

Wisconsin's Cross-Planked Mosquito Fleet:
Underwater Archaeological Investigations
of the Scow Schooners
Iris, Ocean Wave, and Tennie and Laura



State Archaeology and Maritime Preservation Program
Technical Report Series #06-001



Keith N. Meverden and Tamara L. Thomsen

Funded by the Wisconsin Coastal Management Program and the National Oceanic and Atmospheric Administration, Office of Ocean and Coastal Resource Management under the Coastal Zone Management Act, Grant # NA05NOS4191067, and the Wisconsin Department of Transportation Enhancements program. Additional support was provided by the University of Wisconsin Sea Grant Institute.

This report was prepared by the Wisconsin Historical Society under award # 86003-006.29 from the National Oceanic and Atmospheric Administration, U.S. Department of Commerce, and under award # 5101-02-75 from the Wisconsin Department of Transportation. The statements, findings, conclusions, and recommendations are those of the authors and do not necessarily reflect the views of the National Oceanic and Atmospheric Administration, the Department of Commerce, the Wisconsin Department of Transportation, or the University of Wisconsin Sea Grant Institute.



Cover photo: Wreck of the scow schooner *Ocean Wave* in 110 feet of water off Sevastopol, Wisconsin. Photo by Tamara Thomsen.

CONTENTS

ILLUSTRATIONS.....	iii
ACKNOWLEDGEMENTS.....	vi
Chapter	
1. INTRODUCTION.....	1
Research Design and Methodology.....	3
Lake Michigan's Maritime Economy.....	5
2. THE SCOW SCHOONER.....	8
3. SCOW SCHOONER <i>IRIS</i>	13
Historical Background.....	13
Description of Field Research and Findings.....	21
Conclusions and Recommendations.....	28
4. SCOW SCHOONER <i>OCEAN WAVE</i>	30
Historical Background	30
Description of Field Research and Findings.....	32
Conclusions and Recommendations.....	52
5. SCOW SCHOONER <i>TENNIE AND LAURA</i>	56
Historical Background	56
Description of Field Research and Findings.....	60
Conclusions and Recommendations.....	65
7. CONCLUSIONS.....	67
REFERENCES.....	71

ILLUSTRATIONS

Figure	Page
1. Scow schooner cross section. Note flat bottom and hard chines with chine log. Adapted from Rodgers and Corbin 2003.....	10
2. Cross section of conventional vessel. Reprinted, by permission, from Rodgers 1995.....	10
3. Photograph of <i>Iris</i> in Wisconsin near the turn of the century. Notice numerous patches in sails and lack of scow-shaped hull. Courtesy Wisconsin Maritime Museum.....	13
4. Photograph of <i>Iris</i> abandoned at Jackson Harbor, date unknown. Wreckage of gas boat <i>Sadie</i> is visible off the <i>Iris'</i> stern. Courtesy Wisconsin Maritime Museum.....	20
5. Jackson Harbor.....	21
6. <i>Iris</i> wreck site in Jackson Harbor.....	22
7. <i>Iris</i> site plan.....	23
8. Exposed stern section, facing aft. Photo by Tamara Thomsen...	25
9. Hull cross section, facing forward.....	25
10. Frames and outer hull planking at the turn of the bilge, port quarter. Photo by Tamara Thomsen.....	26
11. Centerboard trunk, facing aft. Photo by Tamara Thomsen.....	26
12. Bow section of wreck site facing forward. Centerboard lays atop rider keelson. Stempost section is visible just forward of rider keelson. Photo by Tamara Thomsen.....	28
13. <i>Ocean Wave</i> wreck site off Whitefish Point, Door County.....	32
14. Screwing mooring anchors into the lakebed. Photo by Tamara Thomsen.....	33
15. Capturing digital images for <i>Ocean Wave</i> photo mosaic with DPV. Photo by Tamara Thomsen.....	34

16. <i>Ocean Wave</i> photo mosaic. Note diver off port bow.....	35
17. <i>Ocean Wave</i> site plan.....	37
18. <i>Ocean Wave</i> 's transom, rudder, and aft deck and cabin. Photo by Tamara Thomsen.....	38
19. Centerboard trunk with centerboard protruding from bottom. Photo by Tamara Thomsen.....	40
20. The exposed port side with outer hull planks, frames, bulwark stanchions, and deck shelf. Photo by Tamara Thomsen.....	41
21. Exposed chine log. Note frames run inside of the chine log. The bulwark stanchion's tapered end is visible between frames beneath deck shelf. Photo by Tamara Thomsen.....	42
22. Hull side cross section.....	43
23. Forward hatch combing off port side, facing south. Headledge rests atop second, inverted deck section. Photo by Tamara Thomsen.....	44
24. Forward hatch coming and deck, facing north. Note three deck beams protruding beneath combing. Photo by Tamara Thomsen.	44
25. Eagle figurehead. Photo by Tamara Thomsen.....	46
26. Port side bow. Note gentle curve of stempost and remnant of cross-planking just below knighthead. Photo by Tamara Thomsen.....	46
27. Starboard side bow with outer hull planks, frames, breasthook, and dislodged deck beam and planking. Photo by Tamara Thomsen.....	47
28. Bow construction.....	47
29. Deck / bow ramp interface.....	48
30. Bilge pump aft of chain locker. Photo by Tamara Thomsen....	49
31. Underside of two whiteware plate fragments. Photo by Tamara Thomsen.....	51
32. Cast iron cook pot. Photo by Tamara Thomsen.....	51

33. Two gallon stoneware jug. Photo by Tamara Thomsen.....	52
34. <i>Ocean Wave</i> deck layout. Locations of masts, bilge pump, and forward cargo hatch are conjectural.....	54
35. <i>Tennie and Laura</i> , date and location unknown. Courtesy Wisconsin Maritime Museum.....	56
36. Benthos MKII Remotely Operated Vehicle (ROV). Photo by Tamara Thomsen.....	61
37. Sonar image of <i>Tennie and Laura</i> showing standing mast.....	62
38. Iron anchor stock on the lakebed off the starboard bow.....	62
39. Hull-deck joint on port side, amidships. Note large covering board atop longitudinal hull planks, recessed bulwark, and quagga mussels colonizing the wreck.....	63
40. Port bow with name board (inside circle). Name is illegible.....	64
41. Looking up towards the port side bow ramp. Hull side is in upper right of photo, bow planking in lower left, joined by framing timbers running diagonally from upper left to lower right.....	64
42. <i>Tennie and Laura</i> , date and location unknown. Note scuppers along lower edge of white paint, as well as large rubbing strake just below white paint. Courtesy Historical Collections of the Great Lakes, Bowling Green State University.....	66
43. Port side hull from covering board down. Note small rubbing strake just above ROV heading near bottom of photo.....	66

ACKNOWLEDGEMENTS

As with any work of this scope, its completion was made possible with the assistance of many people and institutions. The Wisconsin Coastal Management Program and the Wisconsin Department of Transportation provided essential funding, and the University of Wisconsin Sea Grant Institute provided additional material support. Fieldwork was staffed almost entirely with volunteers from the Great Lakes Shipwreck Research Foundation, Inc. (GLSRF), the Wisconsin Underwater Archaeology Association (WUAA), and the Wisconsin Historical Society (WHS). Despite long hours spent topside in the scorching sun, submerged in Lake Michigan's frigid depths, or stoically facing the rough Lake Michigan seas, our volunteers' only repayment was the satisfaction of helping preserve Wisconsin's rich maritime heritage. Those WHS volunteers who made the summer's field season both memorable and enjoyable were Russell Leitz, Tom Milbrath, Paul Bentley, Christa Loustalot, Robert Jaeck, Kimm Stablefeldt, Ethan Brodsky, W. Paul Lothary, Gregg Mikolasek, and Jon Van Harpen. Special thanks go Dave Townsend, Bill Becker, Mike Stauber, Eugene Quever, Bob Berg, and Bob LaViolette, who donated their time to install the *Ocean Wave*'s mooring.

Accommodations for the *Iris* project were provided by Barbara Schall at the Jackson Harbor Inn, who spent many hours keeping the crew well fed. Jeff McDonald contributed local knowledge, and Jacob Ellefson, whose family has owned the property adjacent to the *Iris* since 1907, has provided much information on the *Iris* and the colorful local maritime history. Marianne Porter of Door Dreams Cottages in Baileys Harbor provided comfortable housing for the *Ocean Wave* project, and the village of Baileys Harbor donated launch facilities for our survey vessels. The *Tennie and Laura* project was the result of Rob Paddock's expert ROV piloting. Gregg Stametelakys, John Alberts, and Rad Keener deftly maneuvered the R/V *Neeskay* into position over the wreck site.

John Karl of the University of Wisconsin Sea Grant Institute was there throughout the projects, providing expert editorial advice and suggestions for outreach and education. Phil Emmling and Dan Marklien, also of UW Sea Grant, provided two seaworthy Boston Whalers that carried the crew safely to and from the wreck sites. C. Patrick Labadie of the NOAA Thunder Bay Marine Sanctuary, as always, gave knowledgeable and thoughtful advice on scows and Great Lakes maritime history in general. Wisconsin State Archaeologist John Broihahn has been the driving force behind the Maritime Preservation and Archaeology Program, providing continuity and guidance through personnel changes and never-ending budget cuts. Russel Leitz, President of the Wisconsin Underwater Archaeology Association, deserves special recognition for his work to compile the *Door County Advocate* and *Manitowoc Pilot* newspaper database. If it were not for Russ' work, most of what we know about the *Iris*, *Ocean Wave*, and *Tennie and Laura* would remain hidden in rolls of microfilm within the WHS archives. Brad Rodgers of East Carolina University provided vessel cross sections, as well as guidance on Great Lakes scow construction.



2005 WHS volunteers and staff. Back: Jon Van Harpen, Paul Bentley, Christa Loustalot, Tom Milbrath, Russ Leitz, Keith Meverden, Tamara Thomsen, Bob Jaeck. Front: Paul Lothary, Kimm Stablefeldt, Ethan Brodsky. Not pictured: Gregg Mikolasek.

CHAPTER ONE INTRODUCTION

The Wisconsin Historical Society's 2005 Lake Michigan scow schooner survey was a joint effort between the Wisconsin Historical Society (WHS), University of Wisconsin Sea Grant Institute, Wisconsin Coastal Management Program, Wisconsin Department of Transportation, Wisconsin Maritime Museum, University of Wisconsin - Milwaukee's Great Lakes WATER Institute, Wisconsin Underwater Archaeology Association (WUAA), and the Great Lakes Shipwreck Research Foundation, Inc (GLSRF). The surveys were funded by grants from the Wisconsin Department of Transportation, and the Wisconsin Coastal Management Program, with additional support from the University of Wisconsin Sea Grant Institute. Additional equipment, personnel, and logistical support were provided by other participating organizations. The surveys were organized by the WHS's State Maritime Preservation and Archaeology (SMPA) program and principally staffed by WUAA, GLSRF, and WHS volunteers. Survey work was conducted between 1 June and 30 September 2005.

The WHS is the State of Wisconsin's principal historic preservation agency and charged under state statutes (44.02 and 44.30-44.31) with the research, protection, restoration, and rehabilitation of historic properties within Wisconsin. Under Wisconsin statute 44.47, the WHS is also charged with the identification, evaluation, and preservation of Wisconsin's underwater archaeological resources, including submerged prehistoric sites, historic shipwrecks, and aircraft on state-owned bottomlands. Recognizing the multiple-use values of underwater archaeological sites to scientists, historians, and recreationalists, these underwater remnants of our past are broadly termed "submerged cultural resources." Submerged cultural resource management goes beyond the scope of traditional historic preservation programs, encountering diverse multiple-use concerns such as recreation and commercial salvage.

The State of Wisconsin has additional management responsibilities for submerged cultural resources under federal law, including the National Historic Preservation Act of 1966 and the Abandoned Shipwreck Act of 1987 (Public Law 100-298). State legislation (1991 Wisconsin Act 269) and modifications to state law in adherence with federal guidelines issued under the Abandoned Shipwreck Act has provided Wisconsin with a more formalized and rational framework for underwater archaeological resource management. This legislation also authorizes the WHS and the Wisconsin Department of Natural Resources to designate underwater preserves for the preservation and recreational development of underwater archaeological sites.

Created in 1988, the WHS's State Maritime Preservation and Archaeology (SMPA) program works to survey, inventory, and evaluate Wisconsin's underwater archaeological resources, develop preservation strategies, administer field management practices, and enhance public appreciation and stewardship for Wisconsin's precious and fragile maritime heritage (Cooper 1992, 1993; Jensen 1992, 1993). The SMPA program is within the WHS Division of Historic Preservation – Public History, Office of State Archaeology and Maritime Preservation. To encourage

preservation and visitation of these unique resources while fostering wider public appreciation for Wisconsin's maritime cultural heritage, the SMPA program began the Wisconsin's Maritime Trails Initiative in July 2001. Winding above and below the waves, the Maritime Trails encompass four stretches of Wisconsin coastline and link shipwrecks, lighthouses, historic waterfronts, historic vessels, museums, shore-side historical markers, and attractions. When viewed as a metaphorical "trail," these resources illustrate the state's diverse maritime heritage and links them within the overall context of Wisconsin's, as well as the Great Lakes region's, maritime heritage (Green and Green 2004).

The Maritime Trails initiative has become the WHS's strategic plan for managing the state's diverse submerged cultural heritage while encouraging preservation and promoting public awareness and visitation. Initiatives aimed at identifying, managing, and interpreting Wisconsin's coastal cultural resources must consider these resources at both a local and regional level. The sheer length (approximately 860 miles), as well as the geographical, social, and cultural diversity, of Wisconsin's Great Lakes coastline makes this essential. The Maritime Trails initiative encourages divers and non-divers alike to consider each unique maritime property within the broader context of Wisconsin's maritime heritage. Through websites, interpretive materials, and public presentations, the Maritime Trails initiative integrates archaeological research and public education to encourage visitors to responsibly visit maritime cultural heritage sites. Wisconsin's Maritime Trails' major elements include:

Archaeological Research. The documentation of Wisconsin's submerged cultural resources, primarily historic shipwrecks, is the foundation of the Maritime Trails initiative. Beyond academic and resource management applications, archaeological research results form the basis of interpretation and outreach projects.

Shipwreck Moorings. With volunteer assistance, the WHS maintains permanent moorings on 21 historic shipwrecks statewide. The moorings facilitate recreational access, provide a means of interpreting the wreck sites to visitors, provide a safe point of ascent and descent for divers, and eliminate anchor damage from recreational boaters anchoring into sites.

Dive Guides. Designed with divers, boaters, and kayakers in mind, these rugged, waterproof guides place each vessel within its historical context and highlight unique site features that might otherwise go unnoticed. In partnership with the University of Wisconsin Sea Grant Institute, the WHS has produced guides to twenty five Wisconsin shipwrecks.

Public Presentations. Given at a variety of venues throughout the state, public presentations provide a direct, personal connection between the WHS and the general public. WHS underwater archaeologists and volunteers have reached over 18,963 people via public presentations since the Wisconsin's Maritime Trails inception.

Interpretive signage and kiosks. As of December 2005, the WHS has installed shore-side informational markers for twelve historic shipwrecks and waterfronts. Utilizing an identical template that unifies the signs as attractions and information points within the statewide Maritime Trails program, the markers emphasize the broader connection between Wisconsin's many coastal historic resources. Five interactive

touch-screen kiosks that highlight Wisconsin's historic shipwrecks are installed at the WHS's Museum on the Square, the Wisconsin Maritime Museum, the Kenosha Public Museum, the Door County Maritime Museum, and the WHS's Madeline Island Museum. The kiosks reach an estimated 368,000 museum visitors yearly and make archaeological research results available in a fun, interactive format while educating visitors on the importance of Wisconsin's coastal cultural resources.

Websites. Two websites dedicated to Wisconsin's historic shipwrecks, underwater archaeology, and maritime history ensure the general public has access to timely and useful information. The gateway to these sites is the Wisconsin's Maritime Trails website (www.maritimetrails.org), which serves as a unified "maritime resource" information point for Wisconsin residents and visitors. Unveiled in 2003, this website features a statewide database of shore-side maritime-related resources and over 700 historic Wisconsin shipwrecks. A searchable database includes contact information, hyperlinks, and maps for historic maritime venues, as well as location and historic data for shipwrecks. Wisconsin's Great Lakes Shipwrecks (www.wisconsinshipwrecks.org) is a collaborative effort between the WHS and the University of Wisconsin Sea Grant Institute that began in 1996. Making underwater archaeological research results accessible to the public, this site features detailed information on historically and recreationally significant shipwrecks in Wisconsin's Great Lakes waters. Each shipwreck profile includes information about the ship's archaeology, history, final voyage, sinking, and current condition.

Partnerships. The Wisconsin's Maritime Trails program partners with federal, state, and local agencies, chambers of commerce, private businesses, non-profit organizations, and individuals. With several core partners, dozens of volunteers, and a growing list of project-specific partners, this aspect of the initiative ensures that everyone with a stake in Wisconsin's maritime heritage shares in its management and interpretation.

Research Design and Methodology

Little is known about Great Lakes scow schooners. Participating in the lakeshoring trade that serviced small hinterland communities, scow schooners received little attention and even less documentation during contemporary times. As a result, much of what we will ever know about Great Lakes scow schooners is contained within the archaeological record of vessels that lays on the Great Lakes' bottomlands. Unfortunately, scow schooners represent a very small percentage of that archaeological record, providing scarce opportunities to learn about their operation and how their crews lived (and sometimes died) on the Great Lakes. The opportunity to document three scow schooners within a defined maritime context in a single field season was a rare and exciting opportunity. Additionally, the three scow schooners under study were located within varied marine environments, ranging from exposed in shallow waters to deeply submerged in depths unwelcoming to on-site visitation. This provided not only varied states of preservation, but unique and novel challenges to that resulted in the development of new documentation techniques that carried the WHS into previously unexplored areas.

Field survey methods ranged from traditional baseline surveys to Remotely Operated Vehicle (ROV) operations that provided a telepresence in a deep water

environment hostile to on-site recording and research. Survey work was conducted along guidelines established by the National Park Service for submerged cultural resources survey and evaluation in determining site eligibility for the National Register of Historic Places. Survey research design was directed towards formulating site descriptions and archaeological assessments. Sites were approached with a package of management questions, some specific to the site itself (location, environment, parameters, integrity, extant features, artifacts), and some general questions that place the site in its broader context as a resource (historical significance, archaeological potential, recreational potential, management requirements). Research objectives had the following intents:

1. Determine the site location, environment, and parameters through visual survey of extant elements, features, and artifacts.
2. Document and map exposed remains using trilaterated survey points and an onsite (submerged) datum or using an offsite (surface) datum, transit and electronic distance meter.
3. Document using still photos, underwater video, and measured sketches of those architectural and archaeological elements which are diagnostic of a) vessel type, b) vessel age, c) vessel construction style and method, d) vessel propulsion, e) vessel use, f) vessel identification, g) vessel cargo, and h) shipboard human activity broadly indicative of occupation, status, ethnicity, subsistence or other questions allied with the study of maritime anthropology and Great Lakes social and economic history.
4. Provide assessment of a site's environmental and cultural context for determining its historical significance and archaeological potential (according to the National Register of Historic Places criteria), recreational potential, and management requirements.

Site evaluation and documentation was conducted using scuba and ROV technology. Documentation included measured sketches, construction schematics, digital still and video imagery, and site plans for National Register-level documentation. Analysis was conducted using comparative evidence obtained from archaeological surveys of similar sites, and augmented by historical documentation relating to individual sites and general Great Lakes maritime history. Where artifacts were encountered, material culture was interpreted in the context of its relevance to shipboard activities, shipboard hierarchy, shipboard activity/use areas, and other aspects of maritime anthropology.

This submerged cultural resource survey report will serve as a source for site description, analysis, interpretation, and management recommendations for use in cultural resource management planning, recreational development, and public education. It also serves as the source document for eligibility determination and nomination for listing in the National Register of Historic Places. Inclusion of these sites into the National Register and state resources management plans is an important step in achieving long-term site preservation. Suggested plans for management include mooring buoys to facilitate recreational access (where appropriate) and alleviate damage caused by on-site boat anchoring. Other possibilities include site

interpretation for visitors through self-guided site maps and web-based pages. Site preservation ensures availability both as a future recreational resource and as an important and nonrenewable source of scientific data relating to Great Lakes underwater archaeology, maritime history, marine architecture, and maritime anthropology.

Lake Michigan's Maritime Economy

Discussion of Wisconsin's maritime heritage is difficult without including the eastern Great Lakes of Huron, Erie, and Ontario. Many of Wisconsin's commodities were shipped beyond Lakes Michigan and Superior to eastern Great Lakes ports such as Buffalo, New York, and Kingston, Ontario. These distant ports returned goods, supplies, and immigrants to Wisconsin, creating a diverse economic universe. Separating Wisconsin from the eastern Great Lakes frequently results in a fragmented understanding of Wisconsin's maritime heritage as a whole. There is evidence, however, that a more localized maritime trade developed that was confined to Lake Michigan with the lake's western shoreline at its core. This lakeshoring trade connected communities in Wisconsin, Illinois, Indiana, and Michigan in a discrete local economy, transporting cargo from one Lake Michigan port to another where it could be sold for profit. While only a fraction of Great Lakes tonnage, this trade was the lifeblood of many smaller communities, one in which the scow schooner played a vital role. Worked in no small part by immigrant Scandinavian sailors, Lake Michigan's lakeshoring trade was an entry point for many immigrants into Great Lakes maritime commerce, not only as sailors, but also as vessel owners and masters (Hirthe and Hirthe 1986:97; Gjerset 1928:11).

With the exception of a handful of early vessels, sail technology never had a monopoly on Lake Michigan. The first European sailing vessel to enter Lake Michigan was LaSalle's ill-fated *Le Griffon*, which departed Washington Island on 18 September 1679 and sailed into a crack in the lake. Following *Le Griffon*, it was nearly 100 years before a sailing vessel would again enter Lake Michigan. It is probable that ventures onto Lake Michigan were made by King George's Royal Navy in the 1760s, but the next confirmed sailing ship to enter the lake was John Askin's *Archange* in 1778, which sailed to Chicago and Green Bay in search of corn to supply Canadian fur traders (Quaife 1944:100).

From the *Archange* to 1815, most Lake Michigan vessels supported military outposts such as Fort St. Joseph and Fort Dearborn (present day Chicago). In 1818, the *Walk-in-the-Water* was the first steamer constructed on the upper lakes, and a year later the *Walk-in-the-Water* entered Lake Michigan and sailed to Green Bay (Mansfield 1899:184, 596; Mills 1910:92). By 1836, regularly scheduled steamship lines connected western Lake Michigan with eastern cities, and steam vessels were under construction at Milwaukee (Quaife 1944:150; *Milwaukee Advertiser* 1836). These steamers quickly pulled passenger traffic and high-dollar cargo from the schooners.

Seventeen years later, however, on 21 May 1853, the Michigan Central Railway established the first rail connection with Chicago, and in 1855 the first all-rail connection between Buffalo and Chicago was established (Quaife 1944:155; Mills 1910:155). The railroads quickly stole the steamers' passenger and cargo trade,

resulting in even stiffer competition for sailing vessels. Despite overwhelming competition, lake sail did not die easily. Sail's advantages were lower construction and operation costs, adaptability to many different trades, and that sail technology had developed for centuries and had little room left for improvement. Sail required small capital investment, its propulsion cost nothing, and the smaller crews were inexpensive relative to steamers. These advantages allowed sailing vessels to operate where the volume or value of trade was insufficient to justify steam traffic.

A simple, yet comprehensive, definition of lakeshoring is difficult. Contemporary authors of Great Lakes maritime commerce frequently glossed over sailing vessels, devoting most of their efforts to the new steam technology that it was thought would make sail technology quickly obsolete. Defining lakeshoring today is an even greater challenge, as sail's role changed dramatically during the nineteenth century. The beginning of the nineteenth century found a wilderness frontier populated by a handful of hardy European fur traders, but by the century's close Lake Michigan boasted one of the busiest shipping ports in the world (Karamanski 2000:69). Lake Michigan schooners were subject to rapidly evolving trade patterns, requiring them to be highly adaptable to shifting markets and technologies. The small lake schooner survived this entire period despite increasing pressure from larger vessels, both sail and steam. Given that these small vessels were still sailing into the twentieth century suggests they were one of the most hardy and adaptable vessel types on the lake. This adaptability required these vessels to quickly change routes and cargoes, making a simple description of their trade difficult. As more information is uncovered on this maritime subculture it will become easier to explain the lakeshoring schooner's role.

Lakeshoring has been described as trading with frontier towns prior to improved harbors (Karamanski 2000:46). Prior to the 1830's this included all Lake Michigan settlements, including Milwaukee and Chicago. Despite having deep rivers that entered Lake Michigan, sand bars at the river mouths prevented the entrance of all but the smallest vessels. It was not until 1833 that Chicago received its first harbor improvement to allow entrance to the Chicago River; Milwaukee had its first improvements in 1843, and Racine was not improved until 1844 (Mansfield 1899:338-345). Harbor improvements were slow to spread northward.

Sheboygan first erected a pier in 1841, but its river was blocked by a three foot shoal until 1852. That same year, the Manitowoc River's four foot shoal was removed, as was Kenosha's six foot shoal. Port Washington's one foot shoal wasn't dredged until 1869, the four foot shoal at Two Rivers in 1871, and Algoma's four foot shoal in 1872. The channel into the city of Green Bay had a natural depth of eleven feet, but the channel was winding and torturous until it was straightened by a two mile cut in 1886. Kewaunee's first pier was erected in 1851, but its three foot entrance was not improved until 1881, the same year that Oconto deepened its three foot shoal. Marinette waited until 1891 to dredge (Mansfield 1899:346-352). Settlements lacking any suitable location for an improved harbor simply built piers that extended into the lake (Andreas 1881:267). Lake Michigan's eastern shore received improvements at nearly the same rate as the western.

The spread of improved harbors and lakeshore piers refined lakeshoring. Smaller vessels ventured outside of Lake Michigan less often. Products such as wood, fish, and agricultural produce were carried from one Lake Michigan port to another with a

more profitable market. The vessels often returned with needed supplies or manufactured goods.

Lake Michigan lakeshoring witnessed two periods of development. The first began in the late eighteenth century when Lake Michigan's entire shoreline was frontier. Until the 1840s, lakeshoring connected early Lake Michigan settlements (including Milwaukee and Chicago) with the larger eastern lake cities. As Milwaukee and Chicago developed as commercial centers and shipping ports their trade with eastern cities evolved from frontier supply vessels to deep draft vessels operating between improved metropolitan harbors. The second period of development was from the 1840s onward, as a new lakeshoring trade developed between southern Lake Michigan cities and the smaller lakeshore communities as smaller schooners were squeezed out of interlake trade. By the 1880s, lakeshoring had evolved to include those vessels that traded within Lake Michigan and rarely, if ever, ventured onto other lakes.

Despite its survival into the twentieth century, lakeshoring is often neglected by maritime authors. These small vessels set no records for the fastest passage, or for the largest tonnage carried. They were not the products of fierce competition between wealthy or powerful men. Typically well-used vessels, they were owned and sailed by common men supporting local economies. If lost, even with all hands, they were soon forgotten. They operated alongside the more glamorous sail and steam vessels, but always in their shadows. This lack of recognition does not make the historian's job an easy one. What we know of these vessels is far from complete. Overlooked and underappreciated, much of how the lakeshorens operated is lost to us today. What little we know comes from occasional newspaper articles and the archaeological record. These bits and pieces are all we have to reconstruct the life and times of the small lakeshorens that were vital to many Wisconsin communities.

CHAPTER TWO

THE SCOW SCHOONER

Scow schooners were vital to many Lake Michigan communities, connecting them with regional markets through the lakeshoring trade. As vessel size grew throughout the nineteenth century, so too did their draft, making stops at small lakeshore communities with shallow harbors difficult or impossible. The flat-bottomed scows, however, were well-suited to shallow harbors. Inexpensive transportation, the scow schooner was the life-blood of many lakeshore communities and immigrant families, providing an entry point for many into the Great Lakes maritime trades as sailors, masters, and vessels owners.

Scows were used in great numbers throughout North America, wherever there was a need for low-cost, shoal-draft transportation. Scows saw use along the Atlantic Coast from the Maritime Provinces to Mexico, the Great Lakes, the Gulf Coast, San Francisco Bay, and on nearly every river large enough for small craft (Chapelle 1951:45; Merchant Vessels of the United States 1885; Merriman 1997). Despite its proliferation, or perhaps as a result of it, it is difficult to trace the scow's introduction to the New World. It is also unknown when the term "scow" came into popular usage, but it was likely derived from the Dutch term "schouw", indicating a square-ended hull possessing a flat, or nearly flat, bottom. The first recorded use of the term appears well into the eighteenth century (Chapelle 1951:33). Flat-bottomed craft were numerous for several reasons. One was that vessels with flat bottoms and sides were easily constructed by people with limited shipwright skills working under primitive conditions. Flat surfaces and angular corners did not require the advanced woodworking skills necessary to construct vessels with round hulls and fine lines. An equally important reason was that flat-bottomed craft easily navigated shallow water with little difficulty. If they ran aground, they were easier to refloat and less likely to sustain damage. They were also a very stable craft able to carry large cargoes relative to their size.

Little recorded information has been discovered for colonial flat-bottomed craft. Considering that planked canoes and scows were the easiest boats to build with the least skill, scows were numerous in the New World by 1670. Nearly every community used the scow or some other form of flat-bottomed boat (Chapelle 1951:15). There were several variants of flat bottom boats common to the New World, but differentiation in lineage is often blurred, as there were more similarities than differences between vessel types. The scow-type hull appeared under several names, including punt, flat, radeau, periaugua, gondalow, and gondolo. Sloop-rigged scows were common as early as 1725, and by the time of the American Revolution the scow rig expanded to schooners and occasionally square-riggers (Chapelle 1951:32-38). Prior to the war of 1812, few commercial craft sailed the western Great Lakes. Following the war, the scow schooner made its appearance alongside conventional sailing craft and expanded onto the western lakes (Inches and Partlow 1964:289). The Great Lakes scow schooner's earliest record appears in the mid-1820s, with reports of several scows on Lake Ontario and New York's Finger Lakes, as well as the 60-ton *Bolivar* constructed at Erie, Pennsylvania in 1825. By the 1840s,

scows were common throughout the Great Lakes, surviving into the twentieth century and the last days of lake sail (Labadie and Herdendorf 2004:5; Martin 1991:4).

Other North American regions mirrored the scow's Great Lakes expansion, including the Atlantic coast, Gulf coast, and San Francisco Bay. The scow expanded all the way to the Pacific Islands, and if imitation is the highest form of flattery, much can be said by the fact that New Zealand scows were descendants of those of the Great Lakes. New Zealand's first scow was built in 1873 and named *Lake Erie*, followed by the *Lake Superior* in 1875, and the *Lake St. Claire* and *Lake Michigan* in 1876 (McGregor 1982:120; Hawkins 1987:23). Even today, the "Jon boat" is common on shallow waters throughout the United States. Built of aluminum, the Jon boat's lines are nearly identical to those of early colonial flat bottom craft.

The term "scow" refers to hull form rather than the rig type, resulting in the terms "scow schooner" or "scow sloop" to describe these vessels. Despite a wide range of regional variation, the scow is defined as a vessel with a flat bottom, vertical sides, and a hard chine. They more closely resembled a barge than conventional sailing craft. Conventional sailing vessels had rounded bottoms and sides with a relatively gentle curve at the turn of the bilge, where the hull bottom and sides met. As in other regions, there was wide variation in Great Lakes construction techniques, and the term "scow" was used to describe variety of vessels. One of the clearest contemporary definitions is found in *Merchant Vessels of the United States* (1885):

Scows are built with flat bottoms and square bilges, but some of them have the ordinary schooner bow....The distinctive line between the scow and the regularly-built schooner is, in the case of some larger vessels, quite obscure but would seem to be determined by the shape of the bilge, the scow having in all cases the angular bilge instead of the curve (futtock) bilge of the ordinary vessel.

As the above definition points out, there was occasional difficulty in distinguishing conventional craft from scows. This problem was not limited to Great Lakes vessels. A dispute arose in New Zealand's Auckland Anniversary Day scow race in 1884. Scow captains refused to race until the *Vixen*, a round-bilged vessel over which there was some dispute whether or not she was indeed a scow, withdrew from the competition (Hawkins 1987:24). Despite occasional confusion, several traits were characteristic of scows and used to differentiate them from conventional vessels. These traits are most easily understood when viewed in cross section. Scows are boxy vessels with a flat bottom and sides, connected by a hard chine, or a nearly ninety-degree angle where the bottom meets the side (Figure 1). Conventional sailing vessels, whether flat-floored or with deadrise¹, possessed a soft chine, or a smooth, rounded edge where the bottom and sides meet (Figure 2).

¹ Due to the shallow nature of many Great Lake harbors, as well as the Welland Canal locks, wooden vessels developed flat floors as they increased in size. Flat floors, or a flat hull bottom, allowed greater cargo capacity while limiting draft, but retained conventional soft hull lines.

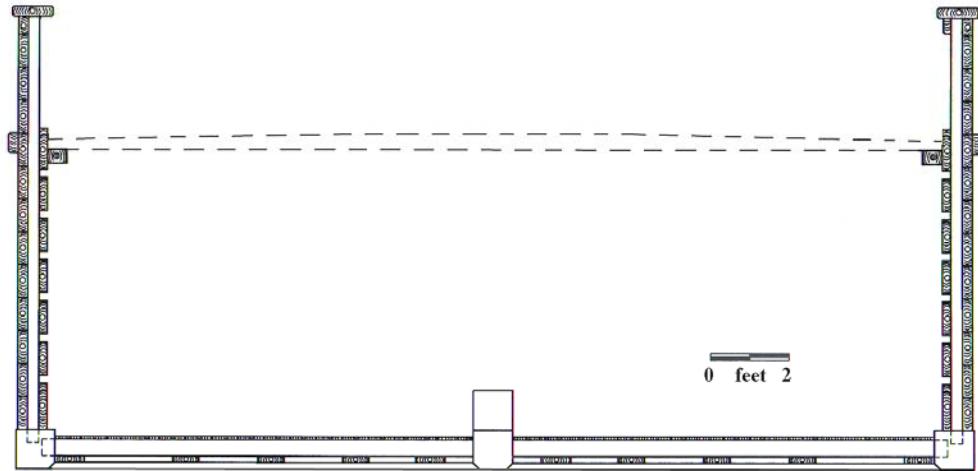


Figure 1. Scow schooner cross section. Note flat bottom and hard chines with chine log. Adapted from Rodgers and Corbin 2003.

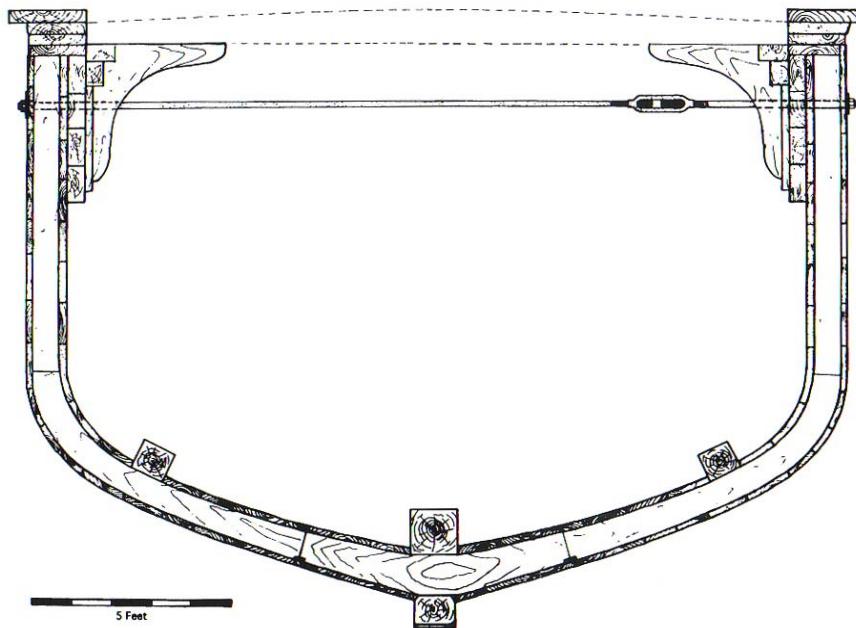


Figure 2. Cross section of conventional vessel. Reprinted, by permission, from Rodgers 1995.

Scow construction varied from hull to hull as well as from region to region. This variation included obvious features such as sheer lines, transoms, and bows, in addition to less obvious features like cross or diagonal planking and longitudinal framing. Several bow variations are visible in historic photographs, including the square butt-end bow with little or no forward projection of the stempost, the pointed flat-iron bow that produced a finer entry (similar to conventional craft), and the rounded spoonbill, swim-headed, or barrel-shaped ends (Labadie and Herdendorf 2004:8).

Martin (1991:2) categorizes scows into three distinct types: (1) full scow with angular bilge along its entire length, (2) half scow with angular bilge along only part of its length with the bow and stern being similar to that of a conventional hull, and (3) a less defined category for hulls not clearly exhibiting an angular bilge, but flat-bottomed enough to be considered scows by contemporaries. Martin supports this classification with evidence from insurance registers that list both “scow” and “half scow” hulls as well as vessels with a “scow stern” or “scow bottom” (Martin 1991:2). This model illustrates the large variation within the scow vessel type, but may be too simplified. Problems arise when attempting to define a vessel with a bow or stern “similar” to a conventional hull. The flat-iron bow, while having a fine entry not unlike a conventional vessel, remains an obvious scow with an angular joint where the bow meets the hull side. More historical and archaeological research is needed to determine the extent of variation within the scow vessel type, and how dissimilar from conventional hulls they needed to be for consideration as a scow. This may be a daunting task, as contemporaries appear to have been as confused as modern researchers.

Scow bottoms could be longitudinally, cross, or diagonally planked, the latter two methods requiring nontraditional framing. Hull sides were also subject to variation, from the traditional frame-on-plank construction to the scow-specific “gunnel-built” sides. Gunnel-built scows were constructed with thick longitudinal hull planks edge-bolted with iron drift bolts that ran through two or more side planks (Inches and Partlow 1964:290). These edge bolts not only clamped the side hull planking together, but served as reinforcement against horizontal forces, eliminating or reducing the need for frames as in conventional hulls. Gunnel-built planking averaged four inches thick in vessels of sixty to ninety feet in length. Inches and Partlow (1964:291) suggest that gunnel-built construction, with few, if any, frames, was one characteristic common to nearly all Great Lakes scows. A second trait unique to scows, and perhaps equally as common as the gunnel-built side, was the use of a chine log at the turn of the bilge. The scow’s hard chine was a weak point in the hull, strengthened through the incorporation of a heavy longitudinal timber. These six to eight inch stringers were the principle framing members of the hull, fitted along both sides for the entire length of the bilge (Inches and Partlow 1964:291).

It is open to debate whether the scow’s development and popularity resulted from a need for vessels capable of transiting shallow waters or because their unsophisticated hull form was economical to build and maintain (Labadie and Herdendorf 2004:8; Inches and Partlow 1964:290). It is certain, however, that scows required the simplest construction techniques of any freight-carrying vessels. The great variation in construction and appearance is likely a combination of the builder’s shipbuilding skill, the type and quality of construction materials available, and available funding.

Variation in construction was not limited to the Great Lakes. Despite the fact that New Zealand’s scows were based on a Great Lakes model, there were many adaptations to fit local needs. For example, New Zealand’s scows carried all of their cargo above decks. While proportional in length and beam to Great Lakes scows, New Zealand’s scows carried half the depth of hold with no provisions for internal cargo. Registration documents stated that “no cargo is to be carried below deck,

everything carried above; in fact, no hatchways are provided” (Hawkins 1987:23). There were several variations in hull framing as well. New Zealand scows utilized either a “post and rail” construction that used longitudinal stringers and stanchions, or a “solid partition” construction that utilized longitudinal bulkheads that partitioned the vessel into compartments. Centerboards were not as common as on the Great Lakes, and both the drop keel and pivoting centerboard was used (Hawkins 1987:26).

San Francisco’s scows were more similar to Great Lakes’ scows than New Zealand’s, but even they exhibited an equal amount of variation in both construction and hull lines. San Francisco Bay had both longitudinal- and cross-planked hulls, but the latter was less common. Longitudinally-planked hulls were framed similarly to conventional vessels, with transverse floors scarped into frames at the chine, precluding the need for a chine log. Ceiling planking was usually longitudinal, as was the ceiling planking on both the hull bottom and sides.

Cross-planked scows were of an entirely different construction, called “log built” in local vernacular. These vessels used several longitudinal floor keelsons with a heavy outer hull and ceiling planking that was edge bolted. The sides were sometimes stiffened with widely spaced frames. The most noticeable difference between longitudinal and cross planked vessels was the angle of the bow and stern ramps. Longitudinally planked vessels required steaming the bow and stern hull planks and resulted a more gradual upward curve of the bow and stern ramps. Cross-planked vessels did not require steamed hull planks, allowing a more abrupt angle where the bow and stern ramps met the bottom. This created a boxy hull with a nearly vertical bow and stern. Local opinion held that the boxy cross-planked hulls were less handy and slower than the finer longitudinally-planked ones. Many builders, however, opted for the cross planked construction as it was cheaper to build and provided more cargo capacity (Olmsted 1988:67-72).

Scows were generally considered good sailors and were as fast, or faster, than conventional schooners, perhaps with the exception of sailing in heavy seas. Their shallow draft and flat bottoms created little water drag. Sailing to windward was their worst point of sail. The wide, flat bows took a beating in head seas and their shallow draft allowed considerable leeway in strong winds (Chapelle 1951:50; Inches and Partlow 1964:292; Kristiansen 1981:3; Olmsted 1988:19). Despite how seaworthy a scow may or may not have been, insurance companies held little faith in the scow’s seaworthiness, and even less confidence in cross-planked bottoms and gunnel-built sides. Construction rules for 1866 note:

Frame built scows, well constructed and of good material, with fore-and-aft bottom planking, may be entitled to Class B1, [for] five years, but in no case will scows be entitled to the B1 grade if built with gunwale sides or athwartships bottom” (Board of Lake Underwriters 1866:14).

Vessels built according to underwriters’ rules were given a classification rating that determined a vessel’s insurance premium. Ratings of A1, A2, B1, B2, C1, C2, or “not insurable” were assigned, A1 being the highest rating with the lowest premium - a rating scow schooners never achieved. In 1876, the Board of Lake Underwriters (1876:74) categorized scows with barges and even describes them as “of unseaworthy form.”

CHAPTER THREE

SCOW SCHOONER *IRIS*

Historical Background

The *Iris*, official number 12096, was built in Port Huron, Michigan, in 1866 by Lornezo S. Bedford and first enrolled on 15 May 1866 (Figure 3). She was registered as a two-masted schooner 74 feet in length, 19.2 feet in beam, and 6.6 feet in depth of hold, with a registered tonnage of 62.14 gross and 56.9 net. Captain L.S. Bedford was the sole owner and sailed the *Iris* as master for her inaugural season out of Port Huron (Bureau of Navigation 1866). Bedford had been a Port Huron resident since at least 1850, but little else is known of her builder or the Bedford shipyard (United States Genealogy Network 2005). Port Huron and the Bedford yard did not fare the Panic of 1873 very well. Following the Panic, new vessel construction ceased at Port Huron, with nothing but repair facilities remaining (Hall 1884:172).

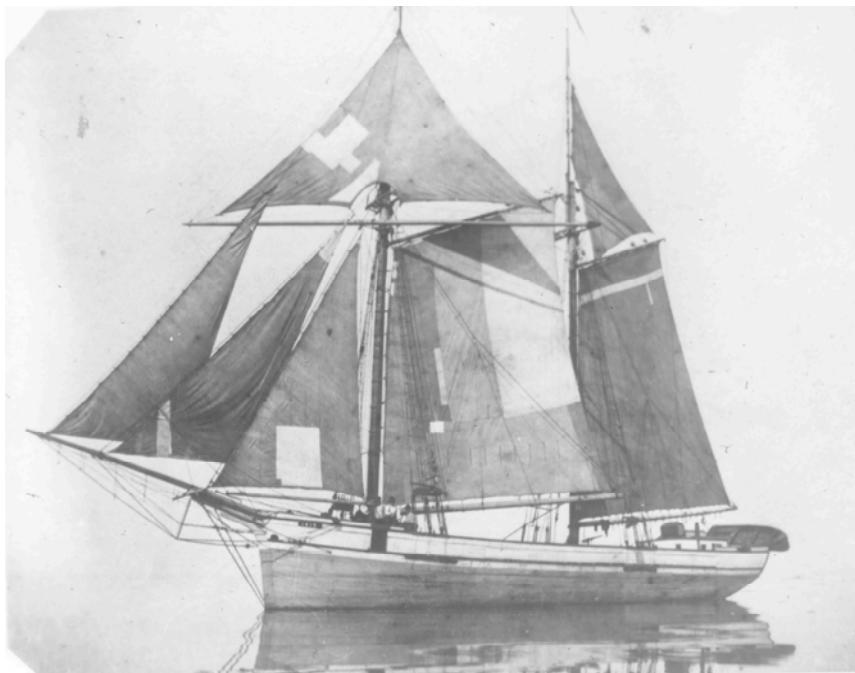


Figure 3. Photograph of *Iris* in Wisconsin near the turn of the century. Note numerous patches in sails and lack of scow-shaped hull. Courtesy Wisconsin Maritime Museum.

The *Iris* hailed from Port Huron for only one season. Less than a year from her original enrollment she was sold to Captain S. Burrell of Detroit for \$4,200, and began the 1867 season under his sole ownership and command (Bureau of Navigation 1867a; *Detroit Free Press* 1867:2). Capt. Burrell sailed the *Iris* for six years before he sold her to other Detroit interests at the beginning of the 1873 season, just prior to the Panic of 1873. On 15 April 1873, B. Cole and L. A. Lebot filed a new enrollment that listed each as equal owners and Cole as master (Bureau of Navigation 1873). Cole and Lebot owned the *Iris* for the duration of the Panic of 1873, caused by the collapse

of the railroad boom and did not lift until the spring of 1879. The *Iris'* operation during the recession is largely unknown, but one year into the Panic the *Iris* was valued at \$2,200 with a B2 insurance rating (Board of Lake Underwriters 1874:57). During the spring of 1879, about the same time the Panic of 1873's recession lifted, M. J. Cousino purchased Lebot's half share of the *Iris*. Cole retained his share as well as his position as master (Bureau of Navigation 1879).

The Cole / Cousino partnership lasted only one season. Early in 1880, the *Iris* returned to Port Huron where Cole and Cousino sold their shares to Horatio N. Jex, who became the *Iris'* sole owner and master. Captain Jex was a lifelong Port Huron resident, born there on 18 June 1851. Jex entered the lake trade at age of thirteen on the schooner *Idaho*; by the age of twenty he was captain of the *Hanson* (Andreas 1883). It is uncertain whether the *Iris* was Capt. Jex's first foray into vessel ownership, with sixteen years experience as a lake sailor when he purchased her. Mysteriously, when Jex filed his new enrollment at the Huron customs house on 17 June 1880, the *Iris* was registered as a scow, having been registered as a schooner on all previous enrollments (Bureau of Navigation 1880). Capt. Jex sailed the *Iris* for only one season, which turned out to be her last season in Michigan. In May 1881 he sold the *Iris* to purchase the scow *W.R. Hanna*, which was nine years older than the *Iris* (Labadie and Herdendorf 2004:30). It is curious that Capt. Jex sold the *Iris* for a vessel nearly a decade older, which may indicate the *Iris* was in a deteriorating condition. The *Hannah*, however, was 24.02 tons larger than the *Iris*, and Capt. Jex resold the *Hannah* one year after her purchase in May 1882, which may be indicative of revolving ownership patterns rather than the *Iris'* poor condition.

Captain Arthur E. Dow of Manitowoc, Wisconsin, purchased the *Iris* from Jex, bringing her to Manitowoc in May 1881. Capt. Dow was born in 1858 in South Danvers, Massachusetts. His father, Richard P. Dow, was a courier until he moved his family to Manitowoc during the 1860s, where both father and son became lake sailors. Arthur Dow was twenty-three years old when he purchased the *Iris* in 1881, becoming the *Iris'* sole owner and master (Bureau of Navigation 1881a, 1881b; United State Census Bureau 1860:99, 1870:6, 1880b:1, 1910:10A). Capt. Dow's tenure aboard the *Iris* was an exciting one. In early September 1881 the *Iris* was more than two weeks overdue at Sturgeon Bay and given up for lost. On 22 September, however, the *Iris* arrived at Sturgeon Bay, and Capt. Dow went immediately to the newspaper office to telegraph his family in Manitowoc that he was indeed "still in the land of the living" (*Door County Advocate* 1881:3). The following December Capt. Dow again encountered late season heavy weather, and again was feared lost. A load of Christmas trees awaited the *Iris* at a Sturgeon Bay pier, consigned for Chicago, but the *Iris* was overdue (*Door County Advocate* 1882a:3). She eventually arrived, however, and carried the load of holiday cheer to Chicago, arriving just in time for Christmas and the close of the 1882 navigation season on 13 December 1882 (*Door County Advocate* 1882b:3). The *Iris'* first two seasons in Wisconsin were typical of how she would spend her next thirty-one years, connecting northeastern Wisconsin communities with the Milwaukee and Chicago markets.

Two years after coming to Wisconsin, the *Iris* moved to Milwaukee when she was purchased by Captain B. A. Anderson on 29 August 1883 (Bureau of Navigation 1883). Capt. Anderson served as sole owner and master until 23 June 1886, when half

of the vessel was purchased by B. Leopold Anderson, with Capt. B. A. Anderson remaining as master (Bureau of Navigation 1886). Three years following their partnership, the Andersons moved the *Iris* to Detroit Harbor on Washington Island, and B. L. Anderson replaced B. A. Anderson as master (Bureau of Navigation 1889). Under command of Capt. B. L. Anderson, the *Iris* continued in the lakeshoring trade, often carrying Washington Island wood products to Milwaukee and returning with merchandise for Jon Gislason's island store. Winter lay-ups were spent in Detroit Harbor (*Door County Advocate* 1891:5, 1891:8). Under command of the Andersons, the *Iris* spent nine trouble-free years sailing Lake Michigan, but tragedy struck on 15 July 1892. Moored in the Milwaukee River, B. A. Anderson fell overboard. His cries for help quickly brought assistance, but not quickly enough. Pulled from the river and transported to the local hospital, Capt. Anderson died a few hours later. His body was returned to Washington Island for burial (*Door County Advocate* 1892:5).

The surviving B.L. Anderson put the *Iris* up for sale the following spring. In March 1893 Peter Hanson Pederson of Washington Island purchased the *Iris* for \$1,000, just under half of what she was worth nineteen years earlier (*Door County Advocate* 1893a:8, 1893c:5). It took a bit of work to get the *Iris* ready for the 1893 season, as she was not ready to sail until early June (*Door County Advocate* 1893b:8). This suggests the *Iris* did not finish the 1892 season following Capt. Anderson's death, and required extra time to recommission her the following season. A new enrollment was entered at Milwaukee on 12 July 1893 that listed Capt. Pederson as sole owner and master, with the *Iris*' hailing port returned to Milwaukee (Bureau of Navigation 1893). Much of the Capt. Pederson's first season aboard the *Iris* was uneventful, but as with Capt. Dow, heavy winter weather provided exciting times.

On one late November run, Capt. Pederson was carrying several thousand dollars worth of merchandise consigned to Washington Island. As he approached the island a strong westerly gale kicked up and overpowered the small schooner. Blown clear across Lake Michigan, the *Iris* was about to go ashore on North Manitou Island when the island's life-saving station managed to get a line on her and tow her to safety inside the harbor. This incident was a blow to Capt. Pederson's pride, and went unmentioned when he finally arrived at Washington Island. When a *Door County Advocate* reporter saw an article in a Leelenaw newspaper describing the event, however, he could not leave well enough alone. Rubbing salt in Capt. Pederson's wounds, the reporter not only described the incident in the *Door County Advocate*, but also stated that it was "queer that the crew don't remember such things when they got [sic] home" (*Door County Advocate* 1893d:8). On the very next trip she lost her raffee sail and had to run all night under bare poles through a blinding snow storm (*Door County Advocate* 1893d:8).

Capt. Pederson's 1894 season didn't begin much better than the previous one ended. A heavy storm blew across the lake on 18 May 1894. Despite being anchored inside the Milwaukee breakwall, large waves continuously broke over the *Iris*' bow, rolled along her deck, and entered the ship through her cargo hatches and any other opening. The crew manned the pumps continuously to keep her from flooding. The lengthy exposure to cold water and weather caused Capt. Pederson to fall so ill he was bedridden. Captain J.C. Jessen took temporary command of the *Iris* while Capt. Pederson recovered (*Door County Advocate* 1894a:8). The rest of the season was

uneventful, with the exception of 20 November 1894. Carrying a load of Washington Island potatoes and cordwood to Milwaukee, the *Iris* encountered a southeast gale and anchored in the shelter of the Sturgeon Bay Canal near the head of the bay. The *Iris* was not anchored far enough from the channel, however, since the passing steamer *Minnesota*, coming in for shelter from the heavy weather, collided with her and carried away her jib boom (*Door County Advocate* 1894b:5). The *Iris* finished out the season without her jib boom, which was not refitted until the following spring (*Door County Advocate* 1895a:5).

The 1895 season was much less eventful for Capt. Pederson and the *Iris*. Early that year the *Door County Advocate* reported that George Moe made his first venture into vessel ownership and purchased a half share of the *Iris* from Capt. Pederson for between \$450 and \$500. This transaction was under the table, for it is not reflected in the official enrollments. George Moe's first venture into vessel ownership was not exactly a legal one (*Door County Advocate* 1895a:5). The rest of season found the *Iris* in her local trade between Washington Island and Milwaukee with very little excitement. Her most notable experience came in November when she was wind bound in Sturgeon Bay for four days while bound for Milwaukee with a load of Washington Island potatoes (*Door County Advocate* 1895b:5).

Capt. Pederson put the *Iris* up for sale the following season. After investing nearly \$1,000 over the last four years in maintenance, the *Iris* was described as in "excellent condition and considered about the fastest of her size on the lake" and a "bargain" for someone (*Door County Advocate* 1897a:1). A few weeks later Captain Peder Knudsen purchased the *Iris* for \$1,100 and moved her to Newport, Wisconsin (*Door County Advocate* 1897:1, 1897b:8). The official enrollment was entered on 26 April 1897 with Capt. Knudsen listed as sole owner and master (Bureau of Navigation 1897). Capt. Knudsen kept the *Iris* in her comfortable role of hauling Door Peninsula products to Milwaukee, and the first half of his inaugural season was uneventful.

As with previous owners, however, the gales of November brought some challenges. After carrying a load of lumber from Newport to Milwaukee on 18 November 1897, Capt. Knudsen was returning light when a northerly gale began blowing as he was abreast of Cana Island. Unable to make headway, Capt. Knudsen turned the *Iris* and made for the shelter of the Sturgeon Bay Canal, where he laid at anchor for two days until the winds subsided. Capt. Knudsen told the Advocate he still hoped to make two more runs before laying up for the season (*Door County Advocate* 1897c:1).

Capt. Knudsen took on two partners the following spring when he sold half the *Iris* to John C. Jessen and Anton M. Jessen, who each purchased one-quarter shares on 18 April 1898. The *Iris*' hailing port was returned to Washington Island, and John C. Jessen became master (Bureau of Navigation 1898). Capt. Jessen was a conservative captain, not pressing his luck aboard the thirty-two year old *Iris*. On 18 September 1899 Capt. Jessen was enroute to Milwaukee with Martin Jorgeson and Christian Jacobsen as crew. Exiting the Sturgeon Bay canal to find a heavy sea running, Capt. Jessen came about to return to Sturgeon Bay to await calmer waters. With little sea room inside the harbor of refuge and a west-southwest wind blowing off shore, the *Iris* became stuck upon a shoal. The Sturgeon Bay Life-Saving station, immediately to the north, quickly launched a small boat. The station's crew carried lines to the

nearby pier and the *Iris* was quickly pulled free. The momentum of pulling her free, coupled with the strong wind and waves, began propelling the *Iris* towards the pier at a frightening rate, threatening damage to both her hull and the pier. Quick-thinking, the crew dropped one of the *Iris'* anchors, checking her speed just in time to avoid impact. Now under control, lines were made fast to the pier and the anchor recovered. Capt. Jessen heartily thanked the Life-Saving Station crew for their help. The entire episode lasted less than one and a half hours. Of interest, the Life-Saving Station reported the *Iris'* value at \$900. This was \$200 less than her purchase price one and a half years prior. The *Iris'* load of cordwood was valued at \$80, and neither the vessel nor her cargo were insured (United States Life-Saving Service 1898).

The following spring the Jessens bought out Peter Knudsen's half share, becoming each equal owners with Capt. John Jessen retaining his position as master (Bureau of Navigation 1899). Not far into the season, the *Iris* lost her jib boom for a second time to a larger vessel. On 28 June 1899 the *Iris* and the three-master *Pride* were anchored in the lee of Plum Island in Death's Door, riding out a northeasterly gale. The *Pride* dragged her anchors and ran afoul of the *Iris*, carrying away her jib boom and one of her catheads. The Plum Island Life-Saving crew helped disentangle the vessels and provided the *Iris* a replacement spar (*Door County Advocate* 1899:1).

Early in 1901 the *Iris* departed from her usual Washington Island – Milwaukee route to participate in a cargo salvage on Fisherman's Shoal east of Washington Island. A coal shortage on the Door Peninsula left local steam tugs scrounging for fuel. On 17 May 1901 the *Iris* arrived at Sturgeon Bay with sixty tons of coal salvaged from Fisherman's Shoal after a larger vessel ran aground and had to jettison its load to free herself. The *Iris* received \$3.20 per ton for the load, for a total of \$192, far more than she could earn hauling wood (*Door County Advocate* 1901:1).

The Jessen partnership lasted until October 1902, when John Jessen purchased Anton Jessen's share to become the *Iris'* sole owner and master (Bureau of Navigation 1902). Anton Jessen's experience with the Life-Saving Service while aboard the *Iris* influenced him to join the service, and he worked his way up to rank of Number One at the Plum Island Station. In 1913 Anton Jessen was appointed Captain of the Kewaunee Station (Vickery 2005). At the close of the 1902 season, the *Iris* had survived thirty-six years on the Great Lakes, a grand feat for any wooden sailor. An increasing anomaly on Lake Michigan, sailing vessels were being squeezed out of the lake trade. In the 1890s, scores of schooners were abandoned in Lake Michigan harbors (Karamanski 2000:209). Those that survived were usually reduced to tow barges, shorn of much of their rigging and towed behind steam vessels. By 1903, the *Iris* was one of only a handful of self-propelled schooners actively working the lake, but she was beginning to show her age. Early in June 1903, Capt. Jessen arrived at the Sturgeon Bay shipyard to have the *Iris* dry-docked to stop a leak. With no dry-docks available, Capt. Jessen elected to make another trip with a leaking hull rather than wait for an open dock (*Door County Advocate* 1903a:1). The November gales of 1903 dealt a serious blow to the *Iris*, who limped into Milwaukee the second week of November with a broken and spliced mainmast (*Door County Advocate* 1903b:1).

The *Iris* disappears from the records for the 1904 season, not reappearing until February 1905 when Capt. Jessen sold the *Iris* in equal shares to Bo L. Anderson and

Julius Jensen for \$400 (*Door County Advocate* 1905a:8). B. L. Anderson had previously owned the *Iris* in the 1890s until B. A. Anderson's death, and now claimed he was "just as much at home on the rolling deep as on terra firma" (*Door County Advocate* 1905c:8). During his time away from the *Iris*, Anderson purchased nearly 500 acres of Washington Island forest with partner Ole Christensen. In 1902 they constructed the Anderson-Christianson lumber yard and pier at Jackson Harbor, and purchased the *Iris* to haul wood products from their lumberyard pier (*Door County Advocate* 1903a:1, 1905b:8). The official enrollment was entered at Milwaukee on 22 April 1905, the hailing port moved to Detroit Harbor and Julius Jensen became the new master (Bureau of Navigation 1905). The *Iris* spent the 1905 season hauling wood products from the Anderson-Christianson yard to ports throughout Wisconsin, including 300 cords of fuel wood consigned to the N. S. Washburn Co. in Sturgeon Bay, reportedly the first Washington Island wood delivered there (*Door County Advocate* 1905d:1). After delivering her first load of the 300 cords on 7 October 1905, the *Iris* remained in Sturgeon Bay until she could enter dry-dock on 10 October to be recaulked. Taking only one day, the *Iris* was returned to the water on 11 October, but Capt. Jensen was wind bound by strong northwest winds for several days before returning to Washington Island for the remaining cordwood (*Door County Advocate* 1905e:1). As always, the November gales played havoc with the small schooner. On 27 November 1905 the *Iris* departed Washington Island bound for Green Bay with a load of wood, but just after passing the Red River a strong southerly wind began to blow, halting all forward progress and requiring Capt. Jessen to set both anchors. After a long, frigid night in heavy seas, Capt. Jessen had enough. The *Iris* weighed anchor and ran for the shelter of Sturgeon Bay, where Capt. Jessen disposed of his cargo and returned to Detroit Harbor to lay up for the winter, as there was "neither pleasure, nor profit in the business under existing conditions" (*Door County Advocate* 1905f:1).

In August 1906 the *Door County Advocate* reported that Capt. Jessen sold his half-share to Bo Anderson for \$150 (*Door County Advocate* 1906a:1), who in turn sold the *Iris* to Charles E. Swanson on 7 September 1906. Charles Swanson transferred the *Iris*' hailing port to Marinette, Wisconsin, and registered Captain A. A. Bjorkland as master (Bureau of Navigation 1906). Once again, an unremarkable season gained excitement in November, when the *Iris* encountered fierce weather on Green Bay on 18 November 1906. While halfway between Marinette and Sturgeon Bay with a heavy deck load of lumber, the winds shifted to the southwest and increased to gale force. Covered in ice, the *Iris* began to heel heavily in the building seas when the deck load shifted and threatened to capsize the vessel. Capt. Bjorkland had no choice but to cut the lashings, releasing the deck load overboard in order to regain control and make the shelter of Sturgeon Bay (*Door County Advocate* 1906b:1).

The *Iris* spent the winter of 1906-1907 in the Menomonee River (*Door County Advocate* 1907a:1), but did not immediately return to the lakes at the start of the 1907 season. She remained laid up in the river until purchased in early July by Captain Andrew J. Anderson, who spent more than a week recommissioning her for service (*Door County Advocate* 1907b:1, 1907c:1). It was not until 9 August 1907 that Capt. Anderson re-enrolled the *Iris* at Milwaukee as sole owner and master, hailing from

Horseshoe Bay (Bureau of Navigation 1907). The 1907 season was otherwise unremarkable.

At forty-two years of age, the *Iris'* career on Lake Michigan was coming full circle. During the 1907-1908 winter lay-up Capt. Anderson sold the *Iris* to her original Wisconsin hailing port, Manitowoc. William Williamson purchased the *Iris* for \$500 as sole owner and master and entered her new enrollment on 21 January 1908 (Bureau of Navigation 1908; *Door County Advocate* 1908a:1). By April 1908, the *Iris* was again carrying Door County cordwood to southern Lake Michigan, making a brief stopover in Sturgeon Bay on her first trip of the season. Of note, the Advocate reported Capt. A. Bjorklund as her master (*Door County Advocate* 1908b:1). Later that season the *Iris* was unlucky enough to be struck once again by another vessel, this time while moored in the Manitowoc River. On 11 September 1908, the steamer *Roosevelt* was departing Manitowoc when she collided with a log raft. Attempting to free herself, the *Roosevelt* struck the *Iris*, carried away several stanchions and broke several frames. A claim was filed by Capt. Williamson, who was compensated \$275 (over half the vessel's value) the following week (*Door County Advocate* 1908c:1, 1908b:1).

Following the *Roosevelt* collision, the *Iris* disappears from the records until late the following season, when she arrived in Sturgeon Bay with a load of slab wood on 6 August 1909. Capt. Bjorkland was again at the helm, complaining of a very slow season, as this was only his third trip of year (*Door County Advocate* 1909:1). It is unknown how many more trips the *Iris* completed that year, as there is no mention of her until winter lay up in the Manitowoc Harbor. The *Manitowoc Pilot* (1909:1) comments that one of the most striking features of the harbor that winter was the small number of sailing craft in the winter fleet, the *Iris* being one of only four schooners in port that winter, in contrast to the many schooners of years past.

It is unclear whether the *Iris* was recommissioned for the 1910 season. If she was, she encountered some sort of mishap that removed her from service in mid-season, as the Advocate reported on 25 August 1910 that Thosten Thomsen of Manitowoc purchased the *Iris* for \$150 with the intent to repair and recommission her the following season on Green Bay (*Door County Advocate* 1910:1, 1911:1). Capt. Thomsen did not re-enroll the *Iris* until 10 June 1911, listing himself as sole owner and master, retaining Manitowoc as hailing port (Bureau of Navigation 1911).

Despite the increasing rarity of commercial sail on the lake during this time, there is little documentation of the *Iris* during her last two seasons. The little documentation we have indicates trying times for the aging vessel as she struggled to maintain a livelihood. Capt. Thomsen sailed the *Iris* with a crew of only two (Merchant Vessels of the United States 1912:49). This is one less than her previous compliment of three, and significantly less than the four to five crew members that were common on vessels of *Iris'* size during the latter nineteenth century (Meerden and Jensen 2005). A vessel of *Iris'* size would have been difficult to handle in close quarters or in heavy seas with only two crew members. The aging vessel had ongoing problems with leaking, and if the pumps needed to be manned while underway, the other needed to tend the helm, leaving no opportunities to rest or get out of the weather. With dwindling cargoes and dropping freight rates the only way to keep the

Iris profitable was to reduce operating costs, most easily done by reducing the payroll.

The *Iris* was forty-seven years old when Capt. Thomsen recommissioned her in 1913, an age to which very few schooners survived on Lake Michigan. Her last season would not be a long one. Capt. Thomsen arrived at Jackson Harbor on Washington Island early in March 1913, a familiar port to the aging *Iris*. Unable to secure a cargo, Capt. Thomsen struck a deal with a local resident to sell the *Iris* for \$5, but the buyer was unable to produce the money. With an elderly, leaky vessel and little hope for lakeshoring's future, Capt. Thomsen weighed anchor on 5 March 1913 and sailed out of Jackson Harbor. Clear of the harbor, all sails were set and the *Iris* was brought about. With as much headway as she could make, Capt. Thomsen sailed back into Jackson Harbor and ran the *Iris* hard aground (Jacob Ellefson 2005, pers. comm; Wisconsin Maritime Museum n.d.). Three days later her final enrollment was surrendered. For the official record, Capt. Thomsen reported the *Iris* foundered at Jackson Harbor, adding that all three crew aboard reached shore safely (Beeson's Marine Directory 1913; Bureau of Navigation 1911; Merchant Vessels of the United States 1913).

The *Iris* never moved again. Anything of value was salvaged over succeeding years. Her cabin's wainscoting was removed and used to line local ice boxes, and any other useful timbers were salvaged by locals. The hulk was a local playground for island children, who fished from her decks into the 1920s, until she became too rotten to safely board (Figure 4) (Jacob Ellefson 2005, pers. comm.). The *Iris*' ignoble disposal was unsurprising. Capt. Thomsen had a worn out, leaking vessel, and Lake Michigan's age of sail was quickly ending. Expanding rail and highway routes stole increasing amounts of cargo from lake carriers large and small. A few of the small schooners like the *James Hall* and the *Oscar Newhouse* installed gas and oil engines to prolong their usefulness, but these improvements only prolonged the death of the lakeshoring schooner (Barkhausen 1948).



Figure 4. Photograph of *Iris* abandoned at Jackson Harbor, date unknown. Wreckage of gas boat *Sadie* is visible off the *Iris*' stern. Courtesy Wisconsin Maritime Museum.

Description of Field Research and Findings

The *Iris* survey project was designed as a Phase II archaeological survey of a shipwreck lying between the public launch ramp and commercial fishing piers in Jackson Harbor, Washington Island ($45^{\circ} 24.034' N$, $087^{\circ} 51.332' W$) (Figures 5 and 6). Predisturbance surveys document the site as it lays without excavation or artifact retrieval. Diagnostic artifacts that may indicate the site's age or identification are measured, sketched, photographed, and left in place. Predisturbance surveys have very little site impact, and are relatively cheap compared to Phase III excavations. The *Iris* site was selected for survey for the information it could provide on Great Lakes scow schooners and the Lake Michigan lakeshoring trade, as well as providing an ideal location to teach shipwreck documentation techniques as part of an underwater archaeology field school for WHS volunteers. The *Iris* site lays in one to four feet of water with some hull structures protruding above the waterline, precluding the need for scuba gear and allowing easy communication.

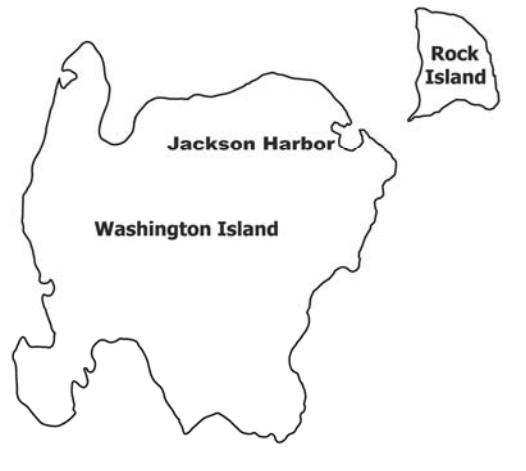


Figure 5. Jackson Harbor.

Locals state that “without a doubt” the vessel at Jackson Harbor is the schooner *Iris*. Jacob Ellefson Jr., a commercial fisherman whose family has owned the adjacent property since 1907, corroborated the story uncovered at the Wisconsin Maritime Museum regarding the *Iris*' loss. An undocumented amount of salvage occurred following the *Iris*' abandonment by the owners and local residents, including rigging, wood trim, and vessel timbers. Jacob Ellefson, Sr. was unconcerned that a hulk was abandoned next his property since there was great care taken not to block the piers when she was run aground. The *Iris*' hull provided a playground for local children until it became too treacherous to board in the 1920s (Jacob Ellefson 2005, pers. comm.).

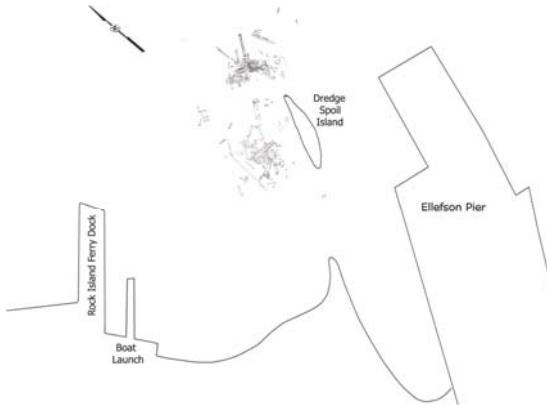


Figure 6. *Iris* wreck site in Jackson Harbor.

Fieldwork began on 6 June 2005 and was completed on 10 June 2005. A baseline was established aft of the vessel's stern and extended over the vessel's centerline to several feet beyond the vessel's bow. Cross lines were established at ten foot intervals on either side of the baseline, extending beyond the farthest extent of wreckage at right angles to the baseline. The scaled baseline gave archaeologists a reference to coordinate all measured sketches and photographs. The cross lines, in addition to acting as an additional reference, partitioned the wreck site into 10-foot by 20-foot sections for mapping. Each survey team member was assigned to sketch one 10- by 20-foot section. All measurements were recorded in tenths of a foot to minimize recording errors and later converted to feet and inches using a Calculated Industries Model 8525 calculator set to a fraction resolution of 1/8 inch. All drawings were oriented to the baseline, and when finished were laid together like pieces of a jigsaw puzzle to assemble the site plan. In this manner the entire site was accurately mapped to scale. A detailed cross-section sketch recording components of the lower hull. Cross section measurements were recorded by stretching a level reference line above the site, perpendicular to the keelson. Systematic measurements were taken from the reference line down to the hull structure with a plumb bob to measure deadrise, or the angle of the ship's bottom. A datum was established on the nearby shoreline to coordinate all in-water activities and orient the site with the shoreline and adjacent piers. The datum was located on Ellefson's pier, chosen for an unobstructed view of the site and surrounding area. A Lietz Set 5 Total Station with an electronic distance-measuring device was set up at the datum, allowing archaeologists to create an accurate map of the shoreline, piers, wreck site, and dredge spoil island. In this way the wreck's orientation to surrounding structures was clearly defined.

The Phase II survey allowed archaeologists to identify and record in plan view the overall underwater site while recording wreckage detail for archaeological interpretation (Figure 7). The *Iris* survey was designed to answer several questions as part of an overall research design. The first objective was to identify, by name or class, the vessel represented by the wreckage. The second project objective was to document lakeshoring schooner construction techniques, specifically those of scow schooners. The third objective was to record any material culture that may provide insight into the vessel's crew and how they lived and worked aboard lakeshoring vessels.

Schooner Iris

June 2005

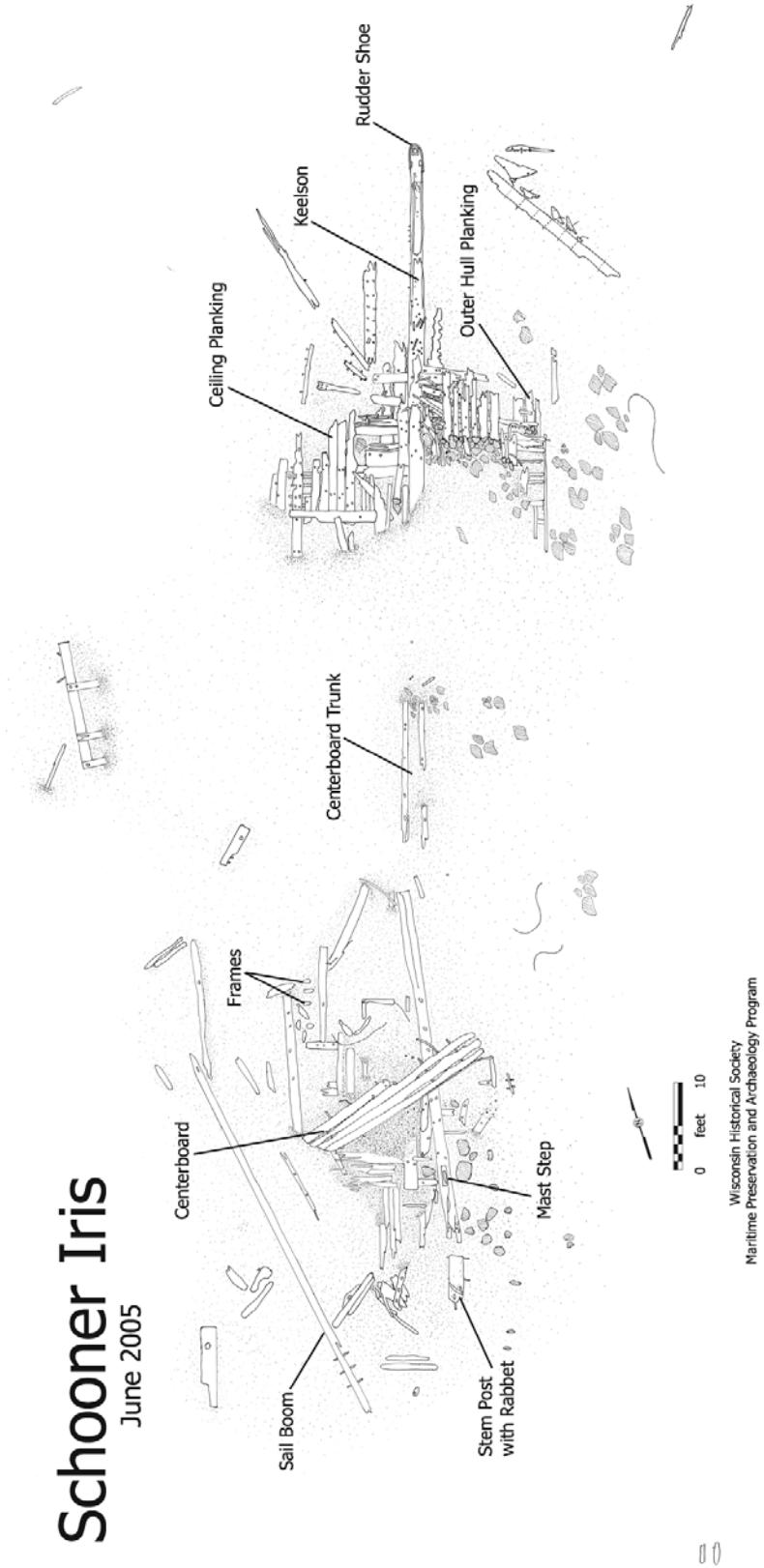


Figure 7. *Iris* site plan.

The *Iris'* remains are quite weathered, having been subjected to 47 years of Great Lake service, followed by 92 years of storms, ice, sun, and salvage. Only the hull's lower bilge remains intact. No evidence of the vessel's sides or deck was discovered. Much of the vessel lays beneath dredge spoil from an adjacent slip that conceals much of the lower hull with the exception of a portion of the centerboard and centerboard trunk, a 23 foot section of the forward hull from the sternpost aft, and a 25 foot section of the after hull from the rudder shoe forward.

Visible construction details are those of a small sailing vessel with a keel length of 72 feet from the center of the rudder shoe to the forward edge of the keelson, comparable with the *Iris'* registered length of 72 feet. Beam was difficult to determine due to heavy overburden. The widest visible breadth was 24 feet forward of the rudder shoe where the port side frames, broken just below the turn of the bilge, extend 8 ft. 3-5/8 in. from the center of the keelson. Starboard side frames at this location were broken much closer to the keelson than on the port side. Compared with historic photographs and the relative position of the centerboard trunk, this location was just aft of the mainmast, and likely not the widest part of the hull. Doubling the port side measurement gives an estimated beam of 16 ft. 7 in., within the *Iris'* registered beam of 19.2 ft. Depth of hold could not be determined.

The stern is the most exposed hull section, from the rudder shoe forward 24 feet, where the hull disappears into overburden. The rudder shoe is an iron plate 5 inches square, fastened with a nail in each corner. The shoe rides atop a timber 3 feet in length that is hook-scarphed into the underside of the keel, a repair from either damage or wear. A 4 in. by 1/2 in. iron reinforcing strap wraps around the end of the shoe timber. The sternpost is missing, but two deadwood timbers are extant to where they abutted the sternpost 1 ft. 11-1/2 in. forward of the rudder shoe. The deadwood timbers are fastened to the keel with 3/4 in. iron through bolts. The deadwood rises above the water's surface and is badly weathered, making dimensional measurements problematic. All cant frames are missing, and no cant frame pockets are visible. The first floor timber is located 14 ft. 5 in. forward of rudder shoe. Few intact frames are visible; those that are measure 4 in. molded by 7 in. sided, with 11 in. spacing. The vessel appears to be single framed; however, highly deteriorated remnants of a second timber are fastened to the after side of the third and fourth floors from the stern. These timbers are significantly more deteriorated than the floor timbers, suggesting they were constructed of a different wood than the floor timbers and later added as a repair to reinforce the floors (Figure 8). Limber holes are cut into the starboard side floors only, 5 in. from edge of the keel, measuring 2 in. wide by 1 in. high. The keelson begins 12 ft. 10-3/4 in. forward of the rudder shoe and is 12 in. sided by 7 in. molded. A badly eroded rider keelson begins 3 ft. 2-3/8 in. forward of the keelson's after end, measuring 12 in. sided by 4 in. molded. Through bolts that fasten the keel assembly protrude 5 in. above the rider's upper face. Keelson assembly through bolts are both 1/2 in. and 3/4 in. diameter with no evidence of clinch rings.



Figure 8. Exposed stern section, facing aft. Photo by Tamara Thomsen.

Ceiling and outer hull planking are present on both port and starboard sides, but are in little better condition than the frames and deadwood. Ceiling plank thickness averages 3/4 in. on the port side and 1-1/4 in. on starboard. Ceiling plank width on the port side varies from 4-1/4 in. to 7-1/4 in., and from 6 in. to 7-3/4 in. on starboard. Outer hull planks average 2-1/4 in. thick, and vary in width from 2-3/8 in. to 9-5/8 in. on the port side, and from 7-1/4 in. to 9-5/8 in. on starboard. Planking is fastened by two sizes of chisel point, rose-head nails 5 in. long by 3/8 in. square, and 7 in. long by 1/2 in. square.

A cross-section detail was taken 20 feet forward of the rudder shoe. At this location the port side hull extended 8 ft. 3-5/8 in. from the vessel's centerline, and 3 ft. 6 in. to starboard of centerline. The measured deadrise was unequal between sides (Figure 9). The starboard side exhibited a deadrise of 5-1/4 in. over a 3 ft. 5 in. span. The port side has less deadrise, with a flat floor that extends 4 ft. 4 in. from the vessel's centerline before beginning a gradual angle towards the turn of the bilge, rising 8-3/4 in. over the last 45 in. of frame. All visible framing is athwartships, typical of conventional schooners. Frames at the turn of the bilge exhibit a soft chine with no evidence of a chine log, king posts, or cross-planked hull (Figure 10).

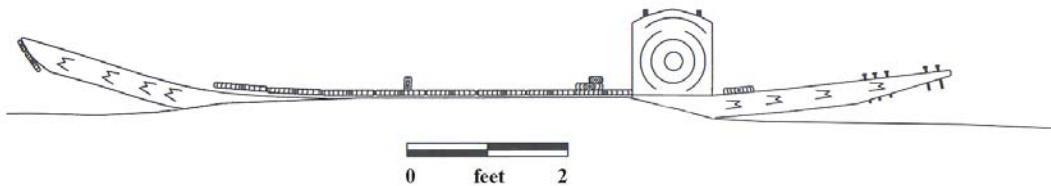


Figure 9. Hull cross section, facing forward.



Figure 10. Frames and outer hull planking at the turn of the bilge, port quarter.
Photo by Tamara Thomsen.



Figure 11. Centerboard trunk, facing aft. Photo by Tamara Thomsen.

A fragment of the centerboard trunk is visible amidships where it protrudes a few inches above the overburden (Figure 11). Nine feet of the trunk is visible from the forward edge aft to where it disappears into the bottom, leaning slightly to starboard. Overburden did not allow inspection of the centerboard trunk / lower hull interface, but the trunk's location relative to visible fore and aft sections of the keelson indicate the trunk is aligned with the vessel's centerline. Trunk planking was 3-5/8 in. thick, edge-bolted with 3/4 in. iron bolts

The centerboard itself lays near the bow and migrates about the site from year to year. The centerboard retains four planks for an overall dimension of 13 ft. in length and 3 ft. 4-3/4 in. tall. Several upper planks are missing, but measurements from the remaining through bolts indicate the centerboard was originally 3 ft. 6 in. tall. Existing planks are 6-1/2 in. wide and 1-3/4 in. thick, edge-bolted with 1 in. iron bolts that run through several planks. The leading edge of the centerboard has a 2-1/2 in. wide by 1/2 in. thick iron shoe along its entire length. The shoe's width compared with centerboard plank thickness indicates each plank has lost 3/4 in. of thickness due to weathering.

The centerboard rests atop the rider keelson, which also migrates about the site (Figure 12). During a site visit the previous fall the rider keelson was replaced atop the keelson from several feet away, aligned on the keel bolts. When WHS archaeologists returned in June 2005, the rider keelson had again moved to its present location to port of the keelson. The rider keelson measures 9 in. sided by 7 in. molded and 22 ft. 8 in. in length. A step is visible on the forward end, measuring 1 ft. 4 in. long by 4-1/2 in. wide and 3 in. deep. The step's inner mortise measures 6 in. long by 2 in. wide and passes completely through the rider. This step is 5 ft. 2 in. from the rider keelson's forward edge. Compared with historic photographs, this step is for the sampson post rather than the foremast. Historic images place the foremast approximately 10 feet aft of the stempost, with sampson post approximately equidistant between the two. No other steps were visible. The keelson is buried in rock and mud, but a 5 in. wide by 2 ft. 6 in. long section of stem iron protrudes from the keel's underside. A 3 ft. 6 in. long disarticulated stempost fragment lays near the end of the rider keelson. Eight inches sided by 9 in. molded, rabbets are visible on either side of the post. Off the starboard bow is a sail boom 25 ft. 8 in. long and 6 in. in diameter. The boom jaws are absent, but its shelf extends 5 feet from the boom's forward end. Compared with historic photographs, the boom's length suggests it was the foremast boom.

Twenty feet to starboard of the centerboard trunk is what initially appeared to be a section of bulwark stanchions and planking. Closer examination, however, suggests it is a pier or crib remnant. The timber's dimensions were much larger than the hull's, and in a far better state of preservation. The planks were roughly fitted, edge-bolted, and fastened to framing timbers with 3/4 in. iron bolts with clinch rings. Various other wreckage and debris lays about the site, but consists of mostly small, indistinguishable fragments. Several large pieces of wreckage lay off the *Iris'* port quarter, but these sections exhibit construction details very different than wooden commercial sail. This is likely the remains of the *Sadie*, a smaller, more modern gas boat abandoned off the *Iris'* stern. Several pieces of 3/8 in., 7-strand wire rope were present around the site, possible wire rigging.

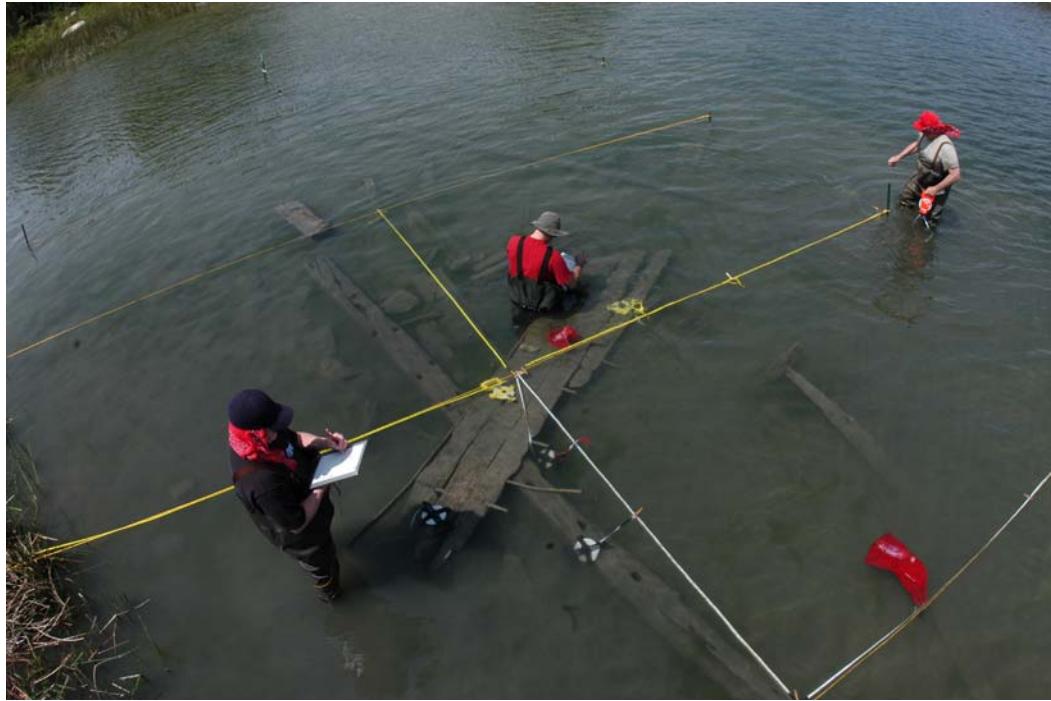


Figure 12. Bow section of wreck site facing forward. Centerboard lays atop rider keelson. Stempost section is visible just forward of rider keelson. Photo by Tamara Thomsen.

Conclusions and Recommendations

No artifacts were discovered that conclusively identify the Jackson Harbor vessel as the *Iris*. Based on historical records, local informants, and archaeological evidence, however, it likely is the *Iris*. The Ellefson family has owned the adjacent property since 1909, and would have been familiar with the *Iris* while she was actively trading at Jackson Harbor, adding validity to the identification. Vessel dimensions are consistent with those of the *Iris*, and documented construction is consistent with the *Iris*' historic image.

Historical documentation is confused as to the *Iris*' typology. The Board of Lake Underwriters lists her as a scow schooner in 1874 (Board of Lake Underwriters 1874), while her enrollment documents at this time list her as a conventional schooner (Bureau of Navigation 1873, 1879). It was not until 1880 that the *Iris* first appeared as a scow on her enrollments, with no explanation to the change in classification. The scow classification continued on all further enrollments. Examination of the *Iris*' historic image indicates that she was a conventional schooner and not a scow (Figure 3). Archaeological evidence indicates the *Iris* was not a scow but a conventional schooner. The *Iris* was constructed of single, athwartships frames with longitudinal hull planking. She has a soft chine at the turn of the bilge, and no evidence of a chine log. The stempost exhibits rabbeting to accommodate longitudinal outer hull planks at a sharp angle, indicating a fine entry rather than the flat scow-type bow. Frames near the stern exhibit a slight deadrise, contradictory to conventional scow construction.

It has been suggested that some scows carried a bow and stern similar to that of conventional vessels (Martin 1991). In the case of the flat-iron bow, however, despite

a fine entry much like conventional vessels, there remained an obvious angular joint where the bow met the hull side, a joint not apparent in the *Iris'* historic image. Flat floors with a tight bilge radius were sometimes used historically to classify scows (Merchant Vessels of the United States 1885), but even with this looser definition the *Iris* would not meet the scow criterion. As shown in Figures 9and 10, the *Iris* possessed a very gradual turn of the bilge with a wide, rather than tight, radius. It appears the *Iris'* misnomer was simply the result of a perpetuated clerical error.

There remain two possibilities to explain this misnomer. First, it is possible, though unlikely, that the term "scow" possessed a vernacular meaning since lost. This could mean the *Iris* was indeed a scow, just not by today's understanding. A second possibility is that classifying a vessel as a scow somehow gave it an advantage, perhaps in cheaper documentation fees or taxes, as compared to conventional schooners. By 1874 the *Iris* already carried an insurance rating of B2, so classifying her as a scow would not have been a disadvantage for insurance purposes. However, it appears the *Iris* did not carry insurance for much of her career, making an insurance rating largely unimportant. These questions will only be answered through further archival research to shed more light on historic scow classification, combined with archaeological documentation of additional scows to better understand the variety and nuances of scow construction methods and classification.

The majority of the *Iris* is covered in dredge spoil that obscures much of her construction detail. Exposed areas exhibit significant weathering from exposure to sun, rain, and ice. While gross construction features remain, many of the finer construction details are obliterated. It is highly likely, however, that areas beneath the spoil are well-preserved and retain much mid-nineteenth century schooner construction detail. If funding became available, the *Iris* would be an excellent candidate for a Phase III archaeological survey to excavate and record remaining hull structure.

The *Iris* is perhaps Wisconsin's most shallow and accessible nineteenth century schooner that remains *in situ*. In a protected harbor rarely subjected to heavy surf, she lays in less than four feet of water approximately 50 feet from the nearest parking lot. Situated between the Rock Island Ferry dock and the Jackson Harbor fishing museum, she is a prime, yet underappreciated resource. Most visitors to the area do not realize the weathered wood protruding from the water is even a shipwreck. The *Iris* is a prime location for a Wisconsin Maritime Trail's marker to educate visitors on local maritime heritage and identify the *Iris* as an important local resource that allows people to experience an historic Wisconsin shipwreck firsthand.

CHAPTER FOUR

SCOW SCHOONER OCEAN WAVE

Historical Background

The *Ocean Wave* was built in 1860 as a two-masted scow schooner by Robert Chambers at Harsens Island, Michigan, for George Fish and John Abrams, each equal owners. The *Ocean Wave* measured 71 feet 5 inches in length, 20 feet in beam, and 7 feet 2 inches in depth, with a tonnage of 89 and 37/95^{ths}. She was built with an unique eagle figurehead, rare for any Great Lakes vessel, especially a scow. Her first enrollment was entered on 17 May 1860 at Detroit with George Fish as master and hailing from Harsens Island (Bureau of Navigation 1860).

George Fish was born in England on 11 May 1812, and emigrated to the United States in 1833, reaching Port Huron in the spring of that year. Fish was one of Port Huron's original settlers; on his arrival Port Huron had only three houses. In 1839 he married Mary Rattray of Scotland, and soon had five children: William, Mary Jane, Thomas, George Jr., and John. When Fish's daughter Jane turned eighteen years of age she was wed to thirty-three year old John Abrams on 16 May 1858 in Fish's home (Wedge and Whiting 2005). During this time Fish spent two years working as a clerk in a local store, learning much about business and saving his money to purchase a small farm (Andreas 1883). By 1860, Fish had moved his family south to Harsens Island, where the St. Claire river empties into Lake St. Claire, and entered into a partnership with John Abrams in the *Ocean Wave* (Bureau of Navigation 1860).

For the next eight years, the *Ocean Wave* helped George Fish build a prosperous local business. During the 1864 season John Abrams became more involved in the *Ocean Wave*'s operation and bought out George Fish's share to become sole owner and master, with Harsens Island remaining as the hailing port (Bureau of Navigation 1864). Soon after this transaction, both Fish and Abrams moved from Harsens Island across the St. Claire River to the growing community of Algonac. The year 1865 brought changes in admeasurement rules, and the *Ocean Wave* was readmeasured on 10 May 1865, decreasing her tonnage to 73.72 tons and her measurements to 71 .5 feet in length, 19.7 feet in beam, and 6.8 feet in depth (Bureau of Navigation 1865; Thompson 1869:122). With the move and the admeasurement changes, Fish bought back his half share in the *Ocean Wave* from Abrams. Capt. Abrams remained master, and the new enrollment reflected the move across the river, with Algonac now listed as hailing port. In 1867, Algonac was officially incorporated as village and fell within the Port Huron Customs district rather than the Detroit district. This required a new enrollment that was entered on 16 April 1867 in the Port Huron district, everything else remaining unchanged (Bureau of Navigation 1867b). Following the move to Algonac, Fish began a grocery and provisions business called George Fish & Company, which grew to include several goods stores and farms in the Port Huron area (Andreas 1883).

With the Fish business taking off, the nine-year-old *Ocean Wave* was sold to Captain Fletcher Hackett of Milwaukee on 16 April 1869. Receiving a temporary enrollment, Hackett sailed the *Ocean Wave* to his hometown of Milwaukee (Bureau of Navigation 1869a). The temporary enrollment was surrendered at Milwaukee on 5 June 1869, and Capt. Hackett received a permanent enrollment listing himself as sole

owner and master (Bureau of Navigation 1869b). Capt. Hackett was a prudent sailor. In anticipation of the strong winds and heavy seas that visit Lake Michigan every fall, Capt. Hackett purchased a \$3,000 insurance policy on the *Ocean Wave* in early September, \$2,000 less than her \$5,000 value (Milwaukee Sentinel 1869). It would prove a wise decision. On 23 September 1869, the *Ocean Wave* departed Mud Bay (now Moonlight Bay) on the Door Peninsula with 23 cords of stone consigned to a harbor improvement project at White Lake, Michigan. At three o'clock the following morning, the *Ocean Wave* ran hard upon something in the water and immediately began settling at the bow. The crew scrambled to launch their small boat, and were just clear of the *Ocean Wave* when she slipped beneath the waves. The crew rowed to shore, landing safely at Whitefish Point several hours later. Capt. Hackett reported the *Ocean Wave* had struck a deadhead or floating piece of wreckage fifteen to twenty miles southeast of Baileys Harbor, approximately twelve miles offshore in 360 feet of water. Sinking within minutes of the collision, the crew barely had time to launch the small boat and all the crew's possessions were lost, including \$160 in cash that Captain Hackett reportedly left in his room (Milwaukee Sentinel 1869).

A small stone scow in 360 feet of water was beyond consideration for salvage, and the *Ocean Wave* was quickly forgotten until August 2003, when the fish tug *Robin B* discovered a ship's mast tangled in its nets in 110 feet of water two miles east of Whitefish Point (Thomsen and Meverden 2005:59). The tug's crew cut the mast free and it sank to the lake bottom, but the crew recorded its location. The hang numbers circulated amongst the diving community, but the wreck was not located and dived until June 2004 by Randy Wallander. The *Ocean Wave* was relocated in 110 feet of water two miles east of Whitefish Point in Door County (Figure 13). A local group of divers headed by Jon Paul Van Harpen dived the site in July of 2005, noting the vessel was a small scow schooner of approximately 75 feet in length and carried a cargo of stone. At this time a small kedge anchor was located on the foredeck, and was chained and padlocked to the starboard side anchor chain to prevent theft. No other artifacts were located. Historical research by Jon Paul Van Harpen and Russell Leitz of WUAA made a tentative identification based on cargo, vessel size, and a search of historic records that showed no other scows lost in the area. Divers from the WHS, with assistance from the GLSRF, made an initial site visit on 8 August 2004 when a crude bird-like figurehead was discovered. Subsequent examination of the *Ocean Wave*'s enrollment documents discovered that the *Ocean Wave* indeed had an eagle figurehead. Given the rarity of figureheads on Great Lakes vessels, the cargo, and the fact that no other scow schooners were reported lost in the vicinity, this vessel is likely the scow schooner *Ocean Wave*.

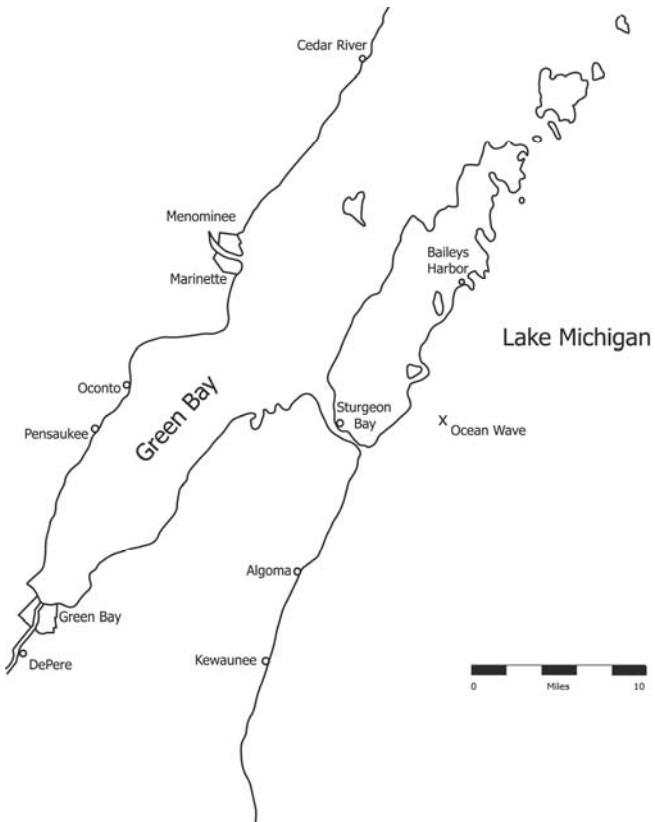


Figure 13. *Ocean Wave* wreck site off Whitefish Point, Door County.

Description of Field Research and Findings

On 7 July 2005, with the aid of local divers, a permanent mooring was placed on the *Ocean Wave* site. Prior to this, a private mooring line of half-inch polypropylene line was tied around the windlass' starboard side. In moderate sea conditions dive boats attached to the mooring line would move the windlass approximately six inches, and up to two feet in heavy seas. It was imperative that a permanent mooring, anchored to the lakebed, be installed as quickly as possible to prevent the bow's collapse. After efforts to lower a 2,000 pound mooring anchor off the *Ocean Wave*'s starboard side were aborted due to heavy seas in June 2005, a screw anchor system, in use on several Wisconsin wrecks (including two at an equivalent depth), was installed over the course of four dives. Three six-foot screw anchors were turned into the lakebed by divers approximately 40 feet off the vessel's starboard side. The anchors were turned into the sand bottom to a depth of approximately four feet by placing a 10 foot pipe through the anchor's eye with a diver (with fins removed) on each end of the pipe. The divers would then walk a circle around the anchor and turn it four inches into the bottom with each revolution, much like sailors turning a capstan (Figure 14). When all three anchors were embedded in a triangular pattern five feet apart, a swiveled, $\frac{1}{4}$ in. galvanized mooring chain was attached to the anchors with a three-leg, $\frac{5}{16}$ in. galvanized chain bridle. The mooring chain runs from the anchors straight up to an 18 in. diameter submerged buoy at a depth of 30 feet, and then on to

an 18 in. diameter mooring buoy at the surface. The 60 feet of chain that runs from the surface buoy to the submerged buoy hangs in a large loop, acting as an effective shock absorber for even large boats in heavy seas. As the dive boat rolls in the waves, the chain loop rises and falls, and if sea conditions are heavy enough to pull the loop taut, the submerged buoy is then pulled sideways in the water column, transferring zero shock load to the embedded screw anchors.



Figure 14. Screwing mooring anchors into the lakebed. Photo by Tamara Thomsen.

The *Ocean Wave* survey was designed as a Phase II archaeological survey of a shipwreck two miles off Whitefish Point in Door County ($44^{\circ} 52.994' N$, $087^{\circ} 09.128' W$). Predisturbance surveys involve the documentation of the site as it lays, with no excavation or artifact retrieval. Diagnostic artifacts that may indicate the site's age or identification are measured, sketched, photographed, and left in place. Predisturbance surveys have very little impact on a site, and are relatively inexpensive compared to Phase III excavations. The *Ocean Wave* was selected for survey for the information it could provide on Great Lakes scow schooners and the Lake Michigan lakeshoring trade. The *Ocean Wave* lays in 110 feet of water, somewhat broken up, but with significant hull structure intact.

The *Ocean Wave* project incorporated a new survey technique for the WHS, the use of photo mosaics to aid Phase II surveys. At 110 feet, bottom times were severely limited by both depth and water temperature, allowing two dives a day with a maximum bottom time of 40 minutes per dive. Bottom temperatures ranged from $40-42^{\circ}$ Fahrenheit, and visibility varied from 40 to 100 feet. To maximize both bottom time and safety, all dives were conducted using 32% Nitrox as a bottom gas and 100% oxygen as a decompression gas. All divers utilized redundant scuba systems, and all divers conducting decompression dives used manifolded doubles with isolation manifold.

On 20 June 2005, WHS archaeologists and volunteers video-recorded the site to gather digital images used in constructing a digital photo mosaic. Images were gathered with a Sony 3 CCD Megapixel Handycam in a Light & Motion Bluefin underwater housing attached to the nose of a Silent Submersion UV-26 Diver Propulsion Vehicle (DPV) (Figure 15). With the DPV in a horizontal position, the camera was aimed directly at the bottom. A bubble level was mounted on the camera housing to aid the diver piloting the DPV in keeping the camera at right angles to the bottom at all times. In this manner, the DPV pilot “flew” the DPV and camera over the *Ocean Wave* site approximately 20 feet above the lakebed, continuously recording video. Lanes were close enough to allow an overlap of video footage of several feet between lanes, ensuring the entire wreck site was recorded without gaps.



Figure 15. Capturing digital images for *Ocean Wave* photo mosaic with DPV. Photo by Tamara Thomsen.

Eighty-three successive, overlapping still images were captured from the digital video. These images were then hand-assembled in Adobe Photoshop 7.0 and printed in a scale of one inch equals two feet (1 in. = 2 ft.) (Figure 16). Because of large variations in site relief, scale errors were introduced into the mosaic by changing lens-to-wreck distances. The wide-angle lens (necessary to gather as much data as possible in a limited bottom time) introduced additional parallax error at the lens’s periphery. These errors made site plan production directly from the photo mosaic problematic. Hull structures on the preliminary site plan, therefore, needed to be checked for accuracy and any errors corrected. A few wreck details were missing or blurred in the mosaic, requiring further on-site documentation.

The printed mosaic was overlaid with graph paper and traced with pencil atop a lighted table. This produced a preliminary site plan with gross site features with varying degrees of detail and accuracy. Project divers were then assigned wreck sections, which were traced from the preliminary site plan onto waterproof Mylar film. Attached to a waterproof slate, the Mylar film allowed divers to take an exact copy of the site plan with them to the bottom. Divers were instructed to correct any errors on their assigned section, as well as record accurate measurements and construction details. This focused diver efforts on specific tasks and eliminated time spent hand-sketching gross wreck features while in-water. All measurements were recorded in tenths of a foot to minimize recording errors and later converted to feet and inches using a Calculated Industries Model 8525 calculator set to a fraction resolution of 1/8 inch.

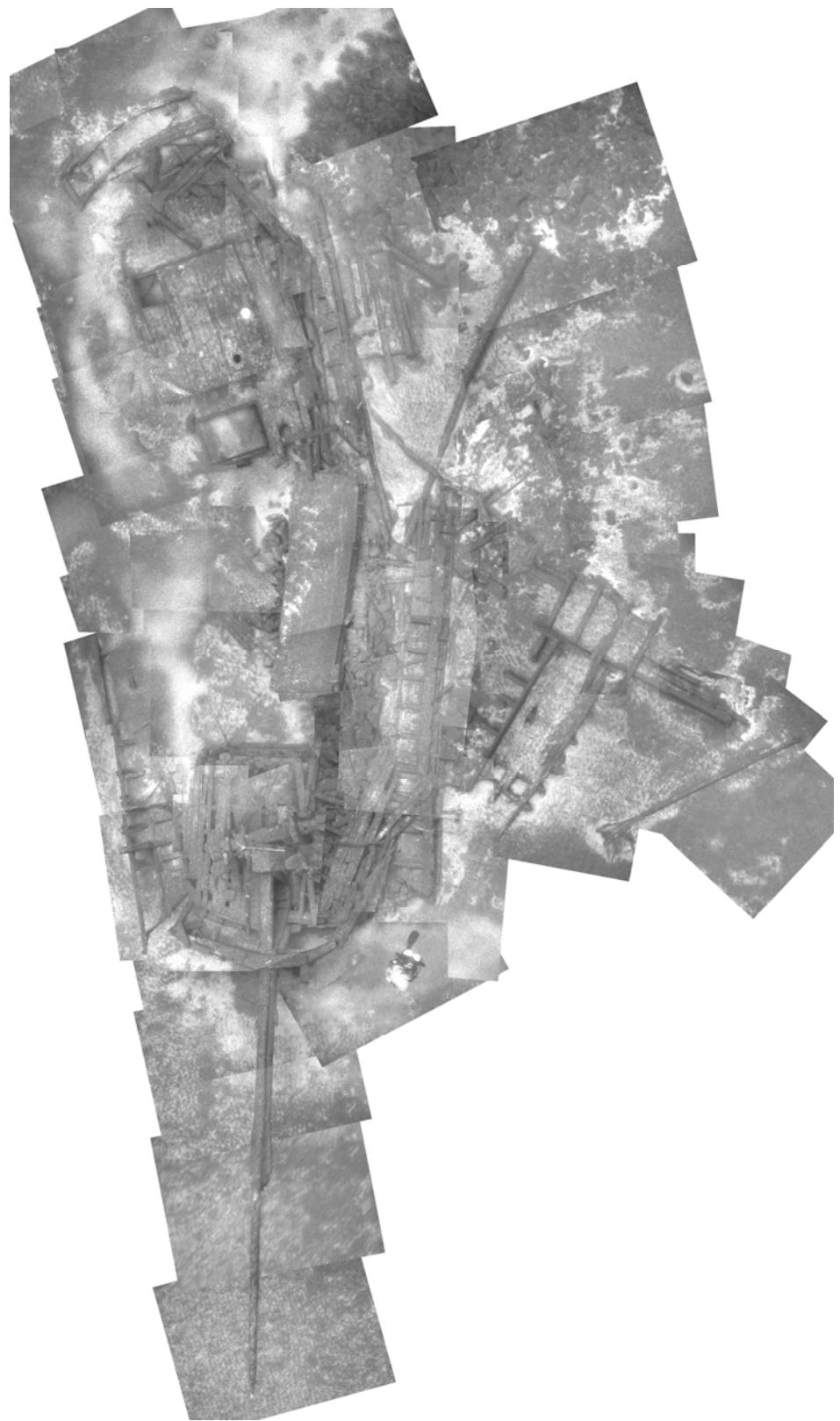


Figure 16. *Ocean Wave* photo mosaic. Note diver off port bow.

The Phase II survey allowed archaeologists to identify and record in plan view the overall underwater site while recording wreckage detail for archaeological interpretation (Figure 17). The *Ocean Wave* survey was designed to answer several questions as part of an overall research design. The primary objective was to document scow schooner construction, especially that of the bow and stern, as these structures are often absent on shallower scows. A second objective was to determine how the *Ocean Wave* was damaged, resulting in her loss. A third objective was to provide positive vessel identification through identifying marks or artifacts.

The *Ocean Wave* capsized near the surface, breaking away the foredeck and spilling cargo onto the lakebed. On her descent she righted herself and drifted slightly northeast, striking the bottom stern first with the bow settling more gently afterward. The collision with the bottom broke her keel and port side hull and dislodged the starboard side. The transom separated and fell astern and the cabin and rear deck collapsed onto the bilge. Subsequent to striking the bottom, the wreck has been encountered one or more times by commercial fishing nets, which may have contributed to her hull collapse. Structures with both significant relief and laying flat on the bottom are entangled in net. A dense tangle of net is snagged off the cabin's port side. This tangle is approximately one foot in diameter and rises six feet from the bottom, suspended by aluminum floats. Most of the netting is woven cotton. This suggests that with the exception of the 2003 encounter that led to the wreck's discovery, it had been many years since the *Ocean Wave* was snagged with commercial fishing nets.

When the *Ocean Wave* struck the bottom she broke her back just aft of the centerboard trunk. The aft cargo hatch, stern cabin and decking, transom, and rudder lie to starboard at an 18 degree angle from the vessel's centerline (Figure 18). The keelson's after end is visible beneath the rear deck and rudder, lying parallel and centered with the aft wreckage and measuring 1 ft. sided by 1 ft. 9-5/8 in. molded. The transom and several feet of stern ramp have fallen away from the hull and are partially buried under several inches of sand. Transom width is 15 ft. 6 in., with a curvature radius of 10-3/4 in. The transom's rail cap measures 7-1/4 in. wide by 2-3/8 in. thick, and has an open chock on either quarter. The chocks are 1 ft. 8 in. long and 7-1/4 inches square, with a 3-5/8 in. opening centered on the chock. The two outermost transom frames are 4-3/4 in. sided by 2-3/8 in. molded; inner frames are slightly smaller at 3-5/8 in. sided by 2-3/8 in. molded. Spacing between the outermost and first inner frame is 2 ft. 4-3/4 in., but narrows to 2 ft. on all inner frames. Transom frames continue uninterrupted from the rail cap to below deck where they are broken approximately 3 ft. below deck level. Much of the transom's and stern ramp's inner planking is missing. Only fragments attached to the frames just below deck level and just below the rail cap remain. Stern ramp ceiling planking is 6 in. wide by 1-3/4 in. thick. Inner bulwark planking is a narrower 4-1/4 in. Transom outer hull planking measures 4-1/4 in. wide and 1-1/2 in. thick, and continues below deck level onto the cross-planked stern ramp.

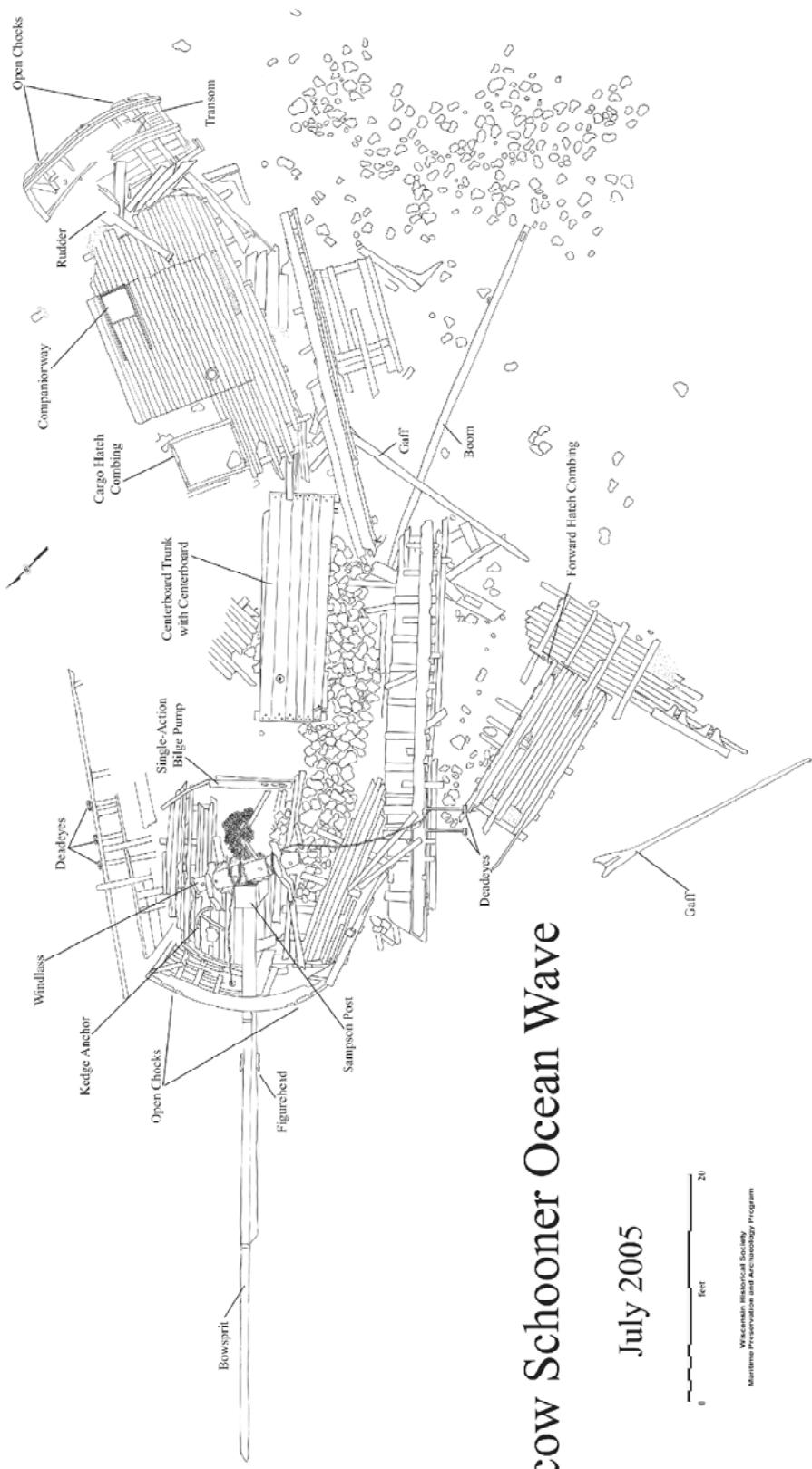


Figure 17. *Ocean Wave* site plan.



Figure 18. *Ocean Wave*'s transom, rudder, aft deck, and cabin. Photo by Tamara Thomsen.

The rudder lays atop the stern ramp's starboard side, buried under several inches of sand. The rudder post rests on the rear deck, and is 7-1/4 in. in diameter with a 2-3/8 in. iron ring reinforcing the top. Just below the ring is a mortise for the missing tiller. The round rudder post extends 5 ft 9-5/8 in. from the top to where the sides are squared to become the rudder blade. Squared timbers are fastened both fore and aft of the rudder post to create a balanced rudder with a width of 4 ft. 1/4 in. before it disappears into the sand.

Forward of the rudder is a 24 ft. section of the aft deck that includes the cabin and aft cargo hatch. The deck lists 13 degrees to starboard. The starboard side is buried in sand up to the cabin's bulkhead. Deck beams remain attached to the underside of the deck and measure 2-3/8 in. sided by 3-5/8 in. molded. They are irregularly spaced at 2 ft. 9-5/8 in., 2 ft. 4-3/4 in., 2 ft. 8-3/8 in., 2 ft. 10-3/4 in., 1 ft. 8-3/8 in., 1 ft. 1-1/4 in., and 2 ft. 4-3/4 in. The deck is longitudinally planked, each plank measuring 2-3/8 in. thick by 7-1/4 in. wide. The cabin's bulkheads are six feet from the transom and three feet from either side bulwark.

The cabin rises 2 ft. 9-5/8 in. from the deck at the port and starboard sides. The roof is cambered, rising 3 ft. 1-1/4 in. from the deck at the center. The roof has 24 longitudinal planks that are 2-3/8 in. thick and average 4-3/4 in. in width. The roof is caulked with no other visible covering. The cabin is supported by five vertical frames along the forward and after bulkheads, and four vertical frames on either side bulkhead (corner frames are counted twice). All frames measure 4-3/4 in. sided by 3-5/8 in. molded. Frames on the forward bulkhead are equally spaced on 2 ft. 6 in. centers, and frames on either side bulkhead are equally spaced at 2 ft. 7-1/4 in. on

center. The aft bulkhead framing is somewhat different to accommodate the cabin's hatchway, which is 1 ft. from the starboard side and 2 ft. wide. Framing on the port side of the hatchway is equally spaced on 3 ft. 4-3/4 in. centers. The cabin's hatch cover is absent. The hatch opening is 2 ft. wide by 2 ft. 9-5/8 in. long. The hatch cover slid forward on two wooden guides on either side of the hatch. Each guide is 4-3/4 in. wide by 2-3/8 in. high and 3 ft. 6 in. long. The entire cabin is surrounded by a combing at deck level that is 1 ft. 2-3/8 in tall by 2-3/8 in. wide, rising 8 in. above deck level. Bulkhead planking was absent with the exception of a few fragments that remained nailed to some frames. A 9 in. stove pipe hole is located near the forward port corner of the cabin roof, 2 ft. 6-5/8 in. from the port side and 1 ft. 4 in. from the forward edge. The stove pipe was surrounded by a missing metal collar 3-5/8 in. wide.

Two feet, six inches forward of the cabin is the aft cargo hatch. Headledges are 6 ft. 4-3/4 in. long; combings are 4 ft. 9-5/8 in. long. Both the headledges and the combings rise 8-3/8 in. above the deck. The combing itself is 1 ft. 4-3/4 in. tall and 2-3/8 in. wide, and is butt-joined at the corners. Each combing has three notches on the combing's inside edge for the hatch cover strongbacks, each notch measuring 3-5/8 in. long by 2-3/8 in. square. The forward and after notches are 2 in. from the headledges; the center notch is centered between the outer two notches, 1 ft. 4-3/4 in. on center from either end notch.

The centerboard trunk lays along the vessel's centerline but has fallen to the port side (Figure 19). The trunk measure 20 ft. 1-1/4 in. long by 6 ft. 4-3/4 in. tall, by 1 ft. wide. The trunk is longitudinally-planked with six planks. Widths (from top to bottom) measure 1ft. 3-5/8 in., 1 ft. 2-3/8 in., 10-3/4 in., 10-3/4 in. 1 ft. 1-1/4 in., and 1 ft. 3-5/8 in. All planks are 3-5/8 in. thick and fastened on either end by three 5/8 in. bolts with 1-3/4 in. clinch rings on either end. Bolts are fastened in a triangular pattern that does not alternate from plank to plank. The centerboard is in a retracted position, protruding six inches from the trunk's aft end. The centerboard is 3-5/8 in. thick, and its leading edge is rounded with a shoulder on either side, suggesting a tongue-in-groove joint with one or more planks missing. The centerboard pivot pin has been dislodged and lays atop the trunk near its former position. The centerboard's pivot hole is 3 ft. 4-3/4 in. on center from the trunk's forward end, and 1 ft. 9-5/8 in. on center from the trunk's lower edge. The pin measures 1 ft. 1-1/4 in. long with a 2-3/8 in. shank. One end is peened onto a washer 4-3/4 in. in diameter. The shank's end opposite the washer has a slot for a forelock pin that is 1-1/4 in. long by 1/4 in. wide, 1/2 in. from the shank's end. The keel, covered by cargo and sand, was not visible beneath the centerboard trunk. A section of decking protrudes slightly from the bottom to the starboard side of the centerboard trunk. Eleven deck planks are visible, averaging 7-1/4 in. wide.



Figure 19. Centerboard trunk with centerboard protruding from bottom. Photo by Tamara Thomsen.

Both the vessel's port and starboard sides have fallen outward from the hull. The starboard side is buried under several inches of sand with the exception of the forward 12 feet and a small section that projects from the sand four feet off the wreck's starboard quarter. Given the angle of the starboard side in relation to the main hull, it is likely that the starboard side remains intact and unbroken. The site should be monitored yearly as shifting sand may uncover the starboard side and allow a complete survey. The exposed portion of the starboard side hull is longitudinally planked with three visible planks measuring 2-3/8 in. thick with widths from the deck down of 9-5/8 in., 10-3/4 in., and 8-3/8 in. The upper hull plank joins a 3 in. thick covering board. Visible frames are 4-1/4 in. sided by 3-5/8 in. molded. Spacing on center from the bow aft is 1 ft. 3-5/8 in., 1 ft. 9 in., 1 ft. 7-3/4 in., and 2 ft. 11-3/8 in. A rail cap is fastened to the top of the bulwark stanchions that measure 8-3/8 in. wide by 2-3/8 in. thick. Bulwark height, from the covering board to the top of the rail cap, is 2 ft. 6 in. No bulwark planking is extant.

Three foremast chainplates are attached to the starboard side hull. Deadeyes are 6 in. in diameter and 5 in. thick. All three chainplates are constructed of iron strap 2-1/2 in. wide by ½ in. thick. The first chainplate is 9 ft. 1-3/8 in. aft of the bow. Spacing on center between chainplates is unequal, being 2 ft. 2-1/2 in. between the forward two chainplates, and 3 ft. 1-3/8 in. between the aft chainplates. Side hull height is 3 ft. 3-5/8 in. just forward of the chainplates.

The port side hull is much more exposed, but is less intact than the starboard side (Figure 20). On impact with the bottom, the port side hull broke 35 feet aft of the bow (measured at deck level). The aft section of the port side hull followed the vessel's stern as the keel broke, resulting in the two port side sections laying at an angle to one another.

It appears the *Ocean Wave* borrows from a variety of construction techniques, being somewhat of a cross between gunnel-built and traditionally framed vessels. The outer hull is longitudinally planked and measures 2-3/8 in. thick. Evidence of edge-bolting is visible at the hull break, but it was impossible to determine bolt spacing or how many planks the bolts passed through. Remnants of a chine log are visible along a short hull section, but is buried under several inches of sand, cargo, and other hull structure. The lower outer hull plank joins the chine log 1-1/4 in. in from the chine log's inner edge. Side frames are not pocketed into the chine log, but rather are fastened inboard of the chine log (Figure 22). The chine log tapers at an angle towards the lower outside edge, with no visible evidence of how it fastened to the lower hull. Molded dimension appears to be 6 in. Vessel sheer was difficult to determine due to the break in the hull side, but it appears the vessel carried a slight sheer that became more pronounced nearer the bow. The port side's forward fragment sheer radius measured 3-1/8 in.; the stern side fragment had a sheer radius of 2-3/8 in. There was no evidence of side hull ceiling planking.



Figure 20. The exposed port side with outer hull planks, frames, bulwark stanchions, and deck shelf. Photo by Tamara Thomsen.



Figure 21. Exposed chine log. Note frames run inside of the chine log. The bulwark stanchion's tapered end is visible between frames beneath deck shelf.
Photo by Tamara Thomsen.

The hull sides are supported by both frames and bulwark stanchions. Frames begin at the chine log and extend 3 ft. vertically to the underside of the covering board (Figure 22). The frames are 4-3/4 in. square and vary in spacing from 2 ft. 10-3/4 in. to 3 ft. 3-5/8 in. No pattern was detected in the variable frame spacing, which appears to be random. Between each frame set is a bulwark stanchion that passes through a mortise in the covering board. The covering board is extant aft of the break on the port side hull, but all bulwark stanchions are broken just beneath the covering board along the entire port side. Several bulwark stanchions are extant on the starboard side near the foremast chainplates, extending 2 ft. 3-5/8 in. above the covering board and 2 ft. below. The stanchions taper near the bottom and are fastened to the hull sides with two through bolts with clinch rings spaced 9-5/8 in. on center. Atop both the frames and bulwark stanchions is a deck shelf 1 ft. wide by 2-3/8 in. thick. The deck shelf has irregularly spaced notches for the deck beams that measure 2-3/8 in. deep and 4-3/4 inches wide. The irregular spacing is similar to that found in the deck beams that remain attached to the aft deck section. Two foremast chainplates remain intact on the portside hull, 1/2 in. thick and 2 in. wide, 1/2 in. narrower than the starboard foremast chainplates.

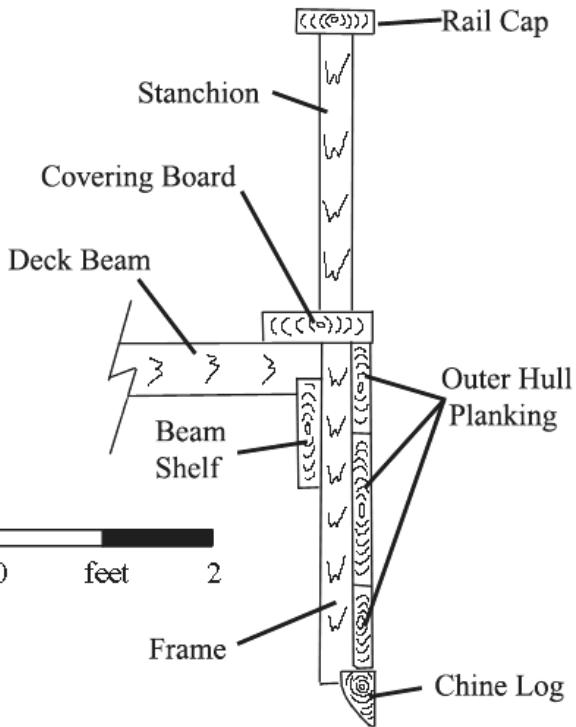


Figure 22. Hull side cross section.

Outboard of the port side hull are two fragments of the forward deck and cargo hatch (Figures 23 and 24). One deck section lays inverted on the bottom, the other upright. The upright section retains one side of the forward hatch combing, which is an unusual 18 ft. 9-3/4 in. long. Hatch width could not be determined as the headledges were broken. The combing measures 9 in. tall by 3 in. wide. Like the aft cargo hatch combing, the forward combing is notched for 9 hatch cover strongbacks. Each of the nine notches are 3 inches long and irregularly spaced from the stern at 2 ft. 2-3/8 in., 1 ft. 4-1/4 in., 2 ft. 4-3/4 in., 1 ft. 4-3/4 in., 2 ft. 4-3/4 in., 1 ft. 4-3/4 in., 2 ft. 5-3/8 in., 1 ft. 4-1/4 in., and 2 ft. 1-1/4 in. Three deck beams cross the hatch's center, irregularly spaced at 2 ft. 10-1/4 in. on center between the forward two beams, and 1 ft. 9-5/8 in. on center between the aft two beams. Deck planking is longitudinal and 1 in. thick. The plank nearest combing is 8 in. wide, with other planks averaging 6 in. wide. Deck planks are fastened 1/4 in. square by 3 in. long rose-head, chisel-point nails. There are two nails per plank at each deck beam at a 45 degree angle to the vessel's centerline. Deck beams on the inverted deck section measure 4-5/8 in. sided by 5-1/4 in. molded, with an irregular spacing of 2 ft. 10-3/4 in., 3 ft., and 3 ft., 2-3/8 in. Two sets of small lodging and bosom knees are present, each knee measuring 13 in. along both the arm and body, and with a gap of 4-1/2 in. between each lodging and bosom knee. Spacing between the two sets is 2 ft 2 in. on center. Deck planking averages 5 in. wide and 1 in. thick.

The upright bow is the wreck's most dramatic feature. Listing nine degrees to starboard, the forward hull, bowsprit, jib boom, planking and framing remain upright and mostly intact, held up by the stem post which gently curves upwards from the



Figure 23. Forward hatch combing off port side, facing south. Headledge rests atop second, inverted deck section. Photo by Tamara Thomsen.



Figure 24. Forward hatch combing and deck, facing north. Note three deck beams protruding beneath combing. Photo by Tamara Thomsen.

keel to the bowsprit, ending in a crude eagle figurehead with an open mouth and extended tongue. Traces of red paint are visible on the eye and tongue (Figure 25). The starboard bow remains wholly intact, but the port side has collapsed with the exception of the bow and port side rail caps. The stempost is constructed from one large timber, measuring 1 ft. 4-1/4 in. sided by 2 ft. molded at the waterline. On either side of the stempost is a knighthead measuring 7-1/4 in. sided by 4-3/4 in. molded (Figure 26). The knighthead begins at the underside of the rail cap and extends downward for 5 ft. 8-3/8 in. The stempost is not rabbeted for the outer hull planking. Below the knighthead's terminus there is no visible support where the planking abuts the stempost. The bow is cross planked, and the cross planking continues down the bow, curving towards the horizontal where it disappears into the lake bottom. There is no evidence of a hard chine-type edge between the bow and hull bottom. The bow curves towards the horizontal to become the vessel's bottom with no visible transition.

The bow's upper edge is covered by a one-piece head rail that is 10-3/4 in. wide 3-1/2 in. thick, and curves aft from the stempost with a radius of 1 ft. 8-3/8 in. (Figure 28). The bow is 16 ft. 9-5/8 in. wide at its widest point, and the ends of the head rail are notched to form a lap joint with the side hull's rail cap, the side rail resting atop the head rail (Figure 29). This lap joint is reinforced by a small horizontal knee that measures 1 ft. 8-3/8 in. along the head rail and 1 ft. 6 in. along the side rail. Atop this lap-joint, sandwiching the side rail, is a double open chock on either end of the bow rail. The chock block is 5 ft. 3-5/8 in. long with two 2-3/8 in. openings, the outermost opening is 2 ft. 1-1/4 in. inboard from the side, the next is 2 ft. inboard of that.

On the bow's starboard side, four frames run from the underside of the head rail and follow the stempost's curve towards the horizontal near the bottom. Three inner frames measure 3-5/8 in. square. The fourth, outermost frame measures 4-3/4 in. sided by 3-5/8 in. molded. This larger, fourth frame supports the bow / side interface. The three inner frames consist of two futtocks; the uppermost futtock is 8 feet long, lap-joined with the next futtock with an overlap of 1 ft. 2 in. The outermost frame has no visible joint or scarph before it disappears into the lakebed.

Starboard bow planking is intact, 2-3/8 in. thick and varying in width from 3-5/8 in. to 9-5/8 in. The planks are butted to the starboard side of the stempost, and fastened to each frame with three square-head nails in a triangular pattern. Above deck level, the outer hull planks terminate flush with the outer edge of the frame, allowing the side hull's bulwark planking to fit flush with the forward edge of the bow planking. Below deck level the pattern reverses, with the bow planking extending 3-5/8 in. beyond the frames outer edge, allowing it to overlap and fit flush with the outer edge of the side hull planking.

A 7-1/2 in. by 1-1/2 in. breasthook is located 2 ft. 2-3/8 in. below the rail (Figures 27 and 28). The breasthook is parallel with the deck and notched to fit around the frames. Directly beneath the breasthook a deck beam was fastened that measures 8-3/8 in. sided by 7-1/4 in. molded. This beam follows the bow's curvature and rides atop, rather than notched into, the bow frames, and is fastened to the frames with 5/8 in. bolts. Deck planking is attached atop the beam and fits flush with the top of the breasthook (Figure 29). The deck beam, with decking attached, has become dislodged from the bow and lays just below its former location.



Figure 25. Eagle figurehead. Photo by Tamara Thomsen.



Figure 26. Port side bow. Note gentle curve of stempost and remnant of cross-planking just below knighthead. Photo by Tamara Thomsen.



Figure 27. Starboard side bow with outer hull planks, frames, breasthook, and dislodged deck beam and planking. Photo by Tamara Thomsen.

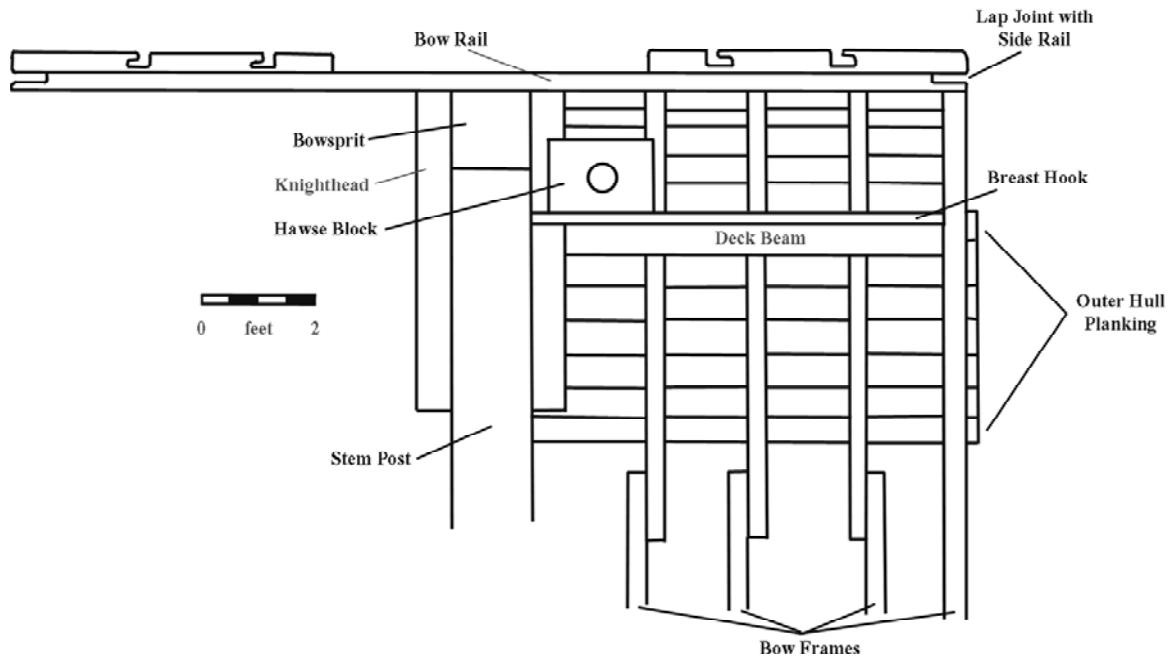


Figure 28. Bow construction.

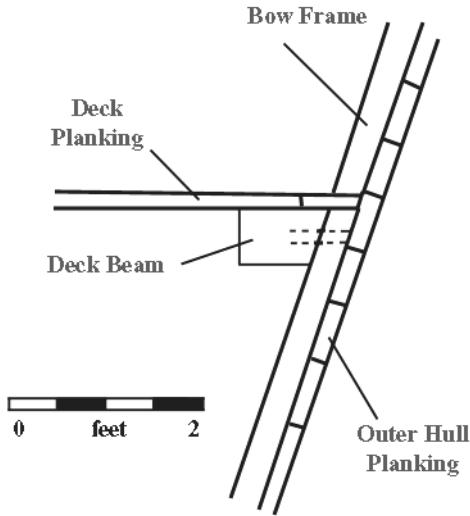


Figure 29. Deck / bow ramp interface.

Atop the breasthook, between the knighthead and the first frame, is a large wooden block with the hawse hole. The block measures 1 ft. 10-3/4 in. long by 7-1/4 in sided and 1 ft. 3-5/8 in. molded. The block is notched to fit onto the knighthead, overlapping the knighthead by 2 in. An iron hawse pipe is attached to the outside of the hawse hole. The hawse pipe is 10-3/4 in. in diameter with a 4-3/4 in. hole. The hawse pipe does not extend all the way through the hawse hole; rather, the inside of the hawsehole is unprotected wood, with a 5-3/8 in. diameter.

The bowsprit is sandwiched between the top of the stempost and the head rail and measures 1 ft. 4-3/4 in. square. The bowsprit angles upward at five degrees, originating at the sampson post 6 ft. 3-5/8 in. aft of the stempost, and extends 14 ft. 7 in. forward of the head rail. The jib boom is attached to the top the bowsprit, fastened by two 2 in. iron rings, one 8 in. forward of the head rail, the second at the bowsprit's tip. The jib boom has a slight taper; its base diameter is 7-5/8 in., narrowing to 6-7/8 in. at the tip; overall length is 29 ft. 1-1/4 in. The jib boom is loose and rocks back and forth inside the iron rings. Two 1 ft. 3-5/8 in. fairleads are fastened to either side of the bowsprit, 3 ft. 3-5/8 in. from the bow. Beneath the fairleads is the eagle figurehead, 6 in. in diameter at the head, and extends 5 ft. 8-3/8 in. from the bow. A deadeye hangs beneath the bowsprit 11 ft. 10-3/4 in. from the head rail, and an 8 in. remnant of the bobstay hangs from the bowsprit's underside 15 ft. 7-1/4 in. from the head rail.

The sampson post is intact on the bowsprit's aft end, stepped into the keelson and rising 8 ft. from the top of the step. The sampson post step is 2 ft. 1-1/4 in. long by 1 ft. 1 in. wide, and rises 5 inches above the keelson. The sampson post tapers towards the step, measuring 4-3/4 in. sided by 1 ft. molded at the step (Figure 26). The top of the sampson post measures 1 ft. 2-3/8 in. sided by 1 ft. 6 in. molded. There is no evidence of purchase rims or cross head for the windlass, and the windlass pawl is absent. Anchors were weighed with hand spikes inserted into the windlass. The windlass barrel has become dislodged from the sampson post but remains attached to the carrick bitts. The windlass and carrick bitts have fallen approximately 2 ft.

towards the port quarter. The windlass is 12 ft. 10-3/4 in. long and 1 ft. 2 in. in diameter at the pawl rim. The carrick bits are 6 ft. apart and measure 3-5/8 in. molded. Both port and starboard anchor chains remain wrapped around the whelps on either side of the windlass, between the carrick bitts and the pawl rim. Outside of either carrick bitt is an 8 in. diameter gypsy head that extends 1 ft. 6 in. from the carrick bitt.

The chain locker is beneath the windlass, and anchor chain spills onto surrounding wreckage. On either side of the chain locker are partial sections of the port and starboard foredeck, dislodged and fallen onto the lower hull and remaining cargo. Foredeck plank widths vary from 6 in. to 9-5/8 in. Plank length varies from 4 ft. to 12 feet. Atop the starboard side foredeck is a small kedge anchor that is missing its stock and one fluke. The shank is 2 ft. 8-3/8 in. long, and the arms measures 2 ft. 3-5/8 in. from bill to bill. The existing fluke measures 8-3/8 in. across its widest part. Aft of the chain locker is a wooden-barreled, single-acting bilge pump (Figure 30). The pump barrel is 6 in. in diameter and 7 ft. 1-1/4 in. long. The pump shaft is beginning to deteriorate, and is approximately 1/2 in. thick. A wooden pump handle, 4 ft. 6 in. long, is fastened to the upper end of the pump barrel.



Figure 30. Bilge pump aft of chain locker. Photo by Tamara Thomsen.

Two identical iron stock anchors lie partially buried at the bow. Each stock measures 4 ft. 9 in. long, each shank is 5 ft. long, and the arms measure 5 ft. long from their shanks to fluke tips. The anchors were carried by hooking their arms on the bobstay that ran from the foot of the stempost to the end of the bowsprit. Two forestays were fastened to two iron eyes on either side of the bow. The first eye is fastened 2 ft. 4-3/4 in. down from the head rail, and 4-3/4 in. from the vessel's side. The second forestay eye is located 2 ft. 2 in. inside of the first. Neither bobstays nor forestays are extant.

No wire rope was located at the site, suggesting the *Ocean Wave* was rigged with natural fiber rope. The mast that was pulled to the surface by fisherman lays nearby on the lakebed, but has yet to be relocated. Two gaffs and one boom lay off the port side. The only indication of the forward mast's location are the forward chainplates, but without historic photographs to indicate the amount of mast rake, if any, it is difficult to pinpoint the forward mast's location without locating the foremast step. The mainmast step and mainmast chainplates were not visible.

A collection of artifacts is accumulating on the cabin's roof through the actions of recreational divers who locate, excavate, and transport the artifacts to the cabin for display. A small coal shovel with an approximately 3 ft. long wooden handle was moved to the cabin from an unknown location; its handle was subsequently broken. Two whiteware plate fragments have also been relocated to the roof from an unknown location. The two plate fragments were brought to the surface for documentation and identification of any maker's marks, and immediately returned to the bottom (Figure 31). The fragments are two nearly equal halves from two separate plates measuring 9 in. in diameter. The plates had no maker's marks, and exhibited a large amount of crazing.

Two artifacts were found that had not been displaced. Twenty-seven feet off the transom's port chock, and fifty-eight feet from the boom's aft end, is a small cast iron cooking pot (Figure 32). The pot measures 1 ft. 9 in. tall and 9-5/8 in. in diameter. The pot is filled with silt and exhibits a large amount of surface corrosion. A two gallon, salt-glazed stoneware jug was located inside the bow (Figure 33). Resting atop a ceiling plank and leaning against the outer hull planks immediately to starboard of the stempost, it appeared as if someone had set it there just prior to abandoning ship. The jug was brought to the surface for documentation and identification of any maker's marks, and immediately returned to the bottom. The jug was marked with a "2" and a decorative pattern in cobalt blue. The jug's base was 6 in. in diameter with no markings. The circumference was 2 ft. 6-3/4 in. at the center, and 14 in. tall. The neck was 2 in. in diameter, chipped and angled slightly to one side. The stopper was missing and the jug was filled with mud. The jug's side had a shallow 2 in. diameter chip.



Figure 31. Underside of two plate fragments. Photo by Tamara Thomsen.



Figure 32. Cast iron cook pot. Photo by Tamara Thomsen.



Figure 33. Two gallon stoneware jug. Photo by Tamara Thomsen.

Conclusions and Recommendations

The *Ocean Wave* is an excellent example of Great Lakes scow construction. She is intact enough to have nearly all hull sections represented, yet opened up enough to allow close examination of construction features that would be obscured in more intact vessels. The *Ocean Wave* had several construction quirks that may have resulted from a lack of construction materials or funding, and others that tailored her to specific trades and cargoes. At the least, these quirks made for an interesting vessel that had a character all her own. At most, they nearly cost the crew their lives.

The *Ocean Wave*'s first unusual feature is the best indicator of her identity: her eagle figurehead. Unlike their ocean counterparts, figureheads were uncommon on Great Lakes schooners of any size. Pragmatic vessels, Great Lakes schooners had little room for decorative niceties that didn't help the bottom line. Those owners whose pride necessitated a figurehead would likely not even consider owning a scow. The *Ocean Wave*, however, has a screaming eagle carved into her bowsprit. However crude, it set her apart from her counterparts.

The *Ocean Wave* appears to be constructed of whatever material was available for the least expense. This is evident in two locations. First is the foremast chainplates. All three starboard chain plates measure 2-1/2 in. wide. The portside chainplates, however, are only 2 in. wide or ½ in. narrower than those on starboard. Given a choice of materials, one would imagine that chainplates of equal strength would be used for single mast, especially considering how disastrous a dismasting could be. A second location is deck beam spacing, where no patterns to the irregular spacing could be deciphered. Apparently random, the irregular spacing may have been due to varying availability of appropriately dimensioned or quality timber, the builders closing the spacing near suspect timbers and widening where timber quality was assured.

It does not appear the *Ocean Wave* is the result of sloppy workmanship or lack of carpentry skills. Several of the *Ocean Wave*'s features suggest the builders were master craftsman skilled in woodworking. First is the aforementioned figurehead. It is unlikely that anyone not comfortable working with wood would attempt an adornment even as crude as the eagle. The figurehead is carved into one of the largest, and most expensive, timbers on the vessel. An error would have resulted in badly scarred bowsprit, rather than a new replacement. Other hull areas demonstrate fine joinery, such as the intact cabin that survived capsizing, falling cargo breaking away the deck, and a tremendous impact with the bottom that shattered the vessel's backbone. Even steel vessels frequently lost their superstructure in the tremendous forces involved in sinking. It is obvious the *Ocean Wave* was not spared these destructive forces, yet her cabin survived nearly unscathed, testament to her fine construction.

Despite an expertise in woodworking skills, however, the shipwrights allowed one error in their construction that may have resulted in the *Ocean Wave*'s quick descent to the bottom. All scows, with their flat bows, are vulnerable to frontal impacts. Unlike conventional vessels, with a fine entry that deflects much of a frontal impact force into a glancing blow, scows take the full force of impact straight on, resulting in greater damage. The *Ocean Wave* had one additional problem with her bow design. Cross-planked, the *Ocean Wave*'s outer hull planking ran over four frames before abutting the stempost (Figure 28). The problem occurred where the outer hull planks met the stempost. There was no rabbet to accept the plank's end. The knighthead provided a strong backing for the bow planking, but ended just below the waterline. Where the lower bow planks met the stempost there was no support whatsoever, making the *Ocean Wave* extremely vulnerable to holing in the event of a collision with a partially submerged object. Striking an object between the stempost and the first frame, below the knighthead, could easily break one or more hull planks to create a large hole. The vessel's forward motion would then force even more water through

the hole, causing the *Ocean Wave* to quickly flood. Given that all starboard bow planks are intact, but none on the port side above the hull's bottom, it appears this is exactly what happened to the *Ocean Wave* that early September morning. She was an accident waiting to happen.

The *Ocean Wave* had an unusual deck layout with an elongated forward hatch (Figure 34). Not typical of Great Lakes sailing vessels, this large hatch must have been specially constructed for a specific trade or cargo, but it is not certain for what cargo or trade. It is unknown if the *Ocean Wave* was originally constructed with the elongated cargo hatch or if it was a later adaptation. It is equally unusual that the elongated cargo hatch would then be obstructed by three deck beams traversing its center. A large cargo hatch would have been more susceptible to leaking, or even crushing, from boarding waves. With the *Ocean Wave*'s low freeboard, boarding waves were probably not uncommon, and perhaps the deck beams supported the center of the cargo hatch. It is more likely they helped support the centerboard trunk, which was routinely subjected to large torsional stresses while underway. Further research into scow schooners and the stone trade may illuminate the elongated hatch's advantages.

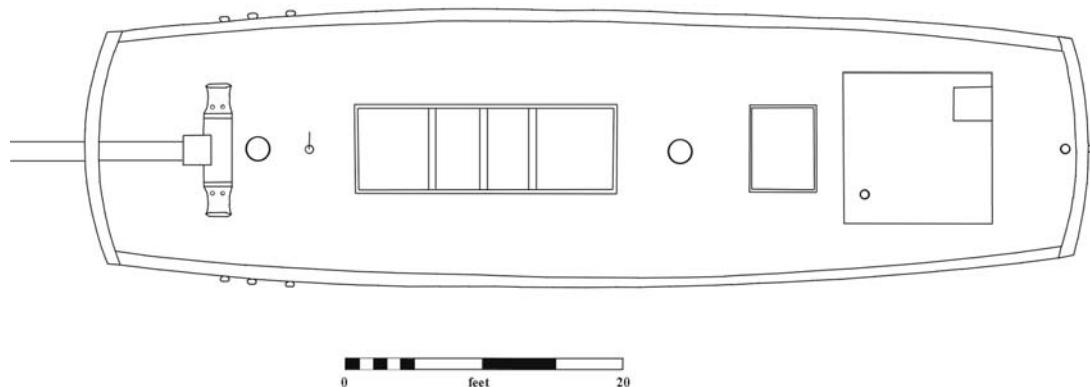


Figure 34. *Ocean Wave* deck layout. Locations of masts, bilge pump, and forward cargo hatch are conjectural.

The final, and most confounding, aspect of the *Ocean Wave*'s construction is her bottom profile. The *Ocean Wave*'s lower hull is completely obscured by sand, cargo, and hull structure, making examination of her lower hull impossible without excavation. From the hull's side construction and registered depth of hold, however, it is possible to estimate the bottom profile and how much, if any, deadrise, was present. Following the 1865 admeasurement changes, the *Ocean Wave* was registered with a 6.8 foot depth. This is consistent with height of the centerboard trunk, which is 6 ft. 4-3/4 in. tall. Considering the height of the hull's sides, however, a problem is encountered. The height of the hull side, from the top of the chine log to the underside of the covering board, is only three feet. This measurement was taken from amidships, outboard of the centerboard trunk. A hull side only three feet tall, coupled with a depth of hold of nearly seven feet, would require a very sharp deadrise angle, so much so that the *Ocean Wave* would have been a V-bottom boat. This seems unlikely.

One possibility is that the centerboard trunk rose above deck level, which was not unheard of on Great Lakes scows. However, there are no pockets or fasteners for deck beams on the side of the centerboard trunk to indicate this was the case, and the resulting depth of hold would have been less than the registered 6.8 feet. A second possibility is that researchers did not measure the full hull side but only a fragment. There was no evidence this was the case, but if so it would mean the *Ocean Wave* is constructed in a way that is yet to be documented on the Great Lakes. The best hope to resolve this problem is to monitor the site yearly. Shifting sands will likely uncover the more intact starboard side in future years, allowing researchers to revisit the site and more fully record construction details that were obscured by sand in 2005.

The *Ocean Wave* is the best location in Wisconsin to study Great Lake scow construction, and quite possibly one of the best locations in all the Great Lakes. It is deep enough to allow large hull structures to remain intact, yet within a reasonable diving depth to allow accurate and comprehensive diver-conducted research. The bow and stern, often missing on shallower wrecks, are complete on the *Ocean Wave*, yet opened up enough to allow easy access for study and documentation. The 2005 *Ocean Wave* project collected a large amount of documentation, some of which has not been documented before on Great Lakes' scows including bow, stern, and side construction details. Despite this documentation, there remains a large amount of information yet to be collected on the *Ocean Wave* site, specifically on the lower hull and starboard side. The *Ocean Wave* site is a prime candidate for nomination to the National Register of Historic Places, and should be monitored yearly as shifting sands uncover new hull sections to allow a complete documentation.

CHAPTER FIVE

SCOW SCHOONER *TENNIE AND LAURA*

Historical Background

The scow schooner *Tennie and Laura*, official number 145115, was built in 1876 at Manitowoc, Wisconsin, by Gunder Jorgensen. Enrolled at the Port of Milwaukee on 14 July 1876, the *Tennie and Laura* had one deck, two masts, and measured 73 feet in length, 19 feet in beam, and 5.6 feet in depth (Figure 35). Her registered tonnage was 53.9 net and 56.96 gross. Owned in equal shares by Otto A. Bjorkgnist and Ole Osmondson of Port Washington, their home city was registered as the hailing port and Captain Osmondson as master (Bureau of Navigation 1876; Gjerst 1928:161). Captains Bjorgnist and Osmondson began a nine-year partnership with the *Tennie and Laura*, occasionally shifting roles and ownership. The first shift came halfway through the second season. In 1877, Capt. Bjorkgnist bought out part of Capt. Osmondson's share, resulting in Bjorkgnist owning 11/16 and Osmondson owning 5/16. Re-enrolled at Milwaukee on 22 August 1877, Capt. Bjorkgnist became the new master (Bureau of Navigation 1877). Two years later, on 24 July 1879, Capt. Osmondson bought back his original interest in the *Tennie and Laura*, and Bjorkgnist and Osmondson became equal owners once again, and Capt. Osmondson regained his position as master (Bureau of Navigation 1879). The following season, on 29 July 1880, Capt. Bjorkgnist and the *Tennie and Laura* moved to Milwaukee, but Capt. Osmondson retained his residence in Port Washington, as well as his half ownership and role as master. In 1882, admeasurement rule changes deducted 2.83 tons from the *Tennie and Laura*, reducing her registered tonnage to 53.86 gross tons (Bureau of Navigation 1880).



Figure 35. *Tennie and Laura*, date and location unknown. Courtesy Wisconsin Maritime Museum.

On 5 April 1885, the longstanding partnership ended when Capt. Osmondson bought out Capt. Bjorkgnist's share of the *Tennie and Laura*, reselling her the following day in equal shares to Lars Hansen and Rasmus Hansen of Manitowoc. The Hansens returned the *Tennie and Laura* to Manitowoc, and Lars Hansen became master (Bureau of Navigation 1885a). Lars and Rasmus' familial relationship is unknown. Rasmus Hansen was typical of many Norwegians sailing the Great Lakes during the nineteenth century. Born at Fleekefjord, Norway, in 1850, Rasmus began sailing the oceans at the age of twelve. Often away from home for up to two years at a time, ocean sailing was difficult work with little pay. Rasmus sailed the oceans for eight years and achieved the position of mate on a full rigged ship by age twenty, but the low wages and long years from home left little prospect for a happy life. The following year, in 1871, Rasmus emigrated to Chicago and became a lake sailor, enjoying the higher wages and frequent visits home. Rasmus found Chicago's urban conditions unsatisfactory, however, and after one year moved north to Manitowoc where he gained the rank of Captain (Gjerset 1928:8, 139).

During winter lay-up following their first season aboard, Lars Hansen left the *Tennie and Laura*, selling his share to Hans Hansen of Manitowoc. Hans and Rasmus' familial relationship is also unknown. Rasmus Hansen became master, re-enrolling the vessel at Milwaukee on 21 January 1886 (Bureau of Navigation 1886). Late in the 1886 season Rasmus had his first mishap aboard the *Tennie and Laura*, running her ashore near Ludington, Michigan in early September. The *Tennie and Laura* was quickly pulled free, but was leaking badly (Manitowoc Pilot 1886:3). Lars and Rasmus sailed the *Tennie and Laura* together for only one season. The following spring Rasmus moved from Manitowoc to Sheboygan, taking the *Tennie and Laura* with him. Hans Hansen sold his share to Ingebret Larsen of Sheboygan. Her new hailing port was officially entered on 7 July 1887, and Capt. Larsen became master (Bureau of Navigation 1887).

Hansen and Larsen sailed the *Tennie and Laura* in the lumber trade for the remainder of the 1887 season (Gjerset 1928:151), but during winter lay-up they sold the *Tennie and Laura* across Lake Michigan to brothers Van Beethoven and Herman M. Ludwig of Ludington, Michigan. Capt. Larsen, after selling his share of the *Tennie and Laura*, took over as master of the schooner *Cynthia Gordon* for two years, and then in 1890 became part owner and master of the *Walaska*. Capt. Larsen eventually gave up the lake trade, however, and moved to California (Gjerset 1928:153).

The Ludwig brothers were born in Park, Michigan; Van was born in September 1856, and Herman was born in May 1857. Van and Herman had seven other brothers and one sister: John, Charles, Samuel, Franklin, Daniel, Lancaster, William, and Mary. During the 1860s, the Ludwig family moved from Park, Michigan, to South Haven, Michigan, where they established a family farm. During the 1870s the family moved once again to Bethany, Michigan, where they reestablished the farm. In 1880, Herman and his brother Daniel married and both returned to South Haven where they became sailors. Soon after Herman and Daniel moved to South Haven, brothers Lancaster and Franklin moved in with Herman, and John and Van moved in with Daniel; all became South Haven sailors (United States Census Bureau 1860b:263, 1870b:10, 1880a:2, 1880c:45). In 1887, Van and Herman joined in a partnership and purchased equal shares of the *Tennie and Laura*, and Herman Ludwig became master.

The *Tennie and Laura*'s hailing port was officially changed to Ludington on 26 March 1888 (Bureau of Navigation 1888).

The Ludwigs' partnership lasted for two years when Capt. Herman Ludwig bought out his brother's share to became sole owner and master on 2 April 1890 (Bureau of Navigation 1890). Van Ludwig continued working as a sailor in Ludington, and married Elliza Harrison, the daughter of a Ludington pilot (United States Census Bureau 1900:22). Capt. Herman Ludwig sailed the *Tennie and Laura* for seven more years until he sold half the vessel to Captain Vasco Roberts of Ludington for \$200 (*Door County Advocate* 1897d:1). Capt. Roberts became master and the new enrollment was entered 28 May 1897 (Bureau of Navigation 1897a). Of interest, enrollment No. 59 lists the *Tennie and Laura* as having a round stern, contrary to her other enrollments. This enrolment was quickly lost, however, and the *Tennie and Laura* received a replacement enrollment on 26 July 1897, with no other changes other than the stern description returning to "square" (Bureau of Navigation 1897b). At twenty one years of age, the *Tennie and Laura* was dry-docked and recaulked early in October 1897 (*Door County Advocate* 1897:1).

In 1899, Capt. Herman Ludwig moved to Benton Harbor, Michigan, and took the *Tennie and Laura* with him. Capt. Roberts sold his half share back to Capt. Ludwig, who once again became sole owner and master. Her new hailing port was officially entered on 5 June 1899 (Bureau of Navigation 1899). Capt. Ludwig only sailed the *Tennie and Laura* for one more year, selling her to his brother Captain Lancaster S. Ludwig, also of Benton Harbor, in 1900. After selling the *Tennie and Laura*, Capt. Herman Ludwig became a pilot in Benton Harbor (United States Census Bureau 1900:13, 16).

Capt. Lancaster Ludwig became the *Tennie and Laura*'s sole owner and master on 26 March 1900 (Bureau of Navigation 1900). Capt. Lancaster Ludwig sailed the *Tennie and Laura* for one and a half seasons. On 20 August 1901 John Sather of North Muskegon, Michigan, purchased the *Tennie and Laura* for about \$1,000 to become her sole owner and master, changing her hailing port to his hometown (Bureau of Navigation 1901; Milwaukee Sentinel 1903:1). Captain Sather sailed the *Tennie and Laura* in the Lake Michigan lumber trade for the next two years, making weekly trips from Muskegon to Milwaukee, buying and selling his own cargos.

The *Tennie and Laura* was twenty-seven years old at the start of the 1903 season and valued about \$500. Anticipating a good season, Capt. Sather purchased a new set of sails for the *Tennie and Laura*, but neglected to purchase insurance. On Saturday, 1 August 1903, Capt. Sather and the *Tennie and Laura* were loaded with a \$500 cargo of slab wood in Muskegon, Michigan, consigned to Milwaukee. The *Tennie and Laura* usually carried a crew of three, but Capt. Sather's son John, who usually shipped as cook, asked for leave of the Milwaukee trip and was granted it by his father. Though shorthanded, the fall gales were still two months away, and the weather was especially pleasant that late summer day. Capt. Sather, with only mate Charles Nordbach aboard, decided to sail for Milwaukee, and they departed Muskegon at ten o'clock that morning (Milwaukee Sentinel 1903:1).

At six o'clock that evening the sky began darkening. An hour later the seas were building under gale force winds. The *Tennie and Laura* was taking a beating in the heavy seas, and soon began leaking. Sather and Nordback took turns between the

pumps and the wheel, but the water level in the hold kept creeping upward. As the night grew on, so too did the seas and heavy rains. Sather and Nordbach were blinded in the downpour, making it nearly impossible to keep the waves on the *Tennie and Laura*'s port quarter as they ran before the storm. If turned broadside to the seas they would quickly swamp. They continued taking turns throughout the night, but the men grew weary and the water continued to rise. At three o'clock in the morning the *Tennie and Laura* began listing, and a large boarding wave swept half her deck load overboard. Righting herself with a lurch, the remaining deck cargo washed over the opposite side and carried away the hatch covers and some of the deck planks. The *Tennie and Laura* was seriously wounded. Each successive boarding wave dumped tons on water into the vessel, and her slab wood cargo began to slosh around, battering her hull with each roll (Milwaukee Journal 1903:3; Milwaukee Sentinel 1903:1).

Despite their precarious position, Sather and Nordback kept the *Tennie and Laura* afloat until five o'clock in the morning when they were ten miles northeast of Milwaukee. Thrown broadside before a large wave, the *Tennie and Laura* capsized. Sather and Nordbach climbed aboard their yawl, which remained attached by its painter to the *Tennie and Laura*'s stern. Inverted, the *Tennie and Laura* did not sink but was carried before the winds with Sather and Nordbach helplessly pulled along in their yawl. They drifted until six-thirty that morning when they were sighted by the passing steamer *Mark B. Covell*, bound for Milwaukee with a load of wood. The *Covell* approached as closely as possible in the heavy seas and a line was thrown to Nordbach, who was sitting in the yawl's bow. Nordbach caught the line, but became a bit too excited at their imminent rescue. Standing up, Nordback capsized the yawl, spilling himself and Sather into the water. Nordbach lost the line, but Sather picked it up, taking several turns around his arm to make sure he was secure. A life preserver was thrown to Nordbach, but he made no effort to retrieve it. The *Covell*'s Mate, Henry Erbe, threw a second line to Nordbach, dropping it directly in front of him. Exhausted, Nordbach made no attempt to grab the second line and sank from sight. Sather was pulled aboard the *Covell*, and the *Tennie and Laura* was left floating in the lake (Milwaukee Journal 1903:3; Milwaukee Sentinel 1903:1).

The experience was quite traumatic for Capt. Sather, who was forty-two years old at the time. He told the *Milwaukee Sentinel* that “[he] was going to give up the lakes now. An experience like this is too much for me, and I am going to work my little farm.” Capt. Skeels of the *Covell* had nothing but respect for Sather, indicating that “Captain Sather is the coolest man I ever saw. He gave Morbach [sic] every chance to be saved first, waiting patiently and calmly for his turn...” Nordbach, who was forty years old, left a wife and five children (Milwaukee Sentinel 1903:1). The *Tennie and Laura*'s last enrollment was surrendered on 5 August 1903 (Bureau of Navigation 1901).

On 11 December 1998 the Port Washington fishing tug *Linda E* disappeared with three crew on a clear day while raising her nets southeast of Port Washington. Subsequent searches discovered a large object lying on the lakebed in 325 feet of water, and on 20 January 1999 the USCG *Acacia* lowered a Remotely Operated Vehicle (ROV) to the lakebed to identify the object. To their surprise and disappointment, what they discovered was not the *Linda E*, but a nineteenth century

schooner (Jones 1999). The *Acacia* explored the wreck for 22 minutes in the unsuccessful attempt of making an identification. The ROV did record an upright vessel that was wire rigged with deadeyes, with remnants of white paint visible on the hull. One mast remained standing, and the cargo hold was loaded with wood. The cabin was missing, but in its place was a small woodstove and associated cooking utensils. It appeared the hull's entire forward half was missing (Baillod 1999; Garza 1999). The ROV surveyed the vessel's starboard side but did not venture to the port side. The ROV footage left many questions unanswered and there was much speculation as to the vessel's identity. Local maritime historians initially suggested several possible identifications, but settled on the *Tennie and Laura* as the most likely candidate (Smith 2003). Beginning in 2003, technical divers began visiting the vessel in an attempt to confirm the *Tennie and Laura* identification, and reported that she was completely intact with both masts standing. Most interesting was the report of a partially intact name board on the port bow with the word "Tennie" lightly visible (Polich 2004:65). Unfortunately, there were no photographs nor video to document the findings.

Description of Field Research and Findings

The WHS visited the wreck tentatively identified as the *Tennie and Laura* via ROV over three days on 9 to 11 August 2005. The wreck lays in 325 feet of water nine miles southeast of Port Washington ($43^{\circ} 15.546' N$ $087^{\circ} 43.643' W$). The WHS has several technical divers on its team with experience in diving to 300 foot depths, but given the difficulty of gathering accurate information at this depth with divers in the Great Lakes, an ROV operation was chosen. An ROV has the advantage of unlimited bottom times and all video data is recorded, allowing unlimited playback for research purposes. The dives had three goals: 1) Provide a positive identification by relocating and recording the port side name board, 2) document vessel construction techniques, and 3) document associated artifacts and vessel assemblages.

ROV operations were conducted aboard the University of Wisconsin – Milwaukee's Great Lakes WATER Institute's R/V *Neeskay*. The *Neeskay* did not have a dynamic positioning system to hold the vessel over the wreck location. Once the wreck was located on the depth sounder, a shot line was dropped with a surface buoy, marking the wreck's location. Set and drift, combined with wind speed and direction, were calculated to determine where a single anchor was to be set from the *Neeskay*'s bow. With the anchor set well away from the wreck to avoid entanglement, the anchor cable was payed out until the *Neeskay* was atop the wreck site. Dives were conducted with a Benthos MKII ROV system, piloted by Rob Paddock of the Great Lakes WATER Institute (Figure 36). The ROV's umbilical was tethered to a weighted down line that was lowered to the lakebed. This reduced the risk of entanglement with the wreck's standing rigging, but only allowed an operating radius of 150 feet.



Figure 36. Benthos MKII Remotely Operated Vehicle (ROV). Photo by Tamara Thomsen.

On the first day of dives the ROV reached a depth of 150 feet when the video feed malfunctioned. Repairs could not be made aboard the vessel and remaining dives were cancelled. The video feed was repaired that evening, allowing a return to the site the following day. On the initial decent the downward thruster failed and the ROV was again brought to the surface. Repairs were made aboard the *Neeskay*, and a second dive was made. The *Neeskay* swung slightly on her anchor and dragged the ROV along the bottom, preventing the ROV from holding a position for more than a few minutes. As the ROV approached the wreck site it would be pulled backward by the *Neeskay* just as the wreck came into view. Limited footage of the starboard side debris field was acquired on the second day. The third day was most successful, allowing exploration of the debris field off the starboard bow and the forward half of the port side hull. Increasing winds eventually called an end to the dives as the *Neeskay* pulled the ROV away from the wreck, resulting in a minor entanglement of the ROV's umbilical with the *Neeskay*'s anchor rode. Despite problems with vessel positioning, approximately 30 minutes of wreck footage was acquired from the debris field off the starboard bow and the port side hull from amidships forward. Visibility on the bottom was approximately three to five feet, occasionally made worse from the ROV's thrusters stirring the bottom silt.

The *Tennie and Laura* rests upright on the lakebed at a heading of 070 degrees, sunk into the bottom to nearly her load line. At least one mast remains standing, rising to a depth of approximately 265 feet. No masts were recorded with the ROV, but the existence of a standing mast was obvious from the depth sounder images (Figure 37) and ROV footage of suspended rigging. The debris field off the starboard bow and beam is littered with a tangle of standing and running rigging. Wire rope lays in large tangles in the silt and a chain is visible lying on the bottom, either an

anchor chain or a bobstay. Both the wire rope and chain exhibit varying amounts of corrosion with sporadic quagga mussel colonization. Laying on the lakebed near the chain is an iron-stock anchor (Figure 38). Looking up from the bottom, wire rigging was visible suspended above the lake floor, perhaps hanging from an upright mast. Off the hull's starboard side a shroud lays on the lakebed. Most likely from the starboard foremast, the shroud is draped from the starboard gunwale and extends away from the hull. A sail boom lays on the bottom next to the shroud, jaws intact. Two pieces of white porcelain, one perhaps a teacup, were visible protruding from the silt.

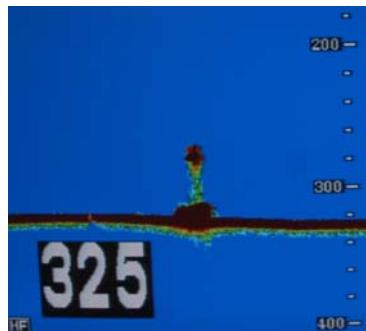


Figure 37. Sonar image of *Tennie* and *Laura* showing standing mast.



Figure 38. Iron anchor stock on the lakebed off the starboard bow.

The large amount of rigging off the starboard bow was a serious entanglement hazard for the ROV, and exploration was moved to the port side, where there was little debris outside the hull. The ROV approached the hull approximately amidships, and slowly worked its way forward along the outside of the hull. The hull exhibits construction traits similar to the *Ocean Wave*. Longitudinal side planks had through bolts with clinch rings not unlike the *Ocean Wave*, perhaps for the bulwark stanchions. A heavy covering board was fastened atop the hull planks, and the bulwark was recessed from the outer hull by several inches (Figure 39). Remnants of white paint were still visible.



Figure 39. Hull-deck joint on port side, amidships. Note large covering board atop longitudinal hull planks, recessed bulwark, and quagga mussels colonizing the wreck.

Moving forward, the foremast chainplates were visible, beneath which is at least one dislodged hull plank. Forward of the chainplates a large wire rope is draped over the bulwark, running directly over the port side name board (Figure 40). The name was not legible. The hull is intact from the name board forward, as is the lower port side of the bow ramp. The bow ramp is cross planked, joined to the longitudinal side planking by framing timbers (Figure 41). The bow curves up sharply from the bottom.



Figure 40. Port bow with name board (inside circle). Name is illegible.



Figure 41. Looking up towards the port side bow ramp. Hull side is in upper right of photo, bow planking in lower left, joined by framing timbers running diagonally from upper left to lower right.

Conclusions and Recommendations

The *Tennie and Laura* ROV project captured less underwater footage than hoped, but the captured footage fills many gaps from the ROV footage recorded aboard the USCG *Acacia*, as well as achieving several project goals. The wreck's forward section is more intact than previously believed, at least on the port bow. The starboard bow was not documented on these dives, but the large amount of debris encountered off the starboard bow suggests it may have received at least some damage. Divers report the starboard bow is intact, but without supporting evidence.

The most exciting discovery was the port side name board. Unfortunately, no letters were discernable. Divers report that only a partial name board remained on the port bow with the word "Tennie" still legible (Polich 2004), suggesting the after end of the name board was damaged or absent. ROV footage revealed the aft end of the name board was intact with no visible lettering.

The vessel is without question a scow schooner. Construction, viewed from the outside, appears to be similar to the *Ocean Wave*. The bottom is cross planked, the sides are longitudinally planked. Through bolts with clinch rings are visible along the outer hull planking on the port side, similar to how the *Ocean Wave*'s bulwark stanchions are fastened. Like the *Ocean Wave*, this vessel has a large covering board, through which the bulwarks stanchions likely pass, resulting in the bulwark being recessed from outer hull by several inches as on the *Ocean Wave* (Figures 22 and 39).

The vessel remains unidentified. No documentation of the legible name board has been produced by divers. The name board recorded by the ROV was inconclusive. The only evidence identifying this vessel as the *Tennie and Laura* is that she is in the general vicinity of her loss, was carrying wood, and is a scow schooner. Other aspects of the wreck site question that identity, however. The first suspect evidence is the stove recorded by the USCG *Acacia*. The stern cabin has been ripped from the deck, and a small wood stove lays on its side where the cabin once stood, unattached to the deck. The *Tennie and Laura* was capsized on the surface for several hours in heavy seas, which would have turned the cabin's interior into a gigantic washing machine. It seems unlikely that the stove would have remained with the vessel, yet unattached, while the cabin was lost. Additionally, a few of the observed construction details do not match historic images. In Figure 42 there are equally spaced scuppers visible along the entire bulwark length. The ROV traveled the port side from amidships forward, but no scuppers were recorded. It is possible the scuppers were obscured by silt or mussels. Also, the port side bulwark has four planks plus a rail cap in the historic image, yet only three planks plus the rail cap were visible on the wreck. Finally, a large rubbing strake runs the length of the port side in the historic image, yet the rubbing strake on the wreck was only a fraction of the size (Figures 42 and 43). Despite these differences between historic images and the wreck site, however, the vessel may very well be the *Tennie and Laura*. We do not know when the historic images were taken. It could have been a decade or more before the vessel's loss, allowing much time for repairs and that could change small cosmetic differences as those listed above. Opportunities to positively identify the wreck will become increasingly difficult. Quagga mussels are beginning to colonize the *Tennie and Laura*, and will quickly obscure any marks that could easily identify her.



Figure 42. *Tennie and Laura*, date and location unknown. Note scuppers along lower edge of white paint, as well as large rubbing strake just below white paint. Courtesy Historical Collections of the Great Lakes, Bowling Green State University.



Figure 43. Port side hull from covering board down. Note small rubbing strake just above ROV heading near bottom of photo.

CHAPTER SEVEN CONCLUSIONS

The WHS's 2005 field season both answered and raised several questions concerning Great Lakes scow schooner construction, documentation, and use. It also attempted to elucidate the scow's role in Lake Michigan lakeshoring, and was successful to varying degrees in that capacity. A lack of personal effects and shipboard tools at the wreck sites required much interpretation of the lakeshoring trade to come from the historical, rather than the archaeological, record. As in the case of the *Iris*, the historical record is often fraught with errors, corrected only through archaeological study. A wise man once said that archaeology is the study of what people did, not what they said they did. In the case of lakeshoring, not much was ever said. Scows, and the lakeshoring trade they participated in, were often referred to as the "mosquito fleet" by contemporaries (*Door County Advocate* 1898:1). Indicative of their diminutive share of the Great Lakes trade, it also suggests that scows and the lakeshoring trade were considered an annoyance compared to larger vessels, hardly worthy of comment. Examination of contemporary writing on Great Lakes commerce often finds even the larger schooners were neglected in the excitement of steam technology and its ever-increasing share of Great Lakes tonnage. Great Lakes commercial sail was doomed, and sailors in the latter half of the nineteenth century knew it.

The rapid changes that took place on Lake Michigan during the nineteenth century create problems in defining lakeshoring. Within one century, Lake Michigan changed from a vast wilderness to one of the busiest bodies of water in the world, and one simple definition cannot suffice to explain the small schooner's role on Lake Michigan. Initially, all trade on Lake Michigan was lakeshoring. Few natural harbors allowed vessels shelter from Lake Michigan, requiring them to load and unload with lighters while anchored offshore. Additionally, these early lakeshorens did not limit their trade to Lake Michigan alone. In fact, they were the Lake Michigan region's only connection with eastern cities. By 1855, however, many small towns around Lake Michigan had improved harbors, and by 1885 few lakeshore towns were without some sort of harbor or pier. The Lake Michigan lakeshoring trade evolved within these transitions, shifting from interlake trade with frontier towns to trade between Lake Michigan port cities. Despite the fact that few schooners were still loaded by lighters while anchored offshore by 1885, the term lakeshorer was still applicable to many vessels that rarely, if ever, ventured outside of Lake Michigan.

The scope of this work did not allow the proper historical research into lakeshoring that it deserves. The harder one tries to define lakeshoring, the more it becomes apparent that there were so many variations to the trade that its definition is difficult. Larger vessels were more often committed to specific cargoes and routes, such as the grain fleet that traveled from southwestern Lake Michigan to Lake Ontario and returned with coal, or the lumber fleet that carried millions of board feet of lumber from Lake Michigan's northern to southern shore, often returning empty. It appears the lakeshorer's route and cargo was more defined by locality than cargo, often carrying whatever was produced or needed by the communities in which the vessel's owner lived. This could include coal, lumber, bark, Christmas trees, cord wood, slab

wood, barreled fish, potatoes, apples, general merchandise, or whatever they could fit into their holds that would bring a profit. Only by examining more vessels like the *Iris*, *Ocean Wave*, and *Tennie and Laura* will we learn more about how these adaptable little vessels hung on until the very end of the Great Lakes' age of sail.

More research is required to confirm the familial relationships between the different owners of each of the vessels. It appears that lakeshoring was very much a family affair. Father and son, cousins, and in-laws worked together in not only operation but ownership. These vessels were often purchased and traded amongst members of the same family.

Scows played no small part in the lakeshoring trade. The fact that most scows were close to seventy five feet in length is indication enough of the sort of trade to which they were best suited. For many of the same reasons we know little about lakeshoring, so too we know little of scows. Scows are frequently absent from the historical record. When they were recorded, the information was often confused or incomplete. This makes the historian's task a difficult one, but the archaeologist's task even more important. Much of what we will ever know of the Great Lakes scow schooner lays in the archaeological record of sail that litters the lakebed.

The archaeological details of the vessel surveys are discussed within their respective chapters, but a few points are worthy of review. First, scow construction methods are widely known to have varied between different regions as well as different builders within a region. We are well aware that scow bottoms could be longitudinally, diagonally, or cross planked. A review of the limited relevant literature gives the impression that side hull construction typically varied between two construction methods – gunnel-built and a more traditional style utilizing king posts (vertical frames set into a chine log) and outer hull planking. The *Ocean Wave*'s sides are somewhat of a cross between these two construction methods, suggesting more variation in scows than previously believed. The *Ocean Wave* utilizes a gunnel-type construction with edge-bolted longitudinal hull planks, but the hull planks are somewhat thinner than expected for a gunnel type hull. To make up for the lack in plank thickness a series of vertical frames were used to stiffen the side hull, but unlike kingposts, these frames were not set into the chine log but rather fastened to the chine log's inside edge. No ceiling planking was used on the sides; instead a simple deck shelf was fastened over the frames to support the deck beams.

The hull-deck joint was of a very simple construction - a covering board fastened horizontally atop the upper hull plank. This covering board rested atop the deck beams, and the frame ends abutted the underside of the covering board. Once the covering board was in place the bulwark stanchions were passed through regularly spaced mortises and fastened to the hull planks with through bolts and clinch rings. Once the covering board and stanchions were in place, the deck and bulwarks were planked over. This provided a simple but robust hull that was economical in both construction and repair. Viewed from the outside, it appears that the *Tennie and Laura*'s construction was similar to that of the *Ocean Wave*.

The *Ocean Wave*'s hull was uncomplicated, but exhibited traits indicating its builders were accomplished carpenters, if not accomplished shipwrights. This supports a widely held notion that anyone who could build a barn could build a scow. The cabin's construction was especially robust, and the joinery between the bow and

side hulls was a simple, but highly effective, way to provide additional strength to a naturally weak joint. One wonders what the builders were thinking, however, when they allowed several outer hull planks to abut the stem post with little to no reinforcement. It is unsurprising that the *Ocean Wave* sank within minutes of a frontal collision. This one design flaw proved fatal for the vessel and nearly so for the crew.

The 2005 field season resulted in an expansion of technological as well archaeological knowledge. On both the *Ocean Wave* and *Tennie and Laura*, the WHS expanded into depths previously unexplored by the WHS. In the case of the *Ocean Wave*, a new survey method was devised that, to the authors' knowledge, has not been previously utilized on shipwreck surveys. Photo mosaics have been used on archaeological surveys for decades. With advances in digital photography and computerized graphics programs, photo mosaic construction is vastly improved over the traditional hand-placement of 35mm photographs. Recent years have witnessed an increased use of digital photo mosaics in shipwreck archaeology, especially within the technical diving range where limited bottom times and extended decompression obligations preclude the use of traditional baseline surveys. The problem of using photo mosaics to document large-scale sites without a baseline is that there are no reference points by which to assemble the photos except for the shipwreck itself. This results in a photo mosaic that is an artist's representation of the shipwreck site. The person assembling the photo mosaic automatically adds his or her personal bias into the mosaic, creating a mosaic that represents what he or she thinks the shipwreck should look like. In extreme cases entire wreck sections, such as a cargo hatch, have been excluded from the mosaic (Labadie 2005). Parallax errors are introduced through image distortion at the periphery of wide angle lenses. Scale errors are introduced by varying lens-to-shipwreck distances. These errors are difficult to control, especially on shipwrecks with varying relief. In the case of the *Ocean Wave*, the mainsail boom appeared to curve in a crescent shape no matter how the photos were rearranged.

"Ground truthing" the photo mosaic can correct many of these errors. Specific wreck sections are copied from the mosaic and carried by divers to the shipwreck site. On-site comparison of the mosaic to the wreck site quickly identifies any discrepancies that require correction. Divers can triangulate major wreck features with one another to confirm or correct any spatial discrepancies in the mosaic. Accurate measurements of specific wreck features and construction techniques can be acquired to aid in interpretation. Without a baseline, this method allows the production of a highly detailed and accurate site plan with a limited amount of in-water time. This is especially effective when project staff consist largely of avocationalsists with limited shipwreck archaeology background.

While much information was gathered at each site, there remains much information buried beneath the lakebed that was inaccessible during 2005. The *Iris* site has much archaeological potential beneath the dredge spoil covering her, but given her sheltered location it is unlikely that natural sediment transport will uncover her in future years. In the event that she does become exposed, undocumented hull sections should be recorded. It is possible the *Iris* holds a key to the sometimes fine differentiation between scows and ordinary schooners. The *Ocean Wave* site is a gold mine for future scow documentation. The site should be monitored yearly as shifting

sands uncover hull sections that were buried in 2005. This will allow a more complete understanding of her construction as well as potentially solve the deadrise dilemma. The *Tennie and Laura* will hopefully remain lightly visited until refined deep-water survey techniques become available to the WHS, such as dynamically positioned survey vessels. The *Tennie and Laura* is an extremely fragile wreck site, and will be quickly damaged if recreational dive vessels grapple into her. Hopefully those who visit the *Tennie and Laura* will do so responsibly and drop shot lines rather than drag anchors or grapnels into her hull, preserving her for future generations.

Few artifacts were visible on the *Ocean Wave* and *Tennie and Laura* in 2005. This may change, especially on the *Ocean Wave*, as currents transport bottom sediments. New artifact finds should be documented and left in place on the wreck or lakebed. Equally important as not removing artifacts, artifacts should be left in their original locations and not transported about the site. Handling fragile artifacts often results in damage, as is the case with the *Ocean Wave*'s broken shovel. Additionally, an artifact's location can tell us much about how the crew lived and worked on the vessel as well as what occurred during the wrecking process. Collecting artifacts and depositing them in a conspicuous pile destroys any archaeological information that can be learned from the items and destroys much of the wreck site's aesthetic appeal. Left in place, artifacts can be "rediscovered" by each diver, resulting in a more rewarding dive and an increased possibility of new "discoveries" for each diver on subsequent returns to the wreck.

REFERENCES

- Andreas, A.T.
 1881 *History of Northern Wisconsin*. Western Historical Co., Chicago, IL.
- 1883 *History of St. Clair County, Michigan*. Culver, Page, Foynes and Company, Chicago, IL. <<http://www.hti.umich.edu/m/micounty/>>
- Baillod, Brendon
 1999 A Tale of Two Ships.
[<http://www.ship-wreck.com/shipwreck/projects/tennielaura/2ships.html>](http://www.ship-wreck.com/shipwreck/projects/tennielaura/2ships.html)
- Barkhausen, Henry N.
 1948 Great Lakes Sailing Ships. *Ships and Sailing Albums, Number 2*. Kalmbach Publishing, Milwaukee, WI.
- Beeson, Harvey C.
 1913 *Beeson's Inland Marine Directory*. H. C. Beeson, Detroit, MI.
- Board of Lake Underwriters
 1866 *Rules Relative to the Construction of Lake Sail and Steam Vessels, Adopted by the Board of Lake Underwriters, 1866*. Mathews & Warren, Buffalo, NY.
[<http://www.hhpl.on.ca/GreatLakes/Documents/Rules1866/default.asp>](http://www.hhpl.on.ca/GreatLakes/Documents/Rules1866/default.asp)
- 1876 *Lake Vessel Register, System of Classification*. Board of Lake Underwriters, Buffalo, NY.
- Bureau of Navigation
 1860 *Ocean Wave Certificate of Enrollment No. 34*, Port of Detroit, Record Group 41, U.S. National Archives, Washington DC.
- 1864 *Ocean Wave Certificate of Enrollment No. 122*, Port of Detroit, Record Group 41, U.S. National Archives, Washington DC.
- 1865 *Ocean Wave Certificate of Enrollment No. 161*, Port of Detroit, Record Group 41, U.S. National Archives, Washington DC.
- 1866 *Iris Certificate of Enrollment No. 118*, Port of Detroit, Record Group 41, U.S. National Archives, Washington DC.
- 1867a *Iris Certificate of Enrollment No. 8*, Port of Detroit, Record Group 41, U.S. National Archives, Washington DC.
- 1867b *Ocean Wave Certificate of Enrollment No. 23 (Permanent)*, Port of Port Huron, Record Group 41, U.S. National Archives, Washington DC.

1869a *Ocean Wave* Certificate of Enrollment No. 1 (Temporary), Port of Port Huron, Record Group 41, U.S. National Archives, Washington DC.

1869b *Ocean Wave* Certificate of Enrollment No. 127, Port of Milwaukee, Record Group 41, U.S. National Archives, Washington DC.

1873 *Iris* Certificate of Enrollment No. 108, Port of Detroit, Detroit Customs District, Record Group 41, U.S. National Archives, Washington DC.

1876 *Tennie and Laura* Certificate of Enrollment No. 4 (Permanent), Port of Milwaukee, Milwaukee Customs District, Record Group 41, U.S. National Archives, Washington, DC.

1877 *Tennie and Laura* Certificate of Enrollment No. 10 (Permanent), Port of Milwaukee, Milwaukee Customs District, Record Group 41, U.S. National Archives, Washington, DC.

1879a *Iris* Certificate of Enrollment No. 86 (Permanent), Port of Detroit, Detroit Customs District, Record Group 41, U.S. National Archives, Washington DC.

1879b *Tennie and Laura* Certificate of Enrollment No. 7 (Permanent), Port of Milwaukee, Milwaukee Customs District, Record Group 41, U.S. National Archives, Washington, DC.

1880a *Iris* Certificate of Enrollment No. 158 (Permanent), Port of Port Huron, Huron Customs District, Record Group 41, U.S. National Archives, Washington DC.

1880b *Tennie and Laura* Certificate of Enrollment No. 13 (Permanent), Port of Milwaukee, Milwaukee Customs District, Record Group 41, U.S. National Archives, Washington, DC.

1881a *Iris* Certificate of Enrollment No. 131, Port of Port Huron, Huron Customs District, Record Group 41, U.S. National Archives, Washington DC.

1881b *Iris* Certificate of Enrollment No. 157 (Permanent), Port of Milwaukee, Milwaukee Customs District, Record Group 41, U.S. National Archives, Washington DC.

1883 *Iris* Certificate of Enrollment No. 16, (Permanent) Port of Milwaukee, Milwaukee Customs District, Record Group 41, U.S. National Archives, Washington DC.

1885a *Tennie and Laura* Certificate of Enrollment No. 169 (Permanent), Port of Milwaukee, Milwaukee Customs District, Record Group 41, U.S. National Archives, Washington, DC.

1885b *Tennie and Laura* Certificate of Enrollment No. 36 (Permanent), Port of Milwaukee, Milwaukee Customs District, Record Group 41, U.S. National Archives, Washington, DC.

1886a *Iris* Certificate of Enrollment No. 95 (Permanent) Port of Milwaukee, Milwaukee Customs District, Record Group 41, U.S. National Archives, Washington DC.

1886b *Tennie and Laura* Certificate of Enrollment No. 28 (Permanent), Port of Milwaukee, Milwaukee Customs District, Record Group 41, U.S. National Archives, Washington, DC.

1887 *Tennie and Laura* Certificate of Enrollment No. 4 (Permanent), Port of Milwaukee, Milwaukee Customs District, Record Group 41, U.S. National Archives, Washington, DC.

1888 *Tennie and Laura* Certificate of Enrollment No. 54 (Permanent), Port of Grand Haven, Michigan Customs District, Record Group 41, U.S. National Archives, Washington, DC.

1889 *Iris* Certificate of Enrollment No. 13, Port of Milwaukee, Milwaukee Customs District, Record Group 41, U.S. National Archives, Washington DC.

1890 *Tennie and Laura* Certificate of Enrollment No. 57, Port of Grand Haven, Michigan Customs District, Record Group 41, U.S. National Archives, Washington, DC.

1893 *Iris* Certificate of Enrollment No. 5 (Permanent), Port of Milwaukee, Milwaukee Customs District, Record Group 41, U.S. National Archives, Washington DC.

1897a *Iris* Certificate of Enrollment No. 107, Port of Milwaukee, Milwaukee Customs District, Record Group 41, U.S. National Archives, Washington DC.

1897b *Tennie and Laura* Certificate of Enrollment No. 59 (Permanent), Port of Grand Haven, Michigan Customs District, Record Group 41, U.S. National Archives, Washington, DC.

1897c *Tennie and Laura* Certificate of Enrollment No. 4 (Permanent), Port of Grand Haven, Michigan Customs District, Record Group 41, U.S. National Archives, Washington, DC.

1898 *Iris* Certificate of Enrollment No. 52, Port of Milwaukee, Milwaukee Customs District, Record Group 41, U.S. National Archives, Washington DC.

1899a *Iris* Certificate of Enrollment No. 98, Port of Milwaukee, Milwaukee Customs District, Record Group 41, U.S. National Archives, Washington DC.

1899b *Tennie and Laura* Certificate of Enrollment No. 84 (Permanent), Port of Grand Haven, Michigan Customs District, Record Group 41, U.S. National Archives, Washington, DC.

1900 *Tennie and Laura* Certificate of Enrollment No. 47 (Permanent), Port of Grand Haven, Michigan Customs District, Record Group 41, U.S. National Archives, Washington, DC.

1901 *Tennie and Laura* Certificate of Enrollment No. 20 (Permanent), Port of Grand Haven, Michigan Customs District, Record Group 41, U.S. National Archives, Washington, DC.

1902 *Iris* Certificate of Enrollment No. 22 (Permanent), Port of Milwaukee, Milwaukee Customs District, Record Group 41, U.S. National Archives, Washington DC.

1905 *Iris* Certificate of Enrollment No. 59 (Permanent), Port of Milwaukee, Milwaukee Customs District, Record Group 41, U.S. National Archives, Washington DC.

1906 *Iris* Certificate of Enrollment No. 18 (Permanent), Port of Milwaukee, Milwaukee Customs District, Record Group 41, U.S. National Archives, Washington DC.

1907 *Iris* Certificate of Enrollment No. 8 (Permanent), Port of Milwaukee, Milwaukee Customs District, Record Group 41, U.S. National Archives, Washington DC.

1908 *Iris* Certificate of Enrollment No. 32 (Permanent), Port of Milwaukee, Milwaukee Customs District, Record Group 41, U.S. National Archives, Washington DC.

1911 *Iris* Certificate of Enrollment No. 83 (Permanent), Port of Milwaukee, Milwaukee Customs District, Record Group 41, U.S. National Archives, Washington DC.

Chapelle, Howard I.

1951 *American Small Sailing Craft: Their Design, Development, and Construction.*
W. W. Norton and Company, NY.

Cooper, David J.

1992 Wisconsin Underwater Archaeology: An Introduction. *The Wisconsin Archaeologist*, 73(1-2):1-6, Madison, WI.

1993 Synthesizing the Archaeological and Historical Record of Great Lakes Maritime Transportation. *Underwater Archaeology Proceedings from the Society for Historical Archaeology Conference*: 7-12. Society for Historical Archaeology, Kansas City, MO.

Detroit Free Press

1867 *Detroit Free Press*. 21 December.

Door County Advocate [Sturgeon Bay]

1881 *Door County Advocate*. 22 September.

1882a *Door County Advocate*. 14 December.

1882b *Door County Advocate*. 21 December.

1890 *Door County Advocate*. 11 January.

1891 *Door County Advocate*. 5 December.

1893a *Door County Advocate*. 11 March.

1893b *Door County Advocate*. 3 June.

1893c *Door County Advocate*. 21 October.

1893d *Door County Advocate*. 16 December.

1894a *Door County Advocate*. 9 June.

1894b *Door County Advocate*. 24 November.

1895a *Door County Advocate*. 23 March.

1895b *Door County Advocate*. 23 November.

1897a *Door County Advocate*. 13 March.

1897b *Door County Advocate*. 10 April.

1897c *Door County Advocate*. 24 April.

1897d *Door County Advocate*. 19 June.

- 1897e *Door County Advocate*. 20 November.
- 1898 *Door County Advocate*. 26 November.
- 1899 *Door County Advocate*. 8 July.
- 1901 *Door County Advocate*. 18 May.
- 1903a *Door County Advocate*. 28 February.
- 1903b *Door County Advocate*. 13 June.
- 1903c *Door County Advocate*. 14 November.
- 1905a *Door County Advocate*. 4 February.
- 1905b *Door County Advocate*. 4 March.
- 1905c *Door County Advocate*. 15 April.
- 1905d *Door County Advocate*. 13 May.
- 1905e *Door County Advocate*. 14 October.
- 1905f *Door County Advocate*. 2 December.
- 1906a *Door County Advocate*. 2 August.
- 1906b *Door County Advocate*. 22 November.
- 1907a *Door County Advocate*. 14 February.
- 1907b *Door County Advocate*. 11 July.
- 1907c *Door County Advocate*. 1 August.
- 1908a *Door County Advocate*. 23 January.
- 1908b *Door County Advocate*. 30 April.
- 1908c *Door County Advocate*. 17 September.
- 1908d *Door County Advocate*. 24 September.
- 1909 *Door County Advocate*. 12 August.

1910 *Door County Advocate*. 25 August.

1911 *Door County Advocate*. 8 June.

Garza, Jesse

1999 Sunken Wreckage Isn't the Linda E. *Milwaukee Journal Sentinel*, 21 January 1999.

Gjerset, Knut

1928 *Norwegian Sailors on the Great Lakes: A Study in the History of American Inland Transportation*. The Norwegian-American Historical Association, Northfield, MN. Reprinted 1979 by Arno Press, New York, NY.

Green, Russ, and Cathy Green

2004 Wisconsin's Maritime Trails. *Wisconsin Great Lakes Chronicle*, pp. 12-13. Madison, WI.

Hall, Henry

1880 *Report on Ship-Building Industry of the United States*. Tenth Census, Vol. 8, Department of the Interior, Washington, DC.

Hawkins, Clifford

1987 The Hard Times and Romance of the Sailing Scow. *Sea Spray*, May:22-28.

Hirthe, Walter M. and Mary K. Hirthe

1986 *Schooner Days in Door County*. Voyageur Press, Minneapolis, MN.

Inches, H.C., and Chester J. Partlow

1964 Great Lakes Driftwood Schooner-Scows. *Inland Seas*, 20(4):289-294. Cleveland, OH.

Jensen, John O.

1992 Gently Down the Stream: An Inquiry into the History of Transportation on the Northern Mississippi River and the Potential for Submerged Cultural Resources. *The Wisconsin Archaeologist*, 72(1-2):61-110. Madison, WI.

1993 Development and Disaster: Shipwrecks of the Northern Mississippi.

Underwater Archaeology Proceedings from the Society for Historical Archaeology Conference: 102-106. Society for Historical Archaeology Kansas City, MO.

Jones, Meg

1999 Discovery of 1800s Shipwreck in Lake Michigan Tantalizes Scuba Divers. *Milwaukee Journal Sentinel*, 12 April 1999.

Karamanski, Theodore J.

2000 *Schooner Passage: Sailing Ships and the Lake Michigan Frontier*. Wayne State Press. Detroit, MI.

Kristiansen, Soren

1981 *Diary of Captain Soren Kristiansen, Lake Michigan Schooner Captain 1891-1893*. Mid-Peninsula Library Cooperative, Iron Mountain, Michigan.

Labadie, C. Patrick

2005 More than One Way to Skin a Cat: Current Shipwreck Documentation Techniques at the NOAA Thunder Bay National Marine Sanctuary. Paper presented at the 1st Annual Wisconsin Underwater Archaeology Conference, Oak Creek, WI.

Labadie, C. Patrick, and Charles E. Herdendorf

2004 Wreck of the Scow Schooner *W.R. Hannah*: An Archaeological Investigation in Lake Erie at Kelleys Island, Ohio. Great Lakes Historical Society, *Peachman Lake Erie Shipwreck Research Center Technical Report No. 2*. Vermillion, OH.

MacGregor, David R.

1982 *Schooners in Four Centuries*. Model and Allied Publications, Hemel Hempsted, Hert, England.

Manitowoc Pilot

1886 *Manitowoc Pilot*, 2 September.

Mansfield, J.H.

1899 *History of the Great Lakes*. Vol. 1. J.H. Beers and Company, Chicago, IL. Reprinted 1972, Freshwater Press, Cleveland, OH.

Martin, Jay C.

1991 Not for Shallow Water Only: Scow Construction Along the Maumee River, 1825-1859. *Marine History Lines: Journal of the Western Lake Erie Historical Society* 10(1):2-6. Perrysburg, OH.

Merchant Vessels of the United States

1885 United States Printing Office, Washington DC.

1913 Unites States Printing Office, Washington, DC.

Merriman, Ann M.

1997 The Cypress Landing Shipwreck of Chockwinity Bay: A North Carolina Sail Flat, An Archaeological and Historical Study. East Carolina University, *Program in Maritime Studies Research Report No. 9*. Greenville, NC

Meurerden, Keith N. and John O. Jensen
 2005 Hetty Taylor. *National Register of Historic Places Registration Form*.
 Division of Historic Preservation – Public History, Wisconsin Historical Society,
 Madison, WI.

Mills, James Cook
 1910 *Our Inland Seas: Their Shipping & Commerce for Three Centuries*. A. C.
 McClurg and Company, Chicago, IL. Reprinted 1976, Freshwater Press, Inc.,
 Cleveland, OH.

Milwaukee Advertiser
 1836 *Milwaukee Advertiser*, 20 October.

Milwaukee Journal
 1903 *Milwaukee Journal*, 3 August.

Milwaukee Sentinel
 1869 *Milwaukee Sentinel*, 28 September.
 1903 *Milwaukee Sentinel*, 3 August.

Olmsted, Roger R.
 1988 Scow Schooners of San Francisco Bay. California History Center, *Local History Studies Volume 33*. Cupertino, CA.

Polich, Rob
 2004 Port Washington's Mystery Schooner, Lake Michigan. *Advanced Diver Magazine*. 16:62-65. Bradenton, FL.

Pott, Kenneth R.
 2001 The Wreck of the *Rockaway*: The Archaeology of a Great Lakes Scow Schooner. Master's thesis. Department of Anthropology, Western Michigan University, Kalamazoo, MI.

Quaife, Milo M.
 1944 *Lake Michigan: The American Lake Series*. Bobbs – Merrill Company, Indianapolis, IN.

Rodgers, Bradley A., and Annalies Corbin
 2003 Mud Box – Filled with Stone: The Wreck of the Scow Schooner *Dan Hayes*. *International Journal of Nautical Archaeology* 32.2:210-224.

Rodgers, Bradley A.
 1995 The 1995 Predisturbance Wreck Site Investigation at Claflin Point, Little Sturgeon Bay, Wisconsin. East Carolina University, *Research Report No. 10*. Greenville, NC.

Smith, Susan Lampert

2003 Diving in Lake Michigan for Historical Treasure. *Milwaukee Journal Sentinel*, 31 August 2003.

United States Census Bureau

1860a South Danvers, Essex County, Massachusetts. U.S. Department of the Interior, Government Printing Office, Washington DC.

1860b Township of Park, St. Joseph County, Michigan. U.S. Department of the Interior, Government Printing Office, Washington DC.

1870a Manitowoc Second Ward, Manitowoc County, Wisconsin. U.S. Department of the Interior, Government Printing Office, Washington DC.

1870b South Haven, Van Buren County, Michigan. U.S. Department of the Interior, Government Printing Office, Washington DC.

1880a Bethany, Gratiot County, Michigan. U.S. Department of the Interior, Government Printing Office, Washington DC.

1880b Manitowoc Second Ward, Manitowoc County, Wisconsin. U.S. Department of the Interior, Government Printing Office, Washington DC.

1880c South Haven, Van Buren County, Michigan. U.S. Department of the Interior, Government Printing Office, Washington DC.

1900 Benton Harbor, Berrien County, Michigan. U.S. Department of the Interior, Government Printing Office, Washington DC.

1910 Manitowoc Township, Manitowoc County, Wisconsin. U.S. Department of the Interior, Government Printing Office, Washington DC.

United States Genealogy Network, Inc.

2005 1850 St. Clair, MI, Census Index by Township and Village, Port Huron Village A-D. <<http://www.usgennet.org/usa/mi/county/stclair/1850cen/pthurvilad.htm>>.

United States Life-Saving Service

1898 Wreck Report, Sturgeon Bay Canal Life-Saving Station, 18 September. U.S. Treasury Department, U.S. Life Saving Service. Government Printing Office, Washington DC.

Thompson, Thomas S.

1869 *Thompson's Coast Pilot for the Upper Lakes, on Both Sides, from Chicago to Buffalo, Green Bay, Georgian Bay and Lake Superior, Including the Rivers Detroit, St. Clair and Ste. Marie: with the Courses and Distances on Lake Ontario, and Other Information Relative Thereto*, 5th edition. Free Press Book and Job Printing House, Detroit, MI.

Thomsen, Tamara L, and Keith N. Meverden

2005 The Scow Ocean Wave: Lake Michigan Wreck. *Advanced Diver Magazine*. 19:59-61. Bradenton, FL.

Vikery, Tina

2005 Kewaunee County Genealogy and History, USGenWeb Project.
[<http://www.rootsweb.com/~wikewaun/maritime.htm>](http://www.rootsweb.com/~wikewaun/maritime.htm)

Wedge, Lois, and Helen Whiting

2005 *St. Claire County Marriages 1857-1866, Book 2*. St. Claire County Clerks Office, Port Huron, MI.
[<http://www.rootsweb.com/~mistcla2/m_records2.htm>](http://www.rootsweb.com/~mistcla2/m_records2.htm)

Wisconsin Maritime Museum

n.d. *Iris* Historic Vessel Records. Manitowoc, WI.