew quarters, and stowage for boat equipment. No steering mechanism is illustrated. Finally, there is no indication of how well these vessels were built by the men who put them together. The historical record is largely silent on these details of hull construction, therefore, it is necessary to consult the archaeological record to answer these questions. Fortunately, several examples of sailing canal boats, including one built by Orson Spear, are preserved beneath the waters of Lake Champlain and have been the subject of archaeological study.

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CHAPTER VIII

THE ISLE LA MOTTE SLOOP (VT-GI-24)

Lake Champlain is home to a wide variety of vessels from the lake’s rich historic past. Most are in an amazing state of preservation due to the cold, fresh water. These wrecks have always been of fascination to the public and a few hulls from the colonial period and the Revolutionary war have been raised, but only recently have archaeologists begun to systematically survey the lake and inventory the cultural material preserved on the lake floor. This work has led to the discovery of five sailing canal boats (Fig. 8). Four of these sites are presented in detail in this dissertation: the Isle La Motte sloop, the North Beach wreck, General Butler, and O. J. Walker. The fifth site located in Cumberland Bay is discussed along with the North Beach wreck because the two hulls are similarly constructed with one significant exception in their sterns. Burlington Bay has been more extensively surveyed than any other area on the lake and contains more known examples of sailing canal boat wrecks than any other location (Fig. 9).

We will begin by examining the first sailing canal boat site in the lake to be found and studied by archaeologists, the Isle La Motte sloop. When this vessel was discovered in 1978 off Isle La Motte, Vermont, investigators concluded that it was a common late-nineteenth-century merchant sailing vessel. They did not appreciate the uniqueness of their find because the existence of sailing canal boats had been all but forgotten. It was not until the discovery of a similar vessel, General Butler, two years later that the Isle La Motte sloop was identified as a sailing canal boat and became the focus of archaeological investigation. These studies and associated historical research have not been able to identify the name of the wreck, but they have provided a much clearer picture of the function and date of the vessel.

Discovery and Excavation

A Canadian-American research team under the direction of Marc A. Théorêt discovered the vessel during a remote sensing survey performed by Professor Harold “Doc” Edgerton in 1978. The survey team was seeking a British sloop from the War of 1812, but when Théorêt’s team could not find this wreck during a second campaign in 1979, they opted to record the Isle La Motte sloop.¹ Théorêt’s team recognized that it was a sailing vessel and that its features included a mast stepped on deck which could be lowered for overhead obstructions. What their preliminary survey did not reveal was that the

Figure 8. Sailing canal boat sites in Lake Champlain.
Figure 9. Sailing canal boat sites in Burlington Bay.
hull is shaped like a canal boat. Their preliminary site plan, instead, more-closely resembles a typical lake sailing vessel.

This might have been the end of the story had it not been for the discovery of General Butler in 1980. A preliminary survey of this second discovery revealed both canal and sailing features and so brought these hybrid sailing canal craft to light again after years of obscurity. Investigators were excited by these finds and hoped to learn more about each vessel's form and function. Differences between the Isle La Motte sloop and General Butler suggested variations within this class of vessels and necessitated taking a closer look at the sloop, which is located in 55 feet (16.8 m) of water between Isle La Motte and the New York shore around Trembleau Point, just south of Chazy Landing, New York.

In 1982 an eight-person research team, consisting of members of the Champlain Maritime Society (CMS), examined several sites including General Butler and the Isle La Motte sloop. The initial CMS survey at Isle La Motte was completed in three days between June 29 and July 1, under the direction of Arthur B. Cohn and chief archaeologist Kevin J. Crisman. The hull was found to be intact on the lake floor, with only the mast, spars, and rigging missing.

Working from two inflatable boats moored to the wreck, each two-person dive team completed specific recording tasks. The first task was to place a tape measure on deck, along the centerline of the vessel, to serve as a baseline datum from which individual features could be provenanced. This work produced a preliminary site plan (Fig. 10). In addition to deck features, the crew recorded the vessel’s transom stern, rudder, stern cabin interior, deck beam spacing, and the height of the vessel’s gunwale above the lake floor. The team’s findings were reported to the Vermont Division of Historic Preservation (VTDHP) and included in a volume on nautical archaeology fieldwork in Lake Champlain published the following year.

In 1983, the research team, with a few changes and additions in personnel, returned to the Isle La Motte sloop between August 5 and 11. The crew gathered frame and plank scantlings, documented the site through photography, and recorded details of the vessel’s windlass, centerboard trunk, mast tabernacle, rudder, and bulwarks. In addition, they found a pump shaft and a cabin door, and exposed a

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1A full discussion of the archaeological and historical investigations of General Butler are presented in Chapter 10.

2CMS was a group of lake historians, archaeologists and divers that conducted nautical archaeology projects on sailing canal boats and other lake vessels in the 1980s. The group merged with the Lake Champlain Maritime Museum (LCMM) at Basin Harbor, Vermont in 1986. Since that time LCMM has sponsored nautical archaeology investigations.

Figure 10. Isle La Motte sloop 1984 preliminary site plan, by Kevin J. Crisman. Reproduced with permission of the Lake Champlain Maritime Museum.
small portion of the vessel's floor by excavating with a water-induced dredge. The depth of water in which the Isle La Motte sloop lies, together with its essentially intact hull and a cargo of marble, limited examination below the vessel's load waterline. The information gathered, nevertheless, provided insights into the operation of the vessel in addition to further outlining its basic form and construction. The results of this second field season on the Isle La Motte sloop were reported in another volume on the nautical archaeology of Lake Champlain.\footnote{R. M. Fischer, ed., A Report on the Nautical Archaeology of Lake Champlain: Results of the 1983 Field Season of the Champlain Maritime Society.}

The two campaigns of work at Isle La Motte were undertaken in conjunction with an investigation of General Butler and provided the first conclusions concerning sailing canal boats. The wrecks were quite similar in some features, yet different in others. General Butler had two masts, while the Isle La Motte vessel had a single mast. Both vessels sank carrying a cargo of marble. Most importantly, through archaeological techniques, both projects uncovered the characteristic features of a sailing canal boat, providing a clear picture of their design, construction, and general appearance.

**Hull Remains**

Just as the boat's builder did so many years ago, we will begin at the bottom of the vessel and work our way up. Due to limited access on this particular site, little is known of the vessel below the mud line. The vessel that would have been visible to someone on the deck of a passing canal boat 150 years ago, however, is essentially visible to a diving archaeologist today. A list of the vessel's scantlings and principal dimensions can be found in Appendix E.

**Keel and Posts**

The heavy marble cargo carried by the Isle La Motte sloop in the nineteenth century pushed it deep into the lake floor when it wrecked. This has prevented any detailed examination of the keel to date. Excavation at the stern revealed the sternpost down to the keel, where each has a sided dimension of 8 inches (20.3 cm). Any future work on this site should include an effort to determine the molded dimension of this important centerline timber at the stern, as well as molded and sided dimensions at other locations, especially at the bow and amidships.

The stem is exposed for a distance of almost 5 feet (1.5 m) above the lake bottom. Divers examining it believe it is constructed from two timbers, an inner stem which has a rabbet for hull planking and an outer stem. This interpretation of two posts is based on observations of white paint in what appeared to be a seam between the inner and outer portions of the stem. This may not be the case, however, for the stem of General Butler was also initially thought to be a two-piece structure, but closer
examination indicated that it was one timber. If the Isle La Motte sloop’s stem is in two pieces, it is the only archaeological example among the three known sites with completely preserved stem remains to carry this feature. It would also differ from stems illustrated by Orson Spear.

An iron plate covers and shields the forward surface of the stem. Like the stem, the plate extends down into the bottom sediments. It measures 3½ inches (8.9 cm) in width and ½ inch (1.3 cm) in thickness. An eye formed at the top serves as the point of attachment for the mast’s forestay.

The entire stem assembly is molded 1 foot, 4 inches (40.6 cm) and sided 10 inches (25.4 cm). The stem is sided 4 inches (10.2 cm) on the forward face, increasing to 10 inches (25.4 cm) at the planking rabbet. This dimension remains constant to the stem’s inner surface.

A breast hook is fastened by iron bolts to the inner face of the stem and to the port and starboard sides. It is 8 inches (20.3 cm) below the stem head and just above the deck. The arms of the breast hook are 3 feet, 7 inches (1.1 m) long, and its throat is molded 9½ inches (24.1 cm) and sided 5 inches (12.7 cm). The ends of the arms are sided 4½ inches (11.4 cm). The upper surface of the breast hook has remnants of green paint applied on top of white paint, indicating that the vessel was in use long enough to have been painted on at least two occasions. The presence of a weighty marble block on deck at the bow precluded, for safety reasons, any examination of the stem below deck.

The Isle La Motte sloop’s stem is what enrollment documents referred to as a “moulded” stem. This means that the vessel’s bow was molded in a curved shape when viewed from either a deck plan, a sheer plan, or a body plan. It is differentiated from boats with a flat bow that raked forward, and were commonly referred to as a “scow” bow. The scow arrangement was less expensive to build, because it did not require expensive compass timber.

Scows were very popular until outlawed by the New York Canal Board in 1846 for several reasons. Scow bows created sizeable wakes that rapidly eroded canal banks, necessitating frequent repairs. When their sharp corners struck the soft banks of the canal they gouged a hole causing water to leak out. This occurred frequently as boats passed one another in the channel whose bottom width was only a foot (30.5 cm) wider than the combined breadths of the two vessels. Most disturbing to the Canal Board was that scow bows caused considerable damage when colliding with other boats. The sharp corner of a scow bow would frequently punch a hole in any other canal vessel it struck causing it to sink on the spot which closed the channel and created a backlog of boats waiting to pass. After 1846, no boats were to be built and registered with a scow bow. Those scows already built were fined $10.00 to further discourage their use.

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The 1846 regulation called for bows with an elliptical or semi-circular shape. The curve of the bow was defined as a proportion of the vessel's breadth. For example, a vessel with a breadth of 14 feet (4.3 m) should have a bow that curved out from the dead flat run of the sides a distance of no less than 3 feet, 6 inches (1.1 m). There was no stipulation in the Canal Board's new policy on how, or whether, the vessel should curve from the keel up the stern. In theory, canal boat stems could have been completely vertical. In practice they became vertical over most of their length with a very tight turn to the keel. They also became increasingly full in the bow with some types of Erie Canal boats from the 1890s carrying the shape dictated by the Canal Board from deck level to within a foot (30.5 cm) of the keel. This arrangement may have been what is referred to in the enrollment documents of the 1840s and 1850s as a "round bow."

The Isle La Motte sloop had a molded stern along with its molded bow. This combination is well represented in the enrollment documents. So are molded sterns in combination with scow sterns. The 1846 regulation did not prohibit scow sterns and they remained popular into the late 1850s.

The Isle La Motte sloop's sternpost is 4 feet, 3 inches (1.3 m) long and is molded and sided 8 inches (20.3). It sits on top of stern deadwood, according to the diver who reached down into a small excavation at the stern. The precise configuration of the sternpost, stern deadwood, and keel arrangement could not, however, be determined. Hull planking at the stern fits into a rabbet in the post that begins at the deadwood and angles upward and aft. The upper half of the sternpost is contained within the hull.

On the interior of the vessel, the forward face of the sternpost is notched for a single transom piece. The transom piece is 10 feet, 8 inches (3.3 m) long, sided 9 inches (22.9 cm) and molded 5 inches (12.7 cm). Above the transom piece the sternpost is enclosed behind a decorative panel. A standing knee was spiked to either end of the transom piece for the attachment of side and transom planking. The arms of the knees are 2 feet (60 cm) long with a sided dimension of 5 inches (12.7 cm).

Just over a foot (30.5 cm) above the transom piece four windows are framed into the transom with vertical timbers that are molded 6 inches (15.2 cm) and sided 3 inches (7.6 cm). A deck beam frames in the top of the windows. The framing at the bottom of the windows was not recorded.

The transom rakes aft 3½ inches (8.9 cm) over 3 feet (90 cm). This is roughly equal to the rake of the rabbet on the lower sternpost. Two transom planks are raked at 45 degrees. These are located at the bottom of the transom where the sternpost and rudder stock emerge from the hull.

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Frames

The limited information collected suggests that the Isle La Motte sloop is framed with square timbers measuring 4 inches (10.2 cm) on a side. Near the forward end of the centerboard trunk, one floor timber was examined. It has sided and molded dimensions of 4 inches (10.2 cm). Fasteners in the ceiling planks are spaced on centers of 1 foot, 7 inches (48.3 cm), indicating that this is also the spacing of the floor timbers at this location. Futtocks are visible inside the vessel in a few locations where there is no ceiling planking present. Some futtocks run all the way up to deck level, while others fall well short of the clamp that supports the vessel's deck beams. The ends of top timbers are visible in the stern cabin and vary in size with at least one-sided 4½ inches (11.4 cm) and molded 5 inches (12.7 cm). Most, however, were 4 inches (10.2 cm) on a side.

Keelson and Sister Keelsons

The Isle La Motte sloop's keelson assembly was uncovered just forward of the centerboard trunk where it consists of four timbers laid side by side. On either side of the vessel's centerline are two keelsons, which are flanked on their outboard sides by a pair of sister keelsons. The starboard keelson is sided 7¼ inches (18.4 cm), while the port keelson is sided 7 inches (17.8 cm). Each keelson is molded 4½ inches (11.4 cm). The port keelson has a straight nibbed scarf that is 5½ inches (14 cm) long at a distance of 8 inches (20.3 cm) from the centerboard trunk, while the starboard keelson has a small repair piece screwed into its upper outboard edge, roughly opposite the scarf in the port keelson. The keelson timbers have cut outs on their inboard edges to fit around the centerboard trunk. The sister keelsons are sided 9 inches (22.9 cm) and molded 3½ inches (8.9 cm). Both keelsons and sister keelsons are fastened to floor timbers with bolts and spikes.

Planking and Ceiling

The hull planking of the Isle La Motte sloop is 1½ inches (3.8 cm) thick and varies in width from 2 to 12 inches (5.1-30.5 cm). At the stern, 17 planks have an average width of almost 7 inches (17.8 cm). Planks are fastened to frames with iron nails. No observation was made concerning the presence of wales, or the use of caulking in planking seams, although both are believed to exist. The planking on the transom is similar to the other hull planking. The transom is made up of six planks that range in width from 5 inches (12.7 cm) to 9 inches (22.9 cm) and make up the total width of the transom which is 3 feet. 6 inches (1.1 m).

On the port bow a wooden rail is fastened by iron nails on top of the external planking. It is trapezoidal in section, with the inboard face 3 inches (7.6 cm) thick and tapering over a width of 3 inches (7.6 cm) down to a thickness of 2 inches (5.1 cm) at the outboard face. An iron plate fastened to the outboard face runs along the entire length of the rail which is a distance of 14 feet, 2½ inches (4.3
m) from the stem. The wooden rail is composed of two timbers that are joined by a diagonal scarf located 6 feet, 3 inches (1.9 m) from the stem. This feature is interpreted as a rub rail designed to protect the bow when maneuvering in and out of the canal locks.

The Isle La Motte sloop was originally covered with ceiling planks from the sister keelsons up to the clamp. In many areas above the mud line the ceiling has deteriorated and is no longer present. Sedimentation in the hold hindered any detailed inspection. One ceiling plank next to the port sister keelson is 2 inches (5.1 cm) thick. The ceiling on the vessel’s sides must have been significantly less thick, perhaps just 1 inch (2.5 cm), to have deteriorated away.

**Deck**

Deck support begins with stanchions rising from the keelson to the underside of deck beams. No dimensions were taken on these stanchions, but they appear to be 3 to 4 inches (7.6-10.2 cm) on a side. Iron rods were noted near several stanchions and are interpreted as tie-rods that hold the deck and the vessel’s bottom in tension. One tie-rod was noted along the starboard side of the centerboard at its after end, and another is on the port side of the centerboard at its forward end.

Further deck support is derived from a clamp running along each side of the vessel underneath the ends of deck beams. The clamp is fastened to top timbers, or futtocks heads, by iron spikes. At the vessel’s starboard after end the clamp is 7 inches (17.8 cm) wide and 4 inches (10.2 cm) thick. It is, however, 5½ inches (14 cm) wide and 2 inches (5.1 cm) thick at a point 31 feet (9.4 m) from the stem on the starboard side.

Deck beams vary in sided and molded dimension as do the frames, but most are 4-inch (10.2-cm) square timbers, with some at 5 inches (12.7 cm) sided dimension and 4½ inches (11.4 cm) molded dimension. Deck beams are spaced between 1 foot, 5 inches and 1 foot, 7½ inches (43.2-49.5 cm). The deck beam at the after end of the stern-cabin hatchway is 12 feet (3.7 m) in length, and the second deck beam forward of the sternpost is 11 feet, 9 inches (3.6 m) long.

The waterway is fashioned from a plank 2½ inches (6.4 cm) thick at its outboard edge. The inboard edge is 1¾ inches (4.5 cm) thick and its top surface sweeps upward in a semicircular arc, creating a shape resembling a cove molding. It is shaped in this fashion from the stem aft, to a distance of about 13 feet (4 m). The cove of the waterway is thickly coated in several layers of white paint, indicating frequent maintenance. The outboard edge of the waterway at the stern is 2 inches (5.1 cm) thick, although its inboard edge was not noted. On the starboard side the waterway has a consistent width of 7 inches (17.8 cm) from the stern to the forward end of the fourth hatch from the bow. It reaches a maximum width of 7½ inches (19.1 cm) at the forward end of the third hatch from the bow. The port side waterway varies in width from 4½ inches (11.4 cm) at the stern to 6 inches (15.2 cm) at the third hatch from the bow.
The Isle La Motte sloop has 29 strakes of fore-and-aft deck planks. The width of these planks ranges from 3½ inches (8.9 cm) to 7 inches (17.8 cm), with an average of 5½ inches (14 cm). The deck planks are 1¼ inches (3.2 cm) thick. They are fastened by two iron nails that are placed diagonally at each plank and deck beam intersection.

A bilge pump spear and burr valve (Fig. 11) were found in a port side pump tube located between the two cargo hatches. The spear is 4 feet, 6 inches (1.4 m) long, has a square section of 1 inch (2.5 cm). The spear tapers toward either end, although the taper on the lower end is for attachment of the burr valve the upper end taper appears to be the result of deterioration. The burr valve is made of leather in the shape of an inverted cone, coming to a point at the lower end of the spear. The valve is 5 inches (12.7 cm) long. Three leather straps attached to the base of the cone extend between 6½ and 7¼ inches (16.5-18.4 cm) up the shaft of the spear where they were once attached by three iron nails. The leather that forms the burr valve is fastened to itself by five copper rivets. The tip of the valve was attached to the pump spear by four iron tacks. Each leather strap was fastened to the to the valve by a copper tack.

The deck is interrupted by four hatchways. The first hatch in the bow is a companionway, now partially obstructed by a large marble block on deck, but originally providing access to the bow compartment. It measures 3 feet, 2 inches (96.5 cm) long and 2 feet, 9½ inches (85.1 cm) wide and is located just abaft the windlass at the bow. The next two hatches are located above the cargo hold and are each about 6 feet (1.8 m) long and 4 feet (1.2 m) wide. These are the main cargo hatches.

The cargo hatches have coamings constructed from square timbers measuring 5 inches (12.7 cm) on a side. The hatches begin and end at certain deck beams, while cutting through other deck beams. The inboard ends of these half beams were fastened to fore-and-aft timbers called carlings. Head ledges were placed atop the deck beams at either end of the hatch. The carlings were notched in their upper inboard edge to accept athwartship hatch beams for some sort of hatch cover. The companionway coaming is fashioned from smaller timbers, with carlings sided 3 inches (7.6 cm) and molded 4½ inches (12.1 cm) and head ledges sided 2 inches (5.1 cm) and molded 5 inches (12.7 cm). The companionway coaming is fastened together with iron nails. There are two nails in each carling and three in each head ledge. The companionway carlings are also notched for a hatch beams.

The stern hatchway originally mounted a trunk that formed the upper portion of an after cabin. The hatch is 9 feet, 7 inches (2.9 m) long and 7 feet, 1 inch (2.2 m) wide. A 9-inch (22.9-cm) diameter hole for a stove pipe comes up through the deck at the starboard after corner of this hatch. The carlings each supported six wooden posts or stanchions that rose 1 foot, 5 inches (43.2 cm) above the coaming.
The stanchions fit into mortises in the carlings that are between 4½ and 6 inches (11.4-15.2 cm) long, 2 inches (5.1 cm) wide, and 3 inches (7.6 cm) deep. The cabin access door was found lying near the hatch. It was originally framed in by two uprights in the after ledge toward the port side. One upright has two gudgeons for mounting the door. The door is 1 foot, 8½ inches (52.1 cm) wide by 4 feet, 1 inch (1.2 m) tall. It has two pintles mounted on the starboard side and a throw bolt at the upper port corner. The door consists of four planks that frame a decorative panel.

**Bulwarks**

The bulwarks are constructed in a different fashion at the bow than at midship or at the stern. Curving abaft from the side of the stem for a centerline distance of 11 feet, 9½ inches (3.6 m) from the forward end of the stem, the bulwarks are framed by either top timbers or the heads of futtocks that protrude above the deck a distance of 11 inches (27.9 cm). The frame tops are planked over on both the outboard and inboard surfaces by strakes that are called bulwark and lining respectively. The lining consists of two strakes that are 5½ inches (14 cm) wide and 1½ inches (3.8 cm) thick. The bulwarks are capped by a rail that is 1½ inches (3.8 cm) thick and 6¼ inches (17.2 cm) wide. There are no scuppers in this forward bulwark, and any tumblehome, if present at all, is negligible. There are hawse holes in the bulwark.

Wooden chocks are located on either side of the stem head atop the caprail. The chocks are 3 feet, 5½ inches (1.1 m) long and are fastened to the caprail with iron nails. Each chock has a fair-lead located 3½ inches (8.9 cm) from the stem for a line or cable to be inserted from the top. The cut out is 3 inches (7.6 cm) deep and will accept a rope or chain up to 2½ inches (6.4 cm) in diameter.

The Isle La Motte sloop has a pair of iron straps placed atop the caprail in the bow directly abaft the fairlead chock on both the port and starboard sides. These straps are 3 feet, 1½ inches (95 cm) long, 2¼ inches (5.7 cm) wide, and ¾ inch (0.8 cm) thick. They protect the caprail from chafing by either a line or a chain that ran over the rail. It is presumed that this boat towed better with its tow line run over the bulwarks at this location rather than through the fairlead chock near the stem. This is the only archaeological example with this specific feature.

From the end of the framed, planked and capped bulwarks of the bow and continuing to the stern the bulwarks are constructed from planks called "washboards" or "toe-rails." At the transition point, the after bulwarks consists of a single washboard 11 inches (27.9 cm) wide and 3 inches (7.6 cm) thick. At the stern, the bulwarks are made from a pair of washboards stacked one atop the other and fastened edgewise to the hull. The washboards are fastened with ¾ inch (1.6 cm) diameter iron drift pins through the width of each plank through the waterway and into the hull beneath. This type of fastening is known by a variety of names including "edge-bolting," "edgewise," or "edgeways." The earliest securely dated archaeological evidence for this type of edge-bolted bulwarks is the wreck of a
lake schooner named *Water Witch*, which started out its career in 1832 as a steamboat, but was converted to a schooner in 1835 or 1836 and sank in 1866.  

The bulwarks are fastened to the transom by lodging knees on either side. The port lodging knee has arms of 1 foot, 8 inches (50.8 cm) along the transom and 1 foot, 7 inches (48.3 cm) along the bulwarks. The port knee is molded 7 inches (17.8 cm) through the throat and 2½ inches (6.4 cm) at either end. It has a sided dimension of 2 inches (5.1 cm). It is positioned flush with the top of the bulwarks and the counter of the transom. The starboard knee is molded 6 inches (15.2 cm) through the throat, but otherwise is the same size as the port knee. The forward end of the starboard arm has broken off, so that this arm is only 1 foot, 1 inch (33 cm) long. The knees are fastened with iron nails. Approximately 6 inches (15.2 cm) below the transom arms of each knee is a 2½-inch (6.5-cm) diameter eye bolt fastened through the transom. The purpose of these eye bolts is not presently understood, although they are assumed to play a role in the sail rig of the vessel.

Scuppers are present in the washboard bulwarks and were made by cutting into the lower edge of the plank. They are generally 3 inches (7.6 cm) high, although one is 4½ inches (11.4 cm) high. The length of the scuppers ranges from 1 foot, 2 inches to 1 foot, 9 inches (35.6-53.3 cm), and they are spaced between 2 feet, 2 inches and 3 feet (66-91.4 cm) apart. Only ten scuppers were recorded on the *Isle La Motte* sloop, but the length of the bulwarks and the spacing of the scuppers suggests that the vessel had a total of 16 scuppers per side.

**Steering Mechanisms**

The *Isle La Motte* sloop was steered with a long, but not very tall rudder known as a “barndoor” rudder. This was mounted to a rudder stock that parallels the sternpost and rises above deck. Here a tiller bar is attached to rotate the rudder stock and move the rudder from side to side. The tiller is 5 feet, 10 inches (1.8 m) long and mortised into the 8-inch (20.3-cm) diameter rudder stock. The tiller tapers to a width of 3 inches (7.6 cm) and a height of 4 inches (10.2 cm) about halfway along its length. At this point it narrows further to a 2 inches (5.1 cm) on a side near the control end. This end of the tiller has a knob handle that is 2½ inches (6.4 cm) square and 3½ inches (8.9 cm) long. At the other end, a wooden wedge secures the tiller into a mortise in the rudder stock. The head of the rudder stock is encircled by an iron band that is 2 inches (5.1 cm) wide. The partial remains of a turnbuckle are attached at the center of the rudder stock head and extend out toward the other end of the tiller. The tiller is full over to the port side as a result of the sinking.

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The foot of the rudder stock has a diameter of 7 inches (17.8 cm) and is seated on an iron plate called a "skeg." From there the rudder stock rises up 5 feet, 2½ inches (1.6 m) to the base of the transom where it enters the vessel’s interior. The distance from this point to the top of the rudder stock is 3 feet (91.4 cm), giving the stock an overall height of 8 feet, 2½ inches (2.5 m).

The rudder is comprised of two blades, each constructed from four planks which are edge-bolted together and nailed to the port and starboard sides of the rudder stock. The stock has been notched to accept the planks. The overall dimensions of the rudder are as follows: 3 feet, 11 inches (1.2 m) in length, 3 feet, 10½ inches (1.2 m) in height, and 7 inches (17.8 cm) in width. The planks of each blade vary in width between 6 inches and 1 foot, 3½ inches (15.2-39.4 cm) and are 2 inches (5.1 cm) thick. The rudder blades are capped by a 2-inch (5.1-cm) thick plank at the rudder stock that extends only halfway to the rudder’s after end. The space between the blades is 3 inches (7.6 cm) wide and probably contains a timber to further support the rudder blades. An iron is fastened around the rudder stock and extends onto the rudder blades a distance of 1 foot, 9 inches (53.3 cm). This strap is located 8 inches (20.3 cm) below the top of the rudder blade and supports attachment of the blades to the rudder stock. The rudder’s upper after corner is rounded off, and it is assumed that the lower after corner was shaped in a similar manner. Bottom sediments, however, prevented a complete examination of the lower portion of the rudder.

**Centerboard**

The rudder was not the only device needed to keep a sailing canal boat on course. The shallow, flat-bottomed hull form increased the tendency of the vessel to slip leeward and made the vessel unstable, especially when sailing without a cargo. To combat this problem, hulls were fitted with centerboards contained within a watertight box called a “trunk.”

The Isle La Motte sloop’s centerboard is located beneath the deck and between the two cargo hatches. It begins 29 feet, 1 inch (8.9 m) abaft the stem head and runs aft a distance of 12 feet, 6 inches (3.8 m). It rises from the bottom of the vessel and extends up 4 feet, 10 inches (1.5 m) to the underside of the deck beams. The centerboard trunk is constructed from planks that are fastened to deck beam stanchions at either end. The planks are further fastened by long iron drift pins driven edgewise through the stack of planks. The individual planks are 3 inches (7.6 cm) thick and vary between 6 and 8 inches (15.2-20.3 cm) in width.

The centerboard contained within the trunk is also constructed from edge-bolted planking. It pivoted on an iron pin located near the forward end of the trunk. A section of missing deck plank above the centerboard trunk’s after end has a chain passing up through it and lying across the deck. The lower end of this chain is attached to the centerboard and would have been part of a line used to deploy the centerboard beneath the hull and to retract it within the centerboard trunk.
Rigging Elements

The Isle La Motte sloop had a single mast stepped on deck in a tabernacle (Fig. 12). The tabernacle is located 22 feet, 10 inches (7 m) abaft the stem head, and is constructed from two stanchions that rise up through the deck. The stanchions presumably originate on the vessel's keelson, although this was obscured by sediments within the hold. Above deck and between the forward edge of these stanchions a plank is fastened, making a three-sided box. An iron pin runs through the two stanchions and would have passed through the heel of the mast at one time. This provided the means to pivot the mast up and down. The open after portion of the tabernacle allowed the mast to pivot down toward the stern.

The stanchions are 1 foot, 2 inches (35.6 cm) wide and 3 inches (7.6 cm) thick. The forward plank is 2 feet, 4 inches (71.1 cm) long, 11 inches (27.9 cm) wide, and 2 ½ inches (6.4 cm) thick. The tabernacle protrudes through the deck a distance of 2 feet, 6 inches (80 cm). It would hold a mast heel 1 foot, 1 inch (33 cm) in diameter. The iron pivot pins is 2 inches (5.1 cm) in diameter. It is located 8 inches (20.3 cm) off the deck and 5 inches (12.7 cm) forward of the stanchion’s after end. The upper outer edges of the stanchions and the forward plank all have a recess of ½ inch (1.3 cm). This was the seat for an iron band that once ran around all four sides of the tabernacle to secure the mast while in use. The iron band was found on deck near the tabernacle and was bent out of shape as if ripped from its original position by a violent force.

Three cleats are attached to the forward face of the tabernacle. Two are fastened on the stanchions, while the third is in the center of the forward plank. All three are placed in a vertical orientation beginning 10 inches (25.4 cm) off the deck. Their number and placement suggest that they secured lines for the halyard and a head sail.

A deadeye was found attached at the head of the stem by an iron strop and a forelock bolt fastened to an eye welded atop the iron plate that protects the stem’s forward face. The deadeye’s diameter is 6½ inches (16.5 cm). A second deadeye found loose on the breast hook abaft the stem head is likely a mate to the first one. The second deadeye was probably at the end of the forestay (which does not survive). A smaller line, called a “lanyard” (also was not extant) would have run through the three holes in each deadeye to hold the forestay fast.

A third, slightly smaller deadeye is located at the port side bulwark, and is also held in place by an iron strop fastened to an iron eye. This eye, however, is part of an eye bolt that runs edgewise through the bulwark’s toerail, down below deck, where it terminates in some as yet unknown manner.
Figure 12. Isle La Motte sloop mast tabernacle.
This deadeye secured a shroud, which supported the mast. A second shroud deadeye was originally located 1 foot, 4 inches (40.6 cm) toward the stern from the first and is no longer extant, but a surviving eyebolt attests to its former existence. Two matching shroud deadeyes are presumed to be on the starboard side, but these were not examined.

Three iron rigging horses, sometimes called “horse irons,” were noted during the surveys. They were fashioned from round stock bent into a U-shape and have threaded ends. A separate iron ring called a “traveler” is slipped over each horse. The first horse remains bolted through the breast hook at the bow just 4½ inches (11.4 cm) abaft the stem and rises 2½ inches (6.4 cm) above the breast hook. It is 10 inches (25.4 cm) long and has the concreted remains of a traveler lying to its starboard side. The second rigging horse is bolted through the deck and a deck beam just forward of the stern cabin hatch. This horse iron is 8 inches (20.3) longer than the first, making it 1 foot, 6 inches (45.7 cm) in overall length. The third and aftermost rigging horse is bolted through the transom just abaft the rudder stock. At 1 foot, 9 inches (53.3 cm) it is the longest of the three, but there is not that much difference between them. It protrudes out from the inner surface of the transom by 4½ inches (11.4 cm). The round stock of this horse has a diameter of 1½ inches (3.8 cm). The traveler has a of diameter 6 inches (15.2 cm) and was fabricated from round stock that is 1 inch (2.5 cm) in diameter.

Four large wooden cleats were once attached to the bulwarks of the Isle La Motte sloop, of which three survive and have been recorded. The fourth was unfortunately lost when the propellor of a pleasure boat snagged the research team’s down line which was secured to the port stern cleat. The cleat through-fastened to the starboard stern bulwarks opposite the lost cleat measures 2 feet. 6½ inches (77.5 cm) in overall length, 5 inches (12.7 cm) deep at the center, and has arms 9½ inches (24.1 cm) long. Two cleats are through-fastened to the plank-on-frame constructed bulwarks in the bow, just forward of the transition in bulwarks construction. These cleats were originally 3 feet, 6 inches (1.1 m) in length, with arms 9 inches (22.9 cm) long. The after arm of the starboard bow cleat, however, had broken off sometime prior to the archaeological survey.

A single hardwood sheave from a rigging block was found on deck. It has a diameter of 6½ inches (16.5 cm) and is 1½ inches (3.8 cm) thick. Four holes pass through the sheave. The largest is located at the center of the sheave and contains a brass bushing with an inside diameter of ¾-inch (1.9 cm). The other three holes are ¼ inch (6.4 mm) in diameter, and are spaced equally about ½ inch (12.7 mm) from the central hole. The central hole with its bushing was for the block’s pin. The three smaller holes probably held fasteners that once secured a collar on the bushing which has not survived.
Windlass

The Isle La Motte sloop has a small patent iron windlass located between the stem and the companionway. This device allowed a small crew to raise the anchor or large mainsail. It is mounted on two stanchions, called “bitts,” that rise up from the floor of the vessel and pass through the deck to a height of 3 feet, 3 inches (99 cm) above the deck planking. The bitts are 3¾ inches (9.5 cm) thick and are placed 4¼ inches (10.8 cm) apart. There is a cross timber 1 foot, 7¾ inches (50.2 cm) above the deck. It is 2 inches (5.1 cm) wide and 2¼ inches (5.7 cm) thick and is let into 1-inch (2.5-cm) deep notches on the forward edges of the bitts. A 3-inch (7.6-cm) diameter iron axle is mounted to the after faces of the bitts by iron cheeks, or clamps, that are through-bolted on the after face of the bitts. The warping heads located at either end of the axle are 1 foot, 1 inch (33 cm) in length with a diameter of 7½ inches (19.1 cm). The pawl rim, located next to the bitts, has teeth that are 1 inch (2.5 cm) wide and 1 inch (2.5 cm) high.

Concluding Remarks

Although we do not know the name of the vessel wrecked at Isle La Motte or precisely when it sank, its archaeological study has produced a clear picture of the vessel’s overall size and form (Fig. 13). This permits comparison to other archaeological finds and relevant historical material. The Isle La Motte sloop’s hull is 79 feet, 8 inches (24.3 m) in length with a breadth of 13 feet, 6 inches (4.1 m) and a depth of hold of 4 feet, 8½ inches (1.4 m) as measured from the planking rabbet to the underside of deck beams.6

We do not know the precise method used by customs collectors to determine a vessel’s dimensions or tonnage. On some documents collectors note that they relied on a certificate supplied by the boat’s builder, while on others they refer to “remeasuring” the craft. By comparing the Isle La Motte sloop to vessels of similar length, breadth and depth listed on enrollment documents, our only source of information, we can estimate its burden at 45 tons.

The Isle La Motte sloop’s dimensions closely match those for canal sloops found on enrollment documents for vessels built in the 1840s and 1850s. The vessel at Isle La Motte was definitely built prior to 1862 when enlargement of the Champlain Canal’s locks and channel led to vessels with a greater length, breadth and depth of hold. There is no concrete evidence to exclude this boat as one of the later vessels in the 1823 class, but its full stem and stern together with its long, flat run along the sides suggest a more standardized design. The Isle La Motte sloop, therefore, is most likely of the 1841 class of sailing canal boats.

6Orson Spear measured depth of hold in this manner on his drawings.
Figure 13. Isle La Motte sloop reconstruction.
Insufficient data exist to produce lines drawings to compare to those shown on Orson Spear's drafts from the 1840s. The shape of the Isle La Motte sloop at deck level, the curve of the stern, and the rake of the sternpost, are all similar to Spear's drawings. His drafts also indicate that boats of this size, even those built from the same plan like Eagle and Empire, can vary. For example, Eagle's enrollment papers describe the vessel as 77 feet, 3 inches (23.6 m) in length, 13 feet, 5 inches (4.1 m) in breadth, 5 feet (1.5 m) deep in the hold, with a burden of 49 tons, while Empire is listed at 77 feet, 10 inches (23.7 m) in length, 13 feet, 5 inches (4.1 m) in breadth, 5 feet, 2 inches (1.6 m) deep in the hold, with a burden of 51 tons.

Although a rounded bilge cannot be definitively ruled out, diver's observations of the Isle La Motte sloop's vertical sides suggest some type of chine-built construction. This vessel resembles Orson Spear's drafts with their characteristic flat bottom and vertical sides along most of their length. A hull of this type was increasingly expensive to produce with standing knees, given the depleted state of Champlain Valley forests in the middle of the nineteenth century, and its builder may have adopted the chine-log construction shown on Orson Spear's chine boat draft. The only way to answer this question is to excavate and expose the transition between the bottom and either the port or starboard side.

A great deal is known about the Isle La Motte sloop's deck arrangements. Information that is not found on Orson Spear's drawings. It is on deck that we see several of the basic characteristics of a sailing canal boat. Many are shared with towed canal boats and lake sailing vessels, while others are distinct to this class.

The Isle La Motte sloop has a length to breadth ratio of 5.9:1, which is identical to towed canal boats and greater than lake sailing vessels with a ratio of 3.7:1. For canal boats this ratio was defined by the size of the locks through which the vessel had to pass. Lake sailing vessels had no such restriction and were built beamier to make them more efficient cargo carriers and better handling sailing craft.

Several other features on the Isle La Motte sloop indicate its use on the canal. The cleats through-fastened to the sturdy bulwarks construction of the bow provided a strong attachment for towing lines. The protective iron straps atop the starboard caprail abaft the fair-lead timber probably indicate use on the canal, where the towpath was kept to the vessel's starboard side. Large cleats in the stern may indicate that the vessel could be towed by steamboats in a line with other canal boats. The iron plates on the stern and the rub rails protected the sloop's bow as it passed through canal locks. Finally, the burr pump found at the side of the vessel, not on the centerline, is typical for canal boats with perfectly flat bottoms.10 When these hulls filled with water they listed strongly to one side, making a centerline pump of little use.

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The deck layout of the Isle La Motte sloop is also very typical of a sailing canal boat. Separate hatches for access to the bow compartment, cargo hold, and stern cabin are found on other sailing and canal boats. Towed canal boats have the same arrangement of hatchways. Lake sailing vessels, however, had a different arrangement, at least in the cases of two examples of lake schooners that have been archaeologically studied.\(^\text{11}\) These are Water Witch and Sarah Ellen, whose deck layouts consist of two cargo hatches and a raised stern deck for the after cabin. Water Witch has a small companionway at the forward end of the stern deck to enter the cabin. Sarah Ellen has both a raised stern deck and a cabin trunk similar to those found on towed and sailing canal boats. Neither lake schooner has a companionway in the bow.

The stern arrangement also provides some basis for comparison between the various lake and canal boats. The Isle La Motte sloop's transom stern resembles the lake sailing vessels discussed above. The transom has four windows to light the stern cabin. This feature is known from illustrations of early canal packets and line boats, but most other towed canal boats have windows only in the cabin trunk.\(^\text{12}\)

Some evidence suggests regional differences between Champlain boats and those found on the Erie Canal and other canals. Stern cabins were universally heated by a cast iron stove, which was vented out of the cabin by a stove pipe. The Isle La Motte sloop's stovepipe passes through the deck on the starboard side of the cabin hatchway near the stern. This placement is opposite the door entering the stern cabin, and likely prevented heat from escaping when the cabin door was opened. Placing the stovepipe next to the cabin trunk also made it less likely to be a trip hazard to anyone working on deck. On other sailing canal boat wrecks where this feature survives the same arrangement is evident. The lake schooners Water Witch and Sarah Ellen also have stovepipes placed next to the companionway or cabin trunk, but away from the cabin door.\(^\text{13}\) Canal boats from other localities often have stovepipes passing through the roof of the cabin trunk.\(^\text{14}\) This has not been noted on any Champlain boats.

The Isle La Motte sloop has sailing-related features that differentiate it from towed canal boats and somewhat from lake sailing craft. The Isle La Motte sloop has a centerboard trunk containing a centerboard that pivoted on an iron pin and was deployed by a line fastened to the centerboard's after end. This feature is found on all known sailing canal boat wrecks, and is illustrated by Orson Spear.

\(^\text{11}\)Crisman and Cohn, "The Lake Champlain Schooner Water Witch," pp. 41-54.


\(^\text{13}\)Crisman and Cohn, "The Lake Champlain Schooner Water Witch," pp. 36, 50.

Some lake sailing vessels had centerboards and others did not. The lake sloop LaFayette had a centerboard of some type, and Water Witch was outfitted with a centerboard when it was converted from a steamer to a schooner in either 1835 or 1836. The centerboard and trunk on Water Witch is similar to those on sailing canal boats, except that it was placed on the starboard side of the keel, rather than through a slot in the keel. To the best of our knowledge the lake schooner Sarah Ellen was not outfitted with a centerboard, although what is known of this vessel is from video tape by a remotely operated vehicle, which did not go inside the hull.

The Isle La Motte sloop has standing and running rigging slightly different from lake sailing vessels. Water Witch and Sarah Ellen had two masts that were stepped through the deck, although they carried a fore-and-aft rig like the Isle La Motte sloop. The shrouds on the lake schooners were secured with chain plates fastened to the outside of their hulls, rather than with eyebolts placed edgewise through the toerail. The lake schooners also carried a bowsprit which the Isle La Motte sloops does not have, because it would not have fit within the canal locks. All three of these vessels had a windlass at the bow, which was used to handle the boat’s anchor cable or chain. On the Isle La Motte sloop it may also have been used to raise and lower the masts.

Where sailing canal boats differ from all other boat types is that their masts were stepped on deck. This feature makes them unique from both towed canal boats and lake sailing vessels. Standard canal boats had no need of a mast, because they were towed by either horses, mules, or steamboats. Lake sailing vessels did not have to concern themselves with overhead obstructions while sailing around the lake. The Isle La Motte sloop had to meet both of these situations, and for this reason the mast was stepped in a tabernacle on deck. The vessel’s spars along with their standing and running rigging were removed or stowed when the boat entered the canal system and then raised at either Lake Champlain or the Hudson River. This was accomplished by seating the heel of the mast in the tabernacle at deck level with an iron pin. This feature is also seen on the remains of other sailing canal boats.

Nothing is known about what happened to the crew on the day the Isle La Motte sloop sank. It is possible that they could have escaped injury or drowning, for some sailing canal boats towed a small boat behind them (a small boat can be seen in two photographs of canal schooners on Lake Champlain). In one instance where a canal schooner sank in Burlington Bay, historical sources report

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15Crisman and Cohn, “The Lake Champlain Schooner Water Witch,” p. 35.


17“An Old Timer on Lake Champlain,” [P. E. Havens], postcard in author’s possession; “Canal schooner near Vergennes, Vt.,” Photograph Collection, Lake Champlain Maritime Museum.
the crew escaping in the vessel's small boat.18 This is also a feature that sailing canal boats shared with lake sailing vessels. The remains of a small boat rest at the stern of Water Witch. There was no evidence of a small boat near the Isle La Motte sloop on the bottom of the lake, so perhaps it was used by the crew.

The Isle La Motte sloop's crew would have consisted of a captain, at least one deck hand, and perhaps some members of the captain's family. The written record might reveal crew names if the identity of the vessel can ever be determined. Further excavation within the vessel may also yield clues as to the crew members and their daily regimen. For now, however, it will remain a mystery.

Families often lived on board sailing canal boats, just as they did on towed boats. Any family on board would have lived in the after cabin, which was entered by the small door in the after end of the cabin trunk, toward the port side of the cabin. Stairs led down to a cabin with bunks, cabinets, a table and chairs, and a stove. The cabin was lighted through windows in the transom and perhaps others in the cabin trunk.

The loss of the Isle La Motte sloop was considerable for whoever owned it. The sinking of both the vessel and its cargo of marble was clearly a catastrophic event. That the sloop sank while under sail is indicated by the iron strap from atop the tabernacle that was violently pulled away when the mast either collapsed or was torn out. This interpretation is supported by the deadeyes present at the stem and on the side of the vessel. When found, the deadeyes were in a vertical position where they had rusted while still supporting the mast.

As commerce in the 1840s was increasing throughout the lake and there was demand for boats to carry goods, a vessel like the Isle La Motte sloop would have been in demand. The depth of water in which it was lost made any salvage attempt difficult, if not impossible given the state of diving technology, and the vessel may have been so old when lost that it was not worth the expense of recovery. In addition to the marble block at the bow, divers noted two more just off the starboard side of the wreck. These had originally been a deck cargo that slid across the vessel and broke off a portion of the starboard toerail when the boat came to rest on the bottom. The practice of carrying deck loads was common for vessels late in their careers, and these marble blocks probably made the Isle La Motte sloop too heavy. This may have been a contributing factor in the loss of the vessel.

The Isle La Motte sloop is a fine example of the fully-developed sailing canal boat that arose around 1840. Its dimensions are those of a hull built to carry the maximum that the canal would bear. Its sailing features are unmistakable. A wealth of information is available because of this remarkable.

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18A. B. Cohn, et al., "Underwater Preserve Feasibility Study of the Lake Champlain Canal Schooner O.J. Walker (VT-CH-594) Burlington, Chittenden County, Vermont" (unpublished manuscript), p. 44.
well-preserved inland watercraft. Finally, it still promises to yield more information. Excavation of its interior will likely yield artifacts associated with everyday life aboard a sailing canal boat. New data may help provide a better date for the site and the vessel’s name. Examination of those parts of the hull buried beneath sediments would determine the transition between the bottom and the sides. Whether this vessel has a turn of the bilge or a chine and how it is constructed are questions for future research. There are archaeological examples of sailing canal boats whose shape below the waterline has been more precisely determined and it is there that we next turn our attention.
CHAPTER IX

THE NORTH BEACH WRECK (VT-CH-607)

The discovery of a second canal sloop in 1987 offshore from North Beach in Burlington, Vermont, provided a perfect addition to the study of sailing canal boats. The Isle La Motte sloop gives us a picture of the form and construction of sailing canal boats above the waterline. Other sailing canal boats, to be discussed in subsequent chapters, also lie on the lake floor with the lower portion of the hull buried. The vessel at North Beach, however, lies in only 20 feet (6.1 m) of water, contains no cargo, and has been broken up, probably by winter ice. The boat’s two sides have peeled open and lie flat on the floor of Burlington Bay, leaving the vessel’s bottom obstructed only by a few inches (several centimeters) of sand. This allowed the best opportunity to closely examine the bottom of a sailing canal boat.

Discovery and Excavation

The North Beach wreck was discovered by a local sport diver in 1987. Arthur Cohn, director of the Lake Champlain Maritime Museum (LCMM), heard about the find and inspected the site in October of that year. He observed that it was a canal sloop of similar length and breadth to the Isle La Motte sloop, and noted that the hull had broken up making its bottom easily accessible.

In 1991, the site was revisited by field school students from Texas A&M University (TAMU) and the University of Vermont (UVM). The crew conducted a pre-disturbance survey of the visible remains to learn more about bottom construction on sailing canal boats. The research team measured the overall length and breadth of the site, examined the largely-intact centerboard trunk, and determined how much remained of the vessel’s collapsed sides. The inspection revealed that both sides are present, beneath a light dusting of sand, from the stern to within 15 feet (4.6 m) of the bow.

At the time of the survey, the team also discovered that the vessel was constructed in a manner that was completely unique when compared to the remains of previously-recorded sailing canal boats. For most of the vessel’s length along both the port and starboard sides the crew found a series of iron fasteners protruding up through the sand. This suggested an edge-fastened construction similar to the attachment of the washboard bulwarks on the Isle La Motte sloop. The sides of the North Beach wreck are made from thick hardwood and softwood planks that had been stacked one upon another, and joined together by iron drift pins driven into holes that had been bored through each of the planks (Fig. 14). This is different from the traditional manner of constructing wooden boats where planks are fastened over timber frames. The bow and stern, however, are built in the traditional, or molded, manner. This
Figure 14. North Beach wreck with J. Cozzi recording collapsed starboard side with edge fastenings exposed, photo by Hera Konstantinou. Reproduced with permission of the Lake Champlain Maritime Museum.
new method of construction was reported and plans were devised to return to the site for further investigations.¹

Upon issuance of a permit from the Vermont Division for Historic Preservation (VTDHP), a campaign of excavation was conducted at the North Beach wreck in 1992. The project was sponsored by LCMM and the Institute of Nautical Archaeology (INA), with additional support from Waterfront Diving Center (WDC). The project was part of a joint Texas A&M University (TAMU) and University of Vermont (UVM) field school in underwater archaeology. The project's results were reported to VTDHP in compliance with the permit.² Two weeks were allotted for fieldwork on the North Beach site following a week of student orientation and logistical preparation. The project was staged from the United States Naval Reserve Center in Burlington, Vermont and began on June 15.

The research design called for using a water-induced dredge to excavate along the centerline of the vessel as well as at two locations along the port side (Fig. 15). This would provide information about the molded and edge-fastened construction used on the vessel. A baseline tape measure and steel grid units, measuring 5 feet (1.5 m) on a side, were set up to control provenance. One grid unit was placed just outside the port bow to aid recording while excavating the collapsed port side. This grid was then moved one unit inboard for excavation within the hull to expose the vessel's floor. A second grid unit was placed in the starboard bow where the first floor timber had been noted.

A two-diver team worked on each of these grid units, while a third team excavated along the port side of the keelson, beginning in the bow to expose all the floor timbers of the molded bow where they crossed the centerline. Excavation uncovered artifacts as well as parts of the hull that had collapsed inside the vessel. The crew cleared the grid at the port bow to the bottom planking, revealing a stringer. Upon completion, this grid was placed farther aft on the port side, at the forward end of the centerboard. A plank from the centerboard trunk was lying on the surface at this location and dredging quickly revealed a lodging knee.

The vessel's port side had collapsed outward to the bay floor after breaking off about a foot (30.5 cm) above the boat's bottom. This collapsed side was cleared by hand fanning and found to be intact from this break all the way up to the bulwarks. This enabled an accurate reconstruction of the depth of hold. Port side features included the edge-fastened planks, notches for deck beams, the clamp, scuppers, and bulwarks, as well as fastener holes for lodging and hanging knees.


During excavation it became clear that an extensive portion of the starboard bow had been preserved on the bay floor when the stem had collapsed, although the port bow has not survived. The dive team placed an additional grid in this area. As excavation continued, hull remains appeared outside these grids and were mapped in reference to the nearest grid. While dredging, the crew encountered a sawdust layer between layers of sand. This is thought to have been deposited as a result of lumber operations on shore and is not related to the construction of the boat. We can surmise, then, that the vessel came to rest at North Beach and broke apart prior to 1870 when large shipments of Canadian lumber were stacked in yards along the Burlington waterfront.

Excavation of the centerline trench in the bow revealed the last floor timber at the transition to the edge-fastened sides. Fieldwork also uncovered a second stringer on the port side, a scarf in the keel, and a hanging knee with fasteners, indicating the dimensions of timbers once fastened to it. Amidship, a portion at the after end of the centerboard trunk could not be cleared to the bottom planking due to the many collapsed timbers that ran into the sediments away from the trench. The centerboard trunk's bedlog was uncovered along its entire port side length. The team also encountered collapsed deck components abaft the centerboard trunk and opted to move their excavation to the stem and work forward along the vessel's centerline.

The sternpost and an associated deck plank were found to lie a short distance away from the stern. These, together with several knees, were mapped by triangulation and lifted to the surface for detailed recording. The team uncovered notches in the upper port corner of the keel that are thought to indicate the position of floor joists for the after cabin. At the other end of the site, the forward end of the keel was recorded in detail because it has many iron bolts that protrude in all directions and provide evidence for how the stem was once joined. The remains of one mast tabernacle stanchion were found along the starboard side of the keelson and documented. The team also recorded cant frames at the starboard bow, the location of ceiling planks, and limber holes in the floor timbers. One of the last tasks was to collect wood samples of the major timbers that had been uncovered. Upon completion of all hull recording, and after all artifacts had been documented, tagged, and returned to the site, the crew placed sandbags over the excavated areas.

In 1993, a research team returned to document fully the collapsed sides. Between May 28 and June 1, a two-person dive crew took a series of measurements to confirm data acquired in previous years. Close examination of the starboard bow revealed new information concerning the transition from edge-fastenings to molded construction. Afterwards, the crew excavated the aftermost section of the collapsed port side and triangulated it to known points along the vessel's centerline.
In August, a five-person crew mobilized for five days to record the location of site features using Nick Rule’s WEB program. This is a computer program that plots feature points as distances from a number of datum points. It uses a least-square means to provide a “best fit” for the location of feature points. The crew exposed the collapsed starboard side to reveal the location of fastener holes where hanging and lodging knees had once been located. Hand fanning also uncovered the transition from edge-fastened construction to molded construction in the starboard stern. Finally, wood samples and photographs were taken. A standing knee from the starboard stern was recorded, and the site was backfilled.

**Hull Remains**

The hull of the North Beach wreck was broken up by winter ice or possibly by man-made intervention. It survives to a great extent today, with the exception of the vessel’s deck, the transom stern, and the port bow. The size of the hull, and the centerboard trunk that rises 4 feet (1.2 m) above the lake floor, together indicate that the North Beach wreck is a sailing canal boat built prior to the enlargement of the Champlain Canal. This places it in the same class as the Isle La Motte sloop and makes these sites a perfect compliment to each other and to the information from relevant historical sources concerning the 1841 class of canal sloops. A list of the North Beach wreck’s scantlings and principal dimensions can be found in Appendix F.

**Keel and Posts**

The North Beach wreck has an internal white oak keel of widely varying dimensions. This component was examined over most of its length, with the exception of 12 feet (3.7 m) abaft the centerboard trunk that was obstructed by collapsed deck remains. The keel is 75 feet, 7 inches (23 m) long and made from more than one timber. It is sided a maximum of 1 foot, 3½ inches (39.4 cm) at the centerboard and is molded a maximum of about 11 inches (27.9 cm) in the bow.

At the bow, the keel was formed from the trunk of a tree, probably at the junction of a large branch. On the forward face of this naturally curved timber, the builder fashioned a flat surface 1 foot, 2 inches (35.6 cm) long, which is raked slightly forward. At the base of the keel, he made a shelf 2 inches (5.1 cm) long. The foot of the stem was placed on the shelf and against the flat surface. It is not a true butt join, nor is it much of a scarf. The join was reinforced by an apron that no longer survives. The

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4Dr. Roy Whitmore of the University of Vermont identified wood samples from the North Beach wreck.
The keel’s existence is indicated by bolts that protrude from the top of the keel and bolt holes that go through the stem. Over most of the molded bow the keel was sided between 10 and 12 inches (24.5-30.5 cm) and molded 9½ inches (24.4 cm). The keel’s upper surface was notched to accept floor timbers and rabbeted in its lower edges to accept bottom planking. The rabbet at this location was sided 1½ inches (4.1 cm) and molded 2¼ inches (7 cm).

At the point of transition between the molded bow and the edge-fastened sides the section of the keel changes in size to a sided dimension of 9 inches (22.9 cm) and a molded dimension of about 11 inches (27.9 cm). This assumes that the rabbet at this location is identical to that further forward. The actual molded measurement of 8¼ inches (21 cm) was taken to the top of the bottom planking. In this area, the keel and floors are also notched. The keel is scarfed abaft the last floor in the bow and just before the spot where the mast tabernacle stanchions were fastened through the keelson. The builder used a nibbed flat scarf, although its dimensions were not determined.

The maximum sided dimension of the keel is found where it is slotted to allow the centerboard to pass. There is also a rabbet in the keel’s upper edge to accept ceiling planks. The keel reduces in size abaft the centerboard trunk, although the precise manner of this reduction is not presently known due to our inability to excavate in this location. The keel was strengthened across its sided dimension by three bolts just forward of the centerboard slot. It was not determined whether the keel was reinforced in a similar manner abaft the centerboard trunk.

At the point of transition between the edge-fastened sides and the molded stern the keel is sided 8¼ inches (21 cm) and molded 5½ inches (14 cm) to the top of the bottom planking. Over the last foot of the stern the keel tapers, reaching a sided dimension of 5½ inches (15 cm) and a molded dimension of 6¾ inches (15.9 cm). The upper surface is notched to accept floor timbers, which have reciprocal notches.

The keel is also mortised for the sternpost. The mortise is 4½ inches (11.4 cm) long at the upper face of the keel, 3½ inches (8.9 cm) wide and 6 inches (15.2 cm) deep. Three treenails, each 1 inch (2.5 cm) in diameter, passed from one side of the keel to the other and secured the tenon of the sternpost. These treenails remain in their holes in the keel, but are absent in the mortise. A 1-inch (2.5-cm) hole in the bottom of the mortise may represent additional fastening, or may be a drain hole.

The stem survives for a length of 7 feet (2.1 m) to a point just below the caprail. The upper portion of the stem is heavily eroded, while the well-preserved lower half is rabbeted to accept the hooping ends of the hull planks. It was fastened to the notched forward face of the keel by two bolts, and to an apron by at least one bolt which survives in the stem. Close inspection of the stem revealed waterlines carved into its port side.

At least two breast hooks secured the stem to the sides of the vessel. One was located just below the caprail and slightly above the deck, while the other was directly underneath the deck planking.
All that survives of the breast hooks are their iron fastenings and the fragmentary remains of one starboard arm. Each breast hook was fastened by four bolts with threaded ends and square nuts. Each bolt has a diameter of ¾ inch (1.9 cm) and was secured with iron nuts 1¾ inches (4.5 cm) on a side.

The complete sternpost (NB-01-001, Fig. 16) was found approximately 6 feet (1.8 m) from the after end of the keel. Made of white oak, it has an overall length of 6 feet, 7½ inches (2 m). It is sided a maximum of 9 inches (22.9 cm) and molded a maximum of 10¾ inches (27.6 cm). At the foot of the post, a tenon fit into the mortise in the keel. Three treenails once passed through the keel and into the tenon, but are now absent from their holes in the tenon. One treenail hole is located in the center of the tenon. Of the other two, one passed halfway into the tenon’s after edge and the other passed halfway into the tenon’s bottom edge. The builder placed the other two so that they ran half through the tenon and half through the keel, because the tenon was not large enough to accommodate more than one complete treenail. This arrangement provided a strong attachment of post and keel and required careful boring on the part of the builder or one of his assistants.

Two iron drift pins with diameters of ¾ inch (1.9 cm) fastened the sternpost to a triangular deadwood block which, in turn, was fastened atop the keel by three more drifts. A third fastener above the two sternpost drift pins provided additional fastening to a timber which no longer survives. This timber was originally located above the triangular deadwood block. A pair of iron fish plates reinforced the attachment between the sternpost and keel. These plates have not survived, but the cut-out in the sternpost indicates that they were once fastened with a mixture of round and square fasteners.

A notch in the after face of the sternpost indicates the position of a missing transom piece that once was attached to the sternpost. The notch is located about one-third of the way from the top of the sternpost. It is 1 foot, 3¾ inches (38.7 cm) high and just under 5 inches (12.7 cm) deep. The transom piece would have been fastened by six bolts with a diameter of ¾ inch (1.9 cm). The sternpost also has iron drift pins in its top surface that once fastened a deck beam in place.

The port side of the sternpost is in remarkable condition due to its having been buried in the sediments of the lake floor. Waterlines are also visible on this post. They represent the vessel’s draft at 2 feet (61 cm), 2½ feet (76.2 cm), 3 feet (91.4 cm) and 3½ feet (107 cm). Rabbet lines begin on both sides of the post at the forward base and run up and diagonally aft to a point just under the transom

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5Artifacts were catalogued with a unique designation identifying the site, one of six categories of material, and the order in which the artifact was collected. These designators were made up of the letters “NB” for North Beach wreck. This is followed by a number indicating the type of material: 01 for wood, 02 for stone, 03 for metal, 04 for leather, 05 for glass and ceramic, and 06 for other organic material. The final number indicates collection order.
Figure 16. North Beach wreck sternpost: a) forward face, b) port side, c) after face, d) bottom view, e) top view.
piece. Portions of two hull strakes were still attached to the port side of the post, while four other nails on the port side and four nails on the starboard side indicate the fastening points of other hull strakes. White paint remnants on the forward and port-side faces of the sternpost (Fig. 17), suggest that it and the transom piece would have been visible from inside the after cabin. The after face of the sternpost is concave along its length, to allow for close placement of the rudder stock.

**Frames**

The sloop’s hardwood frames were limited to the molded bow and stern of the vessel. The forward frames consist of 13 floor timbers, each with a standing knee (Fig. 18) or futtock. In some cases, a top timber is present as well. In two instances, half frames located abaft floor timbers run between the keel and the chine. Three cants and two hawse pieces per side complete the bow framing between the stern and the first square frame.

The framing of the molded bow extends aft to an area of transition to the chine-constructed cargo hold (Fig. 19). In the bow and the transition area, the underside of the floor timbers and the upper face of the keel are notched to accept one another. The standing knees of the bow are fastened with 3/8-inch (1 cm) nails to the forward faces of the floor timbers. Where top timbers are found, they are nailed to the hull planking and overlap, but are not fastened to the standing knees. The framing appears to be fashioned from hardwoods, with the exception of one top timber in the starboard bow which is made of white pine. The top timbers have no curvature and are square in section. Shims fill gaps between the top timbers and hull planking (Fig. 20). In one instance, a piece of original bark was observed on the outboard face of a top timber. Shims were also noted between the hull planking and the first starboard futtock.

The framing is heavily deteriorated in the molded stern (Fig. 21), so that very little survives. The stern framing consist of nine floor timbers that were notched into the keel (Fig. 22). There were at least four standing knees. Heavily eroded portions of two floor timbers remain on both the port and starboard sides. No other stern framing was examined.

The chine-built portion of the vessel (Fig. 23) was framed with fore-and-aft timbers set outboard of the centerline of the hull. These are referred to as “stringers.” A large stringer is located 6 inches (15.2 cm) outboard of each side of the keel. They abut the last floor of the molded bow and end slightly beyond the midway point on the centerboard trunk. They are 22 feet, 2 inches (6.8 m) in length, sided 11 inches (27.9 cm), and molded 6 inches (15.2 cm). No fastenings were noted in these two timbers, although the bottom planks are presumably fastened to them. The stringers contributed longitudinal support to the hull and provided a surface on which the inboard ends of athwartship ceiling planks rested.
Figure 17. North Beach wreck sternpost: port side. Reproduced with permission of the Lake Champlain Maritime Museum.
Figure 18. North Beach wreck standing knee. Reproduced with permission of the Lake Champlain Maritime Museum.
Figure 19. North Beach wreck cross section at transition to bow.
Figure 21. North Beach wreck stern remains. Note keel with notches for floor timbers. Reproduced with permission of the Lake Champlain Maritime Museum.
Figure 23. North Beach wreck cross section amidship. Note the lack of framing timbers on the vessel's side.
Two other stringers, one on each side of the vessel, extend from between the fourth and fifth floor timbers of the molded bow to between the fourth and fifth floor timbers of the molded stern. It was noted that the floor timbers passed over these stringers in the bow, but no observation was made in the stern. These stringers vary greatly in dimension along their length. The forward end is sided 4½ inches (12.4 cm) and molded 3½ inches (7.9 cm). They quickly increase in size to a maximum of 8 inches (20.3 cm) sided and 4½ inches (11.4 cm) molded, while the after ends are sided 5 inches (12.7 cm) and molded 4 inches (10.2 cm). They were encountered in several locations on the site, but never completely uncovered along their entire length of 61 feet, 10 inches (18.8 m). It is unknown whether they were single timbers or built from two or more timbers scarfed together. Like the keel, they were notched in the upper face of their forward and after ends to accept floor timbers. The floor timbers in the bow were fastened to these stringers with 2 to 5 nails, and the nail patterns resemble those seen on gaming dice.

Keelson

The builder of the North Beach wreck chose white ash for the keelson. The timber begins in the area of transition between the molded bow and the chine-built amidships portion. Forward of this point, the keel and floor timbers are covered by a thin, narrow plank. The keelson survives for 16 feet, 9 inches (5.1 m) to a point 4½ inches (11.4 cm) before the forward stanchion on the centerboard trunk. Its after end is eroded, especially on the starboard side, and is believed to have originally butted tightly to the centerboard trunk. It is sided a maximum of 7½ inches (18.7 cm) and molded a maximum of 7¼ inches (18.4 cm). No portion of the keelson was discovered abaft the centerboard trunk, although the bolts that once held this timber to the keel in the molded stern are present. It is assumed that the keelson extended from the centerboard trunk to a notch in the forward corner of the stern deadwood, a distance of 29 feet, 1½ inches (8.9 m).

Planking

In the bow and stern, the vessel has longitudinal planking through fastened to the pre-erected athwartship frames. This planking is 1½ inches (3.8 cm) or 2 inches (5.1 cm) thick and ranges in width from 2 inches (5.1 cm) to 1 foot, 1¼ inches (34.9 cm). Planks of lesser width were used at the extreme bow and stern to complete tortuous planking runs. A white oak plank found lying atop the sternpost probably represents a hull strake from the molded stern. The fastening pattern on the plank coincides with the spacing of frames in the stern.

Aomidship, the builder cross-planked the hull over the keel, stringers and a chine log at the base of the edge-fastened sides. It is unclear whether the bottom planks run across the full breadth of the hull, or fit into rabbets in the side of the keel. The bottom planks are definitely interrupted where the
centerboard extends below the hull. The bottom planking amidships is 2 inches (5.1 cm) thick and made from white oak.

The sides amidship are made up of thick planks. These were laid edge to edge and a series of holes were then bored through their widths, from the top of the uppermost plank to somewhere in the lowermost plank, which is the chine log. These holes do not pass completely through the chine log. The planks were then fastened together with iron drift pins ¾ inch (1.9 cm) in diameter. This type of construction would not require caulking as would the planks of the molded bow and stern. Once the thick side planks swelled up and the drift pins rusted the planking seams would remain watertight in the same manner as Classical Period Mediterranean hulls built with mortise-and-tenon construction.⁶

The port side (Fig. 24), which was most extensively recorded, is made up of three white pine planks and one white oak plank. These planks are 4 inches (10.2 cm) thick. The lowest pine plank, or chine log, is about 6 inches (15.2 cm) thick at its base. This provides a larger surface against which the bottom planks are joined and creates a shelf on which the ends of transverse ceiling planks rest. Both the edge-fastened sides and the extra thickness at the base of the chine log contribute longitudinal support to the hull.

Ceiling planks were noted between the aftermost floor timber in the bow and just before the forwardmost floor timber of the stern. They do not survive in continuous fashion. It appears that many ceiling planks were not fastened down to either the chine log or the keel. In three instances, ceiling planks were nailed in position on the starboard side, but no fastenings were observed on six ceiling planks on the port side. Ceiling planks protected hull planks and provided even footing in the hold. They must not have contributed to the overall strength of the vessel, however, as they were only occasionally fastened in place. They appear to be made of softwoods, although no wood samples were taken due to time constraints.

Deck

On the collapsed port side a portion of the vessel’s white oak clamp survives. The clamp supported the deck beams, running beneath them and through notches in hanging knees. These knees provided additional support to certain deck beams. The surviving clamp was 3½ inches (8.9 cm) wide, 3 inches (7.6 cm) thick, and measured just under 8 feet (2.4 m) long, although fastenings in the upper side strake indicated a greater overall length. Extending the clamp into the molded bow and stern meant

Figure 24. North Beach wreck isometric of edge-fastened construction.
placing it over standing knees. The clamp in the bow and stern, therefore, had to be separate from the clamp timber on the inboard face of the edge-fastened sides.

The uppermost side plank has notches cut into its upper, inboard face to accept the ends of deck beams. On the collapsed port side three fastening holes were noted between the deck beam notches. These fastenings secured lodging knees that joined every deck beam to the side of the vessel. Other fastening holes were present for the clamp and for hanging knees.

Sixteen deck beam notches were recorded in the collapsed portion of the port side. They indicate that the beams were molded approximately 4 inches (10.2 cm) and sided from 4 inches (10.2 cm) to 6 inches (15.2 cm). The larger beams may be associated with the location of deck hatches. A portion of one deck beam containing a rigging horse was recovered, recorded, and redeposited. It was slightly eroded and had a sided dimension of 3½ inches (9.5 cm) and a molded dimension of 3½ inches (9.8 cm). This suggests an original cross section of 4 inches (10.2 cm) by 4 inches (10.2 cm). The only stanchions noted were those at the forward and after ends of the centerboard trunk. The forward stanchion was broken off well below deck level. The after stanchion had an iron drift pin protruding from its top which once held a deck beam secure to the stanchion. The upper portion of the forward stanchion does not survive to let us know it, too, had a fastener for a deck beam.

Nail holes between the deck beam notches in the uppermost side strake indicate the position of lodging knees which reinforced the attachment of the deck beams to the vessel’s sides. Two such knees were raised and recorded (Fig. 25a) and two others were noted. They were fastened by rose-headed iron nails of two lengths: 6 inches (15.2-cm) and 4½ inches (11.4 cm). Three nails were placed in each arm of the knee. Four long nails were placed close to the throat of the knee and provided most of the fastening strength. Two shorter nails were placed in each end of the knee.

Four hanging knees were found, three of which were recorded (Fig. 25b), while the fourth could not be completely exposed. The best-preserved example was approximately 3 feet (90 cm) along one arm by about 2 feet (60 cm) along the other. It was sided 4½ inches (11.4 cm). The provenance of these knees suggests that they supported the deck at the forward and after ends of the centerboard trunk (Fig. 26). The knees were fastened to the sides by two iron bolts whose heads were flattened and countersunk flush with the vessel’s side. The bolts were secured on the vessel’s interior by square nuts. A similar bolt and nut fastened the knee to a deck beam. Nails were used instead of bolts at the ends of the knees for additional fastening. The throats of the hanging knees were notched for the clamp. Three knees retained chamfering on the exposed edges to lessen injury when struck by canal boatmen working in the hold.

No securely identified deck planking was located on the site other than that on the collapsed sides. At this location, a portion of deck planking, identified as the waterway, is preserved atop the
Figure 25. North Beach wreck a) lodging knee, b) hanging knee.
Figure 26. North Beach wreck isometric view of chine construction amidship. The after portion of the centerboard and trunk are also illustrated.
uppermost side plank and below the bulwarks. The waterway on the collapsed port side is 1½ inches (3.8 cm) thick. The waterway was the channel that guided water on deck to a scupper where it was discharged overboard.

The only other evidence for the thickness of deck planking comes from the fragment of deck beam found with a rigging horse. Nails protrude only ½ inch (1.6 cm) from its upper surface, suggesting thin deck planking. It is more likely, however, that these nail held a shim in place that created deck camber for a perfectly straight deck beam. This interpretation is supported by the iron rigging horse which was secured by square nuts that still survive, presumably in their original position. This leaves a space of 7¼ inches (18.4 cm) from the nut to the collar on the rigging horse that once sat on deck. This space cannot be accounted for by the deck beam of 4 inches (10.2 cm) and deck planking of ½ inch (1.6 cm). The remaining space of 2½ inches (6.7 cm) must have been taken up by other shim material and then deck planking. Without knowing the amount of deck camber, the thickness cannot be accurately ascertained. The deck camber is known from a slightly later and larger sailing canal boat, General Butler, however. If we use this figure of 2 to 2½ inches (5.1-6.4 cm), then we arrive at deck planking with a thickness of 1 inch (2.5 cm).

Bulwarks

The bulwarks amidships consist of two washboards set one atop the other. The lower of these strakes is oak. This lower strake rests on pine chocks that are 5½ or 6 inches (14-15.2 cm) long. These chocks rest on the waterway and are spaced to create scuppers for draining the deck. The bulwarks at the bow were like those on the Isle La Motte sloop. The standing knees in the area of transition between the molded bow and the chine-built sides are evidence for this conclusion. These knees are long enough to protrude above deck level. The tops of these standing knees would have been planked over on the inside and outside and capped by a rail.

Steering Mechanisms

No remains of a rudder were found, although we can safely assume that the vessel originally had one. No evidence exists for steering by either a tiller or a wheel. Both the Isle La Motte sloop and another canal sloop found in Cumberland Bay near Plattsburgh, New York, are of the same general size and vintage as the North Beach wreck, and were both steered by tillers. The North Beach wreck was most likely steered in the same manner.
Centerboard

The vessel had a centerline centerboard to aid in steering with a wind across the beam. This device and its trunk (Fig. 27) are the most-striking features encountered by divers on this site. They are both constructed from edge-fastened timbers like the sides of the vessel. The centerboard was fastened by five iron drift pins, as is the port side of the trunk, while the trunk’s starboard side has seven drift pins. The centerboard passed through a slot cut in the keel.

The centerboard pivoted on an iron bolt that passes through the trunk (Fig. 28) and is fastened with a washer and nut. This bolt is located 1 foot, 8 inches (50.8 cm) above the keel and just over 3 feet (90 cm) abaft the forward stanchion of the centerboard trunk. A heavily concreted iron eye, located at the after end of the centerboard, was used to raise and lower the heavy centerboard.

The centerboard trunk is 15 feet, 3 inches (4.7 m) long and 9½ inches (24.1 cm) thick. It is composed of five strakes per side, edge-fastened to one another as well as fastened into the keel. The strakes vary in width from 9 inches (22.9 cm) to 1 foot, 1½ inches (34.3 cm) and are 2½ inches (6.4 cm) thick. The wood of one of these strakes was identified as birch. The forward and after ends of the trunk planks were nailed and bolted to stanchions. Notches in the uppermost strake on the port side indicate the location of deck beams.

Rigging Elements

The single mast of the North Beach wreck was stepped on deck in a tabernacle similar to the one on the Isle La Motte sloop. Originally the mast tabernacle was located 22 feet (6.7 m) abaft the stem’s forward edge. This is within a foot (30.5 cm) of the placement of the tabernacle within the Isle La Motte sloop’s hull. The tabernacle originally consisted of two stanchions, one of which survives on the starboard side, although it has collapsed forward. The heels of the tabernacle stanchions were bolted through the keel. They protruded through the deck and presumably formed a three-sided box which contained the heel of the mast.

At the head of this stanchion two bolts pass through the plank’s width. These secured iron bands around the tabernacle. Other sailing canal boat masts pivoted on large diameter iron bolts which passed through the stanchions. None was found on the North Beach wreck, but the starboard stanchion was not completely excavated. A cleat for securing running rigging also survives on the stanchion. There was no evidence of rigging blocks mounted on the tabernacle stanchions as seen on the Isle La Motte sloop.

Two iron rods protrude up from the keelson and have been bent toward the port forward quarter. These originally passed through deck beams and reinforced the hull from stresses exerted by the mast. Another iron tie-rod passed through the edge-fastened sides and ran athwartship just forward
Figure 28. North Beach wreck centerboard trunk: a) top view; b) port side.
of the mast tabernacle. It was kept in tension by a turnbuckle, which prevented the sides from buckling outward and provided additional support in the area of the mast tabernacle.

An iron rigging horse and traveler (Fig. 29) were recovered along with a fragment of associated deck beam. The horse iron is U-shaped, 2 feet, 4½ inches (72.4 cm) long and 1 foot, 3½ inches (31.4 cm) high. The stock from which the horse iron was fashioned has a diameter of 1½ inches (2.9 cm). Two collars functioned as stops and kept the traveling portion of the horse iron above the deck. The collars were not placed with care to insure that each side of the horse iron was an equal height off the deck. On one side the collar is 5½ inches (13 cm) from the top of the horse iron, while at the other end the spacing is 4½ inches (11.8 cm).

Concluding Remarks

The identity of the North Beach wreck has not yet been determined, but like the Isle La Motte sloop much is known about its characteristics as a sailing canal boat. The wreck is reconstructed (Fig. 30) at 79 feet, 6 inches (24.2 m) in length, 13 feet, 6 inches (4.1 m) in breadth, and 4 feet, 3 inches (1.3 m) deep in the hold. The data presented here indicate that the North Beach wreck is comparable to the Isle La Motte sloop, with many of the same architectural features. The North Beach wreck appears to have had a deck layout similar to the Isle La Motte sloop, but it has not survived.

The edge-fastened chine construction of this vessel, while rare, is not unique among the known sailing canal boat sites. The unidentified canal sloop surveyed in Cumberland Bay, New York, by LCMM in 1997 displays edge-fastened construction amidship, with a molded bow and a scow stern (Fig. 31). The remains of Marion, a lake sailing vessel sunk in Malletts Bay, just north of Burlington, Vermont, also has edge-fastened sides.7 Edge-fastened construction is reported for towed canal boats built in the 1880s and was also used to join together timber on ocean-going ships where longitudinal strength was a consideration.8 The earliest historical reference to edge-fastened construction is an 1831 patent.9

The type of construction used on the North Beach wreck supports the conclusion that timber depletion in the Champlain Valley necessitated that boat builders develop construction techniques that cut down on the use of expensive compass timber to frame their hulls. It also points to the relatively low

7Kevin J. Crisman personal communication.


Figure 29. North Beach wreck iron rigging horse. Reproduced with permission of the Lake Champlain Maritime Museum.
THE CUMBERLAND BAY CANAL SLOOP

Figure 31. Cumberland Bay 1997 preliminary site plan, by Kevin J. Crisman. Reproduced with permission of the Lake Champlain Maritime Museum.
cost of iron, because so much was used to fasten the hull together. Iron was especially well-suited to canal boat construction. The use of iron to brace up a hull meant that less wood was required, not only saving on the expense of wood, but also on the space taken up by wooden structure. The hulls at North Beach and Cumberland Bay had more space available for cargo because less of their interior was taken up with wooden reinforcing timbers.

Further economies were derived in chine-building from wage savings. A vessel built like that at North Beach could be put together by practically any house carpenter. It would only require a boat builder to construct the molded stem and stern. Even here we see economies in using shims rather than shaping framing timbers to meet hull planks. The use of so many straight, square timbers would also help produce a low-cost boat. The presence of shims, bark on timbers, and softwoods for some framing timbers, all indicate attempts at cost savings. Chine construction is central to this effort at keeping costs down through the utilization of traditionally less-desirable and thus cheaper and more available wood species, fewer molded timbers, alternative materials, and less-skilled carpenters.

The edge-fastened method employed on the North Beach wreck required a different order of construction from more conventional plank-on-frame boats. The North Beach wreck was built by first laying out and fastening the vessel's bottom. Next the edge-fastened sides were constructed while lying on the ground and then raised upright up and braced. This construction sequence is supported by a photograph depicting the building of a canal boat in Northumberland, New York, in the late 1800s, which shows sides that are braced up. Once the sides were fastened to the bottom, then the molded stem and stern were added. This was done by placing standing knees in the ends of the edge-fastened sides and continuing forward in the stem and aft in the stern. These frames were then planked over. The planking was continued over the exterior of the edge-fastened sides where the planks had been cut down on their outer surface. From this point the deck was laid out in a fairly traditional manner of fitting deck beams and framing out hatchways. It was at this time, too, that tabernacle stanchions were set up for masts stepped on deck.

Alternative methods for building flat-bottomed vessels with vertical sides are explored in the next two chapters. Here we will examine two more archaeological examples of chine-built hulls from the final class of sailing canal boats. They represent the peak of sailing canal boat building in the Champlain Valley during the nineteenth century, reflecting the lessons learned from constructing earlier boats.

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10“Canal boat being built in Northumberland, New York.” Canal Boat Photographic Collection, New York State Library.
CHAPTER X

THE CANAL SCHOONER GENERAL BUTLER (VT-CH-590)

The discovery of a wreck off the Burlington, Vermont, breakwater in 1980, which was identified as General Butler from an 1876 newspaper account of its sinking,¹ is one of the most significant archaeological finds in Lake Champlain for several reasons. The exciting story of its dramatic loss sparked considerable public interest, which helped in designating the site as one of Vermont’s first underwater preserves. Initial examination of the remains by archaeologists provided the first clues that culminated in the rediscovery of sailing canal boats as a class of inland watercraft. This led to a re-classification of the Isle La Motte vessel as a canal sloop and helped to identify subsequent archaeological finds as sailing canal boats. The investigations of General Butler conducted over a span of 15 years have produced more historical and archaeological information than for any other sailing canal boat wreck.

**Historical Context**

The circumstances surrounding the sinking of General Butler are recounted here to provide a context for discussing the world in which sailing canal boats, and specifically General Butler, operated.² This wreck provides an especially interesting study because the passengers and crew survived a catastrophic event that unfolded in front of the citizens of Burlington, Vermont. The story of General Butler’s sinking illuminates the harsh reality of operating a vessel in the Champlain Valley during the mid-nineteenth century and provides a good introduction to the wreck of this vessel. The sequence of events on that fateful day also provided the means to positively identify the archaeological site as General Butler.

On December 9, 1876, Captain William Montgomery and his boat General Butler prepared to depart from Isle La Motte with a cargo of 12 marble blocks stowed in the hold and an additional block placed on deck at the bow. The captain wanted to get in one more profitable voyage before ice forced him ashore for the winter. Montgomery scanned the sky over the New York mountains before he slipped his lines and headed off to Burlington, Vermont.

The Burlington Manufacturing Company, the intended destination, was one of the largest industries in the town. Its owner, Lawrence Barnes, had recently converted an existing mill into a

¹*Burlington Daily Free Press and Times*, December 11, 1876.

marble works, selling his products for an average of 50 cents per foot. The low price for sawn marble illustrates how little Montgomery stood to make for his efforts.

Captain Montgomery brought his teen-aged daughter and her friend along so that they could do some Christmas shopping in town. General Butler also carried one crewman, and an Isle La Motte quarry owner, Elisha R. Goodsell, who sought medical attention for an injured eye. An experienced lake navigator with a solid reputation, Montgomery would not have placed his daughter, a deckhand, and two passengers at risk intentionally. The weather on the lake, unfortunately, can produce sudden and unpredictably severe storms.

The clear sky that Montgomery noted on his departure soon disappeared and a savage winter storm descended upon the 14-year-old canal boat as it approached the north end of the town's harbor. The boat's steering mechanism failed, and the captain ordered his deck hand to set a storm anchor to give them time to chain a tiller to the gear on top of the rudder stock. The storm grew to an unusually ferocious intensity, blowing the boat to the south end of the breakwater, but completely shredding the sails before it could get around into sheltered water. Abandoning all hope of getting the boat ashore, Montgomery ordered the anchor line cut. The vessel drifted to the breakwater, riding wave after wave up onto the stone-filled wooden cribs of the breakwater and pounding back down into the seas (Fig. 32). One-by-one the passengers and crew jumped from the vessel's bow to the relative safety of the breakwater. Captain Montgomery leaped as the crippled hull rode one final wave onto the breakwater and then slipped suddenly beneath the waves.

Burlington residents flocked to the waterfront to stare aghast at the spectacle playing out before them. Among these people was the town's ship chandler, James Wakefield, who was a veteran of the British Navy and had averted a similar disaster at sea by courageously cutting away rigging that threatened to capsize a ship. He and his son Jack commandeered a government rowboat used to service the breakwater's lighthouse. They pulled out to the breakwater, where Jack kept a firm grasp on the tiny rowboat, while his father and Captain Montgomery assisted passengers, including Goodsell who was dizzy after having been knocked unconscious jumping from General Butler. After everyone scrambled

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Figure 32. **General Butler** seconds before sinking off Burlington, Vermont, by Kevin J. Crisman. Reproduced with permission of the Lake Champlain Maritime Museum.
aboard the tiny row boat, the Wakefields pulled back to shore, where a local physician declared everyone in fine health.

The boat’s discovery 104 years after it sank led to further investigations that provided a great deal of information about this boat and its history. The newspaper account of the sinking, years of archaeological investigations, and in-depth historical research have made this one of the most-studied and best-understood of inland watercraft.

From General Butler’s original enrollment document we can surmise that its construction began some time in the winter of 1861-62 at the Hoskins and Ross boat yard in Essex, New York. The vessel was described in the jargon of the day as a “Lake and Canal Boat,” or an “L & C Boat” for short. On August 28, 1862 Jabez G. Rockwell of Alburg, Vermont and his partner Edwin H. Langdon enrolled the still-to-be-completed vessel under the name General Butler. This canal schooner had an active career for 14 years before it sank in Burlington Bay.

Essex, New York turned out as many sailing canal boats as did Burlington, Vermont directly across the lake. Orson Spear constructed vessels in both of these towns. The boat building industry in Essex predates the canal, although activity continued at a heightened pace after the canal opened. The canal spurred other towns, especially in the northern part of the lake, to begin building boats. Sailing canal boats were produced predominantly in northern lake towns such as Champlain, Chazy, Plattsburgh, and Essex, New York, and in Highgate, St. Albans, Swanton, and Burlington, Vermont.

Edwin Langdon and Jabez Rockwell named their canal schooner after Civil War General Benjamin F. Butler, who distinguished himself early in the war by marching an army to the defense of Washington, D.C. He later became notorious by accusing soldiers in Vermont’s 7th infantry of cowardice during the Battle of Baton Rouge in August of 1862 and as the military commander of New Orleans. Butler displayed a penchant for autocratic acts that earned him the nickname “Beast Butler.” Considering these facts, it is somewhat surprising that a vessel that worked in Vermont retained the name General Butler.

General Butler’s owners must have speculated that wartime trade would keep their new boat busy and it probably did. Rockwell and Langdon sold General Butler three years later, after having

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3Enrollment document for the canal schooner General Butler, dated August 28, 1862. Record Group 41, Civil Reference Branch, United States Archives.


profited sufficiently to recoup their investment. Enrollment documents indicate that this was a common pattern of boat ownership for those vessels not employed by a boat line. At first businessmen, usually in association with a lakeman, would have a boat built on speculation. After a few years of success, in which time the boat would be paid off, the property usually passed to lakemen acting as sole proprietors. A towed canal boat in New York cost about $1200 to build, with sailing canal boats slightly more expensive due to their rigging. Orson Spear built canal sloops for between $1,500 and $1,675 in the 1840s.10

*General Butler*’s new owner, in 1865, was a lakeman named Julius Rugar from Plattsburgh, New York. Rugar had previously owned and operated a sailing canal boat and enjoyed a career on the lake long after he had sold *General Butler* in 1868.11 *General Butler*’s next owner was William Montgomery who lost the vessel in 1876. Like Rugar, Montgomery had earlier been sole owner and master of a canal sloop.12 Both Rugar and Montgomery were lakemen who traded up from canal sloops around 80 feet long to a vessel of the 1862 class. Rugar and Montgomery kept their vessels and themselves out on the lake from the moment ice receded in March or April until as late in the year as they possibly could to earn enough money before the winter freeze forced them ashore. The two lakemen owned and operated *General Butler* after the peak years of sailing canal boat trade. After 1865 steam transportation on land and water commanded the majority of freight business. Competition with railroads and steam tugs decreased sailing vessel’s profit margins and pushed lakemen to take risks by sailing until the last day of the navigation season. These men also worked well beyond a reasonable age of retirement from such a demanding life. Julius Rugar is an extreme example who died in November of 1903 while delivering a cargo of potatoes from his home port to New York City, after a career of at least 54 years on the lake.13

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9H. Hall, "Canal-boats," in *Report on the ship-building industry of the United States*, p. 224. Hall states the price for a canal boat on the Delaware and Hudson Canal in 1880 in New York, whose locks were smaller than those on the Champlain Canal.


12Enrollment document for the canal sloop *Young America*, dated July 6, 1866. Record Group 41, Civil Reference Branch, United States Archives.

Captain William Montgomery was another hearty, tough-driving boat handler. His career spanned more than half a century and saw him in peril with sailing craft on three separate occasions, two of which were eerily similar. The first incident, the wreck of General Butler on December 9, 1876, was recounted above. On the same month and day 26 years later, a 72-year-old Captain Montgomery found himself caught up in the same situation he had been in with General Butler. This time he managed to limp into harbor with tattered sails and ice thickly formed on the rigging. Despite these risks to the life of a lakeman, Captain Montgomery lived to retire and reached 92 years of age.\textsuperscript{14}

William Montgomery and other hardy lakemen left sailing canal boats on the lake bottom that are time capsules full of information not contained in the historical record. From the newspaper account of its loss we gain no impression concerning the specifics of General Butler's overall appearance. We do have some descriptive information from merchant vessel enrollment documents. It takes archaeological investigation, however, to provide a wealth of details regarding General Butler's design, construction, and appearance as a boat distinct from other canal boats and other sailing boats.

\textbf{Discovery and Excavation}

In May of 1980 two local sport divers were exploring the Burlington breakwater and stumbled across the intact remains of General Butler. They reported their discovery and word reached the Champlain Maritime Society (CMS). Arthur Cohn and Kevin Crisman, two CMS members, conducted an initial survey that revealed a canal boat hull, which at one time stepped two masts on deck. This was the first time that modern historians and archaeologists of Lake Champlain recognized that sailing canal boats had existed.

In 1981 CMS sponsored an investigation of the General Butler's remains under a phase two survey permit issued by the Vermont Division of Historical Protection (VTDHP). This enabled field research to collect data and recover and conserve artifacts to aid in interpreting the site. The University of Vermont's archaeological laboratory agreed to conserve the artifacts and the Shelburne Museum agreed to curate the collection.

Arthur Cohn and archaeologist Kevin Crisman put together a team and diving operations were conducted over nine days during the summer of 1981. Divers measured the vessel's overall dimensions and details of boat architecture such as deck features and frame spacing. A preliminary site plan (Fig. 33) was drawn up from this information. The structural integrity of the vessel was evaluated to determine if the site could be included in an underwater park system open to the public.

Figure 33. *General Butler* 1982 preliminary site plan, by Kevin J. Crisman. Reproduced with permission of the Lake Champlain Maritime Museum.
The dive team examined the vessel’s steering mechanism to corroborate historical accounts with the remains of *General Butler*. Researchers found that the wreck has a tiller chained atop the rudder stock in a makeshift attempt to control the rudder. This indicates that the wreck was, indeed, *General Butler*. Artifacts associated with the vessel’s operation were recovered from inside the bow and additional artifacts were collected from the stern cabin that relate to life on board a sailing canal boat.

The results of this investigation were reported to VTDHP and included in a CMS publication on nautical archaeology projects in Lake Champlain.15

In 1982, a second campaign of investigations aimed at detailing the construction of the hull exposed above the mud line, in particular the framing components in the bow and stern. Diving operations were conducted over ten days in June. Deck recording concentrated on a plan of deck planking and its fastenings. The side and transom planking were also studied. Deck features incompletely understood from the previous year’s research were re-examined. An extensive photographic study was done to create a visual record of important features whose design and dimensions had been recorded. The results of the 1982 season along with historical research were again published by CMS.16

In 1983, a small crew returned to *General Butler* for two days to clarify and supplement information from the previous two years. The crew excavated and recorded the exterior of the stern at the base of the rudder stock and sternpost to expose and record the vessel’s keel. On August 22, 1988, divers working on another wreck in Burlington Bay made three dives on *General Butler*. Divers returned to the boat to obtain further details regarding the vessel’s windlass and steering apparatus. No further field work took place on *General Butler* until 1993, but in the interim further publications came out and the vessel was turned into one of the favorite destinations in Vermont’s Underwater Historic Preserve System.17

In 1993, *General Butler* again became the focus of investigations when the City of Burlington, Vermont, decided to improve their waste-water treatment facility. The work called for dredging near the archaeological site. Cohn worked out a monitoring program with the city and their contractor that kept

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an eye on sediment levels in the area. This also provided the first opportunity to excavate
archaeologically within the hull. The primary objectives of the project were to gather information on the
vessel’s bottom construction and the transition from the keel to the end posts to aid in reconstruction of
the hull. A secondary goal was to assess site condition a decade after the last serious study. The project
consisted of two weeks of investigations in May, followed by regular silt monitoring over the next year.
The final site recording took place in June 1995.

The project participants in 1993 and 1995 included the Lake Champlain Maritime Museum
(LCMM), Texas A&M University (TAMU), the Institute of Nautical Archaeology (INA), and
Waterfront Diving Center (WDC). Captain Fred Fayette, a modern-day owner and operator on the lake,
piloted his vessel R/V Neptune, which was a luxurious work platform in comparison to previous
project’s small inflatable boats. Additional support in the form of docking facilities was provided by the
Lake Champlain Transportation Company (LCTC).

Investigations began inside the hull by using a water-induced dredge to place a trench just
forward of the centerboard trunk, beginning at the keelson and running to the starboard side (Fig. 34).
The excavation uncovered ceiling planking which was removed to expose the vessel’s floor timbers and
bottom planking. Divers recorded these features as well as futtocks, hull and ceiling planking, and the
deck beams and deck planking overhead. Detailed measurements provided information used to produce
a cross section for General Butler’s hull construction. The team also excavated the base of the stem
along the vessel’s port side exterior until the keel was exposed. The curvature of the stem and other
features like the camber of deck beams were recorded with a new electronic device called a goniometer,
which consists of a digital carpenter’s level housed in a water-tight case that can be used to measure the
angle of a given surface.18 Curvatures are recorded as a series of angles. The field work revealed that
General Butler was chine-built vessel, but of a different variety than the North Beach wreck.19

In 1995 excavation inside the starboard bow revealed the framing timbers of the interior bow,
as well as artifacts associated with the operation of the vessel. The team also excavated and recorded
the transition between the molded stem and the chine-construction of the starboard side. Divers used a
goniometer to record the shape of the vessel’s sheer line and several hull section on the exterior of the
plank from the bulwarks down to the mud line. Finally, the stern deck and remains of the steering
apparatus were inspected to see if the vessel’s original steering mechanism could be figured out.

18 J. Cozzi, “The Goniometer: An improved device for recording submerged shipwreck

19 J. Cozzi, “Chine Construction on Sailing Canal Boats of Lake Champlain.” in Underwater
Archaeology Proceedings From the Society for Historical Archaeology Conference, ed. R. P.
Woodward and C. D. Moore, pp. 103-07.
Figure 34. Excavating with a water-injection dredge inside General Butler in 1993.
Hull Remains

Excavation within the cargo hold and bow compartment of General Butler have provided details of its construction that are not known from the Isle La Motte sloop. To recall Kevin Crisman’s quote from the first chapter, we can now say that nearly as much is known about this vessel below the mud line as is known above it. There has been no opportunity to excavate inside the stern of General Butler, which would help provide more information about its distinct form of chine construction. More is known, however, about this hull than that of any other archaeological example of a sailing canal boat. For an examination of General Butler we begin at the bottom.

General Butler is an intact vessel that sank quickly while loaded with a heavy cargo. This caused the hull to settle deep into bottom sediments, and over the course of another century additional sediments collected in the hold. Tons of marble, silt, and sand hide much of the bottom, but excavations undertaken in 1983, 1993, and 1995 have provided significant information. General Butler, like watercraft for hundreds of years, was built on a backbone comprised of four centerline timbers (keel, stem, sternpost, and keelson). The form of these timbers reflects General Butler’s inland heritage, where sailing on sheltered waters and towing through canals called for different arrangements than those found on ocean-going vessels. A list of General Butler’s scantlings and principal dimensions can be found in Appendix G.

Keel and Posts

Although obstructed by cargo and sediments, General Butler’s keel was examined at the stem, stern, and at one location amidship. These investigations revealed a keel plank fashioned from hard maple, which has a much greater sided than molded dimension, as opposed to a true keel of substantial molded thickness. General Butler’s keel plank is estimated to be 84 feet, 8 inches (25.8 m) in length. Its maximum sided dimension was measured at 1 foot, 3½ inches (39.4 cm), with a molded dimension measured at 4⅞ inches (12.1 cm). The keel plank projects only slightly beneath the hull planking and would not have provided much lateral resistance when under sail, a characteristic common to flat-bottomed craft.

There is no evidence for a rabbet in the keel plank. General Butler’s keel plank was simply another bottom plank, which was not intended to provide great longitudinal support and did not require a rabbet to make a watertight join with the garboard. Further study is required to determine if the keel plank consists of more than one timber, as well as how it was fashioned amidship to permit a centerboard to pass through and extend beneath the hull.

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20Dr. Roy Whitmore of the University of Vermont identified wood samples from General Butler.
The builder reduced the keel plank’s sided dimension to 7 inches (17.8 cm) at the forward and after ends, to meet the posts. The stem merely butts to the end of the keel plank, while the sternpost sits on top of deadwood placed on the keel plank. This arrangement is due to the keel plank’s lack of molded dimension. There is no scarf between the stem and keel plank and no mortise and tenon join at the stern as seen on the North Beach wreck. The builder relied on the timbers fastened to the keel plank and posts for a secure join.

*General Butler*’s stem assembly is comprised of a post and an apron, whose more substantial molded dimensions reflect traditional centerline timbers. The post (Fig. 35) was made from a single piece of white oak 10 feet, 5½ inches (3.2 m) long, and when viewed in section has six sides. The builder narrowed the forward portion of the stem to create better water flow over the vessel’s bow. The forward face of the stem is sided 4 inches (10.2 cm) and this dimension increases to 1 foot, 1⅜ inches (34.3 cm) at a point 10 inches (25.4 cm) abaft the stem’s forward face. This is the maximum sided dimension which is carried for another 5 inches (12.7 cm) to the interior face of the stem, giving the stem a molded dimension of 1 foot, 3 inches (38.1 cm). A rabbet begins 7 inches (17.8 cm) below the stem head where the sided dimension narrows, and follows the curvature of the stem downward.

The apron was fashioned from a white oak crook, and provides the connection between the keel plank and the stem. This component rises 2 feet, 11½ inches (90 cm) off the keel plank, and is joined to the stem by a flat scarf. The stem is notched in two places so that it sits upon the head of the apron, as well as on a table created by a notch in the forward face of the apron. The apron runs for a distance of 3 feet, 7 inches (1.1 m) along the top of the keel. It has a maximum sided dimension of 1 foot, 2 inches (35.6 cm) on the interior of the vessel, where it abuts the first floor timber, and narrows to 7 inches (17.8 cm) at the forward end of the keel plank. The broad apron provides a surface for attachment of hull planking, as there is no rabbet in the keel plank. The apron increases in both sided and molded dimension as it rises off the keel toward the stem. It is molded 5 inches (12.7 cm) above the keel plank, 1 foot, 6 inches (45.7 cm) at the throat, and 5 inches (12.7 cm) at its head on the stem.

On the exterior of the vessel there is a stopwater visible between the stem and the apron where the flat scarf turns, although it was not determined whether a matching stopwater exists on the interior turn of the scarf. Two iron bolts fasten the stem and apron together, with the head of the upper fastener visible on the apron’s interior surface, although the second is obscured by windlass bits that rest upon the apron. The 1-inch (2.5-cm) head on the visible fastener suggests a ¾-inch (1.9-cm) diameter bolt. The other ends of these through bolts protrude from the forward face of the stem, which is covered by an iron rub plate. A square nut, placed within a square cutout in the rub plate, secures each of these bolts. Two more 1-inch (2.5-cm) diameter heads were noted atop the forward end of the keelson indicating that similar bolts pass through the apron and keel plank.
Figure 35. *General Butler* longitudinal profile of stem.
The iron rub plate protecting the forward face of the stem extends from the stem head onto the keel for an undetermined distance. The iron plate is 4 inches (10.2 cm) wide and 1 inch (2.5 cm) thick, and is fastened to the stem and keel with iron bolts. An eye welded to the top of the rub plate anchors the lower dead-eye for the forestay. The stem head has a sides dimension of only 8½ inches (21.6 cm) at a point 10 inches (25.4 cm) beneath the stem head, which creates a table that serves as an attachment point for the bulwark's caprail. Three breast hooks are bolted to the interior face of the stem. One breast hook is above deck level, a second is located immediately below the deck planking (i.e., a deck hook), and the third is located approximately halfway between the deck and the bottom of the vessel. The uppermost breast hook was identified as white oak.

*General Butler's* white oak sternpost (Fig. 36) is visible in the after cabin from just under the main deck to just below the cabin deck. It is 7 feet, 11 inches (2.4 m) long and consistently molded and sided 7 inches (17.8 cm). The sternpost sits plumb atop two deadwood pieces that are in turn resting upon the keel plank. Other than this, little is known about the deadwood arrangement as it is obscured on the vessel's interior by the after cabin's deck planking. The end of a bolt could be felt by a diver touching the bottom surface of the keel plank just forward of the sternpost and likely holds the keel plank and deadwood together. An iron strap 2 inches (5.1 cm) wide passes beneath the keel plank and up each side, ending on the sternpost, reinforcing the join of the keel plank, deadwood and sternpost.

The forward face of the sternpost is notched for two transom pieces placed one above the other. These frame the base of the transom and provide an attachment point for the ends of hull planking called "hooding ends" or "hood ends." The sternpost's port and starboard faces are rabbeted, beginning at the forward edge of the base and angling upwards toward the after edge of the sternpost at the level of the first transom piece. The upper transom timber (Fig. 37) is 11 feet, 7 inches (3.5 m) in length along its upper surface while its lower surface is 10 feet, 1 inch (3.1 m) in length. It is sided 9½ inches (24.1 cm) and molded 6 inches (15.2 cm). The lower transom timber is located 1 foot (30.5 cm) below the upper timber, and is 4 feet, 5 inches (1.3 m) long on its top surface, tapering to 3 feet, 1 inch (94 cm) along its base. It is sided 7 inches (17.8 cm) and molded 4 inches (10.2 cm). Standing knees spiked to each end of the upper transom piece define the curvature of the transom. The arms of the knees are 1 foot, 6 inches (45.7 cm) long where they rest on the transom piece, and 2 feet, 6 inches (76.2 cm) long against the hull planking. Six vertical timbers run between the upper transom piece and the aftermost deck beam, providing nailers for transom planks as well as framing in four stern cabin windows. Each window frame is sided 3 inches (7.6 cm) and molded 5 inches (12.7 cm).
Figure 36. General Butler longitudinal profile of stem.
Figure 37. *General Butler* cross section of stern, by Kevin J. Crisman. Reproduced with permission of the Lake Champlain Maritime Museum.
Frames

The remarkably intact hull of General Butler provided a challenge to studying the vessel’s framing, because few frame ends are exposed in comparison to sites where the upper portion of the hull has deteriorated away over time. Detailed recording of fasteners in ceiling and hull planking, together with excavation of a trench across the bottom of the vessel, and recording of areas where planking deterioration exposes frames, permits discussion of frame locations and assembly methods. General Butler’s hull was not built like most ocean-going vessels. Like the North Beach wreck, it is an example of a bottom-built vessel where the builder conceived of the vessel’s bottom as a separate component to be built first. This was followed by erecting the sides of the hull. General Butler does not have edge-fastened sides, like the North Beach boat, but has square-sectioned chine logs to provide the transition from floor timbers to futtocks (Fig. 38), and to provide longitudinal support absent in the keel plank. Both General Butler and the canal sloop at North Beach are examples of chine-built boats, and both have timbers that can be termed chine logs, but the construction of their bottoms and sides are very different.

Following the laying of General Butler’s keel plank the builder installed 29 floor timbers, which determined the size and shape of the cargo hold. Alternatively, the builder may have laid all the bottom planking with the keel plank prior to the installation of frames. The floor timbers are located atop the keel plank at intervals of 2 feet (61 cm) measured from leading edge to leading edge (room and space), with a slightly closer spacing at the bow and stern. Straight-grained white oak was used for the floor timbers. They extend across the width of the bottom, except amidship, where eight framing stations are interrupted by the centerboard and half-frames are used. The 29 floor timbers are uniformly 13 feet, 6 inches (4.1 m) long and molded and sided 5 inches (12.7 cm), giving General Butler a completely flat bottom. Two limber holes were cut into the lower surface of the each floor timber, one on the port and one on the starboard side, at a distance of 4½ inches (11.4 cm) from the edge of the keel plank. Each limber hole is 3/4 inch (1.9 cm) high and 2½ inches (6.4 cm) wide.

The builder next set up chine logs made of hard maple that define the outboard end of the vessel’s bottom and provide a base for the port and starboard sides. As only the forward end of the starboard chine log was uncovered, we do not know the precise length of the chine logs, but they are estimated to be 58 feet, 4 inches (17.8 m) in length. The starboard chine log begins 11 feet, 10 inches (3.6 m) from the forward face of the stem, and is presumed to end just before the after cabin in the stern. The starboard chine log’s molded and sided dimensions were measured at 10 inches (25.4 cm) and 10½ inches (26 cm) respectively. The chine logs have mortises cut into their interior faces that match one-sided dovetail tenons fashioned on each floor timber’s end. The builder formed the tenons on the floor timbers by removing ¾ inch (1.9 cm) from the molded and sided dimension over a span of 6 inches.
Additional material was removed from the after face of each floor timber's tenon to create the one-sided dovetail. Once a chine log was placed over the ends of each floor timber, the mortise-and-tenon joints were locked with keys driven into the mortise at the forward face of the floor timbers (Fig. 39). The key examined in the 1993 amidship trench was made from hard maple and was 1½ inches (3.8 cm) high, 2 inches (5.1) wide, and protruded from the mortise 2¼ inches (5.7 cm).

The chine logs also serve as the point of attachment for futtocks (also called side frames) that determine the height and shape of the vessel's sides. Like the floor timbers, futtocks are fashioned from straight-grained white oak and have no curvature, except for a slight reduction in molded dimension at their outboard heel, which gives a slight curvature that continues on the outboard face of the chine log. Futtocks are secured to the chine log by keyed, mortise-and-tenon joints that are presumed similar to those between the floor timbers and chine logs.

The futtocks rise up from the chine log between 5 feet, 6 inches and 6 feet (1.7-1.8 m) to deck level. Their dimensions vary slightly over their length, but they average 4 inches (10.2 cm) molded and sided at the heads. The few that were examined midway between their heads and heels proved to be ¼ inch to ½ inch (6.4-12.7 mm) larger in section. Room and space for the futtocks varies between 1 foot, 8 inches (50.8 cm) and 2 feet, 3 inches (68.6 cm), and averages 1 foot, 11 inches (58.4 cm). The mortises in the chine log for the futtocks are placed between those for the floor timbers, rather than directly atop the floor timbers.

At this point the builder turned his attention away from the chine log construction amidships to frame the bow and stern in a fashion that is referred to in merchant vessel enrollment documents as a "moulded" bow and stern, as opposed to the "scow" bow or stern, which the New York Canal Board outlawed in 1846. This left builders to produce hulls with either a semi-circular or a molded bow. The molded bow is a more traditional construction where floor timbers and futtocks butt against each other or overlap to provide the vessel's shape. In General Butler's bow the builder placed three floor timbers forward of the chine log. These are in addition to the 29 floor timbers that frame the chine-built amidship section. The forwardmost of these transitional floor timbers in the bow is molded 5 inches (12.7 cm) and sided 10 inches and marks the forward end of the cargo hold. Forward of this point is storage space for equipment used in operating the vessel.

Along each side are nine futtocks in the form of standing knees, placed between the chine log and the forwardmost floor timber in the bow. Forward of the first floor timber, the bow is framed with three pairs of cants radiating from the vessel's centerline and an additional two pairs of cants that begin slightly away from the centerline. The cants that start on the centerline are comprised of two timbers.

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butted against one another with a small scab timber placed along the forward face over the butt join. A hawse piece on each side of the stem completes the bow framing. The dimensions for the standing knees are the same as those for the floor timbers and futtocks farther aft, while the cant timbers are molded as much as 6 inches (15.2 cm) at some locations.

Two floor timbers were examined beneath the after cabin’s flooring and found to be molded and sided 5 inches (12.7 cm). It is believed that four additional floor timbers lie in the stern based on the spacing of observed floor timbers and the remaining available space. This brings the total number of floor timbers to 38 throughout the hull. Standing knees were presumably used to make the transition from bottom to side abaft the chine log in the stern. This practice is seen in General Butler’s bow and is found in the molded stern of the North Beach wreck. In General Butler top timbers were placed directly abaft these standing knees. The molded and sided dimensions of the stern standing knees and top timbers are between 4 and 5 inches (10.2-12.7 cm), although the head of one futtock is only 3½ inches molded and sided.

**Keelson and Sister Keelsons**

*General Butler* has a keelson flanked by two sister keelsons. The central keelson begins over the apron in the bow and probably extends to beneath the sternpost. All three keelsons are similar to the keel plank in that they were fashioned from hard maple and are much greater in sided than molded dimension. The keelson amidship is molded 3½ inches (8.9 cm) and sided 1 foot 3¾ inches (39.1 cm). The sister keelsons are molded 3¾ inches (9.5 cm) and sided 10 inches (25.4 cm). When a section of the starboard sister keelson was cut out to permit examination of the timbers beneath, it was found to be fastened down to a floor timber with two iron drift pins, each ½ inch (1.6 cm) in diameter.

In the bow the keelson is sided 9½ inches (24.1 cm) and molded 2 to 3 inches (5.1-7.6 cm). The sister keelsons were not found at the forward face of the first floor timber and probably terminate atop this timber. The keelson was fastened to the apron with two iron fasteners whose heads measure 1 inch (2.5 cm) in diameter.

**Planking and Ceiling**

*General Butler*’s garboard on the starboard side is 1 foot, 4 inches (40.6 cm) wide and followed in succession by the first through fifth bottom strakes with widths of 1 foot, ¼ inch (31.1 cm), 10¼ inches (26 cm), 10 inches (25.4 cm), 9 inches (22.9 cm), and 10¾ inches (27.6 cm) respectively. All six bottom planks were identified as hard maple. The bottom planks are 2 inches (5.1 cm) thick, with the possible exception of the garboard whose thickness could not be precisely determined. The outermost bottom plank sits in a 1¼-inch (3.2-cm) by 2-inch (5.1-cm) rabbet in the inboard base of the chine log, as does the lowermost side plank at the upper outer edge of the chine log. *General Butler*’s side
planking is also 2 inches (5.1 cm) thick, with the exception of four wales on each side which are 3 inches (7.6 cm) thick. Side plank widths vary between 4½ inches (12.1 cm), at the bow hooding ends, to 10 inches (25.4 cm) amidships. There are five planks above the chine log followed by three wales, another plank, and a final wale at deck level. The wales range between 5 and 7 inches (12.7-17.8 cm) wide. The lowermost starboard wale is comprised of at least three, and probably four, separate planks. There is an area of missing planking at the starboard bow that corresponds to where the next join in the planks is expected, so the number of planks cannot be precisely determined.

Seven wood samples, taken from planks on the starboard side, proved to be white oak. During the excavation in the hold in 1993, however, a knowledgeable crew member noted that the third side plank up from the chine log appeared to be pine. This identification, while tentative, most likely represents a repair, which would not have been uncommon for a 14-year old vessel. *General Butler*’s hull planking is fastened to the floor timbers, chine logs, and futtocks with square iron nails with a cross section of 5/16 inch to 3/8 inch (20.3-24.3 cm). Each frame and plank intersection is fastened with at least two and sometimes three nails. No evidence of caulking was noted, but was presumably used.

On *General Butler*’s starboard side the ceiling is comprised of five white pine planks laid atop the floor timbers, and six planks placed over the futtocks. The plank next to the sister keelson is 1 foot, ¼ inches (31.1 cm) wide and 2¼ inches (5.7 cm) thick. The next four floor ceiling planks are 2 inches (5.1 cm) thick, and moving outboard are 1 foot (30.5 cm), 1 foot, ½ inches (31.8 cm), 1 foot, ½ inches (31.8 cm) and 7½ inches (19.1 cm) wide respectively. The ceiling on the vessel’s side is all 1 inch (2.5 cm) thick. Beginning at the clamp, and moving down, the ceiling is 10¼ inches (27.3 cm). 9 inches (22.9 cm), 10¾ inches (27.3 cm), and 9 inches (22.9 cm) wide. Two ceiling planks are missing over a span of 1 foot, 10¾ inches (56.5 cm). They may have come off since the vessel sank or, alternatively, they may never have been installed. All ceiling planks are fastened to the frames by iron nails. The forward ends of the ceiling are nailed to the stern’s interior face, and run up to, but not into, the stern cabin.

**Clamp and Hogging Truss**

The clamps provide internal longitudinal support to the hull in the way that the wales do outboard. They also support the deck structure by running from stem to stern beneath the ends of the deck beams. Each clamp is fastened to the futtock heads by an alternating pattern of spikes and bolts. Each ½-inch (1.3 cm) diameter bolt is secured with a 1½-inch (3.8 cm) square nut. *General Butler*’s starboard clamp is sided 5 inches (12.7 cm) and molded 3 inches (7.6 cm). At the bow the clamps lie partly over the deck hook by 1 foot, 9 inches (53.3 cm) on the port side and 1 foot, 5 inches (43.1 cm) on starboard. To accomplish this the builder cut 2½ inches (6.4 cm) from each clamp’s upper surface and a
like amount from the deck hook's lower surface. No fasteners were noted at this overlap. In the stern the clamps run all the way to the transom.

Wooden hogging trusses provide additional longitudinal support for General Butler. A truss was placed on both the port and starboard sides and fastened over the ceiling planking and into the futtocks (Fig. 40). Each truss consists of three timbers (a horizontal top timber and two diagonal braces). The starboard top timber is 15 feet, 4 inches (4.7 m) long and is located approximately amidships and directly below the clamp. From each end of the top timber a brace runs diagonally fore or aft down to the chine log, into which they are presumably mortised. The hogging truss timbers are fastened by two spikes to each futtock along their lengths. The structure is additionally reinforced by two iron rods placed at the ends of the truss' top timber. These run vertically down to the chine log, as well as athwartship, and presumably, down to the chine log on the opposite side. The iron work keeps tension between the vessel's bottom and deck as well as between the two sides. The truss' top timber is sided 9½ inches (24.1 cm) and molded 3 inches (7.6 cm), while the braces are similarly sided, but molded only 2 inches (5.1 cm). The overall length of the hogging truss is approximately 50 feet (15.2 m).

The horizontal top timber was made from red oak, which is not a preferred shipbuilding timber due to its porous structure that allows water to penetrate the wood, causing rot and weakening the timber. Its use high up in the hull, where it was not subject to repeated soaking and drying, suggests a conscious decision on the part of its builder to economize through timber selection. The choice of wood, which is the only known use of read oak in the hull, and the placement of the truss over General Butler's ceiling, suggest that this feature was a later addition to the vessel.

Deck

General Butler's deck still ties the hull together and protects its cargo stowed below. The deck is 85 feet, 9 inches (26.1 m) in length and 13 feet, 10 inches (4.2 m) in breadth. The deck is comprised of deck beams set on clamps at the vessel's sides and stanchions at the centerline. These deck support structures are strengthened by a system of iron tie-rods strategically placed around the hold. The deck is fully planked except where hatches are framed.

Deck support begins with 17 stanchions (a pair of stanchions is found at either end of the centerboard trunk) rising from shallow dish-shaped mortises in the keelson to the underside of deck beams, except in the stern cabin where 3 or 4 shorter stanchions are toe-nailed into the keelson to support the cabin's raised deck. Stanchions in the bow are made from square timbers measuring 3
inches (7.6 cm) on a side and throughout the rest of the vessel are 3 to 4 inches (7.6-10.2 cm) thick and 4 inches (10.2 cm) wide. Two stanchions sampled are white oak, while another two are hard maple.

General Butler has 37 deck beams that are square timbers measuring 4 inches (10.2 cm) on a side and made of white oak. They are cambered 2 inches (5.1 cm) to permit water to drain from the deck. The deck beams have a room and space of 2 feet, 3½ inches (69.9 cm), which is greater than the spacing of futtocks. The ends of the deck beams run over the clamp and right up against hull planking. No fasteners were noted between the deck beams and clamps, but the presence of deck planking atop the deck beams may obstruct fasteners from view. Only the first two deck beams in the bow stop short of hull planking. Due to the difference in spacing, deck beams usually fall between futtocks, and only occasionally rest directly against a futtock. In some cases, deck beam placement coincides partially with a futtock, in which case the beam is notched to allow the beam to reach hull planking. No fasteners are present between the deck beams and futtocks. Evidently, the builder did not see the need to tie these structures directly together.

In only one location is a deck beam placed directly atop a futtock head and this is in the stern at the transition between the cargo hold and the cabin. At this location the builder used care to tie the deck and sides together with hanging knees. These are the only two hanging knees on General Butler with one placed on either side of the vessel. Each knee is 5 feet (1.5 m) long against the side of the hull, 2 feet, 4 inches (71.1 cm) long beneath the deck beam, and molded 11 inches at the throat. They are fastened by two iron bolts to the vessel’s side, a single iron bolt to the deck beam, and a spike at end of each arm.

The builder used much ironwork in addition to spikes and bolts to hold General Butler together. Iron tie-rods, placed next to 12 separate stanchions, run between deck beams and the keelson to hold these components in tension. A pair of iron tie-rods at the forward end of the centerboard trunk bring the total to 13. These vertical tie-rods along the centerline are in addition to the pair on each hogging truss. The builder also set two tie-rods athwartship, anchoring them at the heads of futtocks. Three more athwartship tie-rods were noted between the vessel’s starboard futtocks and the starboard carlings of the hatch coamings. The amount of iron used on the North Beach wreck and General Butler indicates that not only was iron available and affordable, but that boat builders had to be skilled in using it.

The deck of General Butler consists of 32 strakes of white pine planking 1 inch (2.5-cm) in thickness. The planks vary in width from 2 to 7 inches (5.1-17.8 cm), but average 4½ inches (12.1 cm), with the most common size being 4½ inches (11.4 cm). Each deck plank is nailed to each deck beam with two iron nails placed in a diagonal pattern. The waterway on General Butler consists of an extra thick plank whose thickness was reduced on its inboard upper face to create a channel in which water would flow. The waterway is 2½ inches (6.4 cm) thick and 7 to 10 inches (17.8-25.4 cm) wide. The
waterway maintains its maximum thickness over 4 or 5 inches (10.2-12.7 cm) beginning at the outboard end and narrows progressively to meet the thinner deck planking.

General Butler has five hatchways for access to the interior of the vessel. The forwardmost is a companionway leading to the bow and a storage locker for items required to run the boat and handle cargo. The companionway is just large enough for one person to descend. Although a ladder was not in place, there must have been one originally. Moving aft, the next three hatchways are cargo hatches that provide access to the hold, and are a much larger size to facilitate moving cargo. The final hatchway is located in the stern and originally held a trunk and roof for the after cabin.

All hatchways, except for the after cabin hatchway, have coamings framed with white oak. The base of each coaming consists of deck beams that are notched on their upper surface to accept carlings. Next, head ledges with their ends notched on their lower surface were placed on top of the deck beams and the ends of the carlings. These were fastened together by a bolt ¾ inch (1.6 cm) in diameter placed at each corner. On all but one hatchway, the carlings have enough molded dimension to sit flush with the lower surface of the deck beams and with the upper surface of the ledges. Along the starboard side of the second cargo hatch, a plank and then a coaming were placed over the carling with the plank protruding 1 inch (2.5 cm) into the hatchway. This may represent a repair.

The method for battening the hatches and protecting the cargo hold from water on deck is not readily apparent. The companionway has a shelf cut into each carling, which would allow a cover to be inserted. Concretions and iron stains were noted at the corners of the companionway that are not associated with coamings fasteners. On one corner a metal plate was noted on the side of the coamings. This plate may be part of a battening system where a wedge was driven between the plate and a hatch cover to secure it in place.

Bulwarks

With the deck complete, the builder turned his attention to constructing bulwarks. General Butler's bulwarks were constructed by the same two methods employed on the three canal sloops discussed above. White oak was used throughout in the construction of bulwarks. In the bow, low bulwarks were made from futtock heads that rise above the deck and which were planked on either side and capped by a rail. These bulwarks have an overall thickness of 7 inches (17.8 cm) and extend aft from the stem 10 feet, 9 inches (3.3 m) as measured along the centerline, ending just abaft the companionway. This construction provided a sturdy anchor for the towing cleats placed on the inside of the bulwarks, where the cleats are fastened through two frame heads. Atop the caprail, on either side of the stem head, a chock with a fair-lead is fastened for handling towing and mooring lines. This fair-lead is open at the top to allow a line to be easily placed and removed within the chock without drawing it all the way back through the opening, as is the case when a hawse hole is used. A hawse hole is located in
the bulwarks on either side of the stem. The hawse holes were used for the anchor cable, while the chocks were primarily for mooring and towing lines.

The remaining rails are comprised of washboards scarfed together and edge-fastened with iron drift pins through the washboard, the waterway, and into at least the uppermost wale. Along each side of the vessel a single washboard, 9½ inches (24 cm) wide, extends aft for a distance of 61 feet, 4 inches (18.7 m). From this point to the stern, a second washboard is stacked atop the first and the combined height increases gradually from 11½ inches (29.2 cm) at the point of transition to a maximum of 1 foot, 4 inches (40.6 cm) at the transom. The bulwarks are 3½ inches (8.9 cm) thick against the deck and narrow to 3 inches (7.6 cm) at their upper surface, which is slightly rounded. If there is any tumblehome to the hull at all it is this slight reduction in the thickness of the toerail. The ¾-inch (1.9-cm) diameter iron drift pins that fasten the washboard are spaced approximately 2 feet (61 cm) apart. The builder cut notches into the base of the washboards to create 17 scuppers on each side of the vessel. The scuppers are between 1 foot, 7 inches and 1 foot, 8½ inches (48.3-52.1 cm) long, with the exception of one that is 2 feet, 5½ inches (74.9 cm) long. They average 3 inches (7.6 cm) in height and are spaced 3 feet (91.4 cm) apart.

This method of edge-fastening bulwarks seems to have been widely practiced on vessels built in the Champlain Valley. It has been noted on the previously discussed sailing canal boats, the lake schooner Water Witch, and it is also found on the canal schooner O. J. Walker discussed below. Again, the prevalence of this method attests to the availability of iron fasteners and the willingness on the part of builders to use new methods to save not only time, but the expense associated with finding framing timber suitable for plank-on-frame construction.

Steering Mechanism

General Butler's steering mechanism, the failure of which led to the vessel's demise in 1876, was one of the last pieces of equipment installed on the boat. Mid-nineteenth century patent records indicate that steering improvements were a popular submission to the Patent Office, and General Butler's may have been fairly recent in design. The newspaper account of the vessel's loss describes the crew chaining a temporary tiller to the head of the rudder stock in an effort to regain some control over the vessel's course, but it does not give details of the original method of steering. Today, the temporary white oak tiller, which is 6 feet, 8 inches (2 m) long, 3½ inches (8.9 cm) wide, and 4½ inches (12.1 cm) thick, is still chained to the head of the rudder stock (Fig. 41). The chain is intertwined in a gear, which together with some associated hardware and planking located on the stern rail (Fig. 42), as
Figure 42. General Butler steering mechanism remains.
well as iron fastener holes and rust stains on the stern deck. are all that remain as clues to the original steering apparatus. If General Butler did not originally have a tiller, then what kind of steering mechanism failed on that cold winter day?

Canal boats with their shallow-drafted hull form cannot have tall rudders. Instead, their rudders extend a considerable distance abaft the hull and are known as “barn door” rudders. General Butler’s is of elaborate construction. The rudder is made from two blades, each comprised of five white pine planks edge-fastened with two iron bolts. The individual planks vary in width between 7 inches and 1 foot, 2 inches, (17.8-35.6 cm), and are 2 inches (5.1 cm) thick. The two blades are separated by a spacer measuring 4 inches (10.2 cm) thick. The structure was completed by fastening a base plank over the lower ends of the two blades and a cap plank over the upper ends. The completed rudder measures 4 feet, 3½ inches (1.3 m) in length, 4 feet, 8½ inches (1.4 m) in height, and is 8 inches (20.3 cm) wide. The leading edge of the rudder is fastened by two nails per plank to the rudder stock which has been notched to accept the rudder.

The rudder stock is made from American elm and has a diameter of 8 inches (20.3 cm) where the rudder attaches. An iron plate extends from beneath the keel plank to create a table or “skeg” upon which the rudder stock rests. This plate is 2 feet, 3 inches (68.6 cm) long, 3¼ inches (8.3 cm) wide, and ½ inch thick, and is recessed into the keel plank and then attached by either an iron bolt or drift pin. An iron strap running beneath the sternpost, as well as up each side of the post, has a gap between it and the iron plate. The builder drove a wedge into this gap to prevent the iron plate from sagging under the rudder assembly’s weight. The rudder stock extends 9 feet, 9 inches (3 m) up through the transom, into the after cabin, and then through the deck. Above deck the rudder stock increases in diameter to 9 inches (22.9 cm) after it passes through a wooden platform that is 1 foot, 2 inches (35.6 cm) long and wide and 2 inches (5.1 cm) thick, and presumably has an 8-inch (20.3 cm) diameter hole in it. The increased diameter of the rudder stock above deck allows it to overlap the hole in the wooden platform. This platform, therefore, together with the iron plate at the base of the rudder stock, carries the weight of the rudder assembly and serve as the pivot points.

General Butler’s rudder assembly was manipulated by a wheel-steered mechanism that did not use a tiller, as one had to be hastily jury-rigged when the original mechanism failed. Enough of the mechanism’s original parts survive to permit a conjectural reconstruction (Fig. 43) and a description of the apparatus. The gear mounted to the rudder stock head has a diameter of 1 foot, 10 inches (55.9 cm) and 56 teeth. The rudder stock gear also has a vertical shaft that extends up into the bushing of an iron clamp that survives attached to a plank which is mounted on the taffrail. The shaft insured that the rudder stock head and its gear did not move off their axis and out of mesh with the next component, which did not survive. The toothed gear on the rudder stock head would have meshed with a transfer
shaft. The transfer shaft had either splines or a small gear that turned the gear on the rudder stock. The transfer shaft ran vertically up through another iron clamp and bushing above and to the starboard side of the rudder stock gear and also mounted to the plank on the taffrail. Half of the transfer shaft's clamp and bushing survive. The motion of the vertical transfer shaft was transmitted to a third and horizontal shaft that ran fore-and-aft and may be called a wheel shaft, because this shaft mounted the steering wheel. The manner of transmittal between the wheel shaft and the transfer shaft is conjectural, but it could have been easily done with a set of bevel gears. The wheel shaft does not survive, but its after end was seated in a composite wooden and iron bushing housing placed atop the plank on the taffrail. The wheel shaft ran forward from the taffrail and probably passed through an iron A-frame that was fastened to the deck. The A-frame does not survive but its fastener holes can be seen on the deck. This reconstruction is supported by a photograph (Fig. 44) of the canal schooner P. E. Havens that illustrates a similar device. By spinning the wheel, the helmsman rotated the shaft and transmitted the rotation through the accompanying gears and shafts to the rudder stock.

Centerboard

*General Butler's* centerboard trunk measures 16 feet, 1 inch (4.9 m) in length. The centerboard trunk consists of bedlog timbers set atop the keel plank on either side of the opening through which the centerboard will pass. The bedlogs are 8 inches (20.3 cm) wide and 3 inches (7.6 cm) thick. Next, four planks per side are stacked one atop another and rest on the bedlogs. Three planks are 1 foot, 3 inches (38.1 cm) wide, and the uppermost plank is 1 foot, 4 inches (40.6 cm) wide. All planks are 2½ inches (6.4 cm) thick. On *General Butler* only the uppermost starboard centerboard trunk plank was sampled and it proved to be white pine. The planks are edge-fastened together and spiked at the ends to deck stanchions. The centerboard truck is also notched along it top to support the eight deck beams that extend over it.

The centerboard is also constructed from planks edge-fastened with iron drift pins. The top centerboard plank was identified as hard maple and measured 1½ inches (3.8 cm) thick, although it has deteriorated over time. The rudder blades were 2 inches (5.1 cm) thick and they seem to be the minimum thickness required to attempt edge-fastening. Considering the great width of the centerboard and the space of 4 inches (10.2 cm) within the trunk, it seems likely that the builder must have used planks at least 2 inches (5.1 cm) thick.

The centerboard pivot is an iron bolt that runs through the centerboard trunk and is located 3 feet, 10 inches (1.2 m) abaft the forward face of the centerboard trunk and 4 feet (1.2 m) below deck.

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level. The location of the pivot necessitated rounding off the lower forward corner of the centerboard to permit movement within the trunk. The centerboard was raised and lowered by means of a line attached to an iron eye and chain at the after end of the centerboard. A concretion for a similar lifting eye was noted on the North Beach wreck's centerboard. The line from this eye presumably ran up to a block in the mast top. This was most likely the mainmast top as the centerboard ends just forward of the mainmast tabernacle and this would provide the straightest, and therefore, easiest lift. The centerboard could have been raised and lowered by hand with a simple line tackle, or the windlass at the bow may have been used. In either case, the lift line would have still run the mast top and back to the deck where it was secured.

**Rigging Elements**

*General Butler* was a canal schooner, meaning it had two masts rigged with fore-and-aft sails. The masts had to be dropped for entrance into the canal, and so were stepped in two tabernacles on deck, each of which was constructed in a manner similar to the single mast tabernacles on the three wrecks of canal sloops. The stump of a spruce foremost still survives on *General Butler* (Fig. 45), as does considerable evidence regarding how masts were secured and worked.

Each mast tabernacle is built from two substantial white oak stanchions, fastened to the port and starboard sides of the keelson. The stanchions rise through the deck, protruding to a height of 2 feet, 6 inches (76.2 cm). They are 9 feet, 7 inches (2.9 m) in overall length, 11 inches (27.9 cm) in width, and 3 inches (7.6 cm) in thickness. Another white oak plank was fastened between the stanchions' forward edges. This plank is of the same width and thickness as the stanchion, but only 2 feet, 3 inches long, and runs from the top of the stanchions until just above deck level. This construction creates a three-sided enclosure in which the heel of the mast sits. An iron pin, 2 inches (5.1 cm) in diameter, runs athwartship through the stanchions to provide a pivot for the mast. The after portion is left open to allow the mast to be lowered and raised. The mast heel was set above deck level and the lower forward portion of the mast heel was trimmed so that it could freely pivot within its enclosure when necessary. Each mast was secured within its tabernacle by an iron band, 2 inches (5.1 cm) wide, placed around the top of the tabernacle, but with the after side left open. Once the mast was placed on the pivot and raised, a second iron band was placed across the open after face of the tabernacle and two bolts were slid, fore-and-aft, through holes in the iron band and the heads of the mast stanchions. These bolts are ½ inch (1.23 cm) in diameter and are secured with square nuts 1¼ inches (3.2 cm) on a side.

Beneath the deck planking each mast stanchions is supported by a carling that is fit between deck beams. These carlings provide similar support to that supplied on a traditional sailing vessel by the
Figure 45. *General Butler* foremast stump in tabernacle. Reproduced with permission of the Lake Champlain Maritime Museum.
carlings and chocks of a mast partner. General Butler's mainmast carlings are 2 feet, 1½ inches (64.8 cm) in length, 9½ inches (24.1 cm) in width, and 1½ inches (3.8 cm) in thickness. Each carling has a 3-inch by 11-inch (7.6-cm by 27.9-cm) cut out through which the stanchion passes. The carlings were toenailed to the deck beams. The same arrangement of carlings was observed at the foremost, but was not recorded. Similar bracing was placed beneath the deck to support the windlass bitts as well. At the latter location, the carlings are 1 foot (30.5 cm) in length and fit between the forward face of the first deck beam in the bow and the deck hook. The carlings continue forward an undetermined distance into notches in the upper surface of the deck hook. The carlings' cut outs correspond to the size of the windlass bitts. The builder took great care to insure that these important stanchions and bitts were reinforced to perform their function reliably.

Each of General Butler's masts was rigged with a fore-and-aft sail that was run up the mast with a series of hoops and was spread between a boom at the foot of the sail and a gaff at the head of the sail. Each mast was supported by a system of shrouds and stays known as "standing rigging." The lines for the shrouds do not survive, but they originally began at the side of the vessel just abaft the mast, and ran up around the mast top and back down to the side of the hull. The shrouds were attached to the hull by set of deadeyes. One deadeye was secured to the end of the line running to the mast, while the second deadeye was pinned to the hull. The two deadeyes were drawn together with a line called a "lanyard." The lanyard was usually drawn tight by means of a separate tackle and then the end of the lanyard was seized back on itself. The location of each shroud survives along General Butler's toerail in the form of extant deadeyes or chain plates where deadeyes are missing. General Butler had three pairs of deadeyes anchored slightly abaft the foremost and the mainmast on both the port and starboard sides.

On General Butler each deadeye is 4½ inches (11.4 cm) in diameter, 3 inches (7.6 cm) thick, and has three holes of 1 inch (2.5 cm) diameter. Deadeyes are contained within an iron strop made from round stock that is ¾ inch (1.9 cm) in diameter. The strop has eyes on each end that are secured by a forelock bolt that also runs through an eyebolt, which is the chain plate. This form of chain plate is not placed outboard of the chain wale, an arrangement which would limit the vessel's available breadth. Instead, the eyebolt is driven through the toerail, the deck and a chock placed between futtocks. Whether or not the eyebolts are secured on the underside with square nuts is not known, but this would have been a more reliable method.

The masts were also secured by stays. These began at the stem head where an eye was welded to the protective front plate and served as anchor for a pair of deadeyes set up in a manner similar to the shrouds, but with slightly larger deadeyes. From these deadeyes, a line ran up to the top of the foremost where it was attached, and then another line ran from the foremost to the mainmast. No back stays were employed as this would have hampered operation of the boom.
In 1982, four deadeyes were recovered from General Butler. Two are the same size as those remaining to anchor the shrouds, a third is slightly less than 3 inches (7.6 cm) in diameter and has two strop grooves, while the final one is 8½ inches (21.6 cm) in diameter and could be the mate to the forestay deadeye that survives at the stem head. A spare deadeye and five rigging blocks were found during the 1995 project. Three blocks, all single-sheaved, were quite large, with a sheave diameters of 11 inches (27.9 cm). These were probably used for cargo handling, while the smaller ones were spares for the boat’s rigging. One of the boat’s blocks had a single sheave, while the other had two sheaves. A spare gaff jaw was also found. It is 5 feet, 8½ inches (1.7 m) in length and has four holes in the mast end that would anchor rigging for raising and lowering the gaff. A ring with a rope thimble and two eye hooks joined by a rope thimble, all made of iron, were found in 1982 and were associated with the sailing rig.

Windlass and Ground Tackle

The windlass (Fig. 46) abaft the stem head was required to handle the vessel’s anchor cable, sail rigging, centerboard, and heavy cargo. The windlass is mounted on two bitts or stanchions, each 9 feet, 3 inches (2.8 m) long, 8 inches (20.3 cm) wide, 4 inches (10.2 cm) thick, and spaced 1 foot, 5 inches (43.2 cm) apart. The bitts rise up from the apron, through the deck to a height slightly above the stem head. The device is based on an axle rather than the conventional whelps or barrel. The iron axle is mounted to these bitts by iron cheeks or clamps that also serve as bushings. On each end of the axle is a warping head of 8 inches (20.3 cm) diameter over most of its length, but with rims at either end of 10 inches (25.4 cm) diameter. The rim against the bitt has a gear with teeth spaced an inch (2.5 cm) apart. A pole arm is attached at the same rim. The arm has a socket for a bar or pole that would serve as a lever to turn the windlass. The pole arm has a pawl on it to engage the teeth on the warping head’s rim, so the pole arm can be ratcheted back to gain another purchase.

General Butler’s anchor (presumably a sheet anchor) was lost when the vessel was cut free in an ultimately unsuccessful attempt to make around the breakwater to safety. A second anchor was found on deck at the bow in 1980. This anchor weighs 110 lbs. (49.9 kg) and is thought to be smaller than the anchor that was lost. The surviving anchor has a folding stock. It has an overall length along the shank of 3 feet, 4 inches (1 m). The shank is rectangular in section measuring 2 inches (5.1 cm) wide below the stock and increasing to 3 inches (7.6 cm) wide at the crown. The anchor’s thickness is consistently

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T. Tryckare, *The Lore of Ships*, p. 56.
2½ inches (5.7 cm). The straight-line distance between the bills of the flukes is 2 feet, 7 inches (78.7 cm). The palms are 6½ inches (16.5 cm) wide and 9½ inches (24.1 cm) long, although the bill extends for another 2 inches (5.1 cm) beyond the palm. The arms of the anchor curve back toward the shank from the crown a distance of 9¼ inches (24.8 cm). The folding stock is 3 feet, 4 inches (1 m) in length and made from round stock that is 1¼ inches (4.5 cm) in diameter with bulbous ends that have a diameter of 3¼ inches (8.9 cm). The anchor ring has an inside diameter of 4½ inches (11.4 cm) and an outside diameter of 6½ inches (16.5 cm).

**Artifacts**

Captain William Montgomery’s time capsule has also told us something about how space was used and what life was like for those on board a sailing canal boat. Artifacts recovered from General Butler were from six material categories, glass, ceramic, metal, wood, leather, and stone.24 The artifact finds reflect the types of activities taking place on board.

A number of crew possessions indicate food and beverage use, clothing, and leisure time activities. Several glass bottles were found that once contained bitters and spring water for crew refreshment, while other were for medicine. These items were found both in the bow and the stern. Most of the finds associated with the crew’s daily life came from the stern cabin, which was cheaply outfitted for taking meals, sleeping, and relaxing. Here were found a cast iron cook stove, and variety of white wares manufactured in America and England. The cabin had bunks and cupboards. The cabin’s floor had a linoleum-like covering. A model boat was found that may have belonged to a child or a crew member. The model is of a lake schooner with a tapering hull in deck plan, a raised stern deck, and a centerboard slot in its cargo hold.

Other artifact finds relate to the operation of the vessel. A green glass lens (Fig. 47) and copper base plate, together with numerous fragments of tin-coated iron are thought to have been parts of a navigation light. Several tools were found, including chisels. The hold was a dark space and was lighted by oil lamps. Parts of lamps were found, including oil reservoirs, wick adjusters, and lamp glass. A bilge pump’s burr valve was found that is similar to that found on the Isle La Motte sloop. Cargo-related items include the cargo of marble, lumps of coal from a previous cargo, together with large patent blocks (Fig. 48) and wooden rollers for handling bulk cargo.

Several artifacts were observed in place on General Butler, but not recovered. The most significant were two “whippletrees” (alternatively spelled “whiffletrees”) from a mule harness. Whippletrees spread the harness across the rear of the tow animal and evenly distributed the load on the

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Figure 47. *General Butler* navigation light's port lens. Reproduced with permission of the Lake Champlain Maritime Museum.
Figure 48. General Butler blocks found in bow excavation. Reproduced with permission of the Lake Champlain Maritime Museum.
mules collar. They are made of wood with hardware on each end to attach to harness lugs and/or harness chain. Their presence on General Butler indicates that boat operators like Captain Montgomery did on occasion carry their own gear to rig up rented mules. The Champlain boats did not carry their own mules in sheds built into the vessel’s bow as was done on the Erie Canal, because the former canal is so much shorter and it did not pay to sacrifice cargo space to carry mules that could be cheaply rented. On the Erie route a boat could travel without the interruption that dropping off and replacing rented mules entails. Also noted in the bow of General Butler was a metal paint can and a wooden box containing four unidentified metal pieces.

The artifact finds, in addition to the hull recording, help establish the function of areas within the hull. The bow was an equipment locker that housed tools, spare parts, and items required for the day-to-day operation of the vessel. The crew stowed their personal gear here as well, as evinced by two bottles and the rubber overshoe. This area was accessible through the companionway in the deck. The locker had a raised deck or cover that has deteriorated away except for a support on the windlass bitts. Rigging blocks noted by the diver who discovered the wreck were hanging on nails in the windlass bitts. They had been there for 106 years before they were recovered as part of the archaeological study of the site.

The main cargo hold is still home to 12 blocks of marble. A thirteenth block, which had been carried as a deck load, is now resting on the bay floor off the port bow. These marble blocks were placed in the hold through one of three cargo hatches and placed on rollers to get them into their present positions. They were the last of many heavy, bulky cargos that included coal, gravel, slate, and brick. The hold was a dark space, especially if all the hatches were covered and dogged. This may explain why the remains of so many lanterns were found in the bow, along with a hook that could have been hammered into any timber where a lamp was needed to light the interior.

The hold was also the location for the vessel’s bilge pumps. A hole in the ceiling in the vicinity of the forward end of the starboard chine log is a pump well. The pump tube no longer survives, but was likely a tin tube that was slightly longer than the depth of hold.25 The burl valve, when fitted to the end of a spear and placed down a tube could be drawn up quickly to pull bilge water up and onto the deck, where it would run along the waterway to the nearest scupper. This arrangement is virtually identical to that found on the Isle La Motte sloop, whose burl valve and spear survive.26 The Isle La Motte sloop burl valve and spear were found near the side of the vessel, a location similar to where the pump well was observed on General Butler. Canal boats did not have pump wells along the centerline.


of the vessel as is the case with ocean-going ships. When a flat-bottomed hull fills with water it lists quickly over to one side and the weight of the water makes this impossible to combat. For this reason, canal boats generally have four pump wells, one at each corner of the vessel.27

Concluding Remarks

The discovery of General Butler sparked considerable archaeological and historical research. Without its discovery the existence of sailing canal boats may still have been realized, but it is hard to imagine that our knowledge would have been as rich. The desire to protect Vermont’s underwater heritage and the establishment of an extremely popular and successful underwater preserve system can be directly traced to interest in General Butler. It is a site that is known far and wide.28 The site is so intriguing that Burlington, Vermont, divers each winter cut a hole in the ice to experience the site when underwater visibility is at its best. The examination of its remains was followed with equal interest by archaeologists and historians alike. Archaeological investigations have defined the form of this vessel and illustrated a construction technique that is representative of the high standard of inland boat building practiced in the Champlain Valley.

The canal schooner General Butler as reconstructed (Fig. 49) has a length of 88 feet, 7 inches (27 m), a molded breadth of 14 feet, 5 inches (4.4 m) and has a depth of hold of 6 feet, 2 inches (1.9 m). It was rigged with two masts stepped on deck in tabernacles. When sailing on the lake it deployed its pivoting centerboard. When traveling through the canal it pulled up the centerboard and lowered the masts and stored them on shore.

The hull is similar in form to ordinary towed canal boats of the period. The stem and sternpost are vertical. It has a very full entrance that is molded in construction, as is the stern. There is a long run over a dead-flat bottom and vertical sides that are chine-built. The construction throughout is light, but well fit.

General Butler is a chine boat, with chine logs that run longitudinally at the point where the vessel’s bottom meets the sides. Unlike the keel plank, the chine logs have substantial molded dimension and provide considerable longitudinal support that is lacking in the vessel’s centerline timbers. The earliest documentation for this construction method is Orson Spear’s 1852 draft for a chine boat, although Deming’s 1831 patent for edge-fastened timbers suggests it was around at an earlier


28One day while working on the North Beach wreck a large pleasure boat pulled up to one of our tiny inflatable boats, and a man leaned over the side of the yacht and asked, "Où est la General Butler?"
date. One of Spear's later chine boats has been discovered and investigated, and is the last sailing canal boat wreck we will examine in this dissertation.
CHAPTER XI

THE CANAL SCHOONER O. J. WALKER

It is appropriate that this discussion of Lake Champlain sailing canal boats should end by looking at O. J. Walker for several reasons. First, this boat was built by the leading builder of sailing canal boats, Orson Spear, at the height of his career. It is, therefore, representative of the ultimate achievement in sailing canal boat design and execution. Second, it was an attempt to reconstruct this vessel in 1991 that focused attention on the question of how the bottom of these vessels were built and led to so many interesting discoveries about chine-built boats. Third, O. J. Walker has provided more information concerning sailing canal boat rigging than all other sites combined. Fourth, O. J. Walker's career is richly documented in the historical record, because it was one of those boats that continued in use well after most sailing canal boats had been converted to towed boats. Finally, O. J. Walker was built and operated in Burlington, Vermont, which played so prominent a role in raising these boats to the forefront of economic activity.

Historical Context

O. J. Walker was built in Burlington, Vermont, in 1862, the year that enlargement of the Champlain Canal was completed, and it seems to have been typical of the 1862 class of sailing canal boats. By this time builders had several years experience building these larger hulls. Master carpenter Orson Spear obtained an order to build this vessel for Joseph H. Kirby of Burlington, Vermont, and was busy that spring with his new project. Kirby was involved in the production of his boat, as he and his father cut oak timber for Spear. Spear's account records with the firm of Van Sicklin & Walker, and the Pioneer Machine Shops show him making purchases for a boat. Spear ordered 19 kegs of "ship spikes," 105 pounds of nuts and bolts, 51 pounds of castings, several horse irons, 4 eye bands, 4 bales of oakum, a barrel of pitch. These were most likely for O. J. Walker.

Orson Spear's papers also include an undated invoice to obtain rigging items such as sail cloth (No. 8 U.S. Pilot duck) and blocks. This is less firmly associated with his contract to build O. J.

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2Ledger page between Orson Spear and Van Sicklin & Walker, dated 1862, and ledger page between Orson Spear and J. P. Flanders, dated July 18, 1862. Spear Family Papers.

Walker, but the items are those required by a sailing canal boat of this type. On this invoice Spear ordered,

- 2 main sheet blocks with iron bushings at 11 inches
- 3 single patent blocks for tackle at 1 foot, 2 inches
- 2 double patent blocks for [illegible purpose] 9 inches
- 3 single patent blocks for [illegible purpose] 8 inches
- 1 double sheave block with iron bushings at 7 inches
- 3 single sheave blocks with iron bushings at 7 inches
- 2 blocks for [illegible purpose] 4 inches
- 1 block for the topsail halyard 6 inches
- 10 deadeyes at 6 inches
- 2 deadeyes for the spring stay at 5 inches

The total cost was $295. split almost evenly between sail cloth and hardware. This list of blocks matches closely those found on the site of O. J. Walker, although that can be said for any schooner’s rig of this period.

Joseph Kirby enrolled his new boat in July under the name O. J. Walker. The reason for the choice of name is not known, but it could have been that Kirby hoped to gain some freight business for his new boat. The boat’s namesake, Obadiah Johnson Walker, was a member of Van Sicklin & Walker from whom Orson Spear was ordering parts. This firm was one of the leading provisioning businesses in town and had trading relationships throughout Vermont and New York. Walker was not only a prominent businessman, but was also a civic leader as well and Kirby was justified in signaling Walker out for recognition. It is not known if Walker had a financial interest in the new boat. He is not listed on the enrollment document as an owner. Kirby was a business associate of Walker’s later on and may have been in 1862 as well. Certainly he could have expected to carry cargo for Walker’s firm in much the same way the builders of B. Noble hoped to profit from that boat.

Joseph Kirby re-enrolled his boat in the same year listing Thomas Steele as a partner. This partnership lasted 18 years, with Kirby serving as the boat’s master and Steele as an investor. In this time O. J. Walker kept busy carrying roofing gravel from Milton and St. Albans, Vermont, to Canada.

In 1881, the canal schooner was 19 years old and sold to Alexander Breyar of Crown Point, New York. Alexander Breyar, like Joseph Kirby, William Montgomery, and Julius Rugar was a typical

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4Enrollment document for the canal schooner O. J. Walker, dated July 9, 1862. Record Group 41, Civil Reference Branch, United States Archives.

lakeman. Breyar enrolled the boat in Plattsburgh, New York, and ran it for just two years before selling it to another lakeman, Thomas Edgar Weatherwax.  

Considerable information concerning *O. J. Walker*’s operation during Breyar’s and Weatherwax’s tenures survives because boat owners were required to pay a tax to maintain a hospital for mariners. Descendants of the captains have kept the logs that recorded this information. *O. J. Walker*’s Seaman’s Time Book records the period between May 1, 1881 and June 30, 1884 and lists crew members and dates of operation between April or May and November or December, when ice closed the navigation season. The crew in 1881 consisted of sailing master Thomas Edgar Weatherwax, seamen Joseph Goyette and Henry Maple, and cook Laura Goyette. The following year Mr. and Mrs. Joseph Fell replaced the Goyettes on the crew.

In 1883 Thomas Weatherwax re-enrolled *O. J. Walker* as owner and sailing master and based the boat in Peru, New York. Weatherwax had married Breyar’s daughter Matilda, and purchased the boat from his new father-in-law. His new bride became the boat’s cook. For that year, Weatherwax lists seamen Oliver King and Joseph Goyette as the other crew members. The following year Weatherwax ran the boat with his wife and seaman Joseph Fell. The Seaman’s Time Book records no other aspects of the boat’s operation, but does mention that the Weatherwax family moved into a house on shore in 1892 for the health of their oldest son. This indicates that they had lived for nearly ten years on board the vessel. Weatherwax ran *O. J. Walker* for one more season, then became master of a steamboat.

During his final season Weatherwax was on the look out for a buyer for his 30-year old boat. In August 1892, while picking up a load of tiles in Malletts Bay just north of Burlington, Weatherwax may have met *O. J. Walker*’s next owner. By the end of the year the boat belonged to Carter Moses Field who lived in nearby Colchester, Vermont, and who had been a lakeman for at least ten years in this

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6Enrollment document for the canal schooner *O. J. Walker*, dated April 8, 1881. Record Group 41, Civil Reference Branch, United States Archives.


8Enrollment document for the canal schooner *O. J. Walker*, dated April 26, 1883, Record Group 41, Civil Reference Branch, United States Archives.

area, having captained the sloop Averill from Mallets Bay in 1882.\textsuperscript{10} Field re-enrolled the vessel in Burlington, Vermont, listing himself as owner and captain.\textsuperscript{11}

By the beginning of the next navigation season, though, the boat was in the hands of John W. Brown and his son Henry W. Brown from Milton, Vermont.\textsuperscript{12} The pair kept the boat enrolled at Burlington. They owned brick yards on Mallets Bay and in Burlington and, thanks to their own patented innovations, supplied bricks and tiles to much of the New York shore as well as in and around Burlington. The Browns were not lake men, and the enrollment does not list a captain, so they must have relied on others to operate the boat. The 1892 tile load that O. J. Walker picked up may have been from the Brown yard, although this is not confirmed.

Two newspaper articles suggest that the boat’s namesake, Obadiah Walker, may have acted as agent for the vessel and its owners for a number of years. The May 19, 1890 edition of the Burlington Free Press and Times states that the firm of O. J. Walker & Brothers, a grocery and provision firm, advised the captain of O. J. Walker to wait for a soft market to pick up a bit, and so the boat was given a new coat of paint.\textsuperscript{13} Another story in the same newspaper, but dated July 18, 1893, reports the death of O. J. Walker captain, Shell Parkhurst.\textsuperscript{14} The article states that Captain Parkhurst commanded O. J. Walker for the firm O. J. Walker & Brothers for years. This implies that Obadiah Walker had been involved in the boat’s operation for quite some time, perhaps since its launching in 1862.

Upon Parkhurst’s demise at the helm after a career of over 50 years on the lake, his daughter, Mrs. Rock, became the only woman during this period to command a vessel operating between Burlington, Vermont and New York. Mrs. Rock’s nautical career ended later that year when O. J. Walker ran aground in Grand Isle, Vermont.

It may have been at this time that the vessel’s foremost was repaired, limiting the boat to lake travel. Archaeological study has revealed that when the vessel sank the foremost was no longer stepped in a tabernacle on deck, but extended through the deck. Yet, Captain Parkhurst had died in 1893 while O. J. Walker sat in the canal-side town of Mechanicsville, New York, and, therefore, could not have had


\textsuperscript{11}Enrollment document for the canal schooner O. J. Walker, dated November 18, 1892. Record Group 41, Civil Reference Branch, United States Archives.

\textsuperscript{12}Enrollment document for the canal schooner O. J. Walker, dated April 19, 1893. Record Group 41, Civil Reference Branch, United States Archives.

\textsuperscript{13}Cohn, “The O.J. Walker,” p. 43.

\textsuperscript{14}Cohn, “The O.J. Walker,” pp. 39, 43.
a permanently stepped mast. Following repairs from the grounding *O. J. Walker* continued operating under the Browns' ownership until 1895.

On Saturday, May 11, 1895, a brick and tile cargo had been placed on *O. J. Walker*'s deck for a quick trip to Dr. William Seward Webb's estate in Shelburne, Vermont. That afternoon a once-in-a-generation storm overtook the boat in Burlington Bay, similar to the circumstances surrounding the sinking of *General Butler*. *O. J. Walker*'s captain, W. J. Worthen, noticed that the boat was beginning to leak as a result of stresses on the hull from the seas and from the improperly placed cargo. The crew set an anchor and abandoned the vessel with such haste that they forgot to take oars with them in the vessel's small boat. Captain Worthen, his deck hand, and his wife managed to drift safely to shore, but *O. J. Walker* was not so fortunate. The waves caused the top-heavy boat to roll, dumping some of the cargo and flooding the hull. *O. J. Walker* righted itself one more time and then disappeared in 60 feet (18.3 m) of water.\(^{15}\)

James Wakefield, the Burlington chandler who with his son had rescued the crew and passengers of *General Butler* in 1876, inspected the site and concluded that the vessel should not be salvaged due to its age. Plans were made to recover its anchors, chains, and rigging, but were subsequently dropped.\(^{16}\) On the back of *O. J. Walker*'s last enrollment papers are scribbled the date, place, and cause of the document's surrender: June 30, 1895, Burlington, Vermont, vessel abandoned.\(^{17}\)

**Discovery and Excavation**

Two researchers discovered the canal schooner *O. J. Walker* during a 1983 sonar survey of Burlington Bay. The site was relocated in 1984 during a Champlain Maritime Society (CMS) survey following directions supplied from an account of *O. J. Walker*'s sinking in a local newspaper. It was initially scrutinized in October of that year by Arthur Cohn and Kevin Crisman.

*O. J. Walker* proved to be a vessel similar in size and shape to *General Butler*, but the vessel's masts, spars, and other rigging elements were much more complete (Fig. 50). This made its study a perfect compliment to *General Butler*. *O. J. Walker* sank with a deck load of bricks and tiles, many of which remain on deck. This raised questions concerning the public's safety while diving on this site. Its

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\(^{15}\)Cohn, et al., “Underwater Preserve Feasibility Study of the Lake Champlain Canal Schooner *O.J. Walker*,” pp. 43-44.

\(^{16}\)*Burlington Free Press and Times*, May 15, 1895.

\(^{17}\)Enrollment document for the canal schooner *O. J. Walker*, dated April 19, 1893, Record Group 41, Civil Reference Branch, United States Archives.
initial study was undertaken to assess the stability of the site, and to record vital information concerning parallels to General Butler, and the rigging of canal schooners.

In 1988 Cohn and Crisman returned with a larger crew to record the vessel’s exposed remains under a permit from the VTDHP and with the support of the then newly formed Lake Champlain maritime Museum (LCMM). This campaign marked the first occasion where dives on a sailing canal boat were staged from something larger than an inflatable boat or a raft. Captain Fred Fayette joined the team and provided his research vessel R/V Neptune as the on-site base of operations. The vessel simplified logistical concerns and provided a more comfortable environment in which to work, thereby increasing the ability to retrieve information.

Diving operations were conducted between August 22 and 27, 1988. Recording tasks centered on obtaining the vessel’s overall dimensions, and details of features found on deck to produce a site plan. In addition, an inventory was made of artifacts, mainly rigging items located on deck or on top of the mud just off of the vessel’s sides. A videotape record was made along with still photographs to provide a more detailed visual record.

In 1989 a second field season was undertaken on O. J. Walker with diving operations conducted over the last two weeks in July. Artifacts inventoried the previous year were brought up for cataloguing, drawing, and photography. The artifacts were then redeposited beneath sediments on the site. Hull sections were taken off the outer surface of the hull planking at stations set up along the vessel’s starboard side to reconstruct the shape of the hull. The interiors of the bow and stern cabins were mapped and documented. Information was gathered to complete hull details recorded the previous year. Prior to leaving the site, signage was placed to warn the diving public of the hazards that exist on the site. It was concluded not to incorporate the site into Vermont’s underwater preserve program.

In June 1995 LCMM, Texas A&M University (TAMU), and Waterfront Diving Center (WDC) provided staff and crew to continue investigating O. J. Walker. The project was conducted at the same time as the final fieldwork on General Butler. While R/V Neptune stayed on the Butler site, a small inflatable boat ferried dive teams to O. J. Walker. Hull sections were taken with a digital goniometer to compare to previous sections made with a vertical square, and the vessel’s sheer was also recorded with this device. A variety of measurements were taken of the scuppers, bulwarks, the hogging truss, hanging knees, and the centerboard trunk. The most crucial answer sought concerned the nature of the transition from the vessel’s bottom to its side. To accomplish this a small trench was made by hand fanning along the starboard side. A second trench was made in similar fashion at the base of the stern which revealed the forward end of the keel.
Hull Remains

The hull of O. J. Walker provides an interesting comparison with General Butler. Both of these vessels are canal schooners built in 1862 and, therefore, of the enlarged size. This is still early for this class and so some differences exist between the hulls. O. J. Walker is slightly larger in capacity and appears to be framed a little more substantially. The big difference between the two sites is that on O. J. Walker the rigging was not salvaged as it was from General Butler. This provides a great deal of information concerning the rigging of a canal schooner. A list of O. J. Walker’s scantlings and principal dimensions can be found in Appendix H.

Keel and Posts

O. J. Walker also lies intact in a soft mud bottom, and sediments have filled the interior of the vessel to a great extent. The only attempt to uncover the centerline timbers was made at the exterior base of the stem, where a small excavation was completed on the starboard side in order to reveal the stem to keel joinery. At this location, the keel has a molded dimension of 4 inches (10.2 cm) to 6 inches (15.2 cm), and is sided 7 inches (17.8 cm). The similarity to General Butler suggests that O. J. Walker also has a keel plank.

The stem of O. J. Walker is 10 feet, 4 inches (3.2 m) long, and has a maximum sided dimension above deck of 8½ inches (21.6 cm) on its interior face which it holds for 8½ inches (21.6 cm) of its total maximum molded dimension of 1 foot, 5½ inches (44.5 cm). The sided dimension narrows in the same fashion as does that of General Butler. The forward face of the stem is sided 6 inches (15.2 cm). O. J. Walker’s iron rub plate is 6 inches (15.2 cm) wide and 1 inch (2.5 cm) thick, and is fastened to the stem by iron bolts. The eye is welded at the top of the rub plate and serves as point of anchor for two deadeyes, one of which is for the forestay, while the other is associated with running rigging.

Examination of the stem to keel joint indicates that the base of the stem butts against the end of the keel. There is a stop water in the stem to keel joint. The stem has not been examined on the interior of the vessel.

The sternpost of O. J. Walker is sided 9 inches (22.9 cm) and molded 10 inches (25.4 cm). It is near vertical if not completely plumb. Its length has not been determined, but it is composed of two timbers that have been scarfed together over a distance of 1 foot (30.5 cm). It is crossed by at least one transom piece, which is sided 7½ inches (19.1 cm) and molded 11 inches (27.9 cm). In the after cabin the sternpost is contained within an enclosure that also encases the rudderpost, whereas these are visible on General Butler.
Frames

On O. J. Walker a great deal of framing information was recorded on the site in 1988 and 1989. Very little work was undertaken in this area in 1995, due to concerns over placing divers inside a fragile vessel with a heavy deck load especially on the port side and at the stern. Forays inside the vessel were restricted to areas around the hatch openings and limited to the starboard side. Futtocks have a room and space of 1 foot, 8 inches (50.8 cm) on average. The spacing is closer in the bow, where framing timbers average 1 foot, ½ inches (31.8 cm) from forward face to forward face. No direct evidence has yet been uncovered regarding the configuration of O. J. Walker’s floor timbers, but fastenings through the starboard chine log may indicate that the floor timbers are spaced between futtocks instead of being in line with them. This would prevent any weakening of the chine log by floor timber and futtock mortices cut in close proximity to one another. This staggering of mortices is seen on both General Butler and on Orson Spear’s drafts. O. J. Walker has five hanging knees per side, which are spaced from stem to stern by distances of 13 feet, 2 inches (4 m), 15 feet, 8 inches (4.8 m), 18 feet, 10 inches (5.7 m), and 5 feet, 5 inches (1.7 m). All but one are located at the forward end of either a cargo hatch or the cabin hatch. The exception is the second knee from the stern which is located at the after end of the last cargo hatch. General Butler had only a single pair of knees placed beneath the deck beam at the forward end of the stern cabin.

On O. J. Walker a small excavation on the exterior of the starboard side revealed the chine log. From the outside the chine log resembles another planking strake, except that the lines of frame fastenings visible on each planking strake do not extend down to this lowermost timber on the side, indicating that it is not a plank but the chine log. Excavation beneath the hull at this location indicated that the chine log is a square timber of approximately 10 inches (25.4 cm) per side. Time constraints prevented locating the ends of the chine log and further work on O. J. Walker should include digging a trench along the starboard side to determine the length of the chine log.

Keelson and Sister Keelsons

No attempt has yet been made to uncover the keelsons on O. J. Walker, or any other feature buried within the hull. The heavy deck cargo makes this an obvious safety risk, although a small excavation directly beneath a hatch offers the best opportunity of safely gaining this information. The best available indication of this feature must remain the arrangement on General Butler, as the hull are so strikingly similar.
Planking and Ceiling

*O. J. Walker’s* side planking consists of three wales and six other strakes over the dead flat run of the vessel’s sides. One wale is located directly beneath the deck and is between 5½ inches (14 cm) and 6 inches (15.2 cm) wide (depending upon the point along the hull at which a measurement is taken) and is 3 inches (7.6 cm) thick. The next plank down is 6 inches (15.2 cm) wide, and 1 inch (2.5 cm) thinner than the wale. Below this are two wales that are 6 inches (15.2 cm) wide and 3 inches (7.6 cm) thick. Next in succession are five planks between 7 inches (17.8 cm) and 9 inches (22.9 cm) wide and 2 inches (5.1 cm) thick before the chine log is reached. The bottom planking on *O. J. Walker* has not been examined except for the hooping ends at the bow. All planking is attached with iron nails. The ceiling planks on the vessel’s side are 1 inch (2.5 cm) thick and generally range in width from 6 inches (15.2 cm) to 9 inches (22.9 cm). One ceiling plank located amidship on the starboard side directly below the clamp was recorded as 1 foot, 11 inches (58.4 cm) in width.

Hogging Truss

*O. J. Walker’s* hogging trusses (Fig. 51) begin approximately 6 inches (15.2 cm) below the clamp. They are fastened over the ceiling planking, and covered by hanging knees. On the starboard side, the truss’ horizontal top member is composed of two timbers butt-joined over a futtock. They have an overall length of 11 feet, 10 inches (3.6 m), are sided 10 inches (25.4 cm) and molded 2 inches (5.1 cm). The fact that the top timber is made from two timbers rather than a single piece indicates that the truss functioned by tying together the vessels frames along the truss. The starboard forward diagonal is 18 feet, 5 inches long (5.6 m), while the after diagonal is 19 feet, 2 inches long (5.8 m). The truss members are fastened to each framing station by either spikes or bolts, with spikes predominating. All truss members have 1-in. (2.5-cm) diameter holes that indicate that these timbers served another purpose before being used in *O. J. Walker*. Iron tie rods with a diameter of 1 inch (2.5 cm) run vertically from the top member’s ends down toward the chine log to hold the structure in tension. The truss is similar in configuration to the truss on *General Butler*, but differs in that the lower ends of *O. J. Walker’s* diagonal members stop well short of reaching the chine log. This seems flimsy, but it worked well enough until the vessel sank after a 33 year career, so it provided the necessary longitudinal support that the hull required.

Deck

The clamp provided support for the deck structure, and ran from stem to stern beneath the deck beams. The clamp is fastened to the tops of the futtocks, and are 2½ inches to 2¾ inches (6.4-7 cm)
wide and 5 inches to 6 inches (12.7-15.2 cm) thick. The clamp provided a shelf which supported the ends of deck beams.

Stanchions rise from the keelson to support the central portion of the deck beams. On *O. J. Walker* seven wooden stanchions have been examined and their dimensions are irregular. Two stanchions are 4 inches (10.2 cm) square, while the remainder are: 2 inches (5.1 cm) by 3 inches (7.6 cm), 2 inches (5.1 cm) by 6 inches (15.2 cm), 3¼ inches (8.3 cm) by 6 inches (15.2 cm), and 6¼ inches (17.2 cm) square. All wooden stanchions support the deck beams that, in turn, support a hatch coaming. Five iron tie-rods, each with a diameter of 1½ inches (3.8 cm), were noted in close proximity to some of the wooden stanchions. The rods pass through and are fastened on top of the deck beams, their purpose being to keep the vessel in tension, rather than supporting the deck. There was also one iron tie-rod noted that ran athwartship just forward of the stern cabin. This tie-rod ran from the vicinity of the clamp on the starboard side down into the sediments in the hold. It was not determined whether it had simply collapsed on one side or if it had been originally placed at a diagonal. The tie-rod has a turnbuckle in it similar to the one found on the North Beach wreck.

*O. J. Walker* has 42 deck beams. The average deck beam spacing throughout the cargo hold is 2 feet, 1½ inches (64.8 cm) between their forward faces. They have a slightly closer spacing in the bow. The beams are square timbers, generally 4 inches (10.2 cm) per side, but some that support hatch coamings are slightly larger with the largest molded 6½ inches (16.5 cm) and sided 7¼ inches (19.7 cm).

The waterway width on *O. J. Walker* varies between 11 inches (27.9 cm) and 1 foot, 1 inches (33 cm). The waterway is a 2-inch (5.1-cm) thick plank placed directly beneath the bulwarks and atop the ends of deck beams and the uppermost wale. The waterway narrows from its center point to its inboard seam at the first regular deck plank. The deck planking is 1 inch (2.5 cm) thick and on average each plank is 5½ inches (14 cm) wide, with planks of 5½ inches (14 cm) and 6 inches (15.2 cm) as the most common sizes. Not all deck planks could be examined as much of the deck cargo of brick remains on the port side. Each deck plank is fastened to each deck beam by two iron nails in the same fashion as those on *General Butler*.

The deck of *O. J. Walker* has seven hatchways. There are two companionways leading into the bow. This is followed by a large cargo hatch, two slightly smaller cargo hatches, another large cargo hatch, and finally the hatchway for the after cabin trunk. All personnel and cargo hatches on *O. J. Walker* originally had coamings, but the hatchway forward of the after cabin is missing its head ledge, and the next forward hatch is missing all coamings timbers except the deck beams.

*O. J. Walker* has one more companionway and one more cargo hatch than does *General Butler*, permitting greater access to the cargo hold and bow. Both canal schooners have a pair of similarly-sized hatches abaft the main mast, but *O. J. Walker* has an added hatch between the fore- and mainmast which is located directly over the centerboard trunk. This hatch provided yet another place where cargo could
be loaded into the hold, although the centerboard trunk limited the size of cargo items that could pass through. *O. J. Walker*’s original owner-operator Joseph Kirby was involved in the construction of his vessel and may have asked Orson Spear for additional hatches, knowing that this would facilitate the loading of bulky, heavy cargo such as marble. The fewer hatches on *General Butler* meant that once large marble blocks were lowered into the hold they had to be moved on rollers fore and aft to allow other blocks to be loaded.

**Bulwarks**

The configuration of the bulwarks on *O. J. Walker* is similar to the other sailing canal boats in that the forward bulwark is formed by planking over futtock heads and top timbers that protrude up through the deck and are planked inboard and outboard and capped with a rail, while the after bulwark consists of washboards fastened with iron drift pins through the waterway and into the wale. The forward bulwarks are 7 inches (17.8 cm) wide beginning at the stem and ending just after the second companionway in the bow. The toerail runs approximately 75 feet (22.9 m) to the stern. The starboard toerail is composed of three separate timbers, that are joined by two scarf joints which are approximately 3 feet (91.4 cm) long each. For the final 16 feet, 8 inches (5.1 m) another timber was placed upon the toerail to increase the height of the washboards so that they meet the taffrail. The forward toerail has a height of 9½ inches (24.1 cm), while the portion composed of two washboards increases in height from 11 inches (27.9 cm) to 1 foot, 6 inches (45.7 cm) at the transom. The scuppers are formed from notches cut in the lower face of the bulwarks timbers. There are 15 scuppers per side, each approximately 3 inches (7.6 cm) high and 2 feet (61 cm) long.

**Steering Mechanisms**

The fragile remains of a shin-cracker wheel (Fig. 52) are present on *O. J. Walker*. This steering mechanism was aptly named because the tiller which was at shin height above deck could easily and sharply strike an inattentive helmsmen. The wheel and tiller are angled toward the port side and tight against the transom, forcing the rudder hard to starboard. The wheel itself has deteriorated since the vessel was first visited in 1984, but the remainder of the mechanism survives in good condition and can be reconstructed with less conjecture than *General Butler*’s device.

The shin-cracker made it easier for a crew member to transmit movement through the rudder stock to the vessel’s rudder. Above deck the device (Fig. 53) consists of the rudder stock, the tiller and the wheel device. The head of the rudder stock has a diameter of 9 inches (22.9 cm) and rises 1 foot, 7 inches (48.3 cm) above the deck. A mortise, 3½ inches (7.6 cm) wide and 5½ inches (14 cm) high, runs
Figure 52. *O. J. Walker* shin-cracker wheel remains, photo by John V. Butler. Reproduced with permission of the Lake Champlain Maritime Museum.
Figure 53. *O. J. Walker* shin-cracker wheel remains, by Kevin J. Crisman. Reproduced with permission of the Lake Champlain Maritime Museum.
completely through the rudder stock for mounting the tiller. Two iron bands, each 3 inches (7.6 cm) wide, wrap around the rudder stock, with one above and one below the tiller, presumably to support the rudder stock from splitting due to forces exerted by the tiller. Two support arms, made from iron rods with eyes on each end, are secured to the rudder stock’s upper band and angle downward at approximately 45 degrees to either side of the tiller where they are fastened through the tiller. This prevented the tiller from sagging under the weight of its wheel mechanism.

The tiller is 4 feet, 3½ inches (1.3 m) in length excluding its tenon and is square in section, measuring 6⅔ inches (16.5 cm) on a side. The tiller’s forward end was rounded for an iron band that is 1½ inches (3.8 cm) in width. Iron eyes, with an inside diameter of 1 inch (2.5 cm), are welded to the port and starboard sides of this band to anchor ropes that are part of the mechanism. Two single sheave blocks are attached to an iron bar that passes athwartship through the tiller about 2 feet (61 cm) from its forward end. These are also part of the wheel’s rigging and are still frozen in place by corroded iron fittings, even though the rope that originally held them in position has long since deteriorated away.

Two stanchions are mortised into the top of the tiller to support the wheel. They are just over 2 feet (61 cm) in length (not including their tenons). Near the top of the stanchions a wooden drum 8 inches (20.3 cm) in diameter is mounted on an iron axle which allowed the drum to rotate. The forward end of the drum shows signs of wear from its rigging line. This drum is mortised for the spokes of the wheel. The wheel has eight spokes, each shaped in hour-glass fashion, joined by two circular wooden pieces near the outer ends of the spokes.

When the device was rigged with rope (Fig. 54), turning the wheel caused the drum to rotate, taking up rope on one side and paying it out on the other. The rope traveled through the two blocks on the tiller to a pair of blocks fixed on opposite sides of the stern bulwarks, and from these back to the end of the tiller. This caused the tiller to move toward the side where slack was being taken up. The tiller transmitted this movement to the rudder stock and turned the rudder from side to side.

The rudder stock passed through the hull below the transom and extended to the bottom of the keel. The stock has a diameter of 7 inches (17.8 cm) below the transom. The rudder is composed of two blades built up from planks. Each blade is 5 feet, 10 inches (1.8 m) long, 4 feet, 11 inches (1.5 m) high, and 1 inch (2.5 cm) thick and is fastened to the sides of the rudder stock. There is a gap of 3 inches (7.6 cm) between the two blades into which is fit a tail-board that is meant to pivot out from the gap in the rudder blades on a 2-inch (5.1-cm) diameter iron bolt. The tail-board extends 3 feet, 3 inches (99.1 cm) abaft the box rudder, which makes this blade 5 feet (1.5 m) in overall length. It is also 2 feet, 11 inches (88.9 cm) in height, and 1½ inches (3.8 cm) in thickness.
This arrangement is known as a box rudder, and was commonly used on towed canal boats at a later date, although it is not known how early this practice began. The vessel’s crew manipulated the tail-board with a rope attached to a ring on the taffrail. The rope ran down toward the rudder, but at some point this line was switched to chain which was attached to the upper after corner of the tail-board. Chain held up better when repeatedly wetted and dried. The chain survives on O. J. Walker. This means of increasing the surface area over which water had to flow enhanced the vessel’s steering in a manner consistent with canal operation. Orson Spear, O. J. Walker’s builder, could not permanently extend the rudder below the keel due to limited depth of the canal, yet he must have felt that the vessel’s full hull required greater control. None of the other sailing canal boat wrecks are known to have had a tail-board. General Butler did not have one because there are braces fastened between the rudder’s blades. Rudders survive on the canal sloops wrecked at Isle La Motte and Cumberland Bay, but this feature was not investigated on either site. O. J. Walker currently provides the earliest evidence for use of a tail-board.

Centerboard

O. J. Walker’s centerboard (Fig. 55) is contained within a trunk fashioned from 2½-inch (6.4 cm) thick planks that are drift pinned together and fastened to deck stanchions at either end. The centerboard trunk is 16 feet (4.9 m) long, 10 inches (25.4 cm) thick, and consists of five planks per side. The four upper planks on the port side have widths beginning with the top plank of 9½ inches (24.1 cm), 10½ inches (26.7 cm), 10 inches (25.4 cm), and 10½ inches (26.7 cm).

The centerboard pivots on a bolt 4 feet (1.2 m) from the forward end of the trunk and 3 feet, 11 inches (1.2 m) beneath the deck planking. The centerboard trunk begins aft of the first large cargo hatch. It is visible through the next hatch aft, and ends just forward of mainmast tabernacle. The chain for raising and lowering the centerboard ran through an opening in the deck planking 2 feet, 8 inches (81.3 cm) forward of the mainmast tabernacle. The opening is 1 foot (30.5 cm) long, 6 inches (15.2 cm) wide. Segments of the chain, as well as ferrous corrosion stains, remain on the deck. As in the case of the box rudder’s tail-board, the connection of the lift line to the centerboard was made with chain because it stood up better to repeated soaking and drying than did rope.

Rigging Elements

O. J. Walker, like General Butler, was a canal schooner, meaning each had two fore-and-aft rigged masts. The masts were stepped in tabernacles on deck and evidence of this arrangement is

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present on both sites, although *O. J. Walker* has a far more complete assemblage of spars and rigging elements. *General Butler* has both its mast tabernacles, while on *O. J. Walker* only the main mast tabernacle remains intact. During the last few years that *O. J. Walker* was afloat it was relegated to sailing on the lake, because its foremost had been permanently stepped through the deck and could not have been easily lowered. The foremost opening was located 15 feet, 2 inches (4.6 m) from the forward face of the stem.

The mainmast was stepped on deck in a tabernacle located 44 feet, 2 inches (13.5 m) from the forward face of the stem. The tabernacle is similar in construction to those on the other sailing canal boat wrecks. It rises 2 feet, 2 inches (66 cm) above the deck with a square opening for the foot of the mast which measures 10 inches (25.4 cm) on a side. The tabernacle consists of two stanchions with a spacing plank in between them at their forward ends. The stanchions penetrate the deck and are most likely fastened to either side of the keelson, as was noted on *General Butler*. A 2-inch (5.1-cm) diameter iron pin passes through a hole in the starboard stanchion 4½ inches (11.4 cm) above deck level. There is a similar hole in the port stanchion, and although the pin does not currently penetrate this hole, that is clearly its function. The pin, instead, protrudes 3 inches (7.6 cm) outside of the starboard stanchion. Two cleats, each over 1 foot (30.5 cm) long, are located on the stanchions with one on each side. The top of the tabernacle is surrounded on the side and forward faces by an iron band 3½-inch (8.9-cm) in width. The after face of the port stanchion has an iron pivot that secures the port side of an iron gate to retain the mast. The after face of the starboard side has an iron socket to receive the other end of the gate.

The spars and rigging elements remaining on *O. J. Walker* warrant special attention as they are the most extensive of the four sailing canal boat wrecks. The foremost was found lying across the port forward caprail. The mast (Fig. 56) measured 46 feet, 8 inches (14.2 m) from deck to cap with a diameter of 10½ inches (26.7 cm) at deck level. The diameter increases to 11 inches (27.9 cm) a point 6 feet (1.8 cm) above the deck and continues to increase to a 1-foot (30.5 cm) diameter at the hounds.

A pried up deck plank rests on the broken foot of the foremost. Inspection of the plank revealed a mast stepped through an 11-inch (27.9 cm) diameter hole in the deck. A series of nails were driven around the mast hole at intervals of approximately ½ inch (1.3 cm) and set back from the edge of the mast hole by about ½ inch (1.3 cm). At deck level on the mast a 2-inch (2.5-cm) wide iron band and a strip of white painted canvas are attached around its circumference by nonferrous nails. The nails, band, and canvas are clearly the remains of a collar intended to keep water from leaking into the hold through the mast opening. There are three cleats on the mast approximately shin high to a man standing on deck. The cleats were probably intended to secure the halliards for the jib and fore sail. Almost 2
feet (61 cm) above deck level an iron strap secures a 2½-inch (3.8-cm) thick wooden ring that supported the throat of the foremost boom.

The foremost’s wooden trestle-trees sit on hounds 5 feet, 9 inches (1.8 m) below the mast cap. The I-shaped trestle-trees are 1 foot, 3 inches (38.1 cm) in length at the upper flange, 1 foot, 8 inches (50.8 cm) in length at the lower flange, 4 inches (10.2 cm) in width, 1½ inches (3.8 cm) in thickness, and rest on the hounds. The cross-trees are also 1 foot, 8 inches (50.8 cm) in length, but are simple square timbers, measuring 1½ inches (3.8 cm) on a side. The cross-trees rest on the lower flanges of the trestle-trees.

The foremost head tapers upward from 8½ inches to 5 inches (21.6-12.7 cm) and is square in section. It was fit with three irregularly-spaced iron collars, two of which have the remains of shackles attached to eyes oriented fore and aft. The collars held the fore topmast, which is now missing. A spliced metal cable, which had been parceled and served, lies around the foremost head between the trestle-trees and the middle iron collar and falls across the lowest iron strap. In photographs the cable appears to have a diameter of approximately ¾ inch (1.9 cm). There is a second cable on the foremost head, located between the lower and middle collars. It does not have a splice on the forward face of the masthead, and it cannot be determined at this time if such a splice exists elsewhere. It was more corroded than the first, which gives it the appearance of being smaller in diameter, though its original diameter may have been similar.

A spar, believed to be the foremost boom, was found on the lake bottom tight against the vessel’s port side between the step of the foremost and the mainmast tabernacle. This spar was 27 feet, 9 inches (8.5 m) long, with a diameter of 6⅛ inches (16.5 cm) at one end. It has throat pieces 7 feet, 4 inches (2.2 m) long by 2 inches (5.1 cm) square in section for the 6 feet, 3 inches (1.9 m) that they overlapped the spar. The yoke is 2 inches (5.1 cm) thick and its form resembles those common to nineteenth-century fore-and-aft rigs.

During or slightly after O. J. Walker’s demise the mainmast was torn from its tabernacle and its foot dropped through an amidship cargo hatch. The mast now lies directly aft, across the starboard side of the hull. The mast is 50 feet, 5 inches (15.4 m) long overall, with a 9½-inch (25.1 cm) diameter over the majority of its length. The foot of the mast is square in section with sides 8¼ inches (22.2 cm) square over a length of 1 foot, 8 inches (50.8 cm). The heel of the mast has an iron cap or collar of undetermined dimensions. Another iron collar, located 2 feet (61 cm) above the mast heel, supported the throat of the main boom, in a similar arrangement to that seen on the foremost.

The mainmast head, comprising the uppermost 5 feet, 7 inches, (1.7 m) of the spar, is square in section and tapers upward from 6⅛ inches to 6⅝ inches (17.2-16.5 cm). The lesser dimensions of the mast head above the mast create cheeks or hounds on which the trestle-trees rest. The arrangement of trestle-trees and cross-trees on the mainmast is similar those on the foremost. The I-shaped trestle-trees
are 11 inches (27.9 cm) in length at the upper flange, 1 foot, 7 inches (48.3 cm) in length at the lower flange, and 5½ inches (14 cm) in width. The cross-trees are 1 foot, 10½ inches (57.2 cm) in length, and square in cross section, although this dimension was not taken. Four bolts fasten the cross-trees and trestle-trees together.

The mainmast head also has three irregularly spaced iron collars, although unlike the foremast the top and bottom (but not the middle) collars still retain a topmast with a diameter of 2½ inches (6.4 cm). The topmast does not survive beyond the masthead. Iron eyes are present on the after face of all three masthead collars, and on the port and starboard sides of the middle collar. Eye hooks with thimbles were found on the upper and lower collar eyes and probably secured the blocks that raised and lowered the main gaff. The upper thimble has a small length of metal cable attached. Another short section of cable wraps around the masthead and topmast, with two bitter ends just forward of the topmast.

The mainmast boom lies with its throat inside of the aftermost cargo hatch, with its sheet end facing forward and toward the port. The throat pieces are approximately 9 feet (2.7 m) long. There is an iron cap over the sheet end, and immediately forward of this an iron collar with an eye. Two holes pass through the diameter of the boom just forward of the iron collar. These holes have a diameter of 1½ inches (3.8 cm) and are spaced 7 inches (17.8 cm) apart.

No gaffs were found for either the foremast or mainmast, in or on the wreck, or in the debris field to the port side of the vessel. An extensive search was not conducted, but the exposure of so many other objects on the bay floor suggest that if these elements were nearby they would have been visible. It is possible that the gaffs either floated away or were salvaged.

A block was reported hanging inside the bow in 1984, but by 1988 it had disappeared. A total of eleven patent rigging blocks were subsequently found and recorded on the site, eight of which were recovered, photographed, and drawn (Fig. 57). They were originally redeposited on site, but have recently been recovered and conserved by the Lake Champlain Maritime Museum. Two other blocks, constituting part of the rigging for the "shin-cracker" wheel, were fastened in place and could not be removed without damage. They were recorded and photographed in situ, along with a final block which was found in the debris field on the port side of the vessel. The sheaves of all blocks were made of a very dense wood, probably lignum vitae (*Guaiacum* spp.), while the shells or shell plates were made from another, less durable hard wood.

The eight recovered blocks came from several locations, with six found on the deck of the vessel, and two on the lake floor at the port side just forward of the sternpost. Only one block was found on the starboard side of the vessel's centerline. Of the 11 known blocks seven have a single
Figure 57. O. J. Walker patent blocks, after Heidi S. Trueman.
sheave, three blocks have two sheaves, and the last block has three sheaves. The two still secured to the tiller have extant iron strops. A single-sheaved block in the debris field has an iron strop with a 2 foot, 2½-inch (67.3 cm) length of parceled and served rope attached. Degraded sections of parcelling reveal strands of rope with a diameter of ⅛ inch (1.3 cm). Another single-sheaved block was associated with a hook and thimble as well as an eye bolt that is secured to the port side planking. The dimensions of these patent rigging blocks vary significantly. These differences along with the provenance of the blocks provide clues for the reconstruction of the rigging. All the blocks were scored to receive a strop, with the exception of one snatch block, and all blocks have the corroded remains of iron hardware.

Block “a” (Fig. 57) is 10 inches (25.4 cm) in length, 7 inches (17.8 cm) in width, and 4 inches (10.2 cm) in thickness, and has one sheave with a diameter of 6 inches (15.2 cm). It would accept a rope up to a diameter of 1 inch (2.5 cm). It is associated with the rigging of the boat’s steering mechanism. Block “b” (Fig. 57) is 5¾ inches (14.6 cm) in length, 4 inches (10.2 cm) in width, and 2½ inches (6.4 cm) in thickness, and has a single sheave with a diameter of 3¼ inches (8.3 cm). It is most likely a block associated with a secondary sheet for the mainsail, but could also be associated with the tackle that lifted and lowered the box rudder’s tail-board. Block “c” (Fig. 57) is 8 inches (20.3 cm) in length, 5 inches (12.7 cm) in width, and 3½ inches (8.9 cm) in thickness, and has a single sheave with a diameter of 4½ inches (11.4 cm). It is most likely associated with a secondary sheet for the mainsail, but could also be associated with the tackle for the box rudder’s tail-board.

Block “d” (Fig. 57) is large at 1 foot, 8 inches (50.8 cm) in length, 6½ inches (16.5 cm) in width, and 5½ inches (14 cm) in thickness, and has a single sheave that is 6½ inches (16.5 cm) in diameter. It is a snatch block which was most likely used to lift heavy cargo. Its has a pivoting hook whose tip is curved outward so that it could be moused.

Block “e” (Fig. 57) is 7¼ inches (19.7 cm) in length, 5¼ inches (13.3 cm) in width, and 8 inches (20.3 cm) in thickness, and has three sheaves with a diameter of 4½ inches (11.4 cm). It could be the upper block of the main throat halliard, or more likely the upper block of the main sheet. It could also have been used in cargo handling. Block “f” (Fig. 57) is 7 inches (17.8 cm) in length, 4 inches (10.2 cm) in width, and 6¼ inches (17.2 cm) in thickness, and has two sheaves with a diameter of 4 inches (10.2 cm). It could serve either the fore throat or peak halliards equally well, but its provenance, near the foremost boom, may indicate its use as a fore sheet. Block “g” (Fig. 57) is 8 inches (20.3 cm) in length, 4 inches (10.2 cm) in width, and 6 inches (15.2 cm) in thickness, and has two sheaves with a diameter of 4½ inches (10.8 cm). It could serve as either the main throat halliard or peak halliard, but it was found near the mainmast boom and centerboard lifting chain, which suggests it was wither used as a main sheet block or for dropping and raising the centerboard. Block “h” (Fig. 57) is 7½ inches (20 cm) in length, 4½ inches (12.4 cm) in width, and 5¼ inches (13.3 cm) in thickness, and has two sheaves with a diameter of 4½ inches (11.4 cm). It is most likely associated with a secondary sheet for the mainsail.
The two blocks associated with the vessel’s “shin-cracker” wheel (Fig. 53) are both 7½ inches (19.1 cm) in length, 4½ inches (12.1 cm) in width, and 3½ inches (8.9 cm) in thickness, and each have a single sheave with a diameter of 4½ inches (11.4 cm). They were fastened by iron strops and bolts to the square-sectioned tiller. An eleventh block, which is not illustrated, is 7½ inches (19.1 cm) in length, 4½ inches (11.4 cm) in width, and 4½ inches (11.4 cm) in thickness, and has a single sheave with a diameter of 4½ inches (11.4 cm). This may be a tail block, which is a block whose strop can be tied off wherever a block is temporarily required to set up a tackle, for example in loading cargo.

A total of nine deadeyes were found, and there is evidence for a tenth. All extant deadeyes are circular, and have three holes that are scored on each face. Four of these are associated with the foremost shrouds, two each on the starboard and port sides. Only three deadeyes survive that are related to the mainmast shrouds, but a sheered off chain plate reveals the location of a fourth. The remaining two deadeyes are secured to iron eyes attached to the stem chain plate, and sit atop the stern head one after the other.

The shroud deadeyes consist of 7-inch (17.8 cm) diameter hardwood blocks. This size was used on the standard Atlantic fishing schooner. An iron strop that sits in the block’s score is bolted to a chain plate. The chain plate consists of an iron eye bolt whose partially threaded shank passes through the caprail, clamp and a chock set between two frames, beneath which it is secured with a square nut. Among the two deadeyes on the stem head, the forward most has a diameter of 7 inches (17.8 cm), while the diameter of the after deadeye is 8 inches (20.3 cm).

Four rigging horses were recorded on the wreck, one between the stem and windlass, one forward of the mainmast tabernacle, a third forward of the stern cabin, and the fourth between the rudder stock and the transom. All four still retain their travelers, and the center two retain lengths of chain.

The forwardmost rigging horse is fastened through the breast hook on deck. Its method of attachment was not recorded, but is presumed to be like those on other sailing canal boat wrecks, where the ends of the horse are secured with square nuts. The horse is 9½ inches (24.1 cm) in length. The traveler ring on this rigging horse has an outside diameter of 6 inches (15.2 cm), and lies to the port side.

The second rigging horse aft is 4 feet (1.2 cm) in length with a diameter of 1½ inches (3.8 cm). Its traveler also has an outside diameter of 6 inches (15.2 cm), and is still attached to a chain 3 feet, 7 inches (1.1 m) long. They lie at or beyond the port side of the rigging horse.

The third rigging horse, located 2 feet (61 cm) before the aft cabin, is 1 foot, 10 inches (55.9 cm) in length, with a diameter of 1½ inches (3.8 cm). It has a traveler similar in dimension to the first two and like the second is still attached to a length of chain. The traveler lies about 4 inches (10.2 cm) toward the starboard side of center on the horse. The chain is 3 feet, 9 inches (1.1 m) in length. The

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method used for attaching the second and third rigging horses was also not recorded, but they are
presumed to pass through a deck beam where they are secured with square nuts.

The aftermost rigging horse is 1 foot. 5 inches (38.1 cm) in length, and is made from stock with
a diameter of 1½ inches (3.8 cm). Its traveler has an outside diameter of 4 inches to 5 inches (10.2-12.7
cm), and lies to the starboard side of the rigging horse.

Windlass and Ground Tackle

The boat’s windlass is similar to those on the other sailing canal boat sites. It operates on the
ratchet principle, where windlass bars inserted in the sockets on the axle of the windlass are raised and
lowered to haul in chain, cables, or rope. A pawl seated in the teeth of a pawl rim prevents back slipping
by locking the barrel in one direction.

The centerline of the windlass axle is 3 feet. 2 inches (96.5 cm) abaft the forward face of the
stem. The axle is attached to the bitts by cheeks that resemble pipe clamps. The cheeks are fastened
with through bolts to the after face of windlass bitts. The bitts pass through the deck and are themselves
seated on the floor of the vessel. The axle sits 1 foot, ½ inches (31.8 cm) above the deck. Outboard of
the bitts, port and starboard, are pawl rims with a diameter of 1 foot, 2 inches (35.6 cm). Each pawl rim
has an hourglass-shaped warping head held in place by a flange which is through-bolted to the pawl rim,
and on the end of the head is a socket for a windlass bar. A pawl pin 1 foot, 6 inches (45.7 cm) long has
a diameter of 1 inch (2.5 cm). The pin runs through the port pawl, the two bitts, and then the starboard
pawl. The paws are 9 inches (22.9 cm) long with a cross section of 2 inches (5.1 cm).

The anchor chain was stowed in the bow compartment, and passed up to the deck through
hawse pipes beneath the warping heads. A pair of hawse pipes in the bulwarks on either side of the
stem, led the chain off the deck. The chain surviving on the port side runs down the bow to the mud line
and then forward away from the vessel. Somewhere on the bottom, to the south of the wreck, lies the
anchor dropped shortly before the sinking. The chain on the starboard side still runs up to an anchor
resting on the caprail.

The iron anchor on O. J. Walker’s starboard bow is of the admiralty pattern. Its shank is 4 feet,
1½ inches (1.3 m) long. The stock is 5 feet, 3 inches (1.6 m) long. The anchor is 2 feet, 9½ inches
(85.1 cm) from bill to bill. It has a ring with one flat side that passes through the shank. The ring is
made from 1½-inch (3.8-cm) stock, has an outside diameter of 8½ inches (21.6 cm), and is shackled to
the anchor chain.

In addition to the cleats on the foremast and mast tabernacle already discussed, four large
wooden deck cleats survive. Two are located forward and two are at the stern. The forward pair are the
largest with an overall length of 3 feet, 9 inches (1.1 m). The starboard cleat tapers toward the ends
where it is 3 inches (7.6 cm) wide as opposed to 4 inches (10.2 cm) along the central portion. The port
cleat varies in width from 4 inches (10.2 cm) at the forward end to 4⅛ inches (11.4 cm) at the after end. The top of the starboard cleat is 6¼ inches (15.9 cm) off the deck, while this dimension was not recorded for the port cleat. The cleats are fastened by two bolts that pierce the cleat, deck and deck beam, beneath which they are secured by a washer and nut. These cleats run fore-and-aft, and are located on either side of the after edge of the first deck hatch.

The after deck cleats are located between the stern cabin and the transom. They also run fore-and-aft, and are secured by two fastenings. Although the nature of this fastening below deck was not determined, it is most likely similar to that of the forward deck cleats. The port cleat was reported as 3 feet, 2 inches (96.5 cm) long, which is 4 inches (10.2 cm) less than the starboard cleat. The starboard cleat was reported as 3½ inches (8.9 cm) wide. They are located a little over 1 foot (30.5 cm) from the insides of the bulwarks, and almost 1 foot (30.5 cm) forward of the transom. The placement of cleats on the deck differs from both the Isle La Motte sloop, the Cumberland Bay sloop, and General Butler where those cleats that survive are fastened to the bulwarks.

Six grommets were found on the deck of the vessel on the port side, between the after coaming of the aftermost cargo hatch and the after coaming of the next hatch forward. They have a outside diameter of 1¼ inches (3.2 cm), and were made of brass. They likely are remnants of one of O. J. Walker’s sails. The grommets would have run along the edges of the sail for attachment to mast hoops as well as to the gaff and boom.

Concluding Remarks

Historical records tell us that O. J. Walker was a Lake Champlain sailing canal boat of the 1862 class, built by Orson Spear, the leading boat builder in northern Lake Champlain in the mid-nineteenth century. It was designed to fit within the enlarged New York canals. In appearance it is similar to General Butler and photographs of other canal schooners of the late-nineteenth century. Its basic construction is also like that seen on General Butler.

According to its original enrollment O. J. Walker was 86 feet, 8 inches (27 m) in length, 14 feet, 8 inches (4.5 m) in breadth, and 6 feet, 6 inches (2 m) deep in the hold, with a burden of 78 tons according to enrollment papers filed by its first owner Joseph Kirby in 1862. Archaeological study has confirmed that the vessel sunk in Burlington Bay has these dimensions, which, together with its cargo and the extensive rigging remains, help to positively identify this wreck as that of O. J. Walker.

O. J. Walker was constructed with chine logs like General Butler. There are many similarities and differences found on these two canal schooners. O. J. Walker was more solidly built, with more futtocks and deck beams and with several hanging knees. The many iron tie-rods show that Orson Spear also used a considerable amount of iron to support this hull as did Hoskins & Ross on General Butler.

Both vessels required hogging trusses at some point in their careers. Perhaps the greatest area of
differences can be seen on deck where *O. J. Walker* has two more hatches than *General Butler*. The two boats also differ in the placement of towing cleats with *O. J. Walker’s* on deck and *General Butler’s* on the bulwarks. Both vessels were steered with a wheel but *O. J. Walker’s* shin-cracker wheel is a more simple design than *General Butler’s* patent wheel with its gears and shafts. *O. J. Walker* also has the tail-board on its box rudder which *General Butler* does not have. Both vessels carried admiralty patent anchors with folding stocks, although *O. J. Walker’s* was slightly larger. Minor differences exist in the way anchor lines were handled as well. Both vessel have hawse holes in the bulwarks, but *O. J. Walker* also has hawse pipes in the deck to help feed the anchor chain into the bow compartment. *General Butler* does not have hawse pipes, which means the anchor cable was probably passed through the companionway into the bow. In making these comparisons it becomes clear that *O. J. Walker* was built a little sturdier and outfitted slightly better than *General Butler*. This may reflect Orson Spear’s expertise, or Joseph Kirby’s active role in the vessel’s construction, or may be a combination of both. Little is known of the participation of *General Butler’s* original owners in its construction.

*O. J. Walker* is reconstructed ([Fig. 58](#)) according to measurements made on site and the vessel’s enrollment documents. Much of the evidence for its reconstructed sail plan has come from information gathered on site as well as from surviving photographs of *P. E. Havens* and an unidentified canal schooner dating to the 1880s ([Fig. 59](#)). The vessel in the latter photograph could be *O. J. Walker* or another vessel from the same class. From the photograph we can glean the size of several rigging components as well as how they were set up. For example, the sail was attached to the mast with mast hoops, a standard practice on this type of fore-and-aft rig. We can be confident that *O. J. Walker* had such an arrangement.

A third photograph is of a canal schooner docked at Plattsburgh, New York, in the 1890s reveals some interesting details of the vessel’s rigging ([Fig. 60](#)). For example, there is a halyard block

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20“Canal schooner near Vergennes, Vt.,” Photograph Collection, Lake Champlain Maritime Museum.

Figure 59. Canal schooner off Vergennes, Vermont. Reproduced with permission of the Lake Champlain Maritime Museum.
Figure 60. Canal schooner at dockside in Plattsburgh, New York. Reproduced with permission of the Lake Champlain Maritime Museum.
visible on the foremast which has two sheaves. This aids in reconstructing how lines ran on O. J. Walker's running rigging. The vessel in the photograph also has a similar deck layout to both of the archaeologically studied canal schooners. In fact the hatches look identical to those of O. J. Walker, and the rigging visible is consistent with what was found on O. J. Walker. The vessel may very well be O. J. Walker shortly before its foremast was stepped through the deck.

O. J. Walker's career spanned from 1862 to 1895, during which time it was used by a number of people for perform numerous tasks. It carried a variety of cargo such as gravel, bricks, and tiles including the deck load of bricks and tiles on its last voyage. It was originally owned by its sailing master Joseph Kirby and local investor Thomas Steele. These men remained partners in the vessel for almost 20 years before selling it. After Kirby and Steele it was owned solely by lakemen who operated the vessel themselves, until it was acquired by a pair of Mallets Bay brickyard owners. During their tenure O. J. Walker was commanded for a short while by a women. This is the only known instance of a woman sailing canal boat captain on Lake Champlain.

O. J. Walker's lengthy career suggests it was well built by Orson Spear. Archaeological data support this conclusion. The vessel is light-frame, but this represents typical framing patterns on Lake Champlain. The lake is usually calm and shore is never very far away. When boats got into trouble they usually headed for shore and the shelter of a bay. If circumstances dictated they could be beached in shallows, so that if they sank, they could be raised easily. This happened to O. J. Walker a couple of years before it sank, and B. Noble was also beached during its career.22

O. J. Walker played many roles over the span of its 33-year career. It was a vital part of the rapidly-expanding economic development of Lake Champlain in the nineteenth century. It brought cargo to towns along the shores of Lake Champlain, the Champlain Canal, the Hudson River Valley and the St. Lawrence River Valley. In the twentieth century it has given archaeologists the opportunity to compare its data with that of other sailing canal boat sites and historical documents. Most significantly it has told archaeologists a great deal about how sailing canal boats were rigged. Finally, as a newly incorporated site in Vermont's Underwater Preserve System, it brings this story to the diving public.

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CHAPTER XII

CONCLUSION

In the preceding four chapters we examined remains of sailing canal boats and found that four out of five are definitely chine-built and the fifth is also likely constructed in this manner. The chine construction method used on General Butler and O. J. Walker is of a different variety than that seen on the North Beach wreck and the Cumberland Bay canal sloop, but all are chine-built. What does all this archaeology tell us about these vessels as a class of inland water transportation? First, we have a firm grasp of their basic dimensions and characteristics. Ignoring the first experiments in building vessels capable of sailing Lake Champlain and negotiating the Champlain Canal, and the few large boats built in the twilight years of merchant sailing vessels on Lake Champlain, we can distinguish two types based on size. By the 1830s boat builders had figured out how to make the best use of the space allowed within the canal system and began building boats 79 feet (24.1 m) in length, 13 feet 6 inches (4.1 m) in breadth, and 4 feet (1.2 m) in depth of hold, with a burden of 45 tons. Following a major enlargement of the canal, completed in 1862, these boats expanded in size to 88 feet, 6 inches (27 m) in length, 14 feet 6 inches (4.4 m) in breadth, and 6 feet (1.8 m) in depth of hold, with a burden of 66 tons. This gives the earlier vessels a length to breadth ratio of 5.9:1, while the later boats have a ratio of 6.2:1. These dimensions are reflected in merchant vessel enrollment documents as well as on archaeological sites. This size was dictated by the depth of the canal and by the length and width of canal locks. Builders like Orson Spear were careful to get accurate information on what size vessel the canal would admit.

Sailing canal boat hulls were flat-bottomed, with vertical sides, a molded bow, and either a molded or scow stern. They were very full at both ends and chine-built in one manner or another along the majority of their length. Evidence for the earliest boats is lacking, but based on previous chine-built craft in the region it is believed that standing knees joined the bottom and sides of early sailing canal boats. Due to economic considerations, new forms of chine construction were developed in the mid-nineteenth century. These included the use of a chine log, with athwartship framing or the use of edge-fastened sides above the chine log which eliminated the need for athwartship frames, except at the molded bow and stern. Chine construction is a form of bottom-based boat building where the boat’s builder thinks of the vessel’s bottom as a separate component in the construction process.1 The bottom is built first and determines the overall size and shape of the vessel. Champlain Valley sailing canal boat builders, like all canal boat builders, were interested in producing as large a cargo “box” as possible.

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within the confines of their canal. Bottom-based, chine-built methods were ideal for this. The bottom of the North Beach wreck had to be completed prior to standing up the edge-fastened sides. While General Butler and O. J. Walker could in theory have been framed first and planked afterward, it would have been easier to complete the bottom planking prior to setting up the chine logs.

In terms of its principal scantlings, timber dimensions remain fairly constant among the archaeologically-studied hulls, regardless of their size. The timber size and spacing reflect light construction. The keel is usually a keel plank with far greater sided than molded dimension, so that it does not project far beneath the hull, although on the North Beach wreck a true keel is employed, but is contained mostly within the vessel. On all of the boats we have examined the stem assembly consists of a single post and apron. Four out of the five archaeological sites have molded sterns with a sternpost and transom, although the Cumberland Bay canal sloop has a scow stern, which enrollment documents indicate was as common as the molded stern.

The framing timber of preference throughout the hull, exclusive of the major centerline timbers, is a straight piece of white oak with dimensions of 4 inches (10.2 cm) sided and molded. Straight floor timbers and futtocks were let into chine logs running along either side of the vessel. Chine logs were substantial in size to add longitudinal strength to long, narrow vessels with thin keel planks and a definite tendency to hog. Standing knees and futtocks were used to frame the molded bow and stern. Keelsons and sister keelsons parallel the form of the keel. Planking is 2 inches (5.1 cm) thick with the exception of edge-fastened vessels which required thicker material. Ceiling is 2 inches (5.1 cm) thick on the bottom where it often supported heavy cargo, while on the sides it is 1 inch (2.5 cm) thick.

These vessels are built well, but lightly, to sail on Lake Champlain where water conditions are generally quite calm. Storms do churn up the lake from time to time, especially up north where the lake is wider. In these conditions, sailing canal boats were sorely tested as indicated by the loss of both General Butler and O. J. Walker. When caught in rough seas the tactic of sailing canal boats, like the bateau that preceded them on the lake, was to head for the shore where their flat bottom allowed them to be beached without much damage. This technique saved the canal schooners O. J. Walker and B. Noble on at least one occasion each.

Sailing canal boats were built comparable in strength to lake sailing vessels. Frames were spaced just under 2 feet (61 cm) apart. Builders practiced economy by eliminating expensive compass timber and turning to straight timber for chine construction and iron for hull strengthening. Under the supervision of a knowledgeable boat builder, construction of this type could be accomplished by unskilled carpenters with minimal boat building experience, providing further economy by using less-expensive labor. In the bow of the North Beach wreck we get our only glimpse at what might be termed "shoddy" construction. Here, where the hull planking met the frames, shims were used rather than
faying the exterior face of frames. The builders of both General Butler and O. J. Walker took great care to see that the vessels’ various parts fit together well.

The hogging trusses on O. J. Walker and General Butler indicate that sailing canal boats were constructed with a delicate balance of strength, where anything less would constitute weak construction and anything more would be over built. The extra 10 feet (3.1 m) of length added to the 1862 class of boats may have pushed the 4-inch (10.2-cm) square framing timbers beyond their limit. Both archaeological examples of canal schooners have hogging trusses fastened over ceiling planking and into futtocks on the port and starboard sides. The manner in which both trusses have been installed suggests that they were added later in the vessel’s career once they began to hog. None of the canal sloops have a hogging truss. It would be interesting to examine a canal schooner built substantially later than O. J. Walker or General Butler to see if builders used framing timber of larger dimension to head off this problem, or simply installed hogging trusses during original construction. The sides of Erie Canal boats had ceiling planking placed in two diagonal courses, rather than fore-and-aft, specifically to combat hogging.² This practice is not reported for any Champlain Canal boats.

Sailing canal boat decks are supported by stanchions, clamps, deck beams, and in some cases hanging and lodging knees. The deck has hatches leading to the three functional areas below deck, including one or two companionways with a ladder leading to the bow, two to four cargo hatches for the hold, and a hatch to mount a trunk for the stern cabin. A large collection of artifacts from General Butler illustrate the below-deck divisions of space. The bow compartment contained boat’s equipment such as spare rigging, lamps, tools, and mule harnesses. Excavation of the hold uncovered rollers for moving the heavy marble cargo. The stern cabin yielded a cast-iron stove (not collected) for preparing meals, together with ceramics and glass associated with taking meals. The cabin was small, yet contained bunks, cabinets, a table, and chairs. General Butler’s cabin floor was covered in a linoleum-like material, while O. J. Walker’s cabin had tongue-and-groove woodwork decorated with beaded edges.

The mast or masts are stepped on deck in tabernacles so that they can pivot down for removal prior to canal transit. The earliest sailing canal boats retained their rigging on deck for the canal passage, so the masts could be stepped for the trip down the Hudson River. Once boats could count on being towed on the river, sailing canal boats stowed their masts and rigging at “Old Billy Cain’s sail loft” in Whitehall, New York.³


Sailing canal boats used fore-and-aft rigs almost exclusively. They are either sloops or schooners with only one vessel known to have carried a square sail. To combat the tendency for these flat-bottomed vessels to slip leeward under sail, and to improve stability, builders placed a centerboard in a trunk within the hold. These long centerboards pivoted deep beneath the hull. Their pivot point is located at the forward end of the trunk, with a chain for lifting the board attached to its after end. The origin of the centerboard is unclear, but drop keels, which are similar, were developed by a British naval officer in 1774, while the first patent for a centerboard dates to 1811. They reportedly made their first appearance on Lake Champlain in 1834.

The topsides of sailing canal boats are strikingly similar right down to the small details. The low bulwarks in the bow are of plank-on-frame construction, while the toerail amidships and astern is constructed from edge-fastened washboards. A windlass is mounted on deck at the bow that served several purposes. Early sailing canal boats may have had log windlasses like that on the Cumberland Bay canal sloop and on the lake sloop Water Witch, while later boats had patent iron windlasses. The windlass reeled in anchor cable or chain, and it was used to raise and lower masts and the centerboard. Rigging horses are placed along the deck at several locations. The forwardmost sits atop the breast hook. Two or more are located on deck and are placed at deck beams. A final horse iron is located somewhere in the stern. These rigging horses anchored lires needed to work the sailing rig. They are made of iron rather than wood, indicating the liberal use of iron throughout these boats. Wooden rigging horses are known from Europe.

Sailing canal boats were painted to protect the owner’s investment. Colorful patterns are common on towed canal boats in the United States and Europe, but Champlain boats were not overly ornate. White is the most common paint found on sailing canal boats. It is reported from the four archaeological sailing canal boat sites discussed in detail above. The interior of the stern cabin was painted white to brighten up a dark space. The vessel’s exterior above the waterline was also painted. Besides white paint the colors green and blue are reported from archaeological sites.

Sailing canal boats offer insights into mid-nineteenth century culture in the Champlain Valley. These boats represent people’s desires to build and use watercraft within the environment in which they find themselves. The first sailing canal boats resulted from anticipation of opportunities the Champlain Canal would provide. Gleaner was not merely the first vessel through the completed canal, but an enterprise of northern Vermonter’s, speculating on a boat designed to end decades of isolation from

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1Enrollment document for the canal schooner Emma, dated May 15, 1865. Record Group 41. Civil Reference Branch, United States Archives.

desired markets. Once the canal proved itself, and commerce in the Champlain Valley increased, so did the numbers of sailing canal boats until they dominated freight carrying. Businessmen gave up using ordinary lake sailing vessels in combination with standard towed canal boats to ship goods to and from the Hudson River region. The towed boats were relegated to carrying heavy, bulk cargo that paid lower freight charges. The 1840s and 1850s were the heyday of the sailing canal boat.

Where did sailing canal boats originate? At some point before the canal was completed, the idea occurred to someone to build a vessel that would fit within the canal system and sail on the lake. Early builders of all types of canal boats drew on their experience with local watercraft such as lake sloops or river boats. The keelboat and barge were the ancestors of the nineteenth-century canal boat.⁶ Durham boats had sails and were some of the first boats on the Erie Canal. The sailing scows used on the Mohawk River and on the upper reaches of the Hudson River around Waterford. New York would have been easily adapted to fit within New York’s canals. Shallow drafted sloops had sailed Lake Champlain since the 1790s. All of these watercraft provided the models for towed canal boats and sailing canal boats.

The idea that American canal boats were based on European designs came about from the story of Chief Engineer, the first purpose-built canal boat on the Erie Canal. Chief Engineer was based on a model brought from England in 1817 by Canvass White who was an assistant to the Erie Canal’s “chief engineer.” Benjamin Wright.⁷ This model survives in the collection of the Buffalo Historical Society. It is a double-ended hull with a rudder. The cabins placed on Chief Engineer were not original equipment on the English model. Other early boat builders did not have access to this model, however, and had to rely on their own experience.

Sailing canal boats became popular with people living in areas not serviced by steam transportation. Vermont was the first steamboat to ply Lake Champlain when launched in 1809, but even during the 1820s and 1830s when steamboat companies competed to dominate the lake there were never enough boats to guarantee a tow to Whitehall, New York. The steamboats that were available for towing were largely engaged in towing rafts. The northern lake towns dominated sailing canal boat ownership, because they had very little chance of finding a tow on the lake. Steamboats called at Whitehall, Burlington, Plattsburgh, St. Jean, and a few other stops, but competition was at times so fierce that regular stops were skipped. For residents of small northern lake towns sails provided the only dependable means of propulsion for their watercraft.

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⁶S. Dunbar, A History of Travel in America, p. 848.

⁷Dunbar, A History of Travel in America, p. 607, fig. 182. Dunbar cites Joel Munsell’s Collections on the History of Albany, published in 1867, for the illustration of Chief Engineer.
Sailing canal boat use peaked at mid century with the development of line companies and standardized construction practices. The ability of these boats to travel from lake ports directly to New York City without transshipment of cargo had always been their most unique attribute, and it secured for them a hold on freight forwarding once Champlain Valley farms began producing significant quantities of perishable dairy products for export. Unlike lumber, iron, and marble, these products suffered in the holds of lake sailing vessels or on wharfs from long waits for available towed canal boats, as well as from rough handling when moved from one hold to another. For cargo where perishability was not a concern, transshipment meant additional handling charges, which again made sailing canal boats an attractive alternative.

Sailing canal boats were economical to build and operate during their peak years. Those boats not belonging to a line company were initially owned by one or more financial backers often in conjunction with the vessel’s sailing master. After a few years of profitable operation they became the property of sole proprietors, either their original sailing master or another lakeman. They had an insurable life span of 13 years, but many sailed on well after that (O. J. Walker and B. Noble had careers on the lake of over 30 years). These two vessels were salvaged on occasions when they sank in shallow water indicating that their owners still valued them. The archaeological examples of sailing canal boats examined in this study were either not worth salvaging or could not be salvaged for technical reasons. The Isle La Motte sloop lies in 55 feet (16.8 m) of water and its mast may have either broken on impact or not risen above the surface to mark the spot for a salvage attempt. The North Beach Wreck lies in shallow water close to shore. It either sank and was immediately destroyed by ice or it was old at the time of sinking and deemed not worthy of salvage. General Butler, already an uninsurable boat, pounded on the breakwater so many times that it opened a sizeable gash in the starboard bow making it a total loss. James Wakefield felt that only the rigging of O. J. Walker had any value and even this was not salvaged.

The lakemen who operated sailing canal boats often had long careers on the water. William Montgomery, Jabez Rockwell, Julius Rugar, Joseph Kirby, and Shell Parkhurst spent their entire working lives on boats. A few, like Thomas Weatherwax who ran a steam ferry after selling O. J. Walker, managed to get shore-based work later in their careers.

The construction methods used on sailing canal boats also reflect changes in the Champlain Valley economy. As the forests became depleted of compass timber, and as iron was mined and forged, sailing canal boat builders moved away from traditional construction with paired square frames or chine construction with standing knees to methods employing chine logs or edge-fastened sides. Sailing canal

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boat research has pushed back the origin of chine-log construction on New York canal boats to 1852 when Orson Spear drafted a chine-log constructed sailing canal boat. Prior to this discovery, a patent dated 1858 was the earliest evidence. It should be pointed out that canal boat construction with chine logs probably began much earlier. Chine-log construction dates to at least to 1807 when Robert Fulton’s North River Steamboat of Clermont was built with a canal boat style hull using this technique.9

Recent advances in marine technology were frequently incorporated in sailing canal boats. Orson Spear drafted his plans at a time when even many east coast shipyards still relied on half models of hulls. William Annesley was far ahead of his time in promoting a molded-laminate construction technique that is essentially the same method used to form modern pleasure craft. Joseph Deming received a patent for the method used to construct the sides of the North Beach wreck.10 A search of patent records did not turn up a steering device precisely like those on O. J. Walker and General Butler but did indicate that numerous other wheel steering devices were patented between the 1830s and 1860s. Wire cable found on O. J. Walker’s rigging is further proof that sailing canal boat builders and operators wanted the latest and best equipment for their vessels.

Leading-edge technology also put an end to the reign of sailing canal boats. The combination of steam propulsion with a screw propellor yielded a powerful tugboat well-suited to the task of towing canal boats. The first of these appeared on Lake Champlain in 1846, but it was not until the organization of a joint stock company in 1865 that these boats came to the forefront. From this time forward tugs routinely pulled 40 to 60 standard canal boats at a time around the lake. Most sailing canal boat owners did away with what had become an unnecessary and expensive sailing rig in the 1870s. The rash of dismasting is noted in enrollment documents (Appendices B and C). A small number of functioning sailing canal boats remained through the end of the nineteenth century, but only on the fringes of commerce. No longer the property of major financial investors, they belonged strictly to their sailing masters, or like O. J. Walker, to someone who needed only to move things around the lake.

Artifacts from the various sailing canal boat sites offer more insights into mid-nineteenth-century Champlain Valley culture. Life on board a sailing canal boat did not differ greatly from that of standard towed canal boats. The three functional areas within any canal boat hull, sailing or otherwise, were quite similar.

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The bow was reserved for crew activities and boat operation, cargo was stowed amidships and the stern cabin was the center of life on board. The bow compartment was extensively examined on *General Butler* and revealed equipment essential to daily operation of the boat, from bottles of spring water and bitters for crew refreshment, to a rubber overshoe for keeping feet dry. Spare rigging blocks hung from nails on the windlass bits and a box contained tools. Mule harnesses were carried on board indicating that it was cheaper to buy this gear than rent it. The mules were rented along the short Champlain Canal, unlike the Erie Canal where boats had bow cabins to house mules. This meant the Champlain boats could carry more cargo to offset the added cost of renting mules. A navigation light attests to voyages made at night.

The holds of the four archaeological sailing canal boats contain either intact cargo or fragments of previous cargo. These cargo include heavy, bulky, but inexpensive items like marble, brick, tile, and coal. We know from historical sources that *O. J. Walker* also carried gravel. The canal made exploitation of these, as well as lumber and iron resources, possible by providing inexpensive water transportation. These items were regularly carried by sailing canal boats in addition to perishable farm products.

*General Butler's* stern cabin produced a rich assortment of artifacts indicating the nature of life on board. Cabins were accessed through a short hinged door and sliding panels in the roof, leading to a set of stairs that went down to a raised cabin floor. Cabins were heated with stoves that survive intact, or in pieces, on each of the archaeological sites under discussion. These are located opposite from the cabin's door to prevent escape of heat when entering and exiting the cabin. These stoves were used to prepare meals that were served on stoneware plates and bowls made in England and North America. Meals were supplemented with beverages like soda water and bitters contained in glass bottles and stoneware jugs and taken in drinking glasses. When not in use, these meal-related items were kept in cupboards in the cabin. The cabin was also used as sleeping quarters for the crew and sometimes family members, as well as a place to keep spare clothing and personal items. There was time for leisure on board as suggested by a model boat on *General Butler* and a musical instrument from *O. J. Walker*.

The Lake Champlain sailing canal boat is an example of an appropriate technology. They were a good idea when *Gleaner* passed through the canal in 1823, but not the predominant means of lake and canal transportation until the organization of line companies in the 1840s. They arose in a specific environment where a man-made waterway was directly adjacent to a natural waterway. For this reason sailing canal boats are not unique to Lake Champlain, although the particular type used on the lake is different from other known types. The wreck of a large sloop in Burlington Bay called *Cornelia* is a case in point. *Cornelia* looks very similar to the boats discussed above with a mast stepped on deck in a tabernacle, but it has a breadth in excess of the Champlain Canal locks. This vessel was built to move through the larger Canadian canals to the north. Other Canadian-built sailing canal boats, called
"pinflats." visited Lake Champlain, bringing timber from the Ottawa River in Ontario to Burlington, Vermont, and Ticonderoga, New York. Pinflats (Fig. 61)\textsuperscript{11} were distinct from the lake Champlain boats. They had flat bows and sterns, carried a square sail on a single mast, and were set up for large deck loads of lumber and pulp wood.

At least one other area of New York produced sailing canal boats at an early date. In November of 1823, canal schooners from Hector in Tompkins County, New York, departed with farm products destined for New York City. Mary & Hannah and Sally & Mary\textsuperscript{12} sailed the length of Seneca Lake and entered locks at Waterloo. From here they took the Seneca River to the Erie Canal, to the Hudson River, and finally to New York City. Mary & Hannah carried a cargo of wheat and butter and was hailed as the first vessel to reach the metropolis by way of the portion of the Erie Canal completed that year.

Sally & Mary was also recognized as heralding a great trade about to spring fourth from western New York into the port at the mouth of the Hudson River. More importantly, it typifies the enterprise that the canal fostered and which many New Yorkers and Vermonters pursued. Sally & Mary was a venture conceived of, and brought to fruition, by two farmers named Osborn and Sealy. These jacks-of-all-trades designed and built the canal schooner and likely named it after their wives or children. The boat builders obtained the timber and planking used in the vessel's construction locally, and produced their own sails and rigging.

Sailing canal boats were also used in the state of Maine.\textsuperscript{13} In 1830 the Cumberland & Oxford Canal (C&O) opened mainly as an outlet for lumber from the interior by way of Sebago Lake and the canal to the coast. The Maine boats developed on this waterway with many of the same features. They carried two masts stepped on deck in tabernacles, rigged as a schooner. They were outfitted with twin centerboards and their foremost was stepped much farther forward than seen on Lake Champlain boats. The C&O boats were pulled through the canal by horses. They also had cleated walkways and were poled similar to earlier river boats. They sailed on the lake, along the coast, and on one occasion to

\textsuperscript{11}"On the Lake Front, Burlington, Vt." postcard in author's possession.

\textsuperscript{12}R. G. Albion, The Rise of New York Port, p. 86; J. H. Hinton, ed. The History and Topography of the United States of North America, From the Earliest Period to the Present Time, p. 371. Albion recounts the voyage of Mary & Hannah, while Hinton describes the journey of Sally & Mary. Their accounts bear many similarities and it is difficult to determine whether they describe separate events or the same episode.

Figure 61. Canadian sailing canal boats called pinflats.
The vessels were between 60 and 65 feet (18.3-19.8 m) in length, and 9 to 10 feet (2.7-3 m) in breadth.

The remains of a C&O boat have been examined and the frame spacing was found to be 1 foot, 9 inches (53.3 cm). This is comparable to the Lake Champlain boats, but seems perilously light for a vessel used on the open seas. No other details of the sunken vessel’s construction have yet come to light.14

Many other inland boat types shared features and development similar to the Lake Champlain sailing canai boat. Piscataqua River gunnelows were developed from river scows and exhibited flat-bottomed, chine-built construction. They had a stub mast and counter-weighted spar to clear bridges over the river. The spar carried a fore-and-aft sail which resembles, but is distinct from, a lateen rig.15

On the Great Lakes, schooners and scow schooners were built to sail the lakes and pass through the large canal locks that connect each lake and the St. Lawrence River.16 Scow schooners were built with edge-fastened construction similar to the two Lake Champlain canal sloops discussed in this dissertation.17 Vessels exhibiting edge-fastened construction include the scow schooners Gray Oak and Rockaway.18 Scow schooners were also used in San Francisco Bay, but were not associated with canals.19 They were first rigged as sloops in the 1850s, then later as schooners but did not have removable masts. They were chine constructed, using floors locked into chine logs by dovetail joins with keys or wedges. Their flat bottoms and shallow draft allowed them to carry people and goods far inland. They were outfitted with centerboards for sailing the open bay.

Sailing canal boats are also known from Europe, especially England and Holland. England was laced with a non-standardized system of canals which accommodated many different canal boats. Some of the sailing variety included Thames sailing barges, Severn trows, Yorkshire keels. Weaver River flats.


16Chapelle, The National Watercraft Collection, p. 45.


18Kenneth R. Pott personal communication.

19R. R. Olmstead, Scow Schooners of San Francisco Bay, pp. 15-17, 68; Chapelle, The National Watercraft Collection, p. 46.
and East Anglian wherries.20 The remains of a vessel known as Almere Wijk 13 in Flevoland, Holland are thought to represent the hull of a canal boat that also sailed on the Zuiderzee.21 Another Flevoland find contained a defunct cannon which was used as a counterweight on the heel of the mast to help raise and lower the spar when passing beneath bridges.22 These foreign examples of sailing canal craft, like the Champlain Valley boats, arose when a man-made waterway was in proximity to a large, navigable body of water. This could be a lake, a small sea, or a large river estuary. When the opportunity presented itself to add a sailing rig to a canal boat hull, this was done to avoid transhipping cargo.

Lake Champlain's sailing canal boats share many things in common with sailing canal craft from other cultures, as well as with many inland sailing vessels that did not maneuver through canals. The size, shape, construction, and propulsion of these watercraft reflect the restrictions of the inland environment in which they arose. Their development occurred independently. European and American sailing canal craft are derived from an earlier, local river or lake sailing vessel.

The Lake Champlain sailing canal boat had several influences. Lake sloops originated by Daniel Wilcox and built in great numbers by Richard Eggleston dominated lake trade prior to the canal. Wilcox built sloops in St. Albans, so the builders of Gleaner would have been familiar with Wilcox's design. On the other end of the canal in Waterford, New York, sailing scows plied the shallow upper reaches of the Hudson River, and similar vessels navigated the Mohawk River. Modifying a scow for use on the canal required very little effort. As the canal was being anxiously anticipated, businessmen, boat builders, and even farmers schemed to take advantage of the new waterway. They took locally available watercraft types and adapted them to the well-known canal dimensions. Experience and governmental regulations such as the banning of scow bows led to a standardized type that emerged as demand for these vessels increased. The Lake Champlain sailing canal boat played a vital role in the commercial development of the Champlain Valley until replaced by steam technology. Along the way these boats were built, owned, sailed, and lost by a varied cross section of the Champlain Valley population.


The discovery of *General Butler* in 1980 has led to another journey for Lake Champlain’s sailing canal boats. This journey is one of rediscovery. These unique, hybrid workhorses of American inland ingenuity have been resurrected from the depths of Lake Champlain along with pages of documents that were forgotten in libraries and archives. They have provided a glimpse into the lives of those who journeyed to and from the Champlain Valley in the nineteenth century. It is hoped that this dissertation can contribute toward yet another journey, where a replica of a Lake Champlain sailing canal boat can take the non-diving public back to the days when long boats ruled the lake.
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APPENDIX A

GLOSSARY

ABAFT (prep.): toward the stern.

AFT (adv.): toward the stern.

AFTER (adj.): having to do with the stern or located in proximity to the stern.

AMIDSHIPS (adv.): the center point of a vessel halfway between stem and stern.

APRON (n.): a timber that supports the join between the keel and stem.

ARMS (n.): the ends of a knee.

BALK (n.): a heavy beam extending from side to side to support deck planks.

BATEAU (n.): a small, flat-bottom boat with pointed ends introduced to North America by the French. Also used by the English and Americans.

BEAM (n.): 1) a transverse timber which provides lateral and deck support; 2) the width of a vessel.

BEFORE (prep.) toward the bow.

BILGE (n.): a rounded area where the bottom and side of a vessel meet.

BITT (n.): a post rising from the bottom up through the deck in order to secure a windlass and used as a point to secure lines.

BOAT (n.): 1) an inland watercraft as distinct from ocean-going vessels; 2) a small open vessel without a deck usually trailed behind a larger vessel.

BOLT (n.): an heavy iron fastener of constant diameter used to through-fasten timbers and fixtures.

BOW (n.): the forward portion of a hull.

BREAST HOOK (n.): an athwartship timber that reinforces the union of the sides and the stern.

BULWARK (n.): the side of the vessel above deck level.

BUTT JOIN (n.): the joining of two timbers end to end without any overlap, as opposed to a scarf.

CANAL (n.): an artificial water made by cutting a channel through land and using lift locks to overcome differences in elevation where necessary.

CANAL BOAT (n.): a flat-bottom vessel built to maximize cargo capacity with the limits allowed by a canal's locks and channel.

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1This glossary contains words and definition regarding canal boats.
CANAL SCHOONER (n.): a sailing canal boat with two masts outfitted with fore-and-aft sailing rig.

CANAL SLOOP (n.): a sailing canal boat with a single mast with a fore-and-aft sailing rig.

CANT FRAME (n.): a framing timber set at an angle other than perpendicular to the keel in order to reinforce a vessel's bow.

CAPRAIL (n.): a timber attached to the top of a vessel's bulwarks.

CARLING (n.): a longitudinal beam placed between ledges.

CEILING (n.): the planking placed on the inside of a vessel's frames to reinforce the structure and to provide a level surface on which the crew can work.

CENTERBOARD (n.): a structure of timbers bolted together and lowered through a hull to project from the bottom of a vessel in order to provide lateral resistance. Alternatively spelled: center-board, centre-board.

CENTERBOARD SLOT (n.): a cut-out in or next to the keel that allows a centerboard to pass.

CENTERBOARD TRUNK (n.): a watertight housing that encases a centerboard. Sometimes called a centerboard box or centerboard case.

CHAMFER (n.): a flat surface created on the corner of a timber.

CHINE (n.): an angular join of the bottom and side of a vessel, as opposed to a turn of the bilge.

CHINE-BUILT (adj.): having to do with hull construction where the bottom and sides of a vessel meet at an angle by means of a standing knee or a chine log.

CHINE LOG (n.): a heavy longitudinal reinforcing timber at the angular union between a vessel's bottom and side.

CHINE-LOG CONSTRUCTION (n.): a form of chine-building utilizing a chine log.

CLAMP (n.): a thick internal strake that provides longitudinal strength; when it supports deck beams, it is also called a shelf clamp.

CLEAT (n.): a block of wood or iron to which lines are secured.

COAMING (n.): a structure of timbers around a hatch to prevent water from entering the hold.

COMPANIONWAY (n.): a small hatch large enough for a person to use that provides access below deck.

COMPASS TIMBER (n.): a naturally-curved portion of a tree. Used to make tightly-curved timbers and knees where the curved grain provides great strength.

DEADEYE (n.): a circular block pierced by three holes and with a groove around its circumference, being used in pairs to secure standing rigging.
DEADRISKE (n.): the rise of the bottom of a hull from the keel toward the side.

DEADWOOD (n.): timbers that support the join between the keel and the sternpost.

DEPTH OF HOLD (n.): a distance as measured amidships at the centerline from the top of the ceiling planking to the bottom of the deck beams. Alternatively, this measurement was taken in the nineteenth century from the top of the bottom planking to the underside of the deck beams.

DRAFT (n.): 1) the depth of water between the bottom of a vessel’s keel and the waterline; 2) a plan of a vessel’s lines or construction features.

DRIFT (n.): a heavy iron fastener of constant diameter driven into a blind hole of slightly smaller diameter. Also called a drift pin or drift bolt.

EDGE-FASTENED (adj.): a method of joining timbers or planks that are set up edge-to-edge by means of a fastener passing through the widths of the timbers or planks. Also called edge-bolted, edgewise, or edgeways.

ENTRANCE (n.): the shape of the bow below the waterline.

FAY (v.): to prepare the surface of a timber so that it will join another without gaps.

FLATBOAT (n.): a flat-bottom vessel resembling a scow. Also called a flat and with slight variations in design known as a ark, broadhorn, Mackinaw boat, New Orleans boat, or Susquehanna boat.

FLOOR (n.): the bottom of a vessel.

FLOOR TIMBER (n.): a framing timber that crosses the keel and to which the bottom planking is fastened.

FORE (adj.): having to do with the bow or the forward part of a vessel.

FORWARD (adj. or adv.): having to do with the bow, or located toward the bow.

FRAME (n.): a structure of timbers that crosses and is fastened to the keel and to which hull planking is fastened. They usually consist of floor timbers and futtocks.

FUTTOCK (n.): one or more framing timbers, usually fastened to a floor timber and forming the transition to and along the vessel’s side. On chine-log constructed vessels they are sometimes called side frames.

GARBOARD (n.): the hull planking strake closest to the keel.

HALF-FRAME (n.): a framing timber that does not cross the keel, but runs from the keel along the floor and rises up the vessel’s side.

HANGING KNEE (n.): a knee positioned vertically whose long arm points downward. It usually supports the deck by connecting the deck beams and the vessel’s side.

HAWSE HOLE (n.): a hole piercing the bulwarks at the bow in order to provide a fairlead for heavy lines used to anchor, moor, or dock a vessel.
HAWSE PIECE (n.): a framing timber of the bow that runs roughly parallel to the stem.

HAWSE PIPE (n.): a hole piercing the deck at the bow and reinforced with an iron pipe which leads below deck where anchor, mooring, and docking lines are stowed.

HEEL (n.): the base of a mast.

HOG (n.): a condition where the ends of a hull droop due to a lack of buoyancy in combination with excessive or poor distribution of weight within the hull. Also called hogging.

HOGGING TRUSS (n.): a wooden or iron structure to prevent hogging.

KEEL (n.): the primary longitudinal strengthening timber, centrally located, to which the stem, sternpost, and frames are attached.

KEELBOAT (n.): a flat-bottom vessel with a keel. Variations include a barge, Durham boat, Mohawk boat, and Ohio-packet boat.

KEEL PLANK (n.): a centerline strake usually thicker than other strakes, but not of sufficient dimension to be considered a true keel. Also called a plank keel, central plank, or Kingplank.

KEELSON (n.): an internal longitudinal strengthening timber that reinforces the union of the frames to the keel.

KNEE (n.): an angular timber usually cut from the junction of two branches or the trunk and a branch.

LEDGE (n.): an athwartship beam that does not span the vessel from side to side.

LAKE SAILING VESSEL (n.): a vessel relegated to sailing solely on a lake because it is either too long, too broad, or too deep in the hold to fit within a canal.

LIMBER (n.): a channel cut in the lower surface of a floor, half frame, or futtock in order to permit the circulation of bilge water in the hull, so that it may flow to a pump well for extraction. Also called a limber hole.

LINE (n.): a rope with a specific function.

LODGING KNEE (n.): a knee positioned horizontally to reinforce the union of longitudinal and athwartship timbers and/or planks.

MAST TABERNACLE (n.): a structure of timbers rising from the bottom of a vessel up through the deck in order to anchor the heel of a mast.

MIDSHIP FRAME (n.): the frame at the point of the vessel’s greatest breadth.

MIDSHIPS (adj.): having to do with the middle portion of a vessel.

MOLDED BOW (n.): a method for constructing the forward end of a vessel by fastening planks over curved frames. Also called a "moulded" bow on nineteenth-century merchant vessel enrollment documents.
MOLDED DIMENSION (n.): the measurement of a timber’s height or width from the surface resting against planking.

MOLDED STERN (n.): a method for constructing the after end of a vessel by fastening planks over curved frames. Also called a "moulded" stern on nineteenth-century merchant vessel enrollment documents. As opposed to a scow stern.

MORTISE-AND-TENON JOINERY (n.): a system of fastening planks edge-to-edge by means of tenons housed in mortises cut in a plank's edges. It was practiced in the Mediterranean in classical antiquity.

PIROGUE (n.): a vessel made by modifying a hollowed-out log by placing washboards on the sides and/or splitting the bottom and adding bottom planks. Alternatively spelled: peragua, periagua, periogue, perique, pirog, perouge, perroge, petiaugier, petti-augier, and pirogua.

PORT (adj.): the left-hand side of a vessel as one faces forward.

RABBET (n.): a groove cut into the keel, stem, and stern, to receive the edge of external hull planking.

SAILING CANAL BOAT (n.): a canal boat hull outfitted with a removable mast(s), rigging, and a centerboard(s).

SCANTLINGS (n.): the principal timbers in a boat.

SCARF (n.): an overlapping joinery between two timbers, as opposed to a butt join.

SCOW (n.): a flat-bottom vessel with a flat or raked bow and stern.

SCOW BOW (n.): a method for constructing the forward end of a vessel by fastening planks over straight frames.

SCOW-BUILT (adj.): having to do with a form of hull construction where thick planks are stacked edge-to-edge and then edge-fastened together.

SCOW Stern (n.): a method for constructing the after end of a vessel by fastening planks over straight frames. As opposed to a molded stern.

SCUPPER (n.): a hole cut through the bulwarks flush with the top of the deck to permit the flow of water overboard.

SHEET (n.): a tackle that secures and permits adjustment of the corner of a sail.

SHEET HORSE (n.): an iron rod or wooden post mounted horizontally just above deck level to anchor and provide room for a traveller ring, to which a sheet is secured. Also called a horse iron.

SHROUDS (n.): standing cables that secure the head of a mast to the vessel's sides.

SIDED DIMENSION (n.): the measurement of a timber's surface running parallel to the surface of hull planking.

STANCHION (n.): a thick plank or post placed on the floor of a vessel and rising up to or through the deck to support deck beams or deck fixtures (e.g. a mast or a windlass). Sometimes called bitts.
STANDING KNEE (n.): a knee positioned vertically whose long arm points upward.

STARBOARD (adj.): the right-hand side of a vessel as one faces forward.

STEM (n.): a timber attached to the keel that curves upward at the bow.

STERNPOST (n.): a timber attached to the keel that rises upward at the stern.

STRAKE (n.): a run of planking continuous from stem to stern.

STRINGER (n.): a longitudinal reinforcing timber running parallel to the keel.

TABERNACLE STANCHION (n.): a thick plank or post rising from the floor of a vessel up through the deck to form one side of a thee-sided box that serves as the step for the heel of a mast.

THROAT (n.): the point at which the arms of a knee meet along its interior surface.

TRAVELER (n.): a ring placed around a sheet horse to which the working end of a tackle is secured.

TREENAIL (n.): a wooden dowel driven blind or through a hole of a slightly smaller diameter, in order to fasten two timbers.

TURN OF THE BILGE (n.): a curved join between the bottom and the side of a vessel meet, as opposed to a chine.

WALE (n.): a thick external planking strake that reinforces the side of a vessel, and sometimes serves as a rub rail.

WASHBOARD (n.): a thick plank placed on edge along the ends of a vessel’s deck and edge-fastened to the hull in order to create a bulwarks. Also called a toe rail.

WATERWAY (n.): a deck plank of greater thickness located at the bulwarks and often chafered or rounded out in one corner to provide a path for water to reach the scuppers.
APPENDIX B

LAKE CHAMPLAIN CANAL SLOOPs LIST A

<table>
<thead>
<tr>
<th>Name</th>
<th>Built</th>
<th>Length</th>
<th>Breadth</th>
<th>Depth</th>
<th>Tons</th>
</tr>
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<td>1823</td>
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<tr>
<td>Governor Clinton</td>
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<td></td>
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<td>Maria Clinton</td>
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<td>Royal Oak</td>
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<td>1820s</td>
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2Unless otherwise noted this table was compiled from K. J. Crisman, “Nineteenth-Century Lake Champlain Sailing Merchant Vessels: A Preliminary List,” (unpublished manuscript).

3New York Mercantile Advertiser. September 6, 1823.

4A. M. Hemenway, ed., The Vermont Historical Gazetteer. vol. I. p. 298.


7Henry Stevens Papers. State of Vermont Archives.

8Henry Stevens Papers. State of Vermont Archives.


10Cohn and True, Vermont History 60, no. 1 (Winter, 1992): 39. Cohn and True cite four unnamed sailing canal boats built along William Annesley’s design, two by Judge Zephaniah Platt and two by Cyrus G. Hull.


12Rushlow. Plattsburgh Republican. October 20, 1894.

13Rushlow. Plattsburgh Republican. October 20, 1894.
<table>
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<th>Name</th>
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<th>Breadth</th>
<th>Depth</th>
<th>Tons</th>
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14 This column lists the date that sailing canal boats were dismantled to convert them into towed canal boats without any sailing rig.
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\(^{15}\)Rushlow. *Plattsburgh Republican*. October 20, 1894.

\(^{16}\)Rushlow. *Plattsburgh Republican*. October 20, 1894.
## APPENDIX C

### LAKE CHAMPLAIN CANAL SLOOPS LIST B

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17+Compiled from Merchant Vessel Enrollment Documents, dated above. Record Group 241, Civil Reference Branch, United States Archives. This is information not contained in K. J. Crisman, "Nineteenth-Century Lake Champlain Sailing Merchant Vessels: A Preliminary List." (unpublished manuscript).

18+This column lists the date that sailing canal boats were dismasted to convert them into towed canal boats without any sailing rig.
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### APPENDIX D

**LAKE CHAMPLAIN CANAL SCHOONERS**

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19Unless otherwise noted this table was compiled from K. J. Crisman. "Nineteenth-Century Lake Champlain Sailing Merchant Vessels: A Preliminary List," (unpublished manuscript).

20Henry Stevens Papers, State of Vermont Archives.

21Henry Stevens Papers, State of Vermont Archives.

22Henry Stevens Papers, State of Vermont Archives.
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APPENDIX E

PRINCIPAL DIMENSIONS AND SCANTLINGS OF THE ISLE LA MOTTE SLOOP

HULL
Length: between perpendiculars, 79 feet, 8 inches (24.3 m)
Breadth: molded, 13 feet, 6 inches (4.1 m)
Length to beam ratio: 5.9:1
Depth of hold: from top of ceiling to underside of deck beams, 4 feet (1.2 m)
Draft: estimated, 4 feet (1.2 m)
Keel: sided 8 inches (20.3 cm) at stern
Stem: post molded 1 foot, 4 inches (40.6 cm), sided 4 inches (10.2 cm) forward, 10 inches (25.4 cm) at the bearding line
Stern: sternpost molded and sided 8 inches (20.3 cm)
Floor timbers: molded and sided 4 inches (10.2 cm)
Futtocks: molded and sided 4 inches (10.2 cm)
Keelson: in four pieces (starboard main keelson, port main keelson, starboard sister keelson, port sister keelson) main keelsons molded 4½ inches (11.4 cm), sided 7 to 7¼ inches (18.4-17.8 cm), sister keelsons molded 3½ inches (8.9 cm), sided 9 inches (22.9 cm)
Planking: width 2 to 12 inches (5.1-30.5 cm), thickness 1½ inches (3.8 cm)
Ceiling: thickness 2 inches (5.1 cm)
Clamp: width 5½ to 7 inches (14-17.8 cm), thickness 2 to 4 inches (5.1-10.2 cm)

DECK
Length: 77 feet, 9 inches (23.7 m)
Breadth: 12 feet, 10½ inches (3.9 m)
Deck stanchions: molded and sided 3 to 4 inches (7.6-10.2 cm)
Deck beams: maximum length 12 feet, (3.7 m), molded and sided 4 inches (10.2 cm)
Waterway: maximum width 7½ inches (19.1 cm), thickness 2½ inches (6.4 cm) outboard, 2 inches (5.1 cm) inboard
Deck planking: width 3½ to 7 inches (8.9-17.8 cm), thickness 1½ inches (3.2 cm)
Bulwarks: of two types of construction (molded and edge-fastened), molded length 13 feet (4 m), molded height 11 inches (27.9 cm), molded 6½ inches (17.2 cm), edge-fastened bulwarks height 11 inches (27.9 cm) forward, 16 inches (40.6 cm) stern, edge-fastened bulwarks thickness 3 inches (7.6 cm)
Scuppers: length 14 to 21 inches (35.6-53.3 cm), height 3 inches (7.6 cm)
Cleats: length 2 feet, 6½ inches (77.5 cm), molded 5 inches (12.7 cm)
Rub rail: length 14 feet, 2½ inches (4.3 m), width and thickness 3 inches (7.6 cm)
Hatch coamings: in three pieces (deck beams, ledges, and carlings) companionway coaming molded 4¼ to 5 inches (12.1-12.7 cm), sided 2 to 3 inches (5.1-7.6 cm), cargo hatch coamings molded and sided 5 inches (12.7 cm), cabin hatch coamings molded 6 to 8 inches (15.2-20.3 cm), sided 2 to 3½ inches (5.1-8.9 cm)
Windlass bits: width 8½ inches (20.1 cm), thickness 3½ inches (9.5 cm)
Tabernacle stanchions: width 1 foot, 2 inches (35.6 cm), thickness 3 inches (7.6 cm)
Spars: mast diameter 11 inches (27.9 cm) at heel
Deadeyes: diameter 6½ inches (16.5 cm)
Rigging horses: iron, length 10 inches (25.4 cm) at stem, 1 inches, 6 inches (45.7 cm) before cabin, 1 inches, 9 inches (53.3 cm) at transom, stock diameter 1½ inches (3.8 cm)
Traveler ring: outside diameter 6 inches (15.2 cm), stock diameter 1 inches (2.5 cm)
STEERING MECHANISMS

_Tiller_: length 5 feet, 10 inches (1.8 m), width 3½ inches (8.9 cm), thickness 5½ inches (14 cm)
_Rudder stock_: diameter 8 inches (20.3 cm) on deck, diameter 7 inches (17.8 cm) below deck
_Rudder blade_: length 3 feet, 11 inches (1.2 m), height 3 feet, 10½ inches (1.2 m), width 7 inches (17.8 cm)
_Centerboard trunk_: length 12 feet, 6 inches (3.8 m), height 4 feet, 10 inches (1.5 m), width 10 inches (25.4 cm)
APPENDIX F

PRINCIPAL DIMENSIONS AND SCANTLINGS OF THE NORTH BEACH WRECK

HULL

Length: between perpendiculars, 79 feet, 6 inches (24.2 m)
Breadth: molded, 13 feet, 6 inches (4.1 m)
Length to beam ratio: 5.9:1
Depth of hold: from top of ceiling to underside of deck beams, 4 feet, 3 inches (1.3 m)
Draft: estimated, 4 feet (1.2 m)
Keel: white oak, length 75 feet, 7 inches (23 m) (at least two timbers), molded 9½ inches (24.4 cm) forward, 11 inches (27.9 cm) at bow transition and centerboard, 8¼ inches (21 cm) at stern transition, 6¼ inches (15.9 cm) aft, sided 10 to 12 inches (24.5-30.5 cm) forward, 9 inches (22.9 cm) at bow transition, 1 foot, 3½ inches (39.4 cm) at centerboard, 8¼ inches (21 cm) at stern transition, 5½ inches (15 cm) aft
Stem: white oak, in two pieces (stem and apron) stem molded 1 foot, 4 inches (40.6 cm), sided 10 inches (25.4 cm), apron molded 10½ inches (26.7 cm)
Stern: white oak, in two pieces (sternpost, deadwood) sternpost length 6 feet, 7½ inches (2 m), molded 10¾ inches (27.6 cm), sided 9 inches (22.9 cm)
Floor timbers: white and red oak, molded 3½ to 6¼ inches (8.9-17.2 cm) forward, aft, sided 3 to 7½ inches (7.6-19.1 cm) forward
Stringers: beech, at two locations (against keel and half way to side), length 22 feet, 2 inches (6.8 m) outboard, 61 feet, 10 inches (18.8 m) inboard, molded 4½ inches (11.4 cm) throughout, sided 8 inches (20.3 cm) outboard, 11 inches (27.9 cm) inboard
Chine log: white pine, width, thickness 6¼ inches (15.9 cm)
Futtocks: white oak, white pine, and hickory, molded and sided 5 inches (12.7 cm) forward and aft
Keelson: white ash, length 17 feet, 3¼ inches (5.3 m) forward, 29 feet, 2½ inches (8.9 m) aft, molded 7¾ inches (18.4 cm) forward, sided 7½ inches (18.7 cm) forward
Bottom Planking: white oak, width 2 inches to 1 foot 1¾ inches (5.1-34.9 cm) forward, 10 inches to 1 foot 5¾ inches (25.4-45.1 cm) amidship, 2¾ to 8 inches (7-20.3 cm) aft, thickness 1½ to 2 inches (3.8-5.1 cm) throughout
Side Planking: white pine and white oak, width 9½ inches to 1 foot, 7½ inches (24.8-49.5 cm), thickness 4 inches (10.2 cm)
Ceiling: oak and white pine, width 10½ inches (26.7 cm)
Clamp: white oak, width 3¼ inches (8.9 cm), thickness 3 inches (7.6 cm)

DECK

Deck stanchions: molded 4 inches (10.2 cm), sided 6½ inches (16.5 cm) at centerboard trunk
Deck beams: molded 4 inches (10.2 cm), sided 4 to 6 inches (10.2-15.2 cm)
Waterway: thickness 3 inches (7.6 cm)
Deck planking: thickness 1½ inches (3.8 cm)
Bulwarks: white oak, of two types of construction (molded and edge-fastened) edge-fastened width 7 inches (17.8 cm), thickness 3 inches (7.6 cm)
Scuppers: length 5 inches to 2 feet (12.7-61 cm), height 2½ inches (6.4 cm)
Rub rail: length 13 feet, 3 inches (4 m), width 2 to 3 inches (5.1-3.8 cm)
Tabernacle stanchions: length 7 feet, 8 inches (2.3 m), width 11 inches (27.9 cm), thickness 3 inches (3.8 cm)

Rigging horses: iron, length 2 feet, 4½ inches (72.4 cm), stock diameter 1½ inches (4.8 cm)
Traveler ring: iron, outside diameter 6¼ inches (17.2 cm), stock diameter ¾ inches (1.9 cm)
STEERING MECHANISMS

*Centerboard:* white oak, length 13 feet, 8½ inches (4.2 m), height estimated 4 feet (1.2 m), thickness 3 inches (7.6 cm)

*Centerboard trunk:* birch, length 15 feet, 3 inches (4.7 m), height 4 feet, 4 inches (1.3 m), thickness 9½ inches (24.1 cm)
APPENDIX G

PRINCIPAL DIMENSIONS AND SCANTLINGS OF GENERAL BUTLER

HULL

Length: between perpendiculars, 88 feet, 7 inches (27 m)
Breadth: molded, 14 feet, 5 inches (4.4 m)
Length to beam ratio: 6.1:1
Depth of hold: from top of ceiling to underside of deck beams, 6 feet, 2 inches (1.9 m)
Draft: estimated, 6 feet (1.8 m)
Keel: hard maple, length estimated 84 feet, 8 inches (25.8 m), molded 3 inches (7.6 cm) at stern, 4½ inches (12.1 cm) amidship and at stern, sided 7 inches (17.8 cm) at stern and amidship, 1 foot, 3½ inches (39.4 cm) amidship
Stem: white oak, in two pieces (stern and apron) stem length 10 feet, 5⅞ inches (3.2 m), molded 1 foot, 3 inches (38.1 cm), sided 4 inches (10.2 cm) forward, 1 foot, 1⅛ inches (34.3 cm) at bearding line, apron length 3 feet, 7 inches (1.1 m), height 2 feet, 11 inches (90 cm), sided 7 inches (17.8 cm) at stem/keel join, 1 foot, 2 inches (35.6 cm) above keel
Stern: white oak, deadwood undetermined, sternpost length 7 feet, 11 inches (2.4 m), molded 7 inches (17.8 cm), sided 7 inches (17.8 cm)
Floor timbers: white oak, molded 5 inches (12.7 cm) amidship, sided 5 inches (12.7 cm) amidship
Chine log: hard maple, estimated at 58 feet, 4 inches (17.8 m) in length, molded 10 inches (25.4 cm), sided 10¼ inches (26 cm)
Futtocks: molded 4 inches (10.2 cm), sided 4 inches (10.2 cm), room and space 1 foot, 8 inches to 1 foot, 11 inches (50.8-58.4 cm)
Keelson: hard maple, in three pieces (keelson, port sister keelson, and starboard sister keelson) keelson molded 3½ inches (8.9 cm), sided 1 foot, 3¾ inches, (39.1 cm) amidship, sister keelsons molded 3¼ inches (9.5 cm), sided 10 inches (25.4 cm) amidship
Planking: hard maple and white oak, width 4½ inches to 1 foot, 4 inches (12.1-40.6 cm), thickness 2 inches (5.1 cm)
Wales: hard maple and white oak, width 5½ inches (14 cm), thickness 3 inches (7.6 cm)
Ceiling: white pine and American elm, width 7½ inches to 1 foot, ½ inch (19.1-31.8 cm), thickness 1 to 2½ inches (2.5-5.7 cm)
Clamp: width 5 inches (12.7 cm), thickness 3 inches (7.6 cm)
Hogging truss: red oak, molded 2 to 3 inches (5.1-7.6 cm), sided 9½ inches (24.1 cm)

DECK

Length: 85 feet, 9 inches (26.1 m)
Breadth: 13 feet, 10 inches (4.2 m)
Deck stanchions: hard maple and white oak, molded 3 to 4 inches (7.6-10.2 cm), sided 3 to 9 inches (7.6-22.9 cm)
Deck beams: white oak, molded 3½ to 4½ inches (8.9-11.4 cm), sided 3½ to 4½ inches (8.9-11.4 cm)
Waterway: width 7 to 10 inches (17.8-25.4 cm), thickness 2½ inches (6.4 cm)
Deck planking: white pine, width 2 to 7 inches (5.1-17.8 cm), thickness 1 inch (2.5 cm)
Bulwarks: white oak, of two types of construction (molded and edge-fastened), molded height 9¼ inches (24.1 cm), thickness 7 inches (17.8 cm), edge-fastened height 9½ inches to 1 foot, 4 inches (24.1-40.6 cm), thickness 3½ inches (8.9 cm)
Scuppers: length 1 foot, 7 inches to 2 feet, 5½ inches (48.3-74.9 cm), height 3 inches (7.6 cm)
Cleats: white oak, length 2 foot, 6 inches to 3 feet (76.2-91.4 cm)
Hatch coamings: white oak, in three or four pieces (deck beams, ledges, coamings, and sometimes carlings) molded 4 to 9¼ inches (10.2-24 cm), sided 2¾ to 5 inches (7-12.7 cm)
Windlass bits: white oak, width 8 inches (20.3 cm), thickness 4½ inches (10.8 cm)
Tabernacle stanchions: white oak, width 11 inches (27.9 cm), thickness 3 inches (7.6 cm)
Spars: spruce (foremast), diameter 11 inches (27.9 cm) at heel
Deadeyes: diameter 4½ inches (11.4 cm)
Rigging horses: iron, length 10 inches (25.4 cm) at stem, 10 feet. 3 inches (3.1 m) at foremast. 1 foot. 9½ inches (54.6 cm) at centerboard, 1 foot, 5 inches (43.2 cm) before cabin, 1 foot, 1 inch (33 cm) on cabin roof, stock diameter 1½ inches (3.8 cm)
Traveler ring: iron, outside diameter 6½ inches (16.5 cm), stock diameter 1¼ inches (3.2 cm)

STEERING MECHANISMS
Tiller: white oak, (spare) length 6 feet. 8 inches (2 m), width 3½ inches (8.9 cm), thickness 4¼ inches (12.1 cm)
Rudder stock: American elm, diameter 9 inches (22.9 cm) on deck. diameter 8 inches (20.3 cm) below deck
Rudder blade: white pine, length 4 feet, 3½ inches (1.3 m), height 4 feet, 8½ inches (1.4 m), width 8 inches (20.3 cm)
Centerboard: hard maple, length 13 feet, 8 inches (4.2 m), height estimated, 6 feet (1.8 m), thickness 2½ inches (6.4 cm)
Centerboard trunk: white oak and white pine, length 16 feet, 1 inch (4.9 m), height 6 feet, 2 inches (1.9 m), thickness 9 inches (22.9 cm)
APPENDIX H

ARTIFACT CATALOG FOR GENERAL BUTLER

Glass: 16 glass bottles, a glass bottle neck, a drinking glass, a green lens, a fragmentary piece of pane glass, and other fragments of clear and amber glass. Six of the bottles have cork stoppers in place. Several bottles were of recognizable types including, a “Congress & Empire Springs” bottle, a “Burlington Bitters” bottle, a “Moulton’s Oloroso Bitter” bottle with a pineapple trademark, and a “Powers & Turner, Bay City Mich.” medicine bottle. Seven spirit bottles were found including, 2 gin bottles and 5 wine bottles. The gin bottles had no mold seams, but some wine bottles had mold seams while others did not. One wine bottle was made in a three-piece mold. The remaining bottles include: 1 brown flask, 1 clear flask, 1 bottle with a pour spout, two round medicine bottles, and 1 small case medicine bottle. The green lens (Fig. 45) is rounded and has ridges on its outer surface, obviously for navigation light. Some of the clear glass fragments represent lantern glass.


Metal: 57 iron fasteners (nails, spikes, bolts), 8 iron washers, 3 screw fragments with slotted heads, 3 lantern wick adjusters, 2 lantern reservoirs, 2 cast-iron cooking pots, 2 unidentifiable strips of iron (possibly pot rims or handles), 2 spoons, 2 spoon bowls, two chisel blades, 2 tool or utensil handles (most likely for knives), 2 iron eye hooks joined by a rope thimble, 1 iron ring with rope thimble, 1 iron rope thimble, 1 iron band with a rivet, 1 notched iron strip, 1 folding-stock anchor, 1 cargo hook or dog, 1 cast-iron stove leg, 1 axe head, 1 iron flat file, 1 triangular iron file, 1 staple, 1 scissors handle, 1 fragmentary griddle, 1 brass pin, 1 brass clasp, 1 copper base plate, 1 iron lamp hook, 1 brass lantern flange, 1 iron hinge, 1 scale weight, 1 door knab stem (with porcelain knob), 1 lead keel to a model boat, 1 maker’s plate, 1 small metal cup marked “BULL,” miscellaneous lantern parts, and numerous tin-plated iron fragments. The spoons are made from nickel-plated copper, and one is stamped “Hall & ELTOL.” The two spoon bowls are made from silver. The axe head is marked “BROOKS & CO.” The copper base plate is for the navigational light that included the green glass lens mentioned above.

Wood: 6 corks, 5 deadeyes, 2 dowels, 2 tool handles, 2 mast hoops, 2 large single-sheave blocks, 2 small single-sheave blocks, 1 small 2-sheave block, 1 paint stick, 1 hardwood roller, 1 gaff jaw, 1 coconut, 1 model boat with a mast, 1 awl handle, 1 button, and 1 unidentified object with a hole in its center. The large single-sheave blocks (Fig. 46) and the hardwood roller would have been used to handle the heavy marble cargo on board. The smaller blocks and deadeyes (Fig. 46) are associated with the rigging of the vessel. The coconut is evenly cut across one end, suggesting its use as a cup. A similar coconut was found on the North Beach wreck.

Leather: 4 unidentified leather fragments, 1 man’s boot, and 1 burr valve. The burr valve was originally fastened to a stick called a pump spear, and was part of the vessels bilge pump assembly.

Stone: over 100 pieces of coal, and several fragments of brick, gravel, marble, and slate. The stone artifacts all represent previous cargos.

Other organic: 6 rope samples, 2 textiles, 1 rubber overshoes, 1 small bone, and 1 lump of resin. One rope sample is parceled and served and associated with one of the two large single-sheave blocks. One textile is a hot pad, while the other is a women’s skirt. The skirt is both machine and hand sewn and has a brass pin holding the pleats together. The skirt also has 3 pieces of ruffling attached and a patch darned near the hem. The rubber overshoes is for the right foot and has the year 1876 molded into its sole.
APPENDIX I

PRINCIPAL DIMENSIONS AND SCANTLINGS OF O. J. WALKER

HULL
Length: between perpendiculars, 88 feet (26.8 m)
Breadth: molded, 14 feet, 8 inches (4.5 m)
Length to beam ratio: 6.1:1
Depth of hold: from top of ceiling to underside of deck beams, 6 feet (1.8 m)
Draft: estimated, 6 feet (1.8 m)
Keel: molded 6 inches (15.2 cm), sided 7 inches (17.8 cm) at stem
Stem: white oak post, length 10 feet, 4 inches (3.2 m), molded 1 foot, 5½ inches (44.5 cm), sided 6 inches (15.2 cm) forward, 8½ inches (21.6 cm) at the bearding line
Stern: stern post molded 10 inches (25.4 cm), sided 9 inches (22.9 cm)
Floor timbers: undetermined
Chine log: molded and sided 10 inches (25.4 cm)
Futtocks: molded and sided 4 inches (10.2 cm), room and space 1 foot, 8 inches (50.8 cm)
Keelson: undetermined
Planking: width 6 to 9 inches (15.2-22.9 cm), and thickness 2 inches (5.1 cm)
Wales: width 5½ to 6 inches (14-15.2 cm), thickness 3 inches (7.6 cm)
Ceiling: width 6 to 9 inches (15.2-22.9 cm), thickness 1 inch (2.5 cm)
Clamp: width 2½ to 2¾ inches (6.4-7 cm), thickness 5 to 6 inches (12.7-15.2 cm) amidship, width 6 inches (15.2 cm), thickness 2¾ inches (7 cm) in stern cabin
Hogging truss: in three pieces (top member, two diagonal braces) length 11 feet, 10 inches (3.6 m) at top member, 18 feet, 5 inches long (5.6 m) at forward brace, 19 feet, 2 inches long (5.8 m) at aft brace, molded 2 inches (5.1 cm), sided 10 inches (25.4 cm)

DECK
Length: 86 feet (26.2 m)
Breadth: 14 feet, 2 inches (4.3 m)
Deck stanchions: molded 2 to 4 inches (5.1-10.2 cm), sided 4 to 7½ inches (10.2-19.1 cm)
Deck beams: room and space 2 feet, 1¾ inches (64.8 cm), molded 4 to 6½ inches (10.2-16.5 cm), sided 4 to 7¼ inches (10.2-19.7 cm)
Waterway: width 11 inches to 1 foot, 1 inch (27.9-33 cm), thickness 2-inch (5.1-cm)
Deck planking: width ¾ inches (14 cm) on average, thickness 1 inch (2.5 cm)
Bulwarks: of two types of construction (molded and edge-fastened), molded height 7 inches (17.8 cm), edge-fastened length 75 feet (22.9 m), height is 9½ inches to 1 foot, 6 inches (24.1-45.7 cm)
Scuppers: 15 per side, length variable averaging 2 feet (61 cm), height 3 inches (7.6 cm), spaced 3 feet (91.4 cm)
Cleats: length 3 feet, 2 inches to 3 feet, 9 inches (96.5 cm-1.1 m), molded 6¼ inches (15.9 cm), sided 3 to 4½ inches (7.6-10.8 cm)
Hatch coamings: in three pieces (deck beams, ledges, and carlings) molded 3¼ to 5 inches (8.3-12.7 cm), sided 1½ to 2 inches (3.8-5.1 cm)
Windlass bitts: height above deck 2 feet, 7½ inches (80 cm), width 9½ inches (24.1 cm), thickness 4 inches (10.2 cm)
Tabernacle stanchions: height above deck 2 feet, 2 inches (66 cm), width 11½ inches (29.2 cm), thickness 2¾ inches (7 cm)
Spars: foremost length 46 feet, 8 inches (14.2 m) deck to cap, foremost diameter 1-foot (30.5 cm), foremost boom length 27 feet, 9 inches (8.5 m) long, diameter 6½ inches (16.5 cm), mainmast length 50 feet, 5 inches (15.4 m), mainmast diameter 9½-inch (25.1 cm), mainmast boom length 42 feet, 9 inches (13 m), diameter 7 inches (17.8 cm)
Deadeyes: diameter 7 inches (17.8 cm)
Rigging horses: length 9½ inches (24 cm) at stem, 4 feet (1.2 cm) between masts, 1 foot, 10 inches (55.9 cm) before cabin, 1 foot, 5 inches (38.1 cm) at transom, stock diameter 1½ inches (3.8 cm)

Traveler ring: outside diameter 4 to 6 inches (10.2-15.2 cm)

STEERING MECHANISMS

Tiller: length (without tenon) 4 feet, 3½ inches (1.3 cm), width 5 inches (12.7 cm), thickness 6½ inches (16.5 cm)

Rudder stock: 9 inches (22.9 cm) on deck, 7 inches (17.8 cm) below deck

Rudder blade: length 5 feet, 10 inches (1.8 m), height 4 feet, 11 inches (1.5 m), width 5 inches (12.7 cm)

Tailboard: length 3 feet, 3 inches (99.1 cm), thickness 1½ inch (3.8 cm)

Centerboard: undetermined

Centerboard trunk: length 16 feet (4.9 m), thickness 10 inches (25.4 cm)
APPENDIX J
LETTER OF PERMISSION

Lake Champlain

The Lake Champlain Maritime Museum extends permission to J. Cohn to use illustrations and photographs that are part of the museum’s collection and that relate to the sailing canal boats of Lake Champlain.

[signature]
Arthur B. Cohn
Director
VITA

Joseph R. Cozzi was born in Cambridgeshire, England, in 1956 to Joseph R. Cozzi and Elizabeth E. Cozzi. He was an Air Force brat and developed a love of things under water while living on Guam. He received a B.A. in 1978 and an M.A. in 1983, both in History, from the University of Maine at Orono. He enjoyed teaching high school social studies in Maine from 1979 to 1983. He volunteered on the Revolutionary War wreck Defence in Castine, Maine, in 1981 and was hooked on nautical archaeology. He worked as a commercial diver for International Underwater Contractors, of New York between 1983 and 1989. In 1990, he and his wife each decided to pursue a Ph.D. Enrolled in the Nautical Archaeology Program at Texas A&M University, he has participated in archaeological investigations of the Burlington Bay horse boat, the sidewheel steamer Champlain II, the Great Bridge at Mount Independence, the schooner Water Witch, the steam propeller Indiana, the private yacht Cleopatra's Barge, in addition to dissertation research on sailing canal boats. He was assistant project director of La Salle Shipwreck for the Texas Historical Commission in 1996. He is currently a nautical archaeologist at the University of West Florida where he directs excavations such as Florida's oldest shipwreck, the Emanuel Point ship.

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