Scow Schooners: A Regional Analysis

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Cover Photo: Scow Schooner *Tennie and Laura* (Wisconsin Maritime Museum).

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Information will continue to be added, of course, as knowledge of more scow schooners and their significance to the overall vessel type becomes apparent. Any data that can be added will further our analysis of scow schooner design and help us to understand the communities who operated these scow schooners and contributed widely to maritime industry around the world. This analysis contains more archaeological data from Wisconsin and Minnesota waters, due to the access that we have to this knowledge. Ideally, this project will grow to be a more equal comparison of archaeological findings by region.

ABSTRACT

Scows were a vessel type specifically designed to carry cargos into shallow waters and small, unimproved ports. While scow-type crafts have been found throughout the world, Great Lakes scows were primarily rigged as schooners, although a few were also rigged as sloops. Generally built outside of traditional shipyards, regional variations of scows exist throughout the United States, however, they were generally characterized by a flat bottom, vertical sides, and a hard, square chine, or bilge. While occasionally difficult to classify, a few specific variations were prevalent in the Great Lakes. Bows were classified as square/flat, V-bow, or spoon bow, and the bottom hull planking could be either cross, diagonally, or longitudinally planked. Great Lakes scows also made use of a chine log and king posts. As a class, their dimensions and designs varied from region to region. The following regional context defines common scow characteristics and regional variations, attempts to determine their significance within a regional framework, and serves as a detailed guide for scow site identification and significance assessment.

SECTION ONE
Introduction

Scow schooners were vital to many small communities around the Great Lakes, connecting them with regional markets through the lakeshoring or intra-lake trade. As conventional 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 scow, on the other hand, was well-suited to shallow harbors. Offering inexpensive transportation, the scow schooner became the life-blood of many lakeshore communities and immigrant families, providing an entry point into the Great Lakes maritime trades as sailors, masters, and vessels owners.

Scows were used in large numbers throughout North America, wherever there was a need for low-cost, shoal-draft maritime transportation. Scows saw use along the Atlantic Coast from the Maritime Provinces to Mexico, all around the Great Lakes, the Gulf Coast, San Francisco Bay, and on nearly every river large enough for small craft (Chapelle 1951; 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). 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 scow schooners ran aground, they were easier to refloat and less likely to sustain damage than conventional sailing craft. They were also a very stable craft able to carry large cargoes, relative to their size.

Little recorded information has been discovered for colonial era flat-bottomed craft. Considering that planked canoes and scows were the easiest boats to build with the least skill, scows became numerous in the New World by 1670. Nearly every coastal or lakeshore community used the scow or some other form of flat-bottomed boat (Chapelle 1951). 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). 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 soon expanded into the western lakes (Inches and Partlow 1964). 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; Martin 1991).

Other North American regions imitated 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 Australian and New Zealand scows were descendants of those of the Great Lakes. New Zealand's first scow was reportedly built in 1873 and named *Lake Erie*, followed by the *Lake Superior* in 1875, and the *Lake St. Claire* and *Lake Michigan* in 1876 (MacGregor 1982; Hawkins 1987). 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.

SECTION TWO
Scow Schooners and the Western Great Lakes Economy

A simple, yet comprehensive definition of lakeshoring is difficult. Nineteenth-century authors of Great Lakes maritime commerce frequently glossed over sailing vessels, devoting most of their efforts to new steam technology that was expected to 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 some 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 scow schooner survived this entire period despite increasing competition 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, especially for their value. This adaptability required these vessels to frequently change routes and cargoes, making a simple description of their trade difficult. As more information is uncovered on this maritime subculture, it will continue to become easier to understand the scow schooner's role in lakeshoring.

Despite its survival into the twentieth century, lakeshoring was often neglected by maritime authors and journalists. 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, scows 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 lakeshorers operated is lost to us today. Bits and pieces are all that remain to reconstruct the life and times of the small lakeshorers that were vital to many Great Lakes communities.

SECTION THREE
Scow Schooner Typology

The term "scow" refers to hull form rather than 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 or bilge. They more closely resembled a barge than typical 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 the sides met. As in other regions, there was wide variation in Great Lakes construction techniques, and the term "scow" was used to describe a 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 regular-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).

Hull Construction

Despite occasional disputes over identification, scows have several unique characteristics which can be used to differentiate them from conventional vessels. These traits are most easily understood when analyzing the hull. Scow hulls are boxy with a flat bottom and vertical sides, connected by a hard chine, or a nearly ninety-degree angle at the bilge. Conventional sailing vessels, whether flat-floored or with deadrise, possessed a soft chine, or a smooth, rounded edge.

Figure 1. Various scow bow structures (Loudon Wilson).

Scow construction varied from hull to hull and 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 bow (Labadie and Herdendorf 2004).

Martin 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 clearly defined category for hulls not clearly exhibiting an angular bilge, but flat-bottomed enough to be considered scows by contemporaries (1991). 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". This model illustrates the large variation within the scow vessel type, but may be over-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 line where the bow meets the 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.

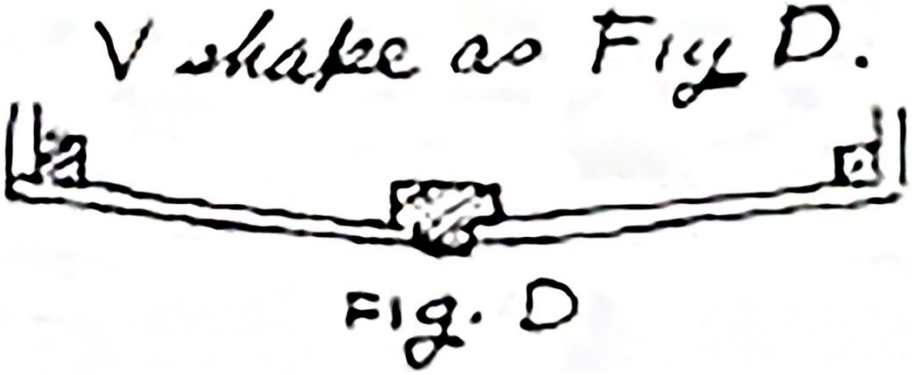

Figure 2. Cross section of a scow with a shallow V–shape bottom (Loudon Wilson).

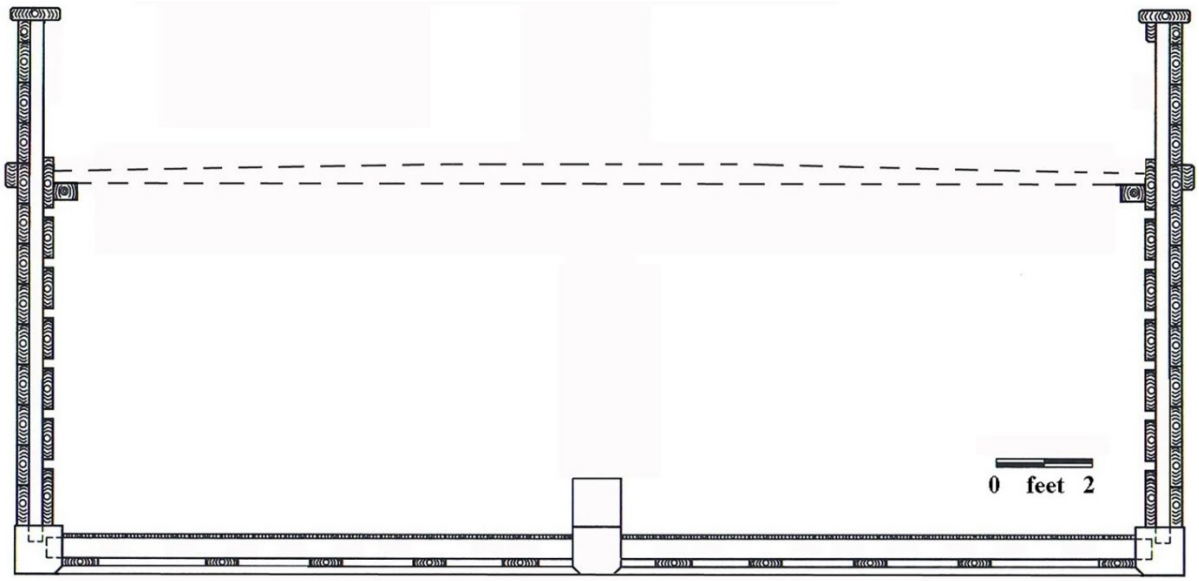

Figure 3. Cross section of a "perfectly flat" scow hull bottom (Wisconsin Historical Society).

Scow bottoms could be longitudinally, cross, or diagonally planked. Longitudinally planked vessels were constructed in a method similar to traditional hull construction, while the latter two methods (cross and diagonally planked vessels) required nontraditional framing. Hull sides were also subject to variation, from the traditional frame-on-plank construction to the scow-specific gunwale or "gunnel-built" sides. Gunnel-built scows were constructed with thick longitudinal hull planks, edge-bolted with "treenails" or iron drift bolts that ran through two or more side planks (Inches and Partlow 1964). 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 typical of conventional hulls. Gunnel-built planking averaged four inches thick in vessels of sixty to ninety feet in length.

Inches and Partlow suggest that gunnel-built construction, with few, if any, frames, was one characteristic common to nearly all Great Lakes scows (1964). Notched frames, intended to bear the floor, were a distinctive trait of San Francisco scows. In this design, frames were spiked and bolted to floor timbers (Olmsted 1988: 68). No other American scows are known to be built in this manner (Olmsted 1988: 68).

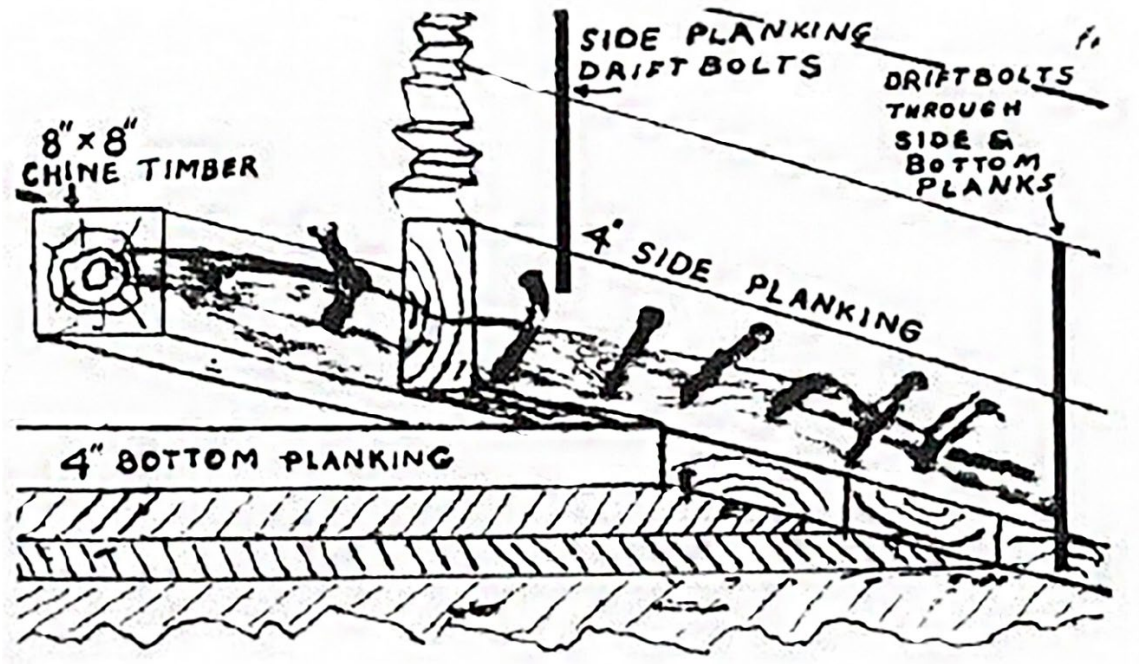

Figure 4. Sketch demonstrating how a chine log was fitted to the bottom and sides of the hull by Chester J. Partlow (Loudon Wilson).

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. Because the scow's hard chine was a potential weak point in the hull, the joint was strengthened through the incorporation of a heavy longitudinal timber, known as a chine log. These six to eight-inch square stringers were the principle framing members of the hull, fitted along both the port and starboard sides for the entire length of the bilge (Inches and Partlow 1964).

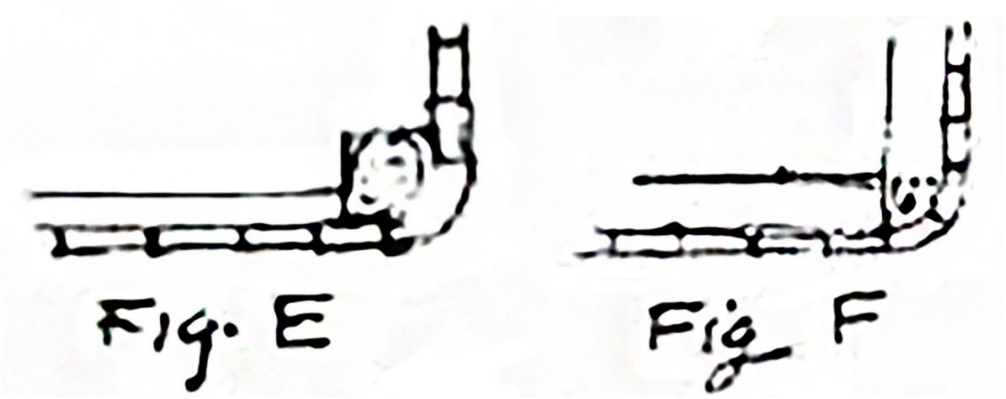

Figure 5. Two styles of scow chine construction (Loudon Wilson).

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 simply more economical to build and maintain (Labadie and Herdendorf 2004; Inches and Partlow 1964). 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 European-influenced shipbuilding skill, the type and quality of construction materials available, and available funding.

Rigging

The rigging of a scow determined if the vessel was a scow 'schooner' or scow 'sloop'. The rigging can shed light on details relating to the vessel's use and on certain aspects of a ship's construction. Because many scows had various purposes, some were stripped of their rigging later in life or never fitted with rigging at all. The rig of scow schooners, at least in San Francisco, was reportedly very uniform (Olmstead 1988: 72). While rigging is less extant through the archaeological record, historical images allow us to analyze the common rig used on scow schooners. This consisted of a main topsail set over three lower sails. Standing rigging was normally made up of eight shrouds, equipped with "deadeyes and lanyards, a mainstay, springstay, headstay, forestay, and bobstay" (72). *Alma*, the last scow schooner still sailing, affords the opportunity to see how variations were made in San Francisco scow schooner operations to accommodate for a large load of cargo, stored above deck.

Regional Variation

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 had 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). 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 hull into compartments. Centerboards

were not as common as on the Great Lakes but drop keels and pivoting centerboards were sometimes used (Hawkins 1987).

San Francisco's scows closely resembled Great Lakes built scows, but they exhibited a substantial amount of variation in construction and hull forms. San Francisco vessels had both longitudinally and cross-planked hulls, but the latter was less common. Longitudinally-planked hulls were framed similarly to conventional vessels, with transverse floors scarphed into frames at the chine, precluding the need for a chine log. Interior, or ceiling planking was usually longitudinal, as was as the outer planking on both the bottom and sides of the hull.

Cross-planked scows were of an entirely different construction, called "log built" in local Great Lakes vernacular. These vessels used several longitudinal keelsons with a heavy outer hull and interior ceiling planking that was edge bolted. The sides were sometimes stiffened with widely-spaced frames. The most noticeable difference between longitudinally and cross-planked vessels was the angle of the bow and stern ramps. Longitudinally-planked vessels required steaming the bow and stern hull planks, which resulted in 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).

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; Inches and Partlow 1964; Kristiansen 1981; Olmsted 1988). Despite how seaworthy a scow may or may not have been, insurance companies held little faith in the scow's durability, 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).

Great Lakes

Typical scow construction on the Great Lakes consisted of athwartship planking, use of a chine log, and a keelson structure. Most Great Lakes scows also had a centerboard, king posts for side hull support, and cross-planked stern and bow ramps. Many of the Great Lakes scows noted in the archaeological record had either a spoon bow, if they were smaller or of average size, or a V-bow, if they were larger than average, and were often home-built by the immigrants and working class that owned and sailed these vessels. The main cargoes of Great Lakes scow schooners were lumber and stone. For comparative purposes, this analysis is organized by the state in which these shipwrecks reside.

North American Inland Rivers

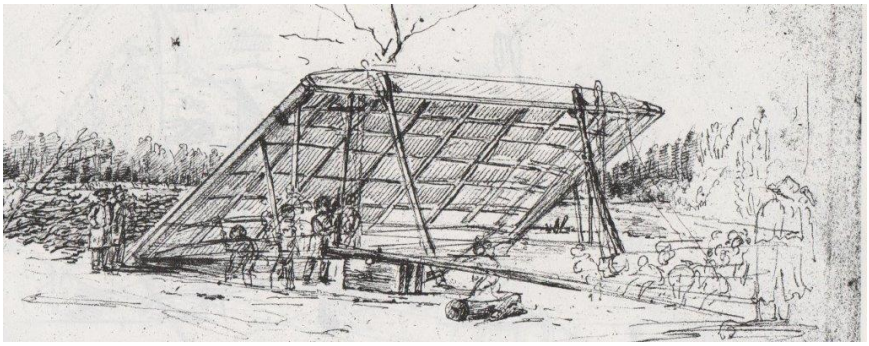

Figure 6. Wabash scow (C. Patrick Labadie Collection).

Historical documents name a scow-barge built for navigating inland waterways between the Wabash River villages and New Orleans. This scow was reportedly built upside down in the winter months in the early 1830s while the river was low and launched by rolling it into the water once the levels rose with melting snow and ice (Charles-Alexandre Lesueur 1816 – 1837).

New Zealand

Figure 7. A New Zealand-type scow, *Moa* underway (Auckland Museum).

Scow schooners were especially useful to the New Zealand economy for their ability to transport cargo despite the changing tides and narrow estuaries. The flat-bottomed vessels were able to beach when the tide went out and resume duties immediately upon its return, a feat that surely aided in productivity of maritime trade in New Zealand. The first New Zealand scow was built in 1873, and the last around 1935 (The Jane Gifford Society; Johnson 1987). Scow size grew

around 1880. By the turn of the century scows were known to be the "workhorses of the timber industry" (Johnson 1987: 113). While it has not been confirmed, one reason that cargo of New Zealand scows was ordinarily carried on deck could have been to avoid harbor charges.

Because of this, the tonnage of a scow was much less than other vessel types, as were their harbor charges (Johnson 1987: 114). New Zealand scows were believed to have reached a "high state of perfection" (Hawkins 1965). While not widely written about in historical records, the heritage ketch-rigged scow *Ted Ashby* was built in what is reported to be a traditional method: upside down on a rolling cradle (New Zealand Maritime Museum).

In New Zealand, net tonnage was charged based on enclosed cargo space, of which the New Zealand scows had little- they did not require cargo space because they carried their cargoes on deck.

San Francisco Bay

Over 400 scow schooners were reportedly constructed around the San Francisco Bay area (San Francisco Maritime National Historical Park). While similar to the scows of the Great Lakes and New Zealand, San Francisco scows were adapted to local conditions and sometimes referred to as 'Square-Toed Packets' (Olmstead 1988: 15). Though they spent a large portion of their time hauling hay, coal, oyster shell, and other cargoes, San Francisco scow owners traditionally sailed their scows to Paradise Cove for family picnics in the spring (San Francisco Maritime National Historical Park). Scows were sometimes rented out in the evening for "dancing and drinking" on the bay; these excursions were known as "drownding parties" (San Francisco Maritime National Historical Park). Unlike the cost-driven needs of Great Lakes scows, San Francisco scow operators made wages that were sometimes higher than offshore crews, due to the specialized jobs they were able to take on (San Francisco Maritime National Historical Park).

Hay scows, as they were called, undoubtedly played a role in expansion and operational needs of the West Coast. These scow schooners were particularly adapted to carry an exceptional amount of bulk cargo, relative to their size. Hay scows were often equipped with a wheel mounted to a pulpit that was moved up or down, which allowed the helmsman to see over many stacks of hay.

Hay scows were reported to have had "almost no sailing competition", as the sharp-bowed schooners of San Francisco were not as well adapted to carry such cargo in tight spaces, like the infamously bustling Hay Wharf of San Francisco Bay. The hay transported by scow schooners served to feed livestock across California at a time when livestock was essential to daily life. The bulk cargo carried by hay scows was said to be the "most characteristic, if not the most important" cargo of scow schooners of San Francisco (Olmstead 1988: 27).

It was said that most San Francisco scow schooners "worked the tides" once outside of San Francisco Bay (San Francisco Maritime National Historical Park). If a fixed object, such as a tree, was located in a favorable position on shore, a line would have been run around the object and back to the ship's windlass, where the crew would then hand-pull the scow upstream, when necessary. When the channels were too shallow or there were no suitable objects to tackle, a

navigating pole would sometimes be used to drag the scow upstream by hand (San Francisco Maritime National Historical Park).

It is written that most San Francisco scows were owned by their captains, but unlike Great Lake scows, it was not uncommon for one captain to own many scows (Olmsted 1988). On the Great Lakes, scows were seen as an economical solution for marginalized communities, like immigrants, while San Francisco scows were a profitable solution to the inland communities that needed bulk cargoes in order to survive. Because of this, San Francisco scows produced fair profits and became a smart business investment. San Francisco's four largest scow operations, each of which owned upwards of a dozen scows (Olmsted 1988: 30). This is far from the 'working-man's' vessel that scows on the Great Lakes were thought to be. The crewman of a San Francisco scow were often immigrants; the owners often were not (Olmsted 1988: 45). Most local scows were regarded as "well-built and maintained" by highly skilled shipbuilders (Olmsted 1988: 24).

Figure 8. A San Francisco-type scow, *Annie L*. (San Francisco Maritime National Historic Park, National Park Service).

Insurance Ratings

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) categorized scows with barges and even described them as "of unseaworthy form."

SECTION FOUR
Analysis and Comparison of Known Scow Schooners

The wrecks contained in this analysis reside beneath the waters of Lake Michigan, Lake Erie, Lake Superior, New Zealand, and San Francisco Bay; they represent scow schooner construction from throughout the Great Lakes region, and their construction dates span from the early and mid 1800s to the turn of the century. These wrecks were also chosen for analysis due to their extensive representation in the historical and archaeological record. With very few records of scow schooners that are still afloat, the archaeological record is often the only tool available with which to understand these vessels. The following analysis is based on data gathered from a compilation of field notes, National Register of Historic Places documentation, archaeological field reports, photographs, and video footage captured with a Remotely Operated Vehicle (ROV).

Although many different trades made use of scow schooners, the majority of goods transported were bulk cargoes such as lumber, stone, salt, gravel, livestock, hay, groceries, and coal. Each of these trades had specific components useful for vessel construction, but many scows were used by different industries and companies throughout their careers. Although scow schooners were built in similar ways by region and contained many of the same modifications to their hull shape, rigging, and other attributes, most scow schooners were not built to drawn plans. Today, little documentation exists that illustrates how these unique vessels were constructed including details of the nuances of differing hull lines, construction techniques, and adaptations to bulk cargo needs. Each scow had its own unique combination of construction and rigging details dependent on cost, intended use, builder's knowledge, material availability, and region. Historical analysis of enrollment records, shipping records, and photographs can reveal common general trends in shipbuilding techniques and design modifications, but a more in-depth analysis of how these mechanisms worked requires additional information.

Archaeological analysis and comparison of known scow schooner wreck sites helps to answer questions about the specifics of scow features on the Great Lakes and how they differed from scows around the world.

Great Lakes Scow Schooners

<u>Wisconsin</u>

Alaska (1869-1890)

Partially covered by sand off of the southern end of Point Beach State Forest, Town of Two Rivers, Wisconsin, the scow schooner *Alaska* lies in 5 feet of water on the bottom of Lake Michigan (Kiefer, Thomsen, and Zant 2015). The vessel's bow, deck machinery, centerboard trunk, some rigging implements, and much of her hull structure remain intact on the site beneath the shifting sand.

A search of Wisconsin Historical Society's shipwreck database, generated from historic newspaper accounts for vessels lost in the area, revealed that several scow schooners went

missing and have not yet been accounted for in the vicinity of Two Rivers (Kiefer et. al 2015). The scow *Speed*, lost in 1894, measured 59.5 feet in length with a 16.9 foot-beam, and the *Libby Carter*, which was lost in 1907, measured 62.3 feet overall with a 17.9-foot beam, were both too short and narrow to match the Point Beach wreck. The scow *Milton*, lost in 1885 measured 101.9 feet in length with a 24-foot beam, and the *Nellie Church*, lost in 1855 measured 99.7 feet in length with 24-foot beam, were both too long and wide. The only other vessel that matched the measurements of the wreck was the *Mary Ann Scott*, which measured 90 feet long with 22.7-foot beam. This vessel was stranded and abandoned in November 1875 two miles north of Manitowoc more than seven miles from where the Point Beach wreckage was actually located. This left *Alaska* as the only remaining unaccounted vessel loss in the vicinity of Rawley Point and a close match for dimensional measurements (Kiefer et. al 2015).

The scow schooner *Alaska* was constructed under the hand of Master Ship Carpenter Smith Neville, Sr. at Sheboygan, Wisconsin, and launched on 18 June 1869. Smith Neville, Sr., a shipbuilder by trade, began his career in Cleveland, Ohio before moving to Sheboygan sometime in the mid-1860s. The *Alaska* was built for Sheboygan businessman Adolph Hoechner primarily for use in the lumber trade and co-owned with the ship's Master C. Kleiver. Hoechner built ships until his death in 1872. At the time of *Alaska*'s registration, the boat was described as a wooden scow schooner with one deck and two masts, a gross tonnage of 85 14/100 tons, 89.6 feet in length, 19.3 feet in beam, with a 6.4-foot depth of hold (Bureau of Navigation 1869).

Alaska changed owners and masters for the next ten years. On 23 March 1879 she was blown ashore on Twin Rivers Point (Rawley Point) in a storm. She remained ashore while attempts were made to repair and remove the vessel from the beach that spanned the next two-year period. She was ultimately abandoned in June 1881 (Kiefer et. al 2015).

Figure 9. The port side bow of *Alaska* (Wisconsin Historical Society).

The *Alaska* has a boxy, spoon-shaped bow with athwartship planking. To the outside of the bow frames, the vessel's bow ramp appears flat and athwartship planked. King post hull construction was noted. The king posts measured 0.4 feet sided and 0.4 feet molded. Structural members of the vessel's floor, possibly the vessel's chine stringers, located outbound of the stringers that would have rested alongside the chine, measure 0.6 feet wide by 0.8 feet thick on the port side and 0.8 feet square on the starboard side. The difference in measurements could likely be the results of the vessel's extensive repairs. Several pieces of athwartship bottom planking were observed beneath the stringers (Kiefer et. al 2015). The centerboard trunk was badly damaged; it is unclear if it was deployed at the time of sinking.

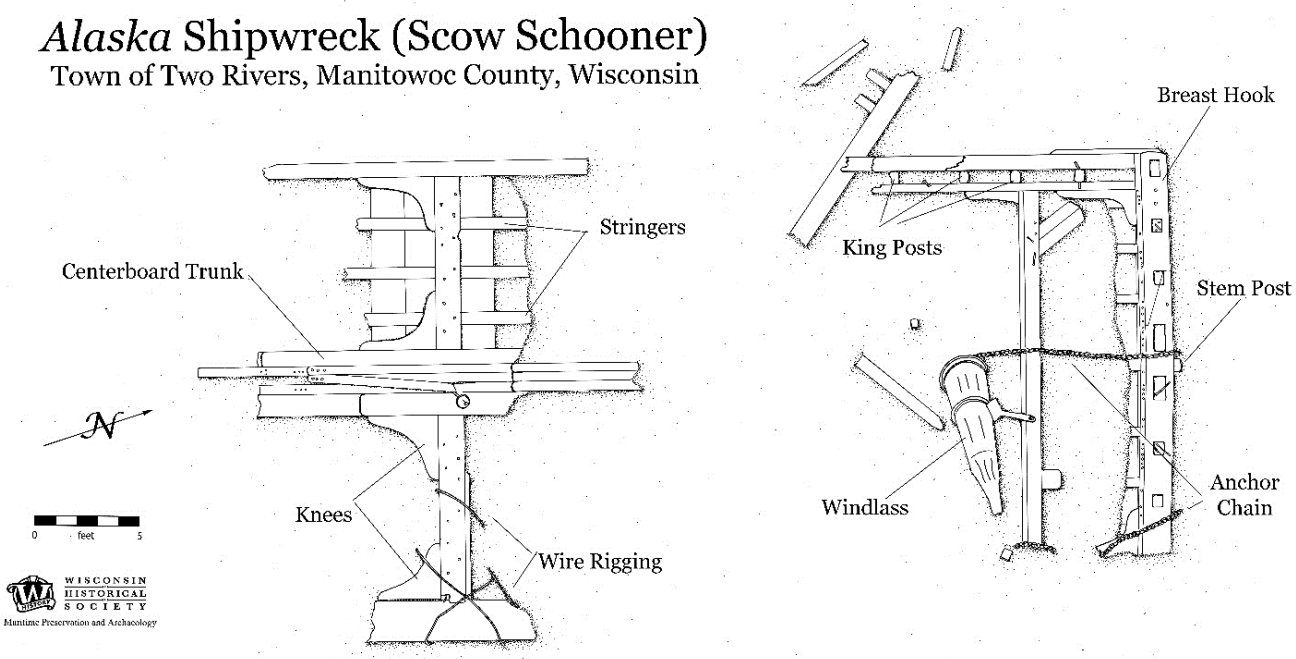

Figure 10. Site plan of the scow schooner *Alaska* (Wisconsin Historical Society).

Alaska is of comparable size and design of many Great Lakes scow, noticeable in her king post hull design, spoon-shaped bow, and overall size, *Alaska* would have been fairly typical of a Lake Michigan cargo carrier, intended to service shallower ports. All measurements seen in the ship construction are very uniform, indicating that *Alaska* was built by a skilled builder and was not built on a frugal budget, which was the case with many scows of the Midwest.

Dan Hayes (1868-1902)

The scow schooner *Dan Hayes*, located in less than 10 feet of water off of Sturgeon Bay, Wisconsin, in what was originally known as McCracken's Cove, was listed as having three masts and a length of 112.1 ft (Rodgers and Corbin 2003: 7).

Dan Hayes was built at Hayes & Fountain shipyard by R. Hayes in Fairport, Ohio. Launched in 1868, the ship spent her early years hauling lumber for lumber merchant Theodore Consaul of Milwaukee. In 1882 the scow schooner was converted to a barge. *Dan Hayes* was repurposed to

haul stone in 1900, by new owners Graef and Nebel Stone Company of Sturgeon Bay, Wisconsin. On 6 August 1904, *Dan Hayes* was loaded with a cargo of stone for delivery in Menominee, when the tug *Duncan City* came to take the scow in tow. the scow was leaking so badly they deposited her near the Graef and Nebel quay in McCracken's Cove in Sturgeon Bay and allowed her to sink.

The *Dan Hayes* had a bent bow, with the planking forming a 'V' shape (Rodgers and Corbin 2003: 8). The *Dan Hayes* has a cross-planked bottom, with planking that is 2 in. thick, and with longitudinal ceiling planking, of 1.5 in. in thickness (Rodgers and Corbin 2003: 10-13). The sides of the *Dan Hayes* are fastened at a 90-degree chine, allowed by the presence of a chine log. The chine log accepts the king posts, spaced at 2 ft. intervals, as well as the cross keelsons (Rodgers and Corbin 2003: 12).

Cross, or athwartships, keelsons are mortised into the keel. The cross keelsons are fastened with iron treenails or drift pins driven through the bottom of the ship, suggesting that the *Dan Hayes* was built in sections before being inverted and attached together (Rodgers and Corbin 2003: 9). The site did not have a centerboard trunk or chainplates, leading archaeologists to wonder if the *Dan Hayes* was rigged with masts and sails before being repurposed, or if it ever sailed at all (Rodgers and Corbin 2003: 10).

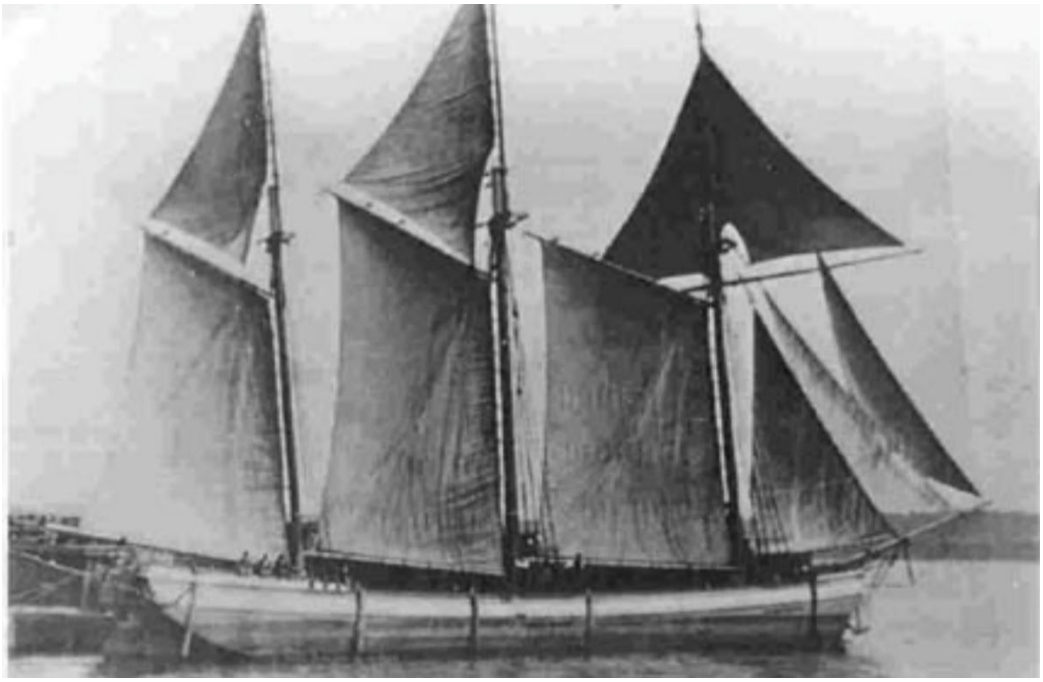

Figure 11. Historic image of *Dan Hayes* under sail (C. Patrick Labadie Collection).

One piece of evidence that supports the idea that the *Dan Hayes* was, in fact, repurposed, is the pockets found in the keel for a set of discontinued cross keelsons, or half keelsons. This pocketing may be due to the initial presence of a centerboard trunk, which would have required half keelsons in order to fit (Rodgers and Corbin 2003: 10). Presence of a centerboard trunk would have been useful if *Dan Hayes* had sailed, but if it had been repurposed and towed in a line, the centerboard trunk would require space that could better be used to carry cargoes.

Figure 12. Orthomoasic of the *Dan Hayes* site (Tori Galloway).

Like the *Traveler*, as well as other historical records of scow-building on inland rivers (see page 51), evidence gathered from the *Dan Hayes* supports the idea that some scows were built in pieces and sometimes upside-down, before being inverted and attached together (Olmsted 1988: 71; Rodgers and Corbin 2003: 13). Although this method is not well understood, new accounts may continue to appear with the discovery of additional historical or archaeological data.

Forest (1857-1891)

Located at the northwestern end of Pilot Island, the remains of the scow schooner *Forest* rest in 20 to 50 feet of water along with the remains of *A.P. Nichols* and *J.E. Gilmore*. All three vessels stranded on Pilot Island and pieces of the wreckage now lie scattered on the sand and gravel lake-bottom. At the time of her registration, *Forest* was described as a scow schooner with one deck and two masts with a length of 87.6 feet. *Forest* was documented in 1988 along with the other two vessels located at Pilot Island (Cooper 1989). Due to the fact that the remains of all three ships lie scattered on top of each other, identifying which structural pieces belonged to which ship was challenging, however, the unique characteristics of scow schooners allowed the remaining pieces of *Forest* to be more easily identified.

Forest was built in Newport, Michigan by David Lester in 1857. Over the winter of 1879 – 1880, the vessel was rebuilt and lengthened, and her rig changed from two to three masts, with a new length of 115.6 feet. Prior to her wrecking on Pilot Island, Forest was driven ashore at Newport, Wisconsin while loaded with lumber at the lumber pier. In the late winter of 1882, the vessel was refloated and continued in service until October 1891 when the vessel was stranded on the reef southwest of Pilot Island during a gale. The vessel remained onshore, wedged on the rocks slowly broken up by wind and wave action (Cooper 1989).

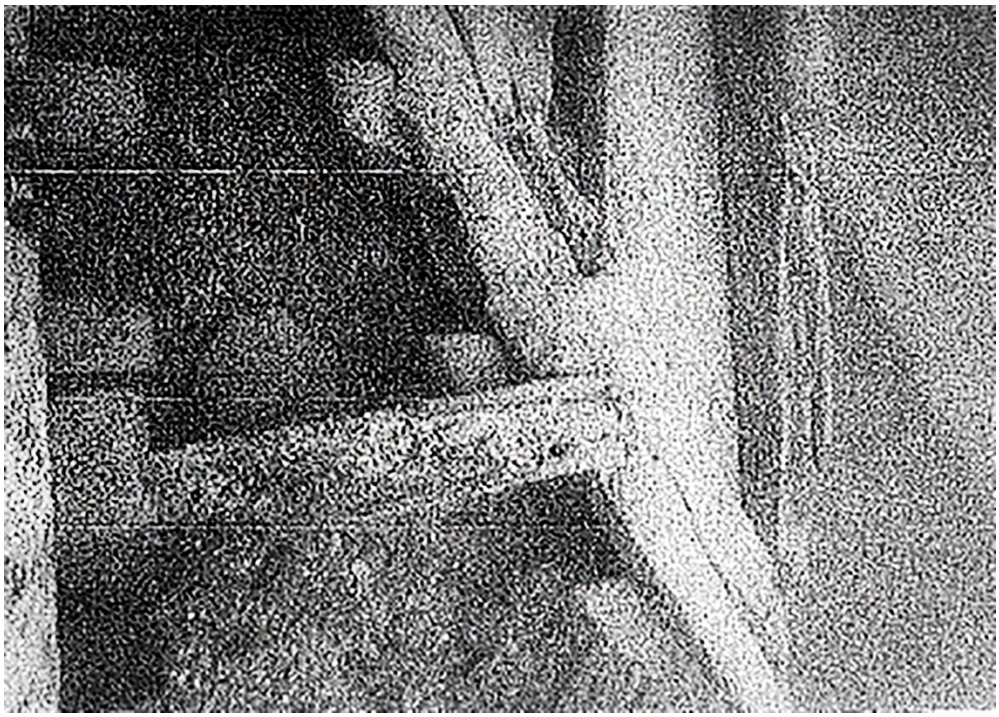

Figure 13. Image of *Forest*'s port side bow construction (Wisconsin Historical Society).

The remains of the *Forest* consist of only the 107-foot-long port side hull. The vessel's bow ramp is easily identified along with remains of the vessel's bulwarks and frames. Unlike traditional Great Lakes built scow schooners, *Forest* was built with a series of double frames, much like traditional built schooners, instead of king posts spaced throughout the length of the ship. *Forest*'s frame sets measured 0.8 feet in overall space, with each futtock measuring 0.3 feet and 0.35 feet wide near the bow and 0.4 feet and 0.52 feet wide near the aft end of the hull section. Each frame set has a moulded dimension of 0.4 feet. Near the vessel's bow ramp, there are three preserved single frames which measure 0.58 feet to 0.63 feet in space (Cooper 1989).

The vessel's deck clamp measures 1.79 feet wide and 0.3 feet thick, with a deck shelf fastened over it. Three ceiling planks remain attached to the frames below the deck shelf, and measure 0.92 feet wide. The ceiling, shelf, and clamp are fastened with drift bolts that measure 0.06 feet in diameter. This construction method is typical of many gunnel-built scows, although no evidence of a chine log was mentioned on the site. Single bulwark stanchions, measuring 0.4 feet square, extend above the deck shelf (Cooper 1989). Other scows that were built with double frames, such as *Success*, tended to be through bolted like traditional schooners. No evidence of the bottom hull of *Forest* was located on the site, so it could not be determined if the vessel was longitudinally or cross-planked.

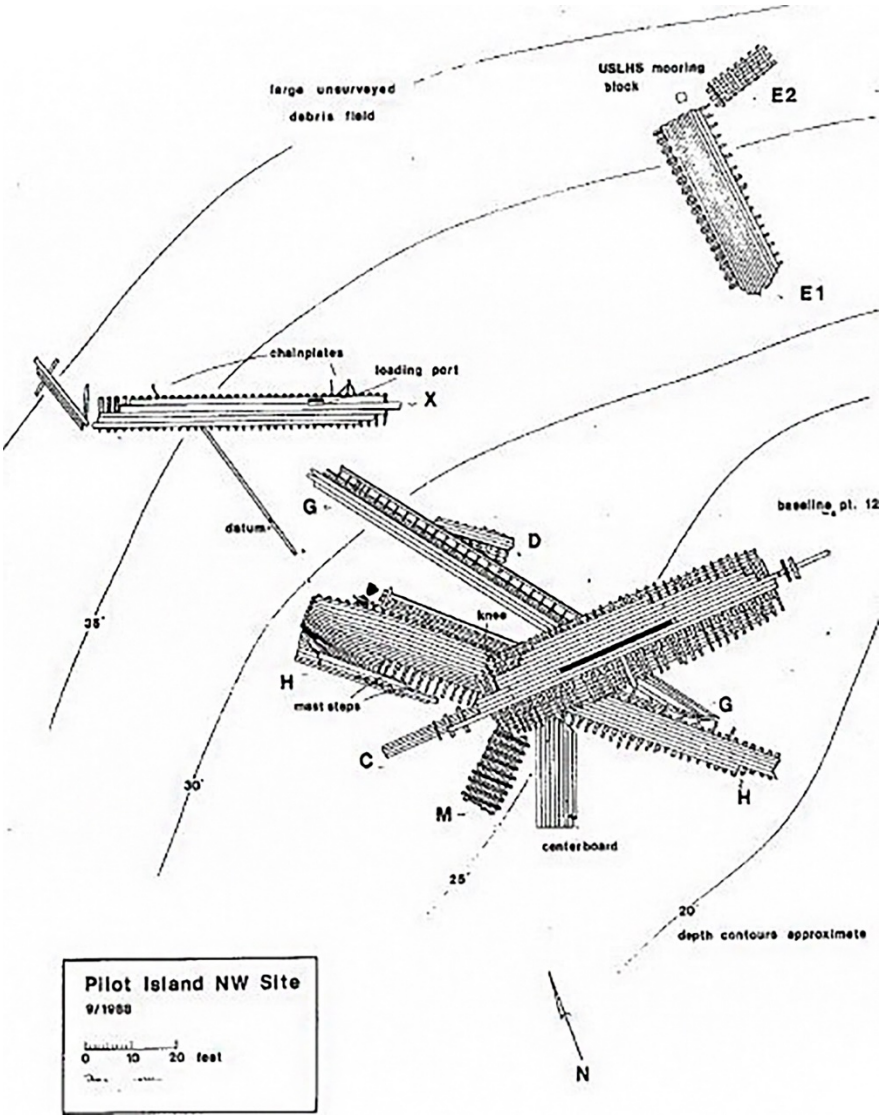

Figure 14. Site plan for the Pilot Island site, with *Forest*'s hull piece highlighted (Wisconsin Historical Society).

I.A. Johnson (1867-1890)

Located 4.4 miles northeast of the Sheboygan, the remains of the wooden scow schooner *I.A. Johnson* rest in 93 feet of water. At the time of her registration, *I.A. Johnson* was described as a wooden scow schooner with one deck and two masts, and a length of 83.8 ft (Bureau of Navigation 1867). *I.A. Johnson* was built in 1867 by J.A. Johnson in Dover Bay, Ohio for Thomas Russell, Jr. of Euclid, Ohio. Very little is known about J.A. Johnson or his shipyard although it is known that *I.A. Johnson* was not the only ship he built. Johnson also constructed the 96-foot two-masted scow schooner *Magdalena* (1865) and the 108-foot two-masted scow schooner *R.H. Becker* (1867) (Kiefer et al. 2018).

In 1885 *I.A. Johnson* was purchased by C.B. Freyberg & Bros. The Freyberg brothers, who were especially important in their impact on Great Lakes maritime industry, were influential in Wisconsin's lumbering trade, and owned many businesses on Washington Island. This industry fueled *I.A. Johnson*'s workload, and most trips made during this time were either for hauling lumber from Washington Island, or on return trips, for hauling groceries back to Washington Island in order to stock the Freyberg's grocery store (Kiefer et al. 2018). *I.A. Johnson's* design was obviously effective at hauling lumber and most other cargoes of the *I.A. Johnson* did not require a specific build or design features.

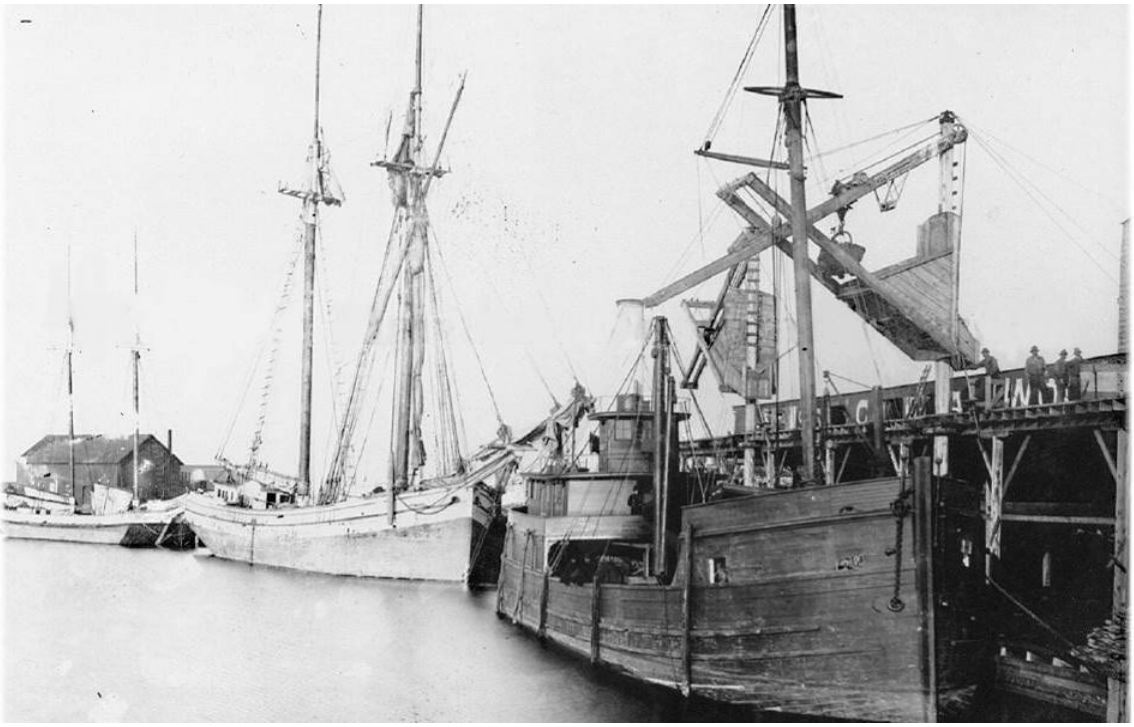

Figure 15. The scow *I.A. Johnson*, schooner *A. Boody* and steamer *Mary Pringle* at dock in Sheboygan, Wisconsin, 1880 (Wisconsin Maritime Museum, Carus Collection)

While it is not uncommon among Great Lakes scow operators and owners, the Freybergs were immigrants. Of German descent, the Freyberg brothers, of which there were five, successfully founded many businesses and managed successful industry on Washington Island, in Door County, Wisconsin. Scow schooner industry on the Lakes was commonly manned by working class and immigrant populations, which created work for those that were skilled in manual labor, and essentially helped build the Midwestern United States as we know it today (Portrait and Biographical Record 1894; Kiefer et al. 2018).

On 22 September 1890, *I.A. Johnson* was struck on the port side bow by the schooner *Lincoln Dahl* while sailing with a light cargo of merchandise for Washington Island, Wisconsin. The vessel was taken in tow by the stern, but the vessel's transom could not take the stress and separated from the hull, causing the ship to sink quickly to the bottom.

In addition to the rich historical record, *I.A. Johnson* is unique to this analysis through the archaeological record. The site as it sits today is intact, in terms of preservation, but the ship is

relatively deconstructed in its parts, due to the wrecking event. In this sense, we are able to understand the way that specific joints and hull components fit together in ways that are not visible on more complete shipwrecks. At the same time, the condition of these parts are well-preserved, making *I.A. Johnson* especially useful when trying to understand common design features of the scow schooners of the Great Lakes.

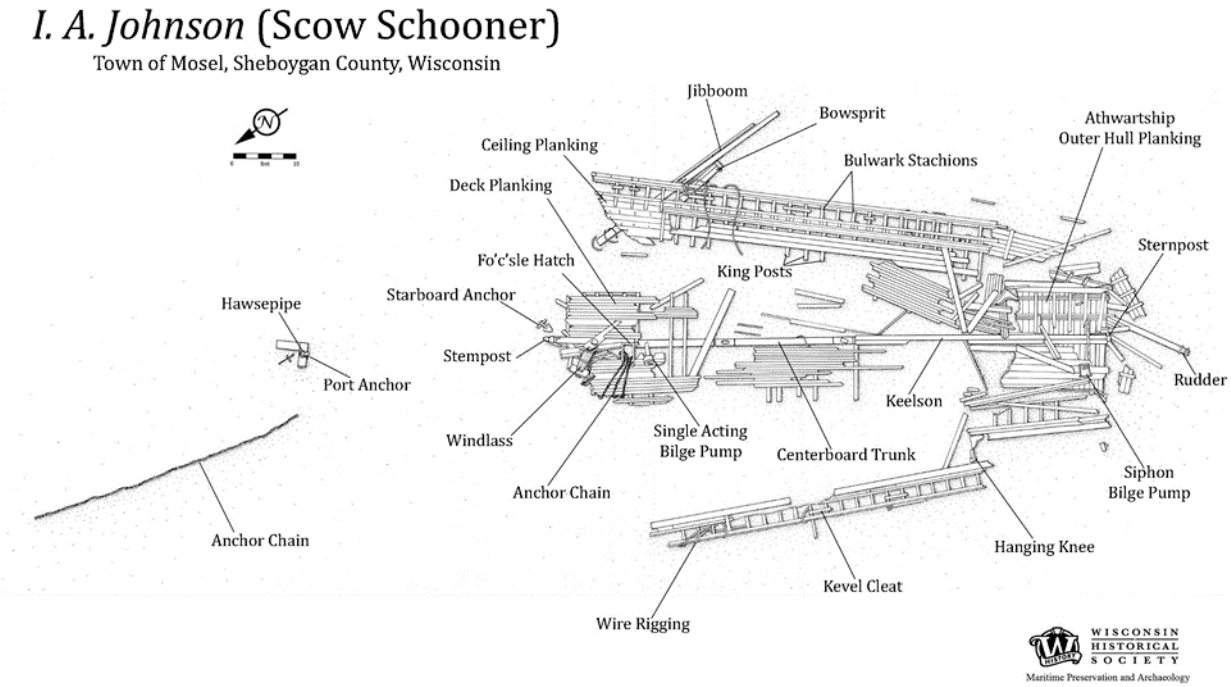

Figure 16. Site plan for the *I.A. Johnson* (Wisconsin Historical Society).

Through the archaeological record, we see that the stempost rises 11.0 feet off the sand, with a 30-degree list forward slant (Kiefer et al. 2018). This is a close approximation to the incline of the bow ramp. The vessel is cross-planked with a spoon bow, like many contemporary scows. The lower portion of the vessel's bow remains intact and features cross-planked (athwartship) planking on its bow ramp that extends out from the stempost. Each plank measures 1.0 feet wide, which is similar to many other scow schooners of the Great Lakes (Kiefer et al. 2018).

When the *I.A. Johnson* crashed into the sand and clay bottom of Lake Michigan, both the port and starboard sides of the vessel broke just above the square turn of the bilge. Both sides now lie outbound of the vessel. Most Great Lakes scow schooners were not constructed with individual futtocks arranged in frame sets, but instead were equipped with king posts that provided the vessel's vertical support. The sides are framed with single timber king posts that are planked over with ceiling and outer hull planks (Kiefer et al. 2018).

The starboard side is more complete, and evidence of the vessel's longitudinal hull planking can be seen near the bow section of the vessel. Although buried in the sand, it appears that the hull sides and bottom are joined with a chine log, which is mortised to accept the king posts. Bulwark stanchions are attached to the king posts, just below the deck shelf. These stanchions measure 0.4

feet wide and 0.5 feet thick, with 2.0 feet spacing. King posts measure 0.4 feet wide and 0.4 feet thick, with 2.0 feet spacing (Kiefer et al. 2018).

As is typical in scows, the vessel's keel and keelson structure lies within the bilge, allowing the vessel to draw a shallow draft, which facilitated the *I.A. Johnson's* work in shallow, near-shore waters. Due to the accumulation of sand in the vessel's hull, it was not possible to determine if the *I.A. Johnson* was equipped with any sister keelsons, but aft of the centerboard trunk, the keelson appears to have two rider keelsons sitting atop the keelson.

Figure 17. Flattened stern of *I.A. Johnson* showing cross planking and floor stringers/keelsons (Wisconsin Historical Society).

The bottom hull planking of *I.A. Johnson* is visible at the stern on both the port and starboard sides. The planks run athwartship, from the keelson and deadwood, to the sides of the hull, and are of two different widths. The planks of the stern ramp measure 0.8 feet wide, while the planks of the vessel's flat bottom measure 1.0 feet wide. As in most other Great Lakes scows, the vessel did not have athwartship floors and frame sets, but instead was equipped with longitudinal floor keelsons running parallel to the centerline. These were made up of three timbers, each measuring 0.3 feet wide. There were two sets of supports visible on the starboard side, that measured 0.9 feet in overall width with spacing of 2.2 feet. Single and double cross keelsons sit on top of these longitudinal timbers, extending from the keelson to the hull sides. As with floors and futtocks in traditional schooners, these cross keelsons support the ceiling planking. On the stern ramp, these are single timbers measure 0.4 feet wide with 1.8 feet spacing. Forward of this, cross keelsons appear to be doubled, with each timber measuring 0.4 feet wide, and 0.8 feet over all (Kiefer et al. 2018).

I.A. Johnson's rigging seemed to be standard of Great Lakes scow schooners. Through historical and archaeological analysis, *I.A. Johnson's* build appeared 'standard' of Lake Michigan scows in her design and related cargoes.

Lady Ellen (1875-1897)

The *Lady Ellen,* which now rests partially submerged in the Ahnapee River at Algoma, Wisconsin, is explained as a scow schooner of one deck and two masts. *Lady Ellen* was built in 1875 at Ahnapee (Algoma), Wisconsin by Scottish shipbuilder, William Irving Henry. Henry remained her owner and Captain John McDonald, a first generation Irish-American was her captain. The *Lady Ellen* started out in the salvage business, from 1875 thru 1880. In late 1881 the vessel was lengthened and rebuilt at Algoma. Her new dimensions were: 61.1 feet long, 18.1 feet in beam, 5.45 feet in depth of hold, and 44.25 gross tons (Merchant Vessels of the United States 1881; Milwaukee Public Library; Meverden, Thomsen, and Carter 2012).

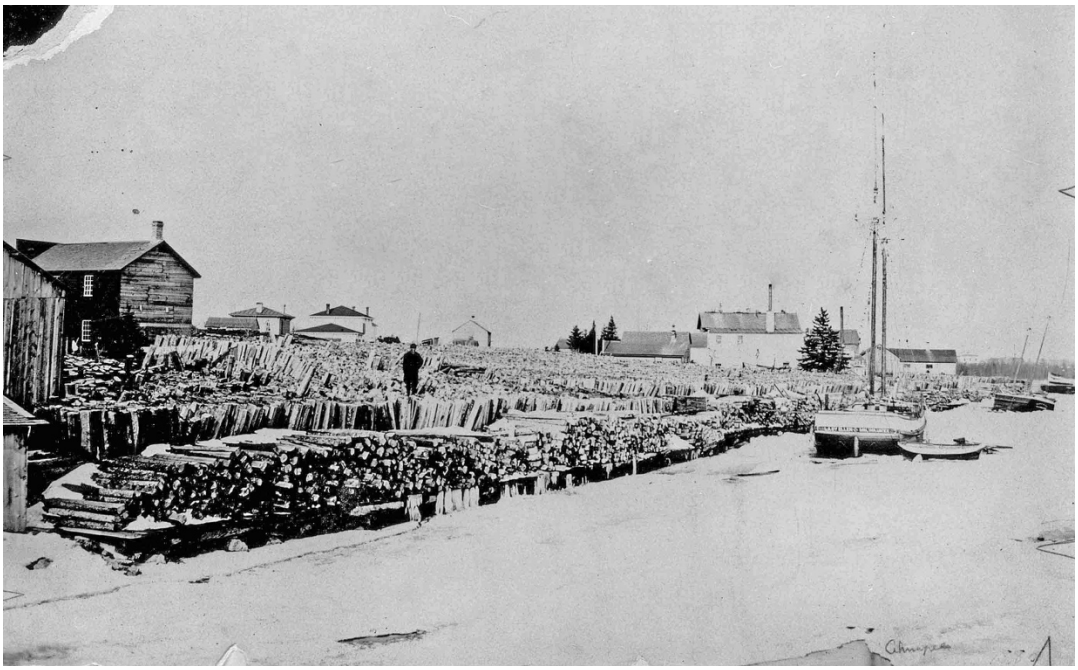

Figure 18. The *Lady Ellen* in the ice in the Ahanapee River
(Wisconsin Maritime Museum Collection).

Lady Ellen's small size made her even more useful to service unimproved lake ports, as she not only had a shallow draft, but also a relatively small length and beam (Thomsen and Meverden 2011a). The *Lady Ellen* spent most of her career servicing these small communities on Lake Michigan, a role that is apparent in her small design and construction. She carried cargoes of stone, lumber, wheat, Christmas trees, general merchandise, and building materials, although lumber and stone were by far the most numerous cargoes (Meverden, Thomsen, and Carter 2012). *Lady Ellen* undoubtedly made a great impact on the Sturgeon Bay Canal Project, for which she hauled many, many loads of stone. On 9 September 1897, Captain William Henry took command of the newly-overhauled schooner *Industry* and *Lady Ellen* was unceremoniously

towed up the Ahnapee River and abandoned in a slip between Second and Fourth Street, where she remains today.

Lady Ellen's sides are of traditional gunnel-built construction, consisting of longitudinal side hull planks 0.3 feet thick, edge-bolted together. The lower three planks of the port side are 0.8 feet, .85 feet and 1.2 feet in width from the turn of the bilge upward (Thomsen and Meverden 2011a). This could have been due to the fact *Lady Ellen* carried a relatively large amount of stone cargo over her twenty-two-year lifespan, or because Captain William Henry was a shipbuilder, which was relatively rare for Great Lakes mariners in charge of constructing scows.

The sides were reinforced with king posts, fastened to the inside of the hull. Several king posts are extant on the port side, each 0.5 feet thick by 0.3 feet wide, and spaced at 3.0 feet on center, fastened to the side with iron through-bolts. The bottoms come to an end flush with the bottom of the sides, indicating that a chine log was not used to reinforce the turn of the bilge. No evidence of fasteners for a chine log were located, but filler chocks would have been necessary to support the outboard ends of the ceiling planks (Thomsen and Meverden 2011a). The *Lady Ellen* is one of the smallest known scow schooners, which was clearly useful for plying the inshore waters around Lake Michigan. Even after being lengthened by four feet in 1878, *Lady Ellen* is still one of the smallest Great Lakes scows that has been archaeologically recorded (Meverden, Thomsen, and Carter 2012).

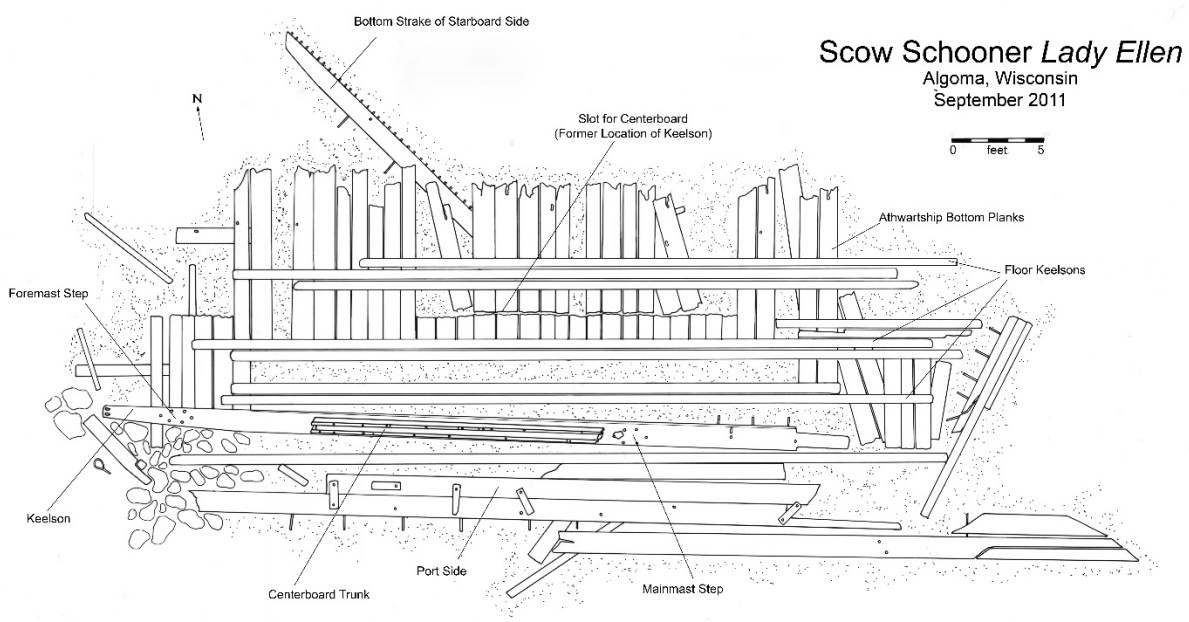

Figure 19. Site plan for the *Lady Ellen* site (Wisconsin Historical Society).

The vessel's centerline was reinforced on the bottom by a keelson that ran from bow ramp to stern ramp. It does not appear that the vessel utilized a keel. Instead, the athwartship bottom planks are continuous from bilge to bilge, except where the centerboard penetrated the bottom of the hull. Bottom planks sit flush with the outboard edge of the hull sides (Thomsen and Meverden 2011a). The ship's bottom was additionally reinforced by double bilge keelsons on

either side of the keelson. The lack of a keel and the thin, flat keelson indicate that the hull sides provided most of the vessel's longitudinal rigidity.

Lady Ellen's rigging seemed to be typical of that of a scow schooner, although numerous repairs were required, due to a number of unrelated circumstances. In 1897, when she had outlived her usefulness, *Lady Ellen* was abandoned in a slip in the Ahnapee River (Meverden, Thomsen, and Carter 2012).

Figure 20. *Lady Ellen* site at low water levels in Ahnapee River (C. Patrick Labadie)

Ocean Wave (1860-1869)

The *Ocean Wave* was built in 1860 as a two-masted scow schooner by Robert Chambers at Harsens Island, Michigan, for grocer George Fish and his partner John Abrams. 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 a unique eagle figurehead, rare for any Great Lakes vessel, especially a scow. For the first nine years of her service career, she was used to move groceries on the St. Claire River between Detroit and Algonac, Michigan.

On 16 April 1869 *Ocean Wave* was sold to Captain Fletcher Hackett of Milwaukee for use on Lake Michigan. On 23 September 1869, the *Ocean Wave* departed Mud Bay with 23 cords of stone consigned to a harbor improvement project at White Lake, Michigan. At 3AM the following morning, the *Ocean Wave* struck a deadhead or floating piece of wreckage. This holed the hull and the ship crashed to the bottom of the lake (Meverden and Thomsen 2006).

The *Ocean Wave* lies in 110 feet of water two miles off Whitefish Point, Door County, Wisconsin. Located after an accidental encounter with commercial fishing nets in 2004, the *Ocean Wave* was documented in 2005 (Meverden and Thomsen 2006). Much of the remaining hull structure above the turn of the bilge is broken into sections and scattered on the lakebed, but all hull sections are represented. The broken hull sections are opened up enough to allow a thorough documentation not possible on more intact vessels yet retain enough integrity to record important construction details.

The *Ocean Wave* possesses several construction quirks that may have resulted from a lack of construction materials or available funds, and others that tailored her to specific trades and cargoes. At the least, these anomalies made for an interesting vessel that had a character all its own, although they nearly cost the crew their lives.

Figure 21. *Ocean Wave*'s stern, looking forward (Wisconsin Historical Society).

Much of the transom and stern ramp's inner planking is missing. 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. Both the vessel's port and starboard sides have fallen outward from the hull. The exposed portion of the starboard side is longitudinally-planked with three visible planks (Meverden and Thomsen 2006).

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 2-3/8 in. thick. Remnants of a chine log are visible along a short section, but is

buried under several inches of dense sand, cargo, and hull structure. The lower outer hull plank joins the chine log 1-1/4 in. in from the log's inner edge. Side frames are not pocketed into the chine log, but rather are fastened inboard of the chine log. The chine log tapers at an angle towards the lower outside edge, with no visible evidence of how it fastened to the lower hull (Meverden and Thomsen 2006).

The 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. 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. Frame spacing 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 of the hull, but all bulwark stanchions are broken just beneath the covering board along the entire port side (Meverden and Thomsen 2006).

Ocean Wave's bow is cross-planked. There is no evidence of a hard chine-type edge between the bow and hull bottom. The bow curves towards the vessel's bottom with no visible transition.

Figure 22. Cross-planked bow of *Ocean Wave* (Wisconsin Historical Society).

The *Ocean Wave* appears to be constructed of whatever material was available for the least expense. This is evident in two locations. First, the foremast chainplates. All three starboard chain plates measure 2-1/2 in. wide. The port side 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 a single mast. A second question concerns 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 appropriate timber, with the builders closing the spacing near suspect timbers and widening where timber quality was assured (Meverden and Thomsen 2006).

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. Parts of the *Ocean Wave* demonstrate fine joinery, seen in the cabin that, despite capsizing and plowing into the lakebed, has survived, intact. Even steel vessels frequently lost their superstructure in the tremendous forces involved in sinking. It is obvious that the *Ocean Wave* was not spared these destructive forces, yet her cabin survived nearly unscathed, testament to her fine construction (Meverden and Thomsen 2006).

Figure 23. Orthomosaic of the *Ocean Wave* site (Tori Galloway).

Despite an expertise in woodworking skills, the shipwrights allowed one error in their construction that may have resulted in the *Ocean Wave's* quick descent to the bottom. Scows, with their flat bows, are vulnerable to frontal impacts. Unlike conventional vessels, with a fine entry that minimizes frontal impact, scows take the full force of impact straight on, resulting in greater damage. The *Ocean Wave* had one additional problem with her bow design: her outer hull planking ran over four frames before abutting the stem. The problem occurred where the outer hull planks met the stem, where there was no rabbet to accept the plank's end. The knighthead provided a strong backing for the bow planking, but it ended below the waterline.

Where the lower bow planks met the stempost there was no support whatsoever, making the *Ocean Wave* extremely vulnerable to holing from wave action or in the event of a collision. Heavy seas or 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 of the port side planks 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 (Meverden and Thomsen 2006).

The *Ocean Wave* had an unusual deck layout with an elongated forward hatch. Not typical of Great Lakes sailing vessels, this large hatch must have been specially constructed for a specific 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 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 examples of scow construction and the stone trade may illuminate the elongated hatch's advantages (Meverden and Thomsen 2006).

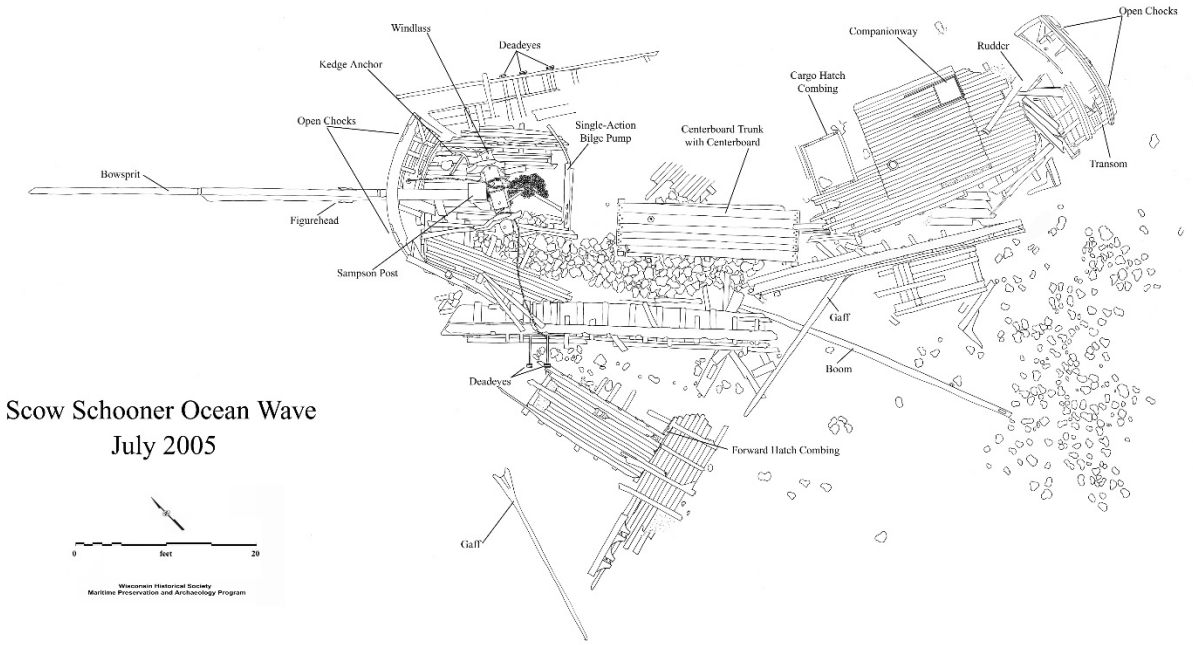

Figure 24. Site plan for the *Ocean Wave* (Wisconsin Historical Society).

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 the height of the centerboard

trunk, which is 6 ft. 4-3/4 in. tall. Considering the height of the hull's sides, a problem is encountered. The height of the hull side, from the top of the chine log to the underside of the covering board, appears to be only three feet. This measurement was taken 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 (Meverden and Thomsen 2006).

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 that this was the case, but unless they measured the *Ocean Wave* incorrectly, it was constructed in a way that is yet to be documented on the Great Lakes (Meverden and Thomsen 2006).

Silver Lake (1889-1900)

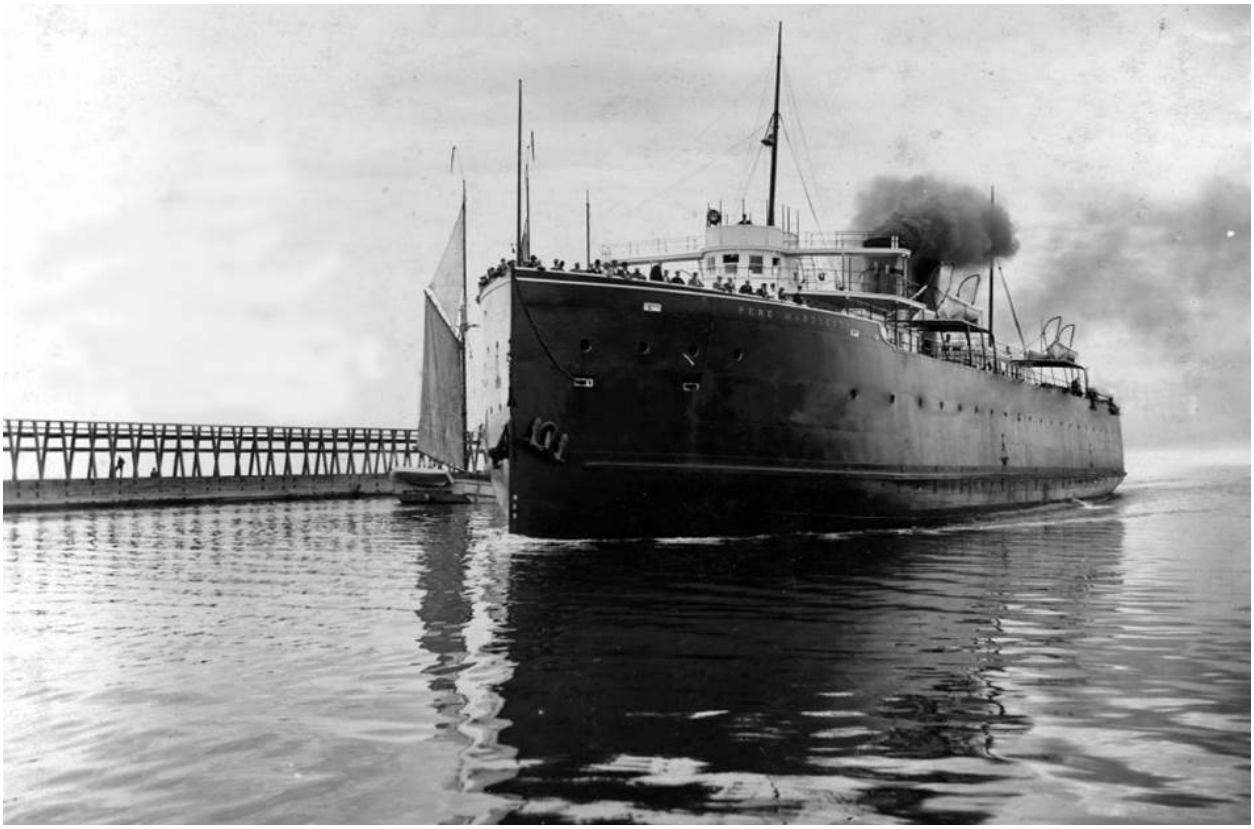

Figure 25. *Silver Lake* passes the *Pere Marquette* in Manitowoc Harbor (Wisconsin Maritime Museum- Carus Collection).

The scow schooner *Silver Lake* was constructed over the winter of 1888-1889 in the remote shipyard of M. L. Johnson in Little Point Sable, Michigan. Built with one deck, three masts, and a square head and stern, her measurements were 95 feet in length, 20 feet in beam, and 7.6 feet in depth of hold, with a tonnage of 105.53 net and 111.08 gross. She was constructed for George

A. Wagen of Mears, Michigan. Wagen owned the vessel for only one season, selling her the following winter to John Joys and John Fitzgerald, co-owners of the Milwaukee Shipyard Company. Joys and Fitzgerald purchased equal shares of the *Silver Lake* and moved her across the lake, to Milwaukee. Three weeks later, on 1 February 1890, the *Silver Lake* changed hands again when Nels Johnson and Jacob Schenkenberger became equal partners in the vessel's ownership. Her home port was changed to Racine, Wisconsin, and Captain John Schenkenberger, brother of co-owner Jacob, became her new Master (Thomsen and Meverden 2011b)

On 27 May 1900, *Silver Lake* cleared Eagle Harbor (Ephraim) in Door County loaded with 80 cords of maple wood bound for Racine. Aboard the vessel were Captain Samuel Martin, First Mate Harry Eastman, and Seamen Olle Williamson and Sigwald Anderson. Around 2:30 AM the next morning, the *Silver Lake* was approximately fifteen miles east of Manitowoc, sailing southward amidst a dense fog with her fog horn regularly blowing. In the distance toward the middle of the lake, First Mate Eastman heard the faint sound of a steamer's fog signal as the other crew members slept below deck. Around 2:50 AM, the *Pere Marquette* car ferry smashed into the *Silver Lake*'s port side. The body of the First Mate Eastman, a Norwegian immigrant from Racine, was never recovered (Thomsen and Meverden 2011b)

Figure 26. Image of *Silver Lake*'s sharp rise of the stern ramp (Wisconsin Historical Society).

The *Silver Lake* floated upside down for several days before coming to rest in 200 feet of water on the bottom of Lake Michigan, seven miles northeast of Sheboygan, Wisconsin. Overall length of the hull is 98.5 feet with a beam of 20.5 feet. All hull components are present, with the

exception of the lower portion of the broken mainmast, which could not be located on the site (Thomsen and Meverden 2011b).

The hull utilizes traditional "gunnel-built" construction techniques. The hull bottom, including the bow and stern ramps, are cross-planked and fastened to the longitudinally-planked hull sides with a chine log. The bottom planks vary in width; planks measured on the stern ramp range between 0.5 and 0.82 feet in width. Angular iron supports extend from the bottom of the stern post on either side and extend outward to the bottom of the stern ramp near the chine.

The hull's sides are constructed of longitudinal planks that are 0.65 feet high by 0.45 feet thick. The planks are edge-bolted together and into the chine log, measuring is 0.5 feet wide by 0.9 feet tall. The joint between side hull planks is caulked. Side planks are fastened to the top of the chine log flush with the log's outside edge so that the chine log forms the turn of the bilge. A sister chine log, 0.6 wide by 0.65 feet tall, is fastened to the inside of the chine log. The sister log serves as both a reinforcement and as a chock, upon which the ends of the athwartship ceiling planks are supported and fastened. The ceiling planks are 0.15 feet tall by 0.75 feet wide and abut the inside edge of the chine log with the tops of the ceiling planks flush with the top of the chine log (Thomsen and Meverden 2011b).

Figure 27. Photo mosaic of *Silver Lake* site (Woods Hole Oceanographic Institution).

King posts are not utilized in the construction, but the side planks are protected from damage from cargo by approximately 0.1 foot thick vertical planks that ceil the hold. The sides are reinforced by three iron tie bolts that hold the sides together. The deck beams are fastened atop this shelf with no chocks or filler pieces between deck beams. Between the deck beams, the bulwark stanchions are butted against the top of the deck shelf and fastened to the inside of the side planks (Thomsen and Meverden 2011b).

The *Silver Lake*'s most unusual feature is that she was constructed with two centerboards. The centerboards were not raised and lowered with a dedicated deck winch, as was typical on single-centerboard vessels, but instead with tackle hung from the rigging. The chain, used to raise and lower the centerboard, passes through a vertical wooden box fastened to the deck that is 0.75 feet wide by 0.8 feet long and rises 4.5 feet above deck level. The box is no longer fastened to the deck but lies on deck next to the centerboard trunk with the chain passing through the box. Presumably the purpose of this box was to allow centerboard chain to run freely and prevent

fouling from deck cargo. Like the forward centerboard, the aft does not have a dedicated winch mounted on deck level, but instead was raised and lowered via the ship's rigging. Likewise, the chain also passes through a wooden box that is 0.55 feet wide and 0.9 feet long, which rose 4.7 feet above deck level (Thomsen and Meverden 2011b).

Figure 28. The V-bow of *Silver Lake* (Wisconsin Historical Society).

The *Silver Lake* is one of the best-preserved examples of a scow schooner discovered to date, anywhere on the Great Lakes. It is also the only known example of a double-centerboard scow schooner in Wisconsin, and possibly in the entire Great Lakes.

Success (1875-1896)

Partially covered by sand in Whitefish Bay, 500 feet south of Whitefish Dunes State Park, Town of Sevastopol, Wisconsin, the scow schooner *Success* lies in 8 feet of water in Lake Michigan (Zant and Thomsen 2015). Nearly all hull structure, artifacts, and some rigging implements remain intact on the site beneath the shifting sand. The vessel was owned by Norwegian immigrants who moved to Wisconsin and was operated primarily in the Lake Michigan lumber trade over her entire career. The *Success* site has been monitored by Wisconsin Historical Society archaeologists since 2004, but was only documented in 2014 when enough of the wreckage was exposed due to sand movement. During a 2019 visit, the site was entirely covered with the exception of the upper portion of the centerboard trunk (Galloway 2019; Zant and Thomsen 2015).

The lower portion of the vessel's bow remains intact and features fore-and-aft (or longitudinal) planking on its bow ramp, that curves upward from the bottom, with each plank measuring 1.0 feet wide (Zant and Thomsen 2015). This is unlike most other scow schooners of the Great Lakes, which feature cross-planked bow ramps. While it is difficult to determine why the vessel was built using this unique construction technique, this type of planking was a distinctive feature of many San Francisco built scow schooners, dating back to the 1860s. In depth research of the *Success*'s builder, Julius Johnson, revealed no connections to San Francisco or any of the city's shipbuilders, indicating that the design of the *Success*'*s* fore-and-aft planking developed independently in the Great Lakes region just over a decade after their development in San Francisco Bay. Longitudinal planking is unusual in ships from the Great Lakes region, which suggests that this construction technique may have been experimental. Although it is not known why the *Success* was built with a fore-and-aft planked bottom, it is possible that this was an experimental technique used to strengthen the vessel because of its length. At 103.0 feet long, the *Success* was one of the larger scow schooners to sail on Lake Michigan, with most other scows measuring only 50.0 to 85.0 feet long (Zant and Thomsen 2015). According to the Board of Lake Underwriters rules for construction in 1866, scow schooners built with fore-and-aft planking were considered stronger and more durable than scows with cross-planked bottoms, awarding the longitudinally-planked vessels higher insurance ratings (Board of Lake Underwriters 1866).

Success's builder, Julius Johnson, a Norwegian immigrant, worked as a foreman and spar maker for Danish shipbuilders Jasper Hanson and H.M. Scove in their shipyard, Hanson & Scove, in Manitowoc. Johnson may have simply built *Success* privately, a feat not unheard of for a scow. The boxy lines of a scow hull would not have required the expertise of a shipyard during the construction process. Moreover, the Panic of 1873 created hard times for the shipbuilding industry; in the wake of these tough economic times, Hanson & Scove employed Johnson, a graduate of a navigation school in Norway to sail cargos from Manitowoc to England. Johnson likely would have taken other jobs during this period, which could have included building vessels independently (Bureau of Navigation 1875; Gjerset 1928; *Manitowoc Pilot* 1881).

Success's initial owners were also all Norwegian immigrants and all residents of Manitowoc. Carpenter Michael Michaelson owned ½ of the vessel, and Hanson & Scove shipbuilder and shipyard superintendent Christen Olson, carpenter Jorge Olson, and Captain Ole Hanson each owned 1/6 of the vessel. Norwegian immigrant and Manitowoc resident Abram Abrahansen served as the *Success*'s first Master (Zant and Thomsen 2015).

Success changed owners and masters several times throughout her career. On 22 November 1896, *Success* arrived at Whitefish Bay (Door County), Wisconsin to pick up a load of lumber for Christen Olson, her former owner. A southwest gale was building, and *Success* untied from the pier to wait out the storm at anchor. By the morning of 24 November, the storm abated enough for the scow to continue loading and she returned to the pier. By that evening, the wind picked up again and she returned to her anchorage to ride out the storm in the bay, but the wind shifted to the southeast on 25 November, which brought even larger waves into the bay. From this direction it blew into Thanksgiving Day, 26 November. *Success* began leaking so badly that by the afternoon her pumps were unable to keep water out of the vessel. At 5PM, a distress signal was displayed aboard the scow. Shortly thereafter *Success* slipped her cables and was driven ashore (Zant and Thomsen 2015).

The lower sections of the port side of the vessel remain standing upright still connected to the bottom of the hull with a 90-degree chine. The sides of the vessel are comprised of longitudinal outer hull planking measuring 0.3 feet thick and 1.0 foot wide. The outer hull planks are edge fastened, although a few planks are joined by plain scarfs (Zant and Thomsen 2015).

Figure 29. Two archaeologists investigate the double frames of *Success* near the vessel's bow (Wisconsin Historical Society).

Unlike traditional scow schooners of the Great Lakes, *Success* was not built with a series of king posts spaced throughout the length of the ship but was instead constructed in a manner closely resembling regular schooner construction. *Success* had double frames with futtocks measuring 0.55 feet and 0.45 feet wide, and 0.45 feet thick. Although many of the futtocks of each frame have been broken or damaged, evidence of their fasteners and their placement is visible along the interior of the hull planking, where the planking is grooved to fit the timber. The frames are spaced irregularly. A 25-foot-long section of the ceiling planking on the port side lies 57.0 feet from the sternpost; it measures 0.4 feet wide, 0.1 thicker than the outer hull planking, a method of construction common throughout the Great Lakes region. The hull structure is through-bolted and peened from the interior of the ceiling planking (Zant and Thomsen 2015).

Although difficult to discern due to the amount of accumulated sand, the frames appear to be attached to a chine log that runs the length of the vessel. These frames, as well as the floors, are likely pocketed into the chine log, a common method of construction for scow schooners. With this combination of features, the *Success* appears to be somewhat of a cross between gunnel-built (the method typically seen on smaller scows) and traditionally framed vessels, which were pocketed but not to a chine log.

Success's bow ramp has a slight V-shape to it. Aft of the bow ramp, sand covers much of the intact planking that makes up the floor. The planks measure 1.1 feet wide and still cover the floor of the ship, bow to stern, beneath the sand. On the starboard side of the vessel, the outer hull and some of the ceiling planking are no longer present, revealing the vessel's floors. The floors are composed of two timbers, each measuring 0.4 feet wide and 0.4 feet thick, spaced 1.45 feet apart. The ceiling planking is attached to each floor timber with bolts measuring 0.1 feet in diameter (Zant and Thomsen 2015). Because of the intact nature of the *Success*'s bilge, it is unclear how the floors were attached to the keel and keelson structure. Research on similarly built scow schooners of San Francisco reveals that the keel was likely notched for the floors, which would have run across the entire beam of the vessel, save for where the centerboard was located, in which case the floors would have been wedged into square boxes cut partway into the keel (Olmstead 1988).

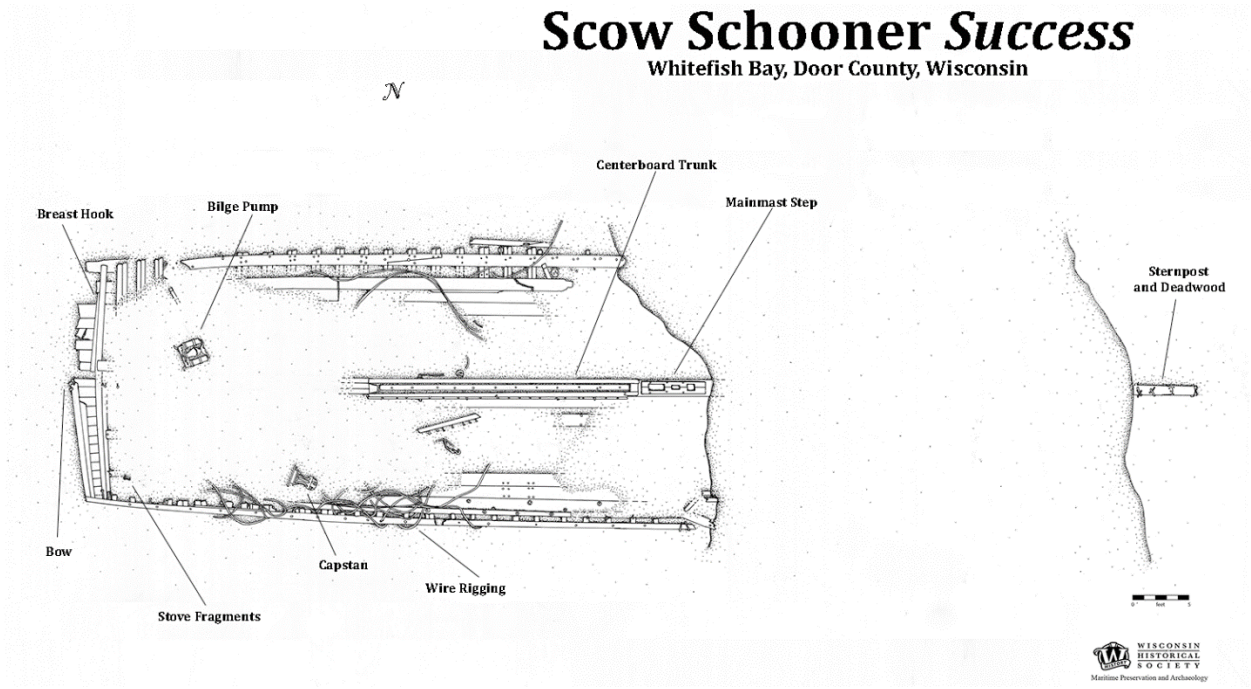

Figure 30. Site plan of *Success* (Wisconsin Historical Society).

The lower sections of the port side of the vessel remain standing upright connected to the bottom of the hull with a 90-degree chine. The sides of the vessel are comprised of longitudinal outer hull planking measuring 0.3 feet thick and 1.0-foot wide (Zant and Thomsen 2015).

Because this is the only documented scow schooner in Wisconsin waters featuring fore-and-aft hull planking, data gathered on the *Success* has significantly increased our understanding of the connection between scow building in different regions.

Tennie and Laura (1876-1903)

The scow schooner *Tennie and Laura* was built in 1876 at Manitowoc, Wisconsin, by Gunder Jorgensen. *Tennie and Laura* was described as having one deck, two masts, and measured 73 feet in length, 19 feet in beam, and 5.6 feet in depth. Her registered tonnage was 53.9 net and 56.69 gross. She was owned in equal shares by Otto A. Bjorkgnist and Ole Osmondson of Port Washington, with Captain Osmondson as Master (Meverden and Thomsen 2007).

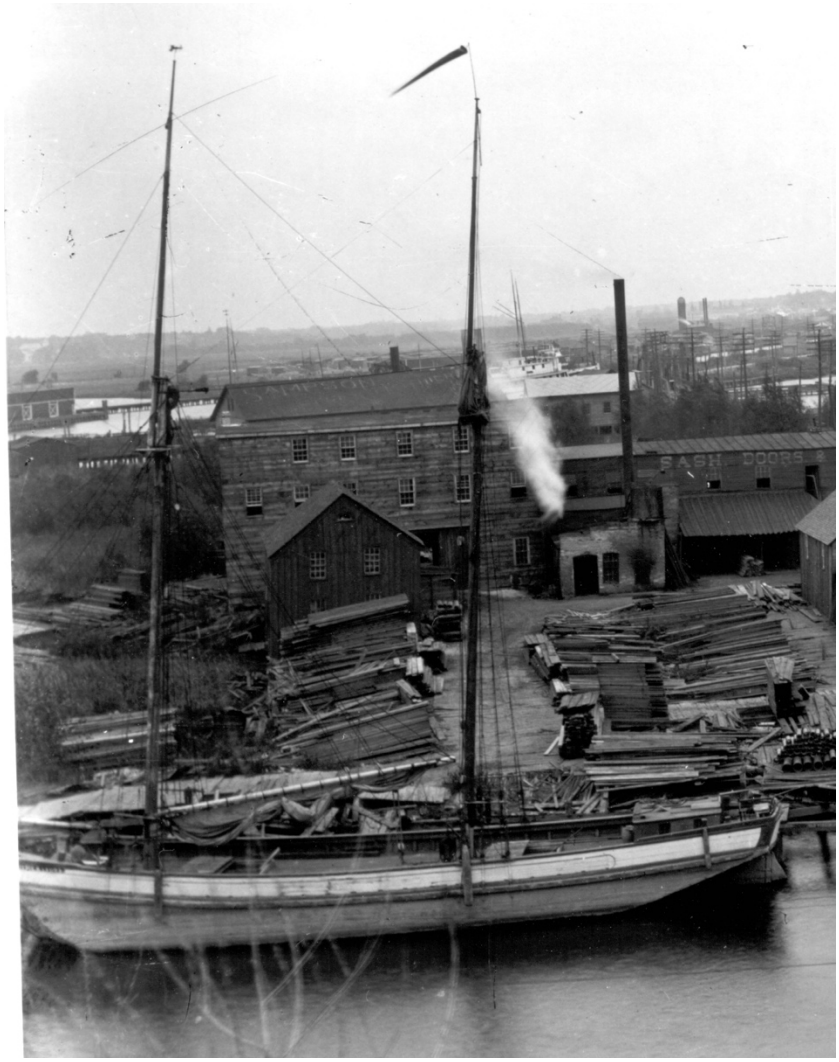

Figure 31. Historic image of *Tennie and Laura* at a dock (Milwaukee Public Library).

After changing hands several times over her twenty-seven year career, she was purchased in 1901 by John Sather of North Muskegon, Michigan. On 1 August 1903, *Tennie and Laura* were loaded $500 worth of slab wood in Muskegon, Michigan, consigned to Milwaukee. The ship usually carried a crew of three, but Sather's son John, who usually shipped as cook, asked for leave from the Milwaukee trip; this leave was granted by his father and Sather, with only mate Charles Nordbach aboard, decided to sail for Milwaukee. They sailed into a building gale, trading places between the wheel and pump. At 3AM the next morning the *Tennie and Laura* began listing; a large wave swept half of her deck load overboard. The men could not keep up with the water. Each successive wave brought them lower, until the ship capsized and eventually sank (Meverden and Thomsen 2007).

The *Tennie and Laura* lies in 307 feet of water, nine miles southeast of Port Washington, Wisconsin (Meverden and Thomsen 2007). The vessel remains upright and mostly intact, with the exception of the deck and stern cabin, which no longer remain extant. While previously reported to be buried up to the load line, the lower hull of the *Tennie and Laura* is exposed. The hull measures 77.8 feet in overall length with a beam of 19.2 feet, and the hull rises 6.0 feet above the silt. With most of the deck planking missing, the deck beams are readily visible (Meverden and Thomsen 2007).

The bulwarks remain intact except on the starboard side's aft quarter. The vessel's transom is no longer intact. A heavy covering board, measuring 1.2 feet wide, was fastened atop the hull planks, and the bulwark was recessed from the outer hull by several inches. Bulwark stanchions likely passed through the covering board, evidenced by the recessed hull, through-bolts, and clinch rings. Through-bolts with clinch rings are visible along the outer hull planking on the portside, similar to the scow construction seen in designs that utilize bulwark stanchions. The bulwark stanchions measure 0.4 feet square and are spaced 1.2 feet apart (Meverden and Thomsen 2007).

The vessel's bow ramp is cross-planked, joined to the longitudinal side-planking by framing timbers. The bow curves upward sharply from the bottom and appears to be constructed of two separate panels. These panels are joined together to create a v-shaped bow that extends 1.6 feet forward of the framing timbers, where it connects at the stempost and is reinforced by a breasthook (Meverden and Thomsen 2007).

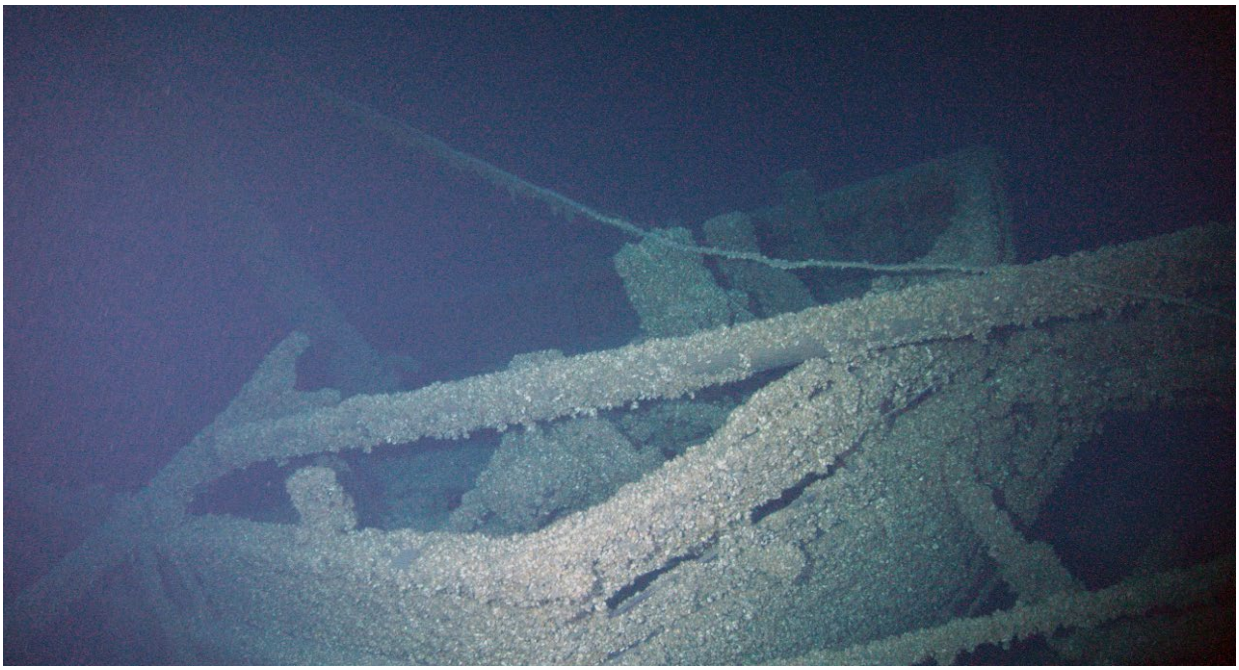

Figure 32. ROV image of *Tennie and Laura*'s V-bow (Marine Imaging Technologies).

Confirmed in a video captured by Remotely Operated Vehicle in 2017, the vessel was constructed with a chine log and kingposts. This was confirmed by an exposed portion of the chine log, near the port side bow (Galloway, Thomsen, Kiefer, and Zant 2019). At the stern, the

bottom hull planking is visible, running athwartship. As in most other Great Lakes scow schooners, the vessel did not have athwartship floors and frame sets, but instead was equipped with longitudinal floor keelsons running parallel to the keelson. These provided athwartship support that functioned as floors and futtocks would function in a traditional schooner. Single and double cross-keelsons sit on top of these longitudinal timbers, extending from the keelson to the hull sides. As with floors and futtocks in traditional schooners, these cross-keelsons supported the ceiling planking. The vessel's centerboard trunk is upright and intact. The hull is intact from the nameplate forward, as is the lower port side of the bow ramp (Meverden and Thomsen 2007).

Minnesota

May Flower (1887-1891)

Located 2.25 miles south of Lester River, Minnesota, the remains of the wooden scow schooner *May Flower* rest in 90 feet of water in Lake Superior (Meverden and Thomsen 2011). The *May Flower* was built in 1887 by Henry Johnson in Sturgeon Bay, Wisconsin reportedly to work in the Leathem & Smith Company's lumber operation. She was commanded by Captain Louis Klinkenberg, a career sailor, born in Norway (Meverden and Thomsen 2011). The vessel was lost in June 1891 while carrying sandstone blocks to Duluth, Minnesota, the *May Flower's* uniqueness in both vessel type and construction methods has yielded significant information regarding nineteenth-century scow construction, on a regional scale.

The *May Flower* lies upright on a sand bottom four miles northeast of the Duluth harbor entrance. Her bow and stern areas are largely intact, but her hull sides have collapsed amidships. At the bow, the bottom depth is 88 feet. The hull is 156.0 feet in length and 24.4 feet in beam. The majority of the hull and cargo are embedded in the lakebed with only a few feet of the hull and cargo visible above the sand bottom (Meverden and Thomsen 2011).

The stem is exposed for three feet above the lakebed and is trapezoidal in section. It appears that the stem is constructed from multiple timbers, but accurate measurements of individual timbers could not be taken because of the inability to distinguish the exact edges of the timbers, due to tight fitment and excellent preservation of the wood. The bow is horizontally-planked with planks that are 1.0 foot wide by 0.25 feet thick. The bow is V-shaped and angles aft from the stem at 35 degrees to where it meets the hulls sides at 12.5 feet on baseline (Meverden and Thomsen 2011).

The hull sides have a plank-on-frame construction that is a blend of traditional plank-on-frame and gunnel-built scow hull construction. The side hulls are framed with single timber king posts that are planked over with ceiling and outer hull planks. King post dimensions are 0.65 feet wide by 0.6 feet thick and rise 6.0 feet above the lake bed near the starboard quarter, where the vessel is the most exposed above the lake bed (Meverden and Thomsen 2011). It was reported that the *May Flower* was "built of the best materials, and her sides were of double thickness to support his immense deck loads of stone," (*Door County Advocate* 1890; *Portage Lake Mining Gazette* 1891).

The *May Flower's* outer hull planks are 0.65 feet wide by 0.3 feet thick and are edge bolted together with iron bolts. Although buried in the sand bottom and difficult to distinguish, it appears that the hulls sides and bottom are joined with a chine log that is mortised to accept the king posts. The bulwark stanchions are fastened to the forward side of the king posts and are 0.55 feet square with a space of 2.5 feet between stanchions (Meverden and Thomsen 2011).

Figure 33. Bow and port side of *May Flower* (Ken Merryman).

Very little of the vessel's rigging remains, and what is visible is rather unusual for a vessel of this size. Chain plates are extant for the port side foremast as well as the starboard side mainmast, which may have contributed to the vessel's rigging being lost during the capsizing. The location of the masts indicate that each mast was set disproportionately towards either end of the vessel, mimicking the proportions of the Grand Haven rig more than the typical schooner rig (Meverden and Thomsen 2011).

The hull was reinforced against spreading by iron through bolts that spanned the width of the vessel just below deck level; one iron through bolt is extant near the starboard quarter immediately forward of the mooring bitts, where it passes through the outer hull and is visible on the outside of the hull planks.

The outside of the transom, above deck level, is planked horizontally with planks that are 0.6 feet wide by 0.27 feet thick. Below deck level, the stern ramp is angled and horizontally-planked, with planks that are 0.7 feet wide by 0.35 feet thick (Meverden and Thomsen 2011).

The *May Flower* is an unusual craft. She is described in historic literature as a two-masted scow schooner, and although her general lines follow that of other Great Lakes scow schooners that have been archaeologically documented, her construction features are somewhat unique compared to most of the others. The *May Flower* is rather large compared to other Great Lakes scows and likely spent most of her life as a scow-barge, being towed behind a steam-powered vessel, rather than as a self-propelled schooner. This is indicated by a complete lack of head rigging – the *May Flower* was not rigged with a bowsprit and therefore carried no head rigging. In place of a bowsprit, a large towing bitt and large iron fairlead for a towing hawser is fastened atop the head rail immediately aft of the stem. Additionally, it appears that her two masts were widely spaced and stepped near either end – more similar to a Grand Haven rig than a true schooner rig. With her large dimensions, lack of head rigging, and widely spaced masts, the *May Flower* was more suited to serve as a barge than a schooner in the truest sense, even though according to historic records she was indeed registered as a schooner (Meverden and Thomsen 2011). Although one historic newspaper accounts stated that she "could" sail independently of a consort, all historic records of her voyages uncovered thus far have indicated she was invariably towed (*Door County Advocate* 1887).

Unlike other Great Lakes scow schooners, no evidence of a centerboard was discovered at the site. Centerboards were common to nearly all sailing vessels on the Great Lakes, as well as some steam-powered vessels, and a scow's flat bottom made it especially suitable for a centerboard. Considering the vessel's flat bottom experiences significant leeway when sailing close-hauled into the wind. Combined with her lack of a head rig, and relatively small sail area, the lack of a centerboard would have made the *May Flower* a rather weak sailer and most likely, quite unhandy in all but the most favorable of sailing conditions (Meverden and Thomsen 2011).

Where a centerboard trunk would have been fitted is a large section of heavily-timbered bulkhead that lies tipped toward the vessel's port side. Another similarly constructed section lies further aft within the hull. These structures are constructed much differently than the hull sides and are much too robust to be part of the deck, making it possible that these structures served as bulkheads to divide the cargo area into compartments, similar to the way New Zealand scows carried cargo on their deck. It was reported that like New Zealand scows, the *May Flower* carried about half of her sandstone cargo stacked on her upper deck. (*Portage Lake Mining Gazette* 1891; *Superior Daily Call* 1891; *Superior Daily Leader* 1891; *Lake Superior Marine Museum* 2010).

Because the hull is deeply embedded in the lakebed, it could not be determined if these structures were fastened to the keelson, but it is possible that they may have stood vertically above the keelson and served as a fore-and-aft bulkhead (Meverden and Thomsen 2011).

Collectively, the *May Flower's* size and construction features are markedly different than other scow schooners documented on the upper Great Lakes. Surprisingly, the *May Flower's* construction features appear to be more closely related to New Zealand's scows than to other scows constructed and used on the Great Lakes during the late nineteenth-century, though she was almost 60 feet longer than the largest reported New Zealand scow.

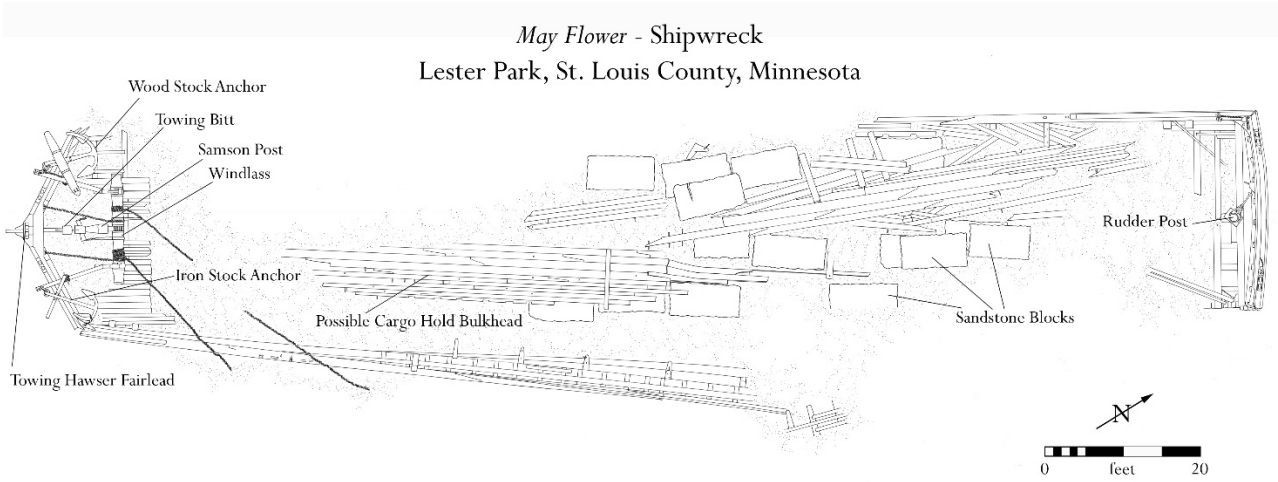

Figure 34. Site plan of the shipwreck *May Flower* (Great Lakes Shipwreck Preservation Society).

While scow schooners were fairly common on the lower lakes during the nineteenth century, with several scow schooners having been archaeologically documented on Lake Michigan, they were somewhat rare on Lake Superior. The *May Flower* is the first scow documented there and is one of only two vessels known to exist in Lake Superior's archaeological record.

Archaeological data gathered indicates the *May Flower* has unique construction features that differentiate her from other scows documented on the lower Great Lakes. Archaeological data, combined with historic research, indicates that the *May Flower*'s construction features are more common to New Zealand scows than Great Lakes scows, evidenced by construction features like hull construction and bulkheads to partition the cargo spaces. Historic research suggests there may be a direct link between Great Lakes scows and those in New Zealand, as evidenced in the *May Flower* (Meverden and Thomsen 2011).

Michigan

Helen (1881-1886)

Helen, a scow schooner that lies off of the coast of Muskegon, Michigan, was surveyed by a team from the Michigan Shipwreck Research Association in 2002. Few details about her construction are listed. *Helen* was built in 1881 at the Wolf & Davidson shipyard in Milwaukee with two masts and a length of 90 feet, beam of 23 feet, and depth of hold of 7 feet. In 1884, she came under the ownership of J.A. Von Thaden of Chicago. The ship was lost on 18 November 1886 off White Lake Michigan. *Helen* was bound for Chicago when she was driven up on a reef, where she capsized and wrecked. A centerboard trunk was noted, while most other technical details were not documented (C. Patrick Labadie; Michigan Shipwreck Research Association).

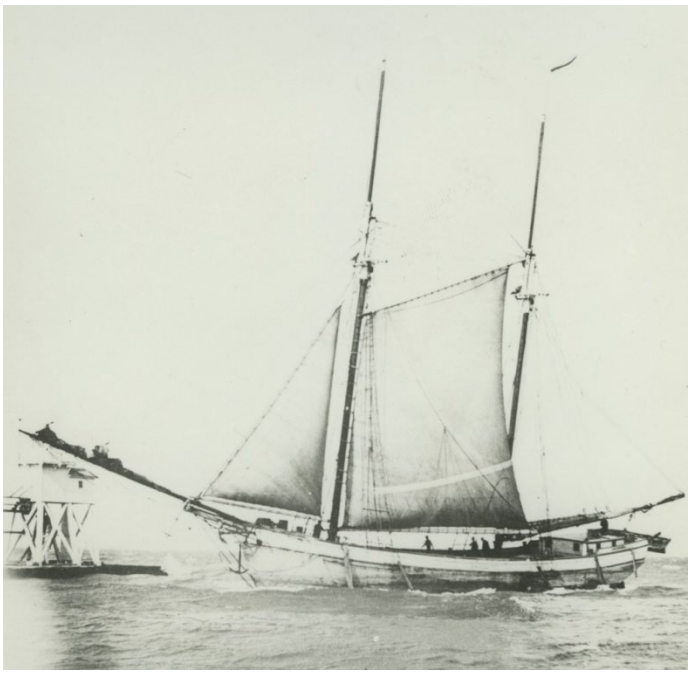

Figure 35. Historic image of *Helen* (C. Patrick Labadie Collection).

Rockaway (1866-1891)

The scow schooner *Rockaway* was documented two-and-a-half miles off of South Haven, Michigan in 1984 by an archaeological team from the Lake Michigan Maritime Museum (Michigan Shipwreck Research Association; Pott 2001).

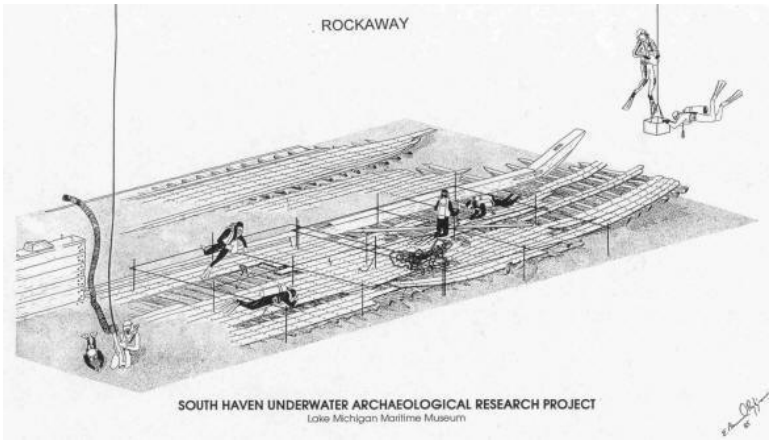

Figure 36. Drawing of *Rockaway* site (Lake Michigan Maritime Museum).

The *Rockaway* was a 106-foot, two-masted scow built by B. Morgan in 1866 in Oswego, New York for Chandler and Albert *Last names? (Pott 2001: 98). By 1888 *Rockaway* came under the ownership of Captain O. Thompson and others from Muskegon, Michigan, where she was used in the Chicago lumber trade. The ship was lost on 20 November 1891 (C. Patrick Labadie). It was reported that the *Rockaway's* remains include a centerboard trunk, but few other construction details are known (Pott 2001: 101). The presence of a chine log, the direction of planking, and bow and stern construction were not disclosed.

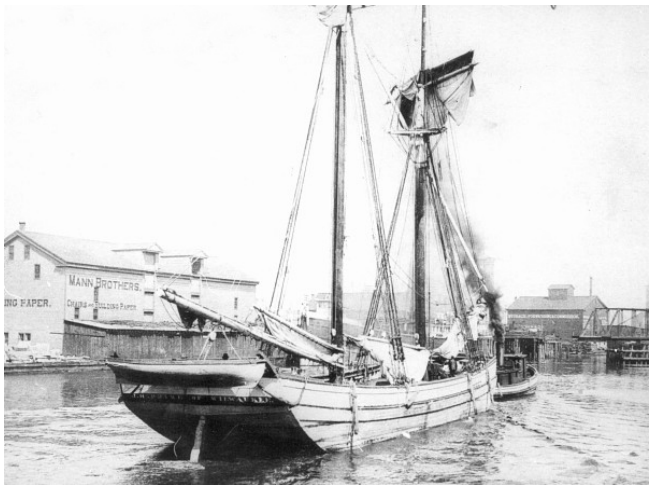

Figure 37. Historic image of *Rockaway* (Bowling Green State University).

Ohio

W.R. Hanna (1857-1886)

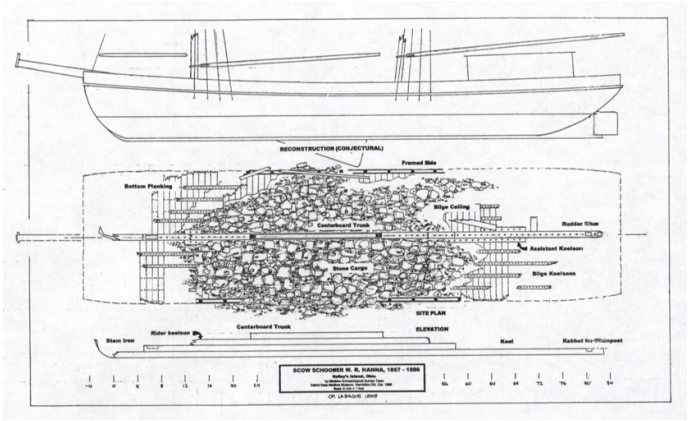

Figure 38. Site plan of *W.R. Hanna* (National Museum of the Great Lakes).

The scow schooner *W.R. Hanna* lies in 10-15 feet of water, approximately 300 feet from the north shore of Kelley's Island, Ohio (Labadie and Herdendorf 2004). The *W.R. Hanna* was built at Sandusky, Ohio by William R. Hanna for Jonathan Learned of Sandusky. The *W.R. Hanna* had two masts and measured 86.2 in length, 22.4 in beam, and 6 feet in depth. By 1882, the ship was owned by L.J. Seek of Toledo, Ohio. On 30 June 1888 *W.R. Hanna*'s enrollment document was surrendered indicating that the vessel wreck and was abandoned. The *W.R. Hanna* is reported to have a centerline keel assembly that is almost fully intact, which is 82 feet long and complete with a centerboard trunk. Like many other scows in the Great Lakes, the *W.R. Hanna* had athwartship planking (Labadie and Herdendorf 2004). The presence of a chine log was confirmed, but configuration was undetermined. The chine logs were recorded as being 6 inches sided and 9 inches molded and fixed to the side and bottom planking (Labadie and Herdendorf 2004). Reports note that while it was impossible to determine the configuration of the chine log due to low preservation of the sides, it was clear that they were characteristic of gunnel-built construction. No rabbets or mortises were noted, resulting in an absence of information regarding the dimensions and spacing on the side hull (Labadie and Herdendorf 2004).

New Zealand Scow Schooners

Lake Erie (1873-unknown)

The first known New Zealand scow, *Lake Erie*, was built by Septimus Meiklejohn in 1873 for George Spencer, a former Great Lakes scow captain that commissioned the build. Spencer had recognized a scow's potential use on the protected waters around Auckland. The *Lake Erie*, built in Omaha, New Zealand, was described as "punt-like; a wide, shallow wooden box with a sharp end and a blunt end," (Johnson 1987: 113). Because the cargo of New Zealand scows was carried on deck, there was no need for a hatchway. *Lake Erie* was just under 60 feet and was equipped with a centerboard rather than a keel (Johnson 1987). It is reported that she was named *Lake Erie* because she was made along the lines of the wood-carrying vessels on the "American Lakes" (Johnson 1987: 113).

Figure 39. Stamp commemorating New Zealand's first scow *Lake Erie* (The Mahurangi Magazine).

Lake Superior (1875-unknown)

George Sharp built the *Lake Superior* at Pakiri, New Zealand in 1875 (Johnson 1987). While few construction details are known about the *Lake Superior*, it is noted that Sharp converted her leeboards to a centerboard in 1878 (Locker 2001).

Lake Michigan (1876-unknown)

Septimus Meiklejohn built the *Lake Michigan* in Omaha, New Zealand, in 1876. The *Lake Michigan* was reported as a "big improvement" equipped with "a centerboard and with better lines" (Locker 2001: 121).

Lake St Clair (1876-unknown)

John Darrach built the *Lake St Clair* at Mahurangi, New Zealand in 1876. The *Lake St Clair* is one of only two scows built at Mahurangi (Locker 2001).

Lady of the Lake (1876-unknown)

Rufus Dunning built the *Lady of the Lake* in 1876 at Mahurangi, New Zealand. The *Lady of the Lake* is the only other recorded scow schooner built at Mahurangi. While no other details about the *Lady's* construction or design are known, it appears that these five scows, all named after American lakes, set off a new wave of shipbuilding in New Zealand, expanding the possibilities of trade as they knew it (Locker 2001).

Jane Gifford (1908-current)

The *Jane Gifford*, a scow schooner registered at 67 feet, was built in 1908 at Whangateau. *"Janie"* carted stone and shell in her deck boxes, a New Zealand adaptation, well past the turn of the century- a true testament to the design and ability of the scow. The *Jane Gifford* serviced both inland and nearshore ports. She had a pointed bow, as many New Zealand scows did. *Jane Gifford* was restored in 2005, preserving only her original longitudinal bottom planking and keel. With the restoration, the *Jane Gifford* received new masts from the three-masted schooner *Shenandoah,* which were then scaled down (The Jane Gifford Society). The restored *Jane Gifford* is New Zealand's last fully-rigged sailing scow (The Jane Gifford Society).

Figure 40. Historic image of *Jane Gifford* (The Jane Gifford Society).

Pirate (1895-unknown)

The *Pirate* was a three-masted scow schooner with 190 tons net, built in 1895 by G.T. Niccol (Johnson 1987: 114). While deeper and narrower than most scows, the *Pirate* is reported to have a much smaller tonnage than other vessels of similar length and beam, a possible effort to pass with lower harbor costs (Johnson 1987: 114).

Alwyn G. (1925-unknown)

Built in Auckland, New Zealand, in 1925, the *Alwyn G*. was fitted with an engine, noted as a "concession to technology" (Johnson 1987: 114). Later, many scows in New Zealand lost their topmasts and were fitted with engines (Johnson 1987).

Rangi (1905-1937)

An exception among scows in the 20th Century, the *Rangi* kept her sails, in apparent disdain toward engines, until her demise. She reportedly sailed past steamers and other powered vessels until 1937, when she capsized in a gale near Rakino Island, New Zealand (Johnson 1987: 115). *Rangi* was the largest reported scow schooner built in New Zealand, stretching 98 feet (Hawkins 1965: 226). This was generally longer than most scows of California, but shorter than many on the Great Lakes.

Figure 41. Historic image of *Rangi* (State Library of South Australia).

Echo (1905-1965)

Echo linked Wellington and Blenheim, New Zealand, of the Cook Strait trade for more than forty years. *Echo* transported raw materials in her built-in cargo hold compartments, meant for bulk cargoes, until 1965 when she was retired (Johnson 1987: 115). She was then permanently docked and made into a museum ship.

Figure 42. Historic image of *Echo* (Picton Museum).

San Francisco Bay Scow Schooners

Alma (1891-current)

Alma, constructed by Fred Siemer in 1891, is the only known remaining scow schooner from San Francisco Bay (Historic American Engineering Record 1968c). *Alma's* construction was reported to be, "not unique, but unusual" (San Francisco Maritime National Historical Park). This, of course, is relative to the patterns of scow building in San Francisco Bay, as *Alma's* design differs noticeably from Great Lakes and New Zealand scows. Like most scows, *Alma* was equipped with a centerboard (Historic American Engineering Record 1968d). *Alma's* bottom planking ran athwartship (San Francisco Maritime National Historical Park). The side planking ran longitudinally, and the bow and stern were both flat (Historic American Engineering Record 1968: b; c; e). While flat bows were also seen on the Great Lakes, a number of New Zealand scows were built with v-shaped bows (Hawkins 1965). This design was likely because San Francisco scows were used mainly for sailing the rivers and San Francisco Bay, rarely travelling far from shore. New Zealand scows travelled offshore more frequently, as did Great Lakes scows, which could account for the variation in bow design. Based off of *Alma's* construction and off of historical images, it appears that San Francisco scows did not utilize a breast hook. Because San Francisco scows were completely flat-bowed, there appears to be no need for a breasthook.

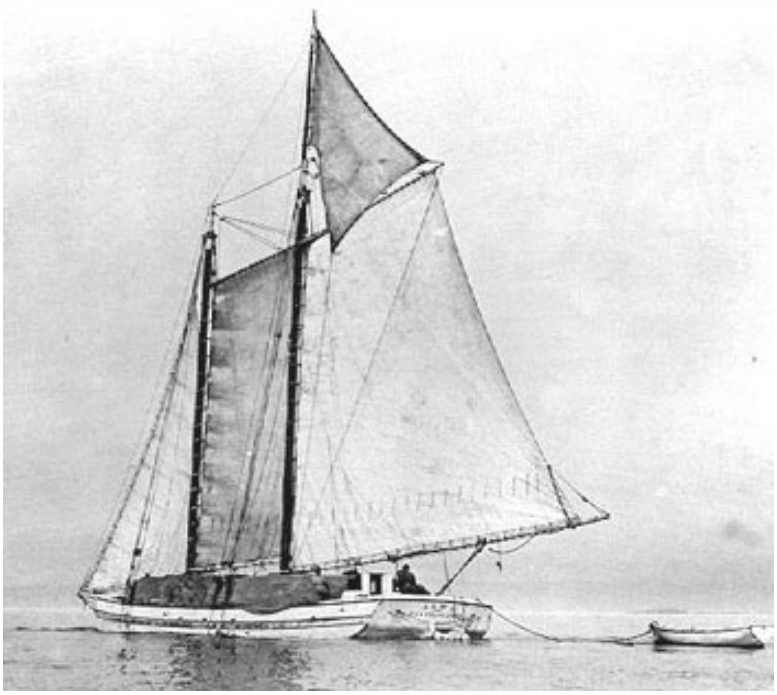

Figure 43. *Alma* on San Francisco Bay, circa 1900 (San Francisco Maritime National Historic Park, National Park Service).

Alma's rigging allowed for her steering wheel to be raised in order to see over the hay stacks she carried early in her career (Historic American Engineering Record 1968a). Scows like *Alma*, nicknamed "hay scows", would "reef up" their sails in order to raise them above the stacks of hay bales on deck (San Francisco Maritime National Historical Park). In 1918, *Alma's* masts

were removed in preparation for hauling Aviso salt, while being towed as a barge (San Francisco Maritime National Historical Park). Sometime after 1926, *Alma* was fitted with a gasoline engine. Her sole cargo following this period was oyster shell, which was stored in a large wooden bin installed on deck (San Francisco Maritime National Historical Park). As did New Zealand scows, *Alma* carried all of her cargo on deck rather than underneath. While this was common for San Francisco scows, some carried a small amount of cargo below deck (Olmsted 1988: 28).

The State of California purchased *Alma* in 1959 and began restoration work in 1964. *Alma* was transferred to the National Park Service in 1978 and is now a designated National Historic Landmark, as of 1988 (San Francisco Maritime National Historical Park).

Crockett (1901-unknown)

While most features of the *Crockett's* construction were common for the Bay Area, deck beams on the *Crockett* were bent to the crown of the deck rather than cut at the edges (Olmsted 1988: 68). The heavy timber atop the stem piece, called the 'anchor stock', was double, and joined the stem and keel firmly together (Olmsted 1988: 68). The floors ran through the keel, except for the section where the centerboard and centerboard case were fitted. *Crockett* was longitudinally planked, as most San Francisco scows were, and had a flat bow and stern (Olmsted 1988: 71). *Crockett* also had a four-berth cabin below deck, which were usual accommodations of a scow of similar size on the West Coast. *Crockett* exhibited many other characteristics of San Francisco scows, such as 3-inch planking that was said to have been "almost universal except in log-built (or cross-planked) scows" (Olmstead 1988: 71). Because of details revealed through the archaeological record, we are able to understand that this 'universal' characteristic of San Francisco scow schooners was not the case for scow schooners of the Great Lakes, which were known to be constructed with non-uniform planking.

Figure 44. *Crockett* (and other scows) at a feed mill (San Francisco Maritime National Historic Park, National Park Service).

St. Thomas (1868-unknown)

Records state that while they were built nearly fifty years apart, the hull form and construction techniques used to build the *St. Thomas* are almost identical to those of the *Crockett* (Olmsted 1988: 70). The main difference between the *Crockett* and *St. Thomas* is the size of the scantlings, attributed to the ability to purchase higher quality materials for a lower price by the time the *St. Thomas* was built (Olmsted 1988: 70). This resulted in "more closely spaced frames- and all-around massive feel to the vessel's frame" (Olmsted 1988: 70). While there is little evidence, this could have been the case for scows such as *May Flower*, a Great Lakes scow equipped with massive features for no apparent reason.

Figure 45. *St. Thomas* at Steamboat Slough (San Francisco Maritime National Historic Park, National Park Service).

Mary (unknown)

One of the cross-planked or 'log-built' scow schooners of San Francisco Bay, *Mary* was built by renowned shipbuilder Emil Munder (Olmsted 1988: 71). Munder, a shipbuilder responsible for constructing many San Francisco scows, including some of those listed above, agreed with Chapelle that cross-planked scows were cheaper to build and stronger, while weighing the same (Chapelle 1951; Olmsted 1988: 71). The construction was known to be much easier in cross-planked scows, as no floor was used and king posts were able to replace traditional side frames. Why cross-planking was not universal is less clear. One possibility is the importance that scow

operators placed on their sailing ability. In the Great Lakes and other regions where scows sailed offshore, longitudinally planked vessels may have been deployed because of their sailing quality. In California, where the annual Master Mariners Race was held, it became tradition for scow schooners to compete- and do well- which could have been a cause for the preferred longitudinal planking of many San Francisco scows. Another objection to cross planking was related to the additional damage that could be sustained at grounding with a cross-planked scow and the extra repairs that a grounding could require (Olmsted 1988: 71).

Mary was said to be an example of the ugly associations of log-built construction, as she had very wide transoms and the "flat of her bottom carried to an unusual length" (Olmsted 1988: 71). This unusual feature made her ends very steep, which affected her sailing abilities and speed. She was not considered a good model of a cross-planked scow, though there were fine examples of log-built scows in San Francisco.

Traveler (unknown)

Traveler was known by old sailors and builders as the scow that was "cross-planked, upside-down, on Goat Island" (Olmsted 1988: 71). *Traveler* was cross-planked, but not edge bolted, which was considered highly eccentric (Olmsted 1988: 72). This method of construction appears similar to that of the *Dan Hayes*, which is believed to have been constructed in pieces before having fasteners driven through from the bottom hull, which would then have been inverted and assembled (Rodgers and Corbin 2003). While unusual for the area, *Traveler* must have been durable, as it operated for seventy-five years, likely longer than any other scow in all of San Francisco (Olmsted 1988: 72).

Edith (1906-unknown)

Likely the last scow built in San Francisco, *Edith* was ordered the day before the great 1906 earthquake (Olmsted 1988: 23). No construction details are known.

SECTION FIVE
Conclusions and Recommendations

Scow schooners were a unique vessel type that operated during a period that was very crucial to the Great Lakes region and the expansion of the United States. During a time period when trade had not yet expanded to railway, scow schooners provided an easier way to trade and deliver cargo to areas farther inland. It was a transitionary period of maritime innovation which facilitated the growing needs of the burgeoning interior of the United States and helped fuel expansion westward. As such, scow schooners were a critical economic connection between the eastern and western United States, linking the economic and industrial landscapes of the Midwest with eastern markets, and fueling the expansion of major Great Lakes industrial centers in previously unexpanded ways. By analyzing the construction of scow schooners, their use in Great Lakes trade, and the unique design and construction features of scows in a global context, this analysis allows for an understanding of scow schooners and their place within the larger historic context of the Great Lakes region and the evolution of maritime industrial commerce.

Scow schooners were designed to transit offshore and inshore communities, including rivers, tributaries, and bays, while carrying the largest possible amount of cargo. Through craftsmanship of shipbuilders and the working class, scow schooners offered an important link in the development of the United States and New Zealand. With little or no drawn plans, and no contemporary examples of scow schooners available, information gathered through historical and archaeological investigations of known scows in the Great Lakes, San Francisco Bay, and New Zealand provide the only opportunity to study the construction techniques of these unique vessels, their adaptations, and the role they played in the development of the region's unique maritime industrial context.

While an in-depth regional analysis of scow schooners has allowed for a greater understanding of the vessel type as a whole, and an understanding of the economic and industrial contexts into which scow schooners fit, there is still much more to be learned from these wreck sites and their histories. This study has relied heavily upon documents, data, and research from ships and shipwrecks of Lake Michigan, Lake Superior, Lake Erie, San Francisco, and New Zealand. While additional video and photographic data has been used to expand the analysis, further research into other known scow schooners can significantly add to the breadth of this study.

Although scow schooners had generalized characteristics and modifications that aided in allowing the vessel to service previously unexplored markets, the features on no two scow schooners were exactly the same. Adaptations to scow schooners demonstrate that the evolution of these shipboard mechanisms was not a blanket development. The design and mechanics of scow schooner components remained similar but could be adapted for different industries in different areas and environments, all on a tight budget. Whenever possible, scow schooners were modified to carry even more cargo, maintaining a delicate balance between seaworthiness and maximizing cargo capacity.

Broad economic trends in the United States have had an effect on the development of maritime technology over time, and this study has touched on many of these factors. Additional research into the specific trends of economic booms and declines in the late nineteenth century and

shipbuilding among ethnic groups contributes to the understanding of the catalysts for historical maritime industrial development.

Although only a contributing factor to the larger trends of industrial and economic development in the United States and New Zealand, the importance of scow schooners and the architectural modifications developed onboard cannot be overlooked. The designs and implementation of this hull type paved the way for the effective trade to inshore communities. By formulating an understanding of the catalysts of maritime innovation and design, a more comprehensive understanding of the nuances of maritime industrial heritage and culture in the late 19th century can begin to develop, revealing the broader regional context of scow schooners.

In all instances, a scow's unique design and shallow draft allowed it to acquire a number of jobs that other ships could not. Their moderate size made them well-adapted to a wide range of tasks, and their versatility from sail to tow to power allowed their lifespan to continue much past the age of sail. While this study focuses on scow schooners of the Great Lakes, New Zealand, and San Francisco, scows were not limited to these areas and the construction and design of scows undoubtedly varied in other areas of the world. When more instances of this variation become known, this analysis will expand to incorporate other regions and designs.

SECTION SIX
References

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.
1876 *Lake Vessel Register, System of Classification.* Board of Lake Underwriters, Buffalo, NY.

Bureau of Navigation
1867 I.A. Johnson Permanent Enrollment No. 112. Port of Cleveland, Cuyahoga Customs District, Ohio. 29 June. Record Group 41. U.S. National Archives, Chicago, IL
1869 *Alaska* Permanent Enrollment No. 134. Port of Milwaukee, Milwaukee Customs District, Record Group 41. U.S. National Archives, Washington, D.C.
1870 *Alaska* Permanent Enrollment No. 113. Port of Milwaukee, Milwaukee Customs District, Record Group 41. U.S. National Archives, Washington, D.C.
1875 Success Permanent Certificate of Enrollment No. 113, Port of Milwaukee, Record Group 41, U.S. National Archives. Washington D.C.

Chapelle, Howard I.
1951 *American Small Sailing Craft: Their Design, Development, and Construction*. W.W. Norton and Company, New York.

Charles-Alexandre Lesueur
1894 *Charles-Alexandre Lesueur en Amerique du Nord (1816 – 1837).* Painting. Museum du Havre.

Cooper, David J.
1989 *Survey of Submerged Cultural Resources in Northern Door County.* 1988 Field Season Report. Underwater Archaeology Program, Wisconsin Historical Society, Madison.

Door County Advocate
1887 Door County Advocate, 7 May.
1890 Door County Advocate, 18 January.

Galloway, Tori, Tamara Thomsen, Victoria Kiefer, and Caitlin Zant
2019 Scow Schooner *Tennie and Laura*. National Register of Historic Places Additional Information Document.

Gjerset, Knut
1928 *Norwegian Sailors on the Great Lakes*. The Norwegian-American Historical Association. Northfield, Minnesota.

Hawkins, Clifford
1965 *The Mariner's Mirror*. The New Zealand Scow.
1987 *The Hard Times and Romance of the Sailing Scow*. Sea Spray, May 22-28.

Historic American Engineering Record
1968a Image 3. Scow Schooner *Alma*, Hyde Street Pier, San Francisco, San Francisco County, CA. Historic Photograph. Library of Congress. https://www.loc.gov/resource/hhh.ca1505.sheet/?sp=3
1968b Image 4. Scow Schooner *Alma*, Hyde Street Pier, San Francisco, San Francisco County, CA. Historic Photograph. Library of Congress. https://www.loc.gov/resource/hhh.ca1505.photos/?sp=4
1968c Image 5. Scow Schooner *Alma*, Hyde Street Pier, San Francisco, San Francisco County, CA. Historic Photograph. Library of Congress. https://www.loc.gov/resource/hhh.ca1505.sheet/?sp=5
1968d Image 10. Scow Schooner *Alma*, Hyde Street Pier, San Francisco, San Francisco County, CA. Historic Photograph. Library of Congress. https://www.loc.gov/resource/hhh.ca1505.photos/?sp=10
1968e Image 13. Scow Schooner *Alma*, Hyde Street Pier, San Francisco, San Francisco County, CA. Historic Photograph. Library of Congress. https://www.loc.gov/resource/hhh.ca1505.photos/?sp=13

Inches, H.C., and Chester J. Partlow
1964 *Great Lakes Driftwood Schooner-Scows*. Inland Seas, 20(4):289-294. Cleveland, OH.

Jane Gifford Society, The
n.d. *The Jane Gifford: History*. http://www.janegifford.org.nz/history.htm

Jane Gifford Society, The
n.d. *The Jane Gifford: Restoration*. http://www.janegifford.org.nz/restoration.htm

Johnson, D.W.
1987 *New Zealand's Maritime Heritage*. Auckland, New Zealand.

Karamanski, T.J.
2000 *Schooner Passage*. Wayne State University Press, Detroit.

Kiefer, Victoria, Tamara Thomsen, and Caitlin Zant
2015 Scow Schooner *Alaska*. National Register of Historic Places Nomination.

Kiefer, Victoria, Caitlin Zant, and Tamara Thomsen
2018 Scow Schooner *I.A. Johnson*. National Register of Historic Places Nomination.

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

Labadie, C. Patrick, and Charles E. Herdendorf
2004 *Wreck of the Scow Schooner W.R. Hannah: An Archaeological Investigation in Lake Erie at Kelley's Island, Ohio.* Great Lakes Historical Society, Peachman Lake Erie Shipwreck Research Center Technical Report No. 2. Vermillion, OH.

Lake Superior Marine Museum
2010 Scow Schooner *May Flower* Vessel Data Sheet. Jim Dan Hill Library, Superior, WI.

Locker, Ronald H.
2001 *Jade River: A History of the Mahurangi*. The Mahurangi Magazine. Warkworth, New Zealand.

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

Manitowoc Pilot (Manitowoc, Wisconsin)
1881 Manitowoc Pilot, 30 June.

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
1881 United States Printing Office, Washington DC.
1885 United States Printing Office, Washington D.C.

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, N.C.

Meverden, Keith and Tamara Thomsen
2006 Scow Schooner *Ocean Wave.* National Register of Historic Places Nomination.
2007 Scow Schooner *Tennie and Laura*. National Register of Historic Places Nomination.
2011 Scow Schooner *May Flower*. National Register of Historic Places Nomination.

Meverden, Keith, Tamara Thomsen, and Matthew J. Carter
2012 *The Golden Age of Sail on the Great Lakes: Underwater Archaeological Investigations of Wisconsin's Sailing Fleet 2010-2011.* State Archaeology and Maritime Preservation Program Technical Report Series #12-002. Underwater Archaeology Program, Wisconsin Historical Society, Madison.

Michigan Shipwreck Research Association
n.d. *Helen*. http://michiganshipwrecks.org/shipwrecks-2/shipwreck-categories/surf-zone-shipwrecks-lost-and-found/helen
n.d. *Rockaway.* http://michiganshipwrecks.org/shipwrecks-2/shipwreck-categories/shipwrecks-found/rockaway

Milwaukee Public Library
1959 Lady Ellen Great Lakes Ship Files (formerly the Runge Collection), Milwaukee Public Library. Milwaukee, WI.

New Zealand Maritime Museum (Hui Te Ananui A Tangaroa)
n.d. "25 Years: The story of Ted Ashby, Freightways Scow". 25 Years: The story of Ted Ashby, heritage vessel. New Zealand Maritime Museum.

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

Portage Lake Mining Gazette
1891 Portage Lake Mining Gazette, 4 June. Houghton, Michigan.

Pott, Kenneth R.
2001 The Wreck of the *Rockaway*: The Archaeology of a Great Lakes Scow Schooner. Masters Thesis. Western Michigan University.

Rodgers, Bradley A. and Annalies Corbin
2003 Mud box-filled with stone: the wreck of the scow schooner *Dan Hayes.* The Nautical Archaeology Society.

San Francisco Maritime National Historical Park
n.d. *Scow Schooner Alma*. Educational Pamphlet.

Superior Daily Call
1891 *Superior Daily Call*, 3 June.

Superior Daily Leader
1891 *Superior Daily Leader*, 3 June.

Wilson, Loudon G.
1928 Great Lakes Sailing Craft. Unpublished Manuscript. Historical Collections of the Great Lakes. Perrysburg, OH.

Thomsen, Tamara and Keith Meverden
2011a *Lady Ellen* Field Notes. Wisconsin Historical Society, Internal Documents. Madison, WI.
2011b Scow Schooner *Silver Lake*. National Register of Historic Places Nomination

Zant, Caitlin and Tamara Thomsen
2015 Scow Schooner *Success*. National Register of Historic Places Nomination.