

Mapping the Mullica River Shipwrecks of the Revolutionary War

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Figure 1. This mural was painted on canvas by John Wanamaker of Philadelphia for Fred & Ethel Noyes, c. 1965. In 2007, Tony Coppola of the Inn at Historic Smithville Village gave the rights to the mural to the Sons of the American Revolution. Credit: Col. Richard Somers Chapter, Sons of the American Revolution.

Abstract

AN OBSCURE HISTORICAL BATTLE along the Mullica River in Port Republic, New Jersey, was one of the first documented amphibious assaults by a foreign nation on American soil and has led to a 10-year investigation of shipwrecks of the Revolutionary War period. These shipwrecks have become on-going field classrooms, and we have used them to instruct marine science students about small boat operations, research diving, and how to use remote sensing technology to understand, map and document local and State history. This is the first time that various side scan sonar platforms have been deployed to collect imagery on these shipwrecks, to provide visual references and data to the State of New Jersey Office of Historic Preservation and help identify, document and preserve the importance of privateers during the Revolutionary War. This study will provide the State Office of Historic Preservation with benchmark data about how shipwrecks deteriorate due to both environmental and man-made factors over time in coastal environments.

Introduction

New Jersey was an important battleground state in the Revolutionary war due to its proximate location between the major colonial cities of New York and Philadelphia. As the fledgling colonial navy was greatly outgunned by the British fleet until the French intervention, privateers operating under letters of marque served as important adjuncts to the colonial naval attacks on British shipping. Throughout the conflict, 1,697 letters of marque were issued by the Continental Congress, making British transport and supply lines slower and riskier (Howarth, 1999). Prompted in part by the capture of the merchantman *Venus* in the late summer of 1778, General Sir Henry Clinton decided to move against the particularly troublesome southern New Jersey coast from his base in New York City (Kemp, 1966). Privateers, operating out of Little Egg Harbor and river (current Mullica River/Great Bay/Beach Haven inlet), had established a sanctuary in the village of Chestnut Neck with wharves, storehouses, and a rudimentary fort. Captured supplies were transshipped up the river and

overland to Philadelphia and even to Valley Forge. The British-formed Little Egg Harbor expedition was led by Commander Henry Colin, and consisted of HMS Zebra, HMS Nautilus, HMS Greenwich, HMS Dependence and a number of smaller vessels. They reached the mouth of Little Egg Harbor river in early October, but unfavorable tides and poor weather kept them offshore for a time. Given the delay, the privateers received advanced notice of the raid and emptied many of the warehouses of goods and moved most of their personal vessels upriver to safe harbor. On the morning of October 6th, the British attacked the village after moving a military force of Royal Marines upriver in small boats. The colonial militia who were poorly trained and equipped were little deterrence to the British Marines who captured the village, and burned the warehouses and the approximately 10 prize vessels found in the river (Figure 1). After the raid on Chestnut Neck, the British attacked and destroyed a salt works on the Bass River and an encampment of colonial militia in Little Egg Harbor. Following these operations, the British forces attempted to move offshore but the HMS Zebra was hard aground and could not be refloated, even after removal of the bulk of her armaments and supplies. The Zebra was fired upon and reported to have exploded from the remains of her magazine. The British force then returned to New York City.



Figure 2. Monument near the 1778 Chestnut Neck Battle Site erected by the Daughters of the American Revolution and maintained by the Richard Somers Chapter of the Sons of the American Revolution. Photo: Steve Nagiewicz.

This engagement is referred to locally as the Battle of Chestnut Neck and the Massacre of Little Egg Harbor and the site commemorated as the Chestnut Neck Battle Monument (Figure 2). Several of the vessels linked to the engagement are in shallow water close to the former village site and have been sighted at low water. One of these vessels is on the NJ State and National Historic Register and has undergone significant deterioration since its inclusion. Stockton University has documented this deterioration over the past three years and provided the data to the State of New Jersey's Office of Historic Preservation to document how wrecks are affected by riverine currents and tidal forces. One vessel in this report, the Phoel archaeological site wreck (hereafter the Phoel wreck) has not been previously documented and may be the most intact in the historic district (Figure 3). The other two known wrecks are the Cramer and the Bead.

In addition to the historic district, the area has been incorporated into the Jacques Cousteau National Estuarine Research Reserve administrated by the National Oceanic and Atmospheric Administration (NOAA), and thus receives additional protection. The purpose of this study was to locate and assess the condition of extant shipwrecks and historical objects within the historic district and to use this information to better inform the development of a management plan for these cultural resources.

Methods

The three shipwrecks discussed here have been explored recently almost exclusively by faculty, staff and students of the Stockton Marine Field Station over the past two years using remote sensing technology. In 2008, using a Klein 595 side scan sonar system, Stockton researchers William Phoel, Peter Straub, Steven Evert, and sonar consultant Vince Capone, surveyed portions of the Mullica River for remnants of the battle of 1778, and discovered the third of the known shipwrecks (Figures 3 and 4). It was found opposite Collins Cove along the marsh on the north shore of the Mullica River and named in honor of William Phoel, a former NOAA Fisheries Scientist and adjunct Stockton faculty who passed away during an expedition in the Amazon rainforest several years ago.

In 2015, interest in the wreck was re-invigorated by Stephen Nagiewicz, Stockton adjunct faculty, who was teaching the Underwater Archaeology course that once was taught by Dr. Phoel. Technology is

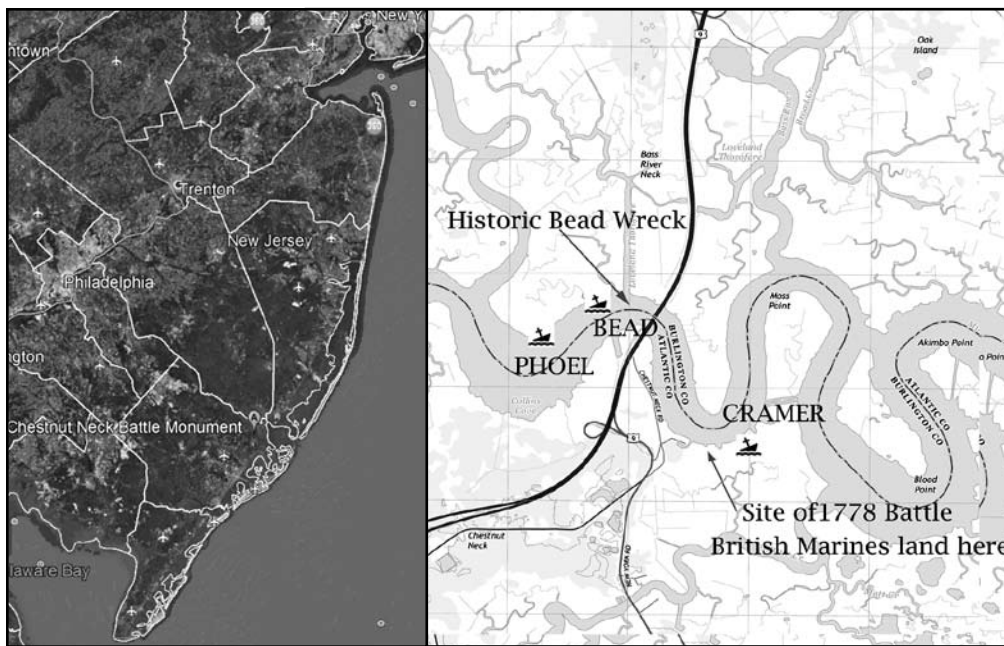


Figure 3. Google Earth image of Chestnut Neck in relation to the coast of New Jersey (left) and (right) local chart showing the relative positions of the three-known revolutionary war era shipwrecks from the Battle of Chestnut Neck on October 6th, 1778. Credit: Stockton University.

now much more advanced than the thermal paper used by the Klein 595. Wreck mapping used three systems. The first was a Klein 3900 (Salem, NH) side scan sonar system with dual frequency 455/900 kHz transducers, with collection and processing using Klein Sonar Pro 12.0. An Edgetech 6205 (West Wareham, MA) multiphase echosounder (MPES) (Brisson and Hiller, 2015) was also deployed with the side scan sonar operating at 550 and 1600 kHz collected on Edgetech Discover software. The third system was used most frequently by the team and was a Humminbird® HELIX 12 CHIRP MEGA DI GPS G2N (Johnson Outdoor Products, Racine, WI), as it was easily deployable on various vessel platforms by faculty and students, easy to operate, and provided varied frequency ranges of 455/800 kHz & 1.2 MHz. Most of the sonar images come from data collected by the Humminbird using SAR HAWK (Black Laser Learning, Hockessin, DE) data processing software.

Operational sonar mapping methodology typically began by identifying the wreck site using GPS coordinates and then marking the wreck with a buoy. Then a survey grid was set up to establish a grid of waypoints that allowed for various transects of the wreck site for the operational sonar to highlight not only the wreck's geographical orientation but also to focus on getting detail on features of interest.

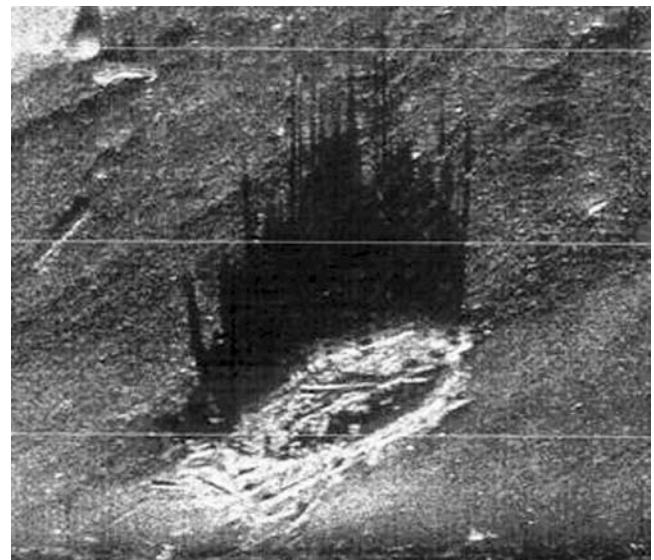
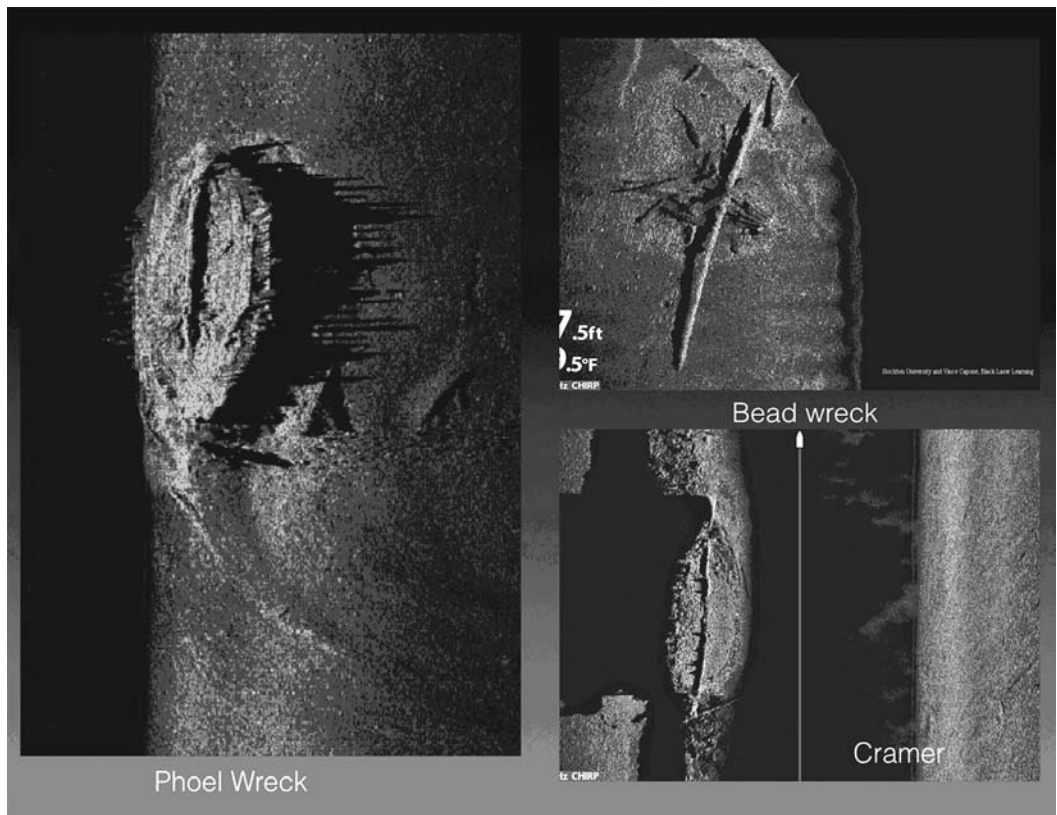


Figure 4. Sonar image of a target in Mullica River known now to be the Phoel wreck. The image was originally captured in 2008 using thermal paper with a Klein 595 side scan sonar system. Credit: Stockton University and William Phoel.

Results

Overall dimensions (Table 1) of the three historic wrecks, the Bead, the Cramer, and the Phoel, were mapped by remote sensing surveys by Stockton in 2016, 2017 and 2018 and from data collected on previous scuba dive surveys overseen by archaeologists Gordon Watts in 1976 and later Duncan Mathewson in 1985 (Fullmer, NJHDA Journal, 1998). The Bead measurements stand out, as it is undergoing the most environmental deterioration by tidal and

Figure 5. All three Mullica shipwrecks found and mapped to date. Credit: Stockton University



riverine currents. In 1975, the wreck which was first surveyed by archaeologists and scuba divers affiliated with the New Jersey Historical Divers Association (NJHDA) dived the wreck in 3.5 m of water and found it to be largely intact but buried in marsh sediment. Over the decades tidal flow and marsh drainage created severe currents outflowing into the river proper that have undercut the wreck and broken it apart.

Table 1.

Chestnut Neck historic shipwreck measurement data.

Wreck	Length (m)	Beam (m)	Height (m)
Bead	9.3	3.1	1.5
Cramer	16.8	4.4	2.3
Phoel	19.1	5.2	3.6

The Bead wreck now rests in 11.8 m of water and is quickly migrating its way over the marsh ledge into the deeper water of a man-made borrow pit used for the construction of the Garden State Parkway Bridges a few decades ago. Figure 5 (upper right corner) shows how the wreck is being undercut by tidal and river currents. In the image, the dark shadow along the straight line, is the shipwreck’s keelson, or what is left of it. That shadow has a slight bend to it, indicating that it is raised off the marsh shelf, allowing currents to

pass underneath, further destroying what is left of the structure. The image also shows that a small section of the keelson overhangs the drop-off, which is supportive of the movement of the wreck due to environmental causes. It should be noted that the Bead wreck was placed on the State and National Registers of Historic Shipwrecks in 1988, (ID# 744) and the National Register (ID #88001899). It is now in danger of total break-up, and its historical significance will be lost.

The Cramer wreck lies within 15 m of the Chestnut Neck Boatyard main docks. The wreck was mapped and surveyed in 1985 by the non-profit group Atlantic Alliance, which is a group of local New Jersey wreck divers who provided support to archaeologists to map the Bead wreck at the same time. This entire area of the marina is part of the Mullica River/Chestnut Neck Archaeological Historic District, State of New Jersey ID#385. (Mathewson, R.D. 1985) This includes the wreck of the Cramer, named after the marina at the time. In fact, all of the wrecks have local names, as their original identities remain unknown. The Bead wreck was named for the glass beads found on the wreck by divers in the early 1970s. In the three images below, the Cramer wreck is very similar in construction to the Phoel wreck,

although it is not as intact. There are several areas where the wreck has broken up and debris is scattered about. Further complicating the area, the Cramer lies along a ledge created by river currents over her entire length and is gradually slipping off into deeper waters. In figure 6, the ledge (arrows) can be identified by the black shadow it casts on the left or port side of the wreck. Shadows are created as the beam fans out from the transducer. (the solid white line in the center of the image) As they pass over objects such as the shipwreck, the height or depth of the object creates a return that the sonar interprets as an image. The height of the object can be calculated in post-processing software. In this case the shadow to the left of the wreck varies from 3 to 5 meters deep. Viewing the grayscale sonar image Figure 7, illustrates much of the debris field that the trails the wreckage, while the cross-section of the Cramer Wreck in figure 8 outlines her frames or ribs, (inset zoom) enough so to be able to count them and measure dimensions. Cross-cutting the wreck highlights parts difficult to see in other images. While the wreck has been accurately mapped, it has not been nominated to the State or National Register, in part because it lies within a working marina, although at some point its designation will happen.

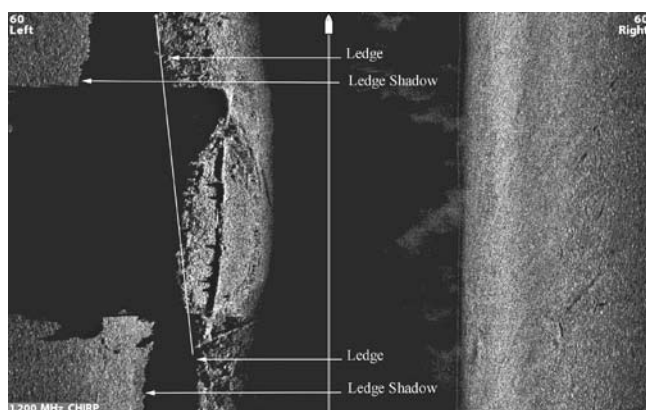


Figure 6

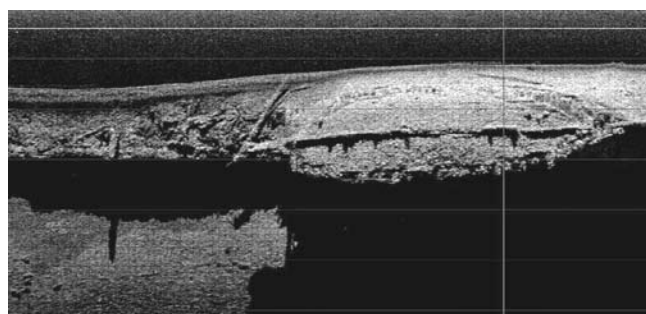


Figure 7

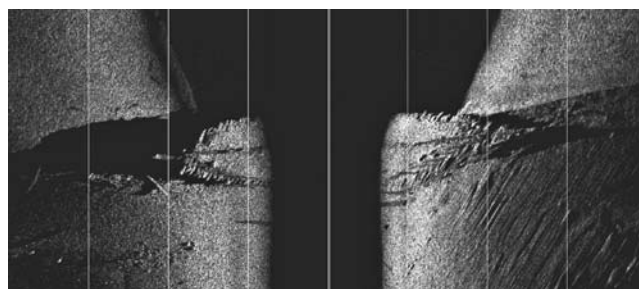


Figure 8

Figures 6, 7 and 8 These three different views of the Cramer wreck help identify feature and document its orientation and physical condition. Credit all three images; Stockton University

Of the three shipwrecks, the Phoel is the most complete (Figure 7), relatively speaking, and represents the best opportunity to study and document its construction and relevance to this battle and its impact on local, state, and national history. All three wrecks are likely the “prizes” of local privateers, or pirated vessels captured by colonial captains, who were issued letters of marque by the Continental Congress. This allowed them to be pirates for the benefit of the new country by hijacking merchant ships for their cargoes. All indications are these shipwrecks are very probably merchant ships and most likely, British merchant ships. What we have yet to learn is whether these vessels sailed from England or were built along our coastline. Testing the wrecks’ construction can help identify the type of wood used in the hull and possibly locate where it was built. For example, a hull built of red cedar could well have been built in New Jersey, where there had been extensive forests of red cedar. Conversely, a ship built along the Maine coast might be constructed using pine, maple, beech, or birch. The frames (ribs), expected to be oak, could be dated by tree-ring analysis to determine the age of the wood and thereby the ship (Miles 1997; Baillie, 1982).

The high resolution in Figure 9 enables scientists and researchers to use sonar data processing software to measure the ceiling planks of the uppermost deck of the wreck and count the individual frames along its port side. Utilizing the software’s capabilities, allows us to collect data remotely that would be difficult if based solely on diver measurements in turbid conditions, and can be used in conjunction with diver measurements to calibrate remote methods. In addition, these images allow a historical interpretation (Davis, 2012; Desmond, 1997), and reconstruction of the actual vessel from the sonar record (Figure 8).

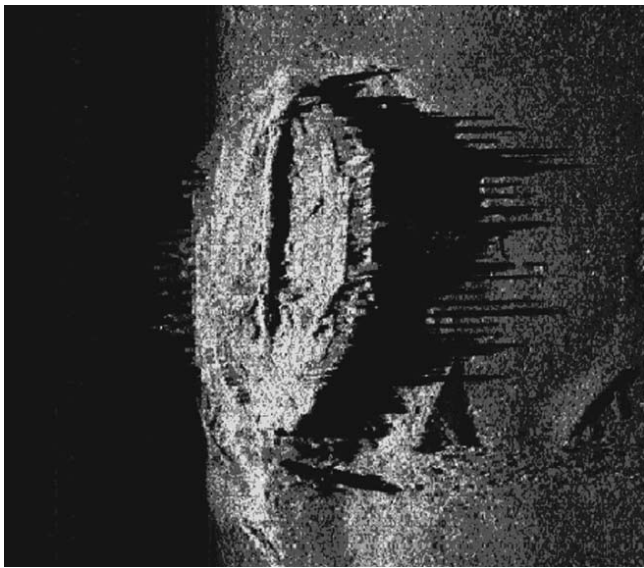


Figure 9. Side scan sonar image of Phoel wreck in the Mullica River. Credit: Stockton University & Vince Capone.

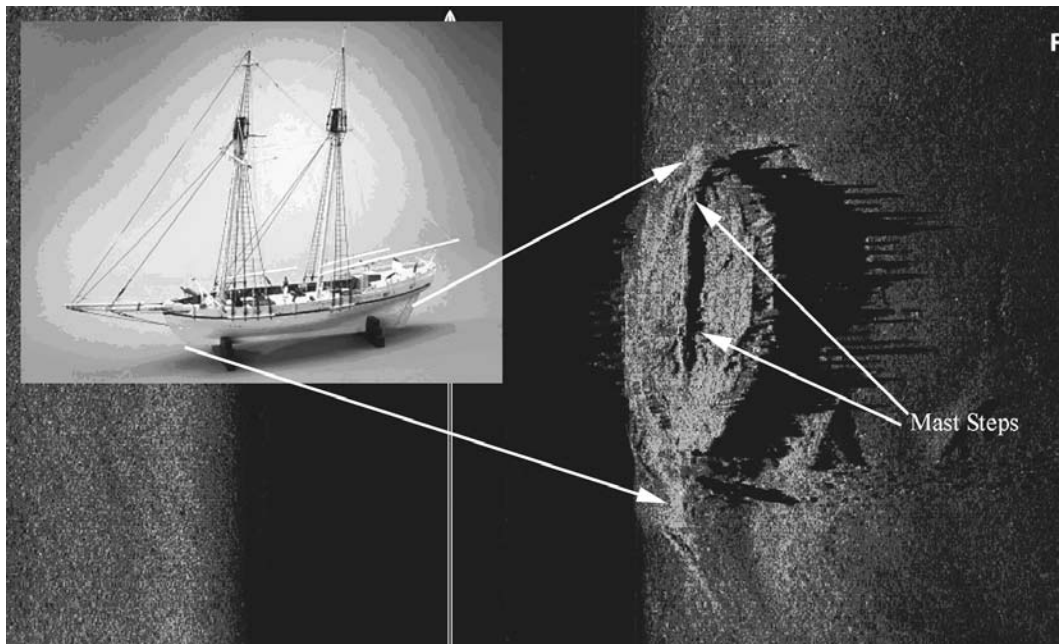
Of these three wrecks, the Phoel wreck provides us with the most complete underwater archaeology laboratory and classroom. Remote technology allows researchers and students to accurately measure components of the wreck and actually ‘see’ the wreck as an image in its completeness, something impossible to visualize in river conditions. Recent dives using a Teledyne Seabotix LBV300 ROV (remotely operated vehicle) on the wreck provided little usable imagery, due to less than 30 cm visibility. The ROV’s onboard Blueview sonar worked well in finding the wreck. However, the ROV thrusters used to maintain position over the

wreck site created additional turbidity stirring-up sediment and plant life in front of the video camera and complicated videography and observations. This is also true of the scuba dives that have been logged on the wreck last month. The low visibility makes visuals by divers very difficult, not unlike the ROV. Our remote sensing technology is giving us data and high-definition sonar generated images of the wreck. Yet despite less than optimum underwater conditions for divers we will still need to log several dives to fully collect measurements and record significant parts of the shipwreck.

Discussion

The collection of the data reported here brings to light issues not uncommon with shipwrecks, in that they will deteriorate due to environmental and man-made interactions over time. This is of major concern as these wrecks represent a focal point in American and Southern New Jersey History. Our sonar data indicate that all three wrecks have shown signs of deterioration over the period during which we have collected data. Most of the damage has been done by river and tidal currents, although this damage also can be linked to construction in of a major highway bridge very near the wreck. Erosional forces from moving water will impact these wrecks, as it does with marshes. The wrecks are too delicate to be raised, and as is the case generally, there isn’t money available from the State or Federal Government to preserve or display them.

Figure 10. Typical sloop of the 18th century, with arrows pointing to the part of the sloop that is represented by the Phoel wreckage. Credit: Stockton University and the Smithsonian Museum of Natural History for inset.



As the conditions of the wrecks are documented, reports to the requisite state and federal agencies will be made, but the loss of history is also a consideration that needs to be addressed regardless of funding. Maritime History in this instance some of the oldest remaining shipwrecks in American History cannot be replaced and while all shipwrecks will ultimately face deterioration over time, documenting of their location, condition and role in history remains the goal of archaeologists and marine scientists on this project. Nomination to the Historic Register will place the wreck's location on nautical charts, advising mariners of their location with the intent to bring awareness of the history and the protection of the site.

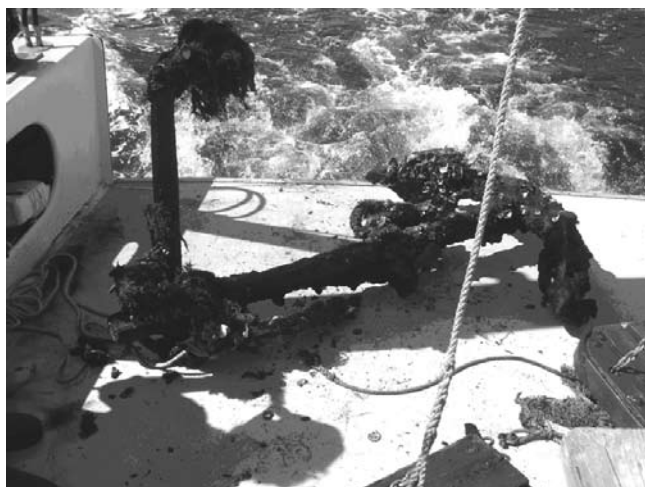


Figure 11. Bead anchor initially dragged from wreck site.



Figure 12. Conservation tank for the Bead anchor at Stockton Marine Field Station. The anchor will undergo chemical bath and electrolysis to slow corrosion and help preserve it for display. Credit: Stockton University

There is also the danger of man-made impacts.

For example, a kedge or stream type anchor was dragged up accidentally from the Bead wreck site several years ago, even though the wreck location is marked on charts. The anchor was accepted by Stockton University, with approval of the State Office of Historic Preservation, for conservation (Figure 11). The Bead wreck lies on a marsh ledge located near very dynamic water flow locations of both the river and marsh drainage canals. In 1975, when first explored and mapped by divers, the wreck was mostly intact (at least the lower meter of the hull) and rested in 3.3 meters of water. Over the years, this ledge has been migrating. Erosional forces have undercut the ledge and the wreck has slipped downward into a deep hole created several decades ago when the area was used as a borrow pit during construction of larger highway bridges and power lines. Images from Figures 6 and 7 now show the wreck in 11.58 m of water, a drop of over 8 meters in 43 years. As the wreck slipped further down the ledge, it has almost completely broken apart, and released the anchor. Only the keelson and a few frames are still recognizable.

The Phoel, which is a popular fishing site, now shows signs of man-caused damage probably due to anchoring. While its location close to the marsh shoreline helps slow down environmental deterioration, substantial hull damage has been recorded that is human caused. The multibeam image (figure 14) provides evidence of more damage at the bow, and more pieces of the wreck have fallen or been dragged off the wreck. Most wrecks provide habitat for marine life, and these Revolutionary War wrecks are no different. Large fish schools hover around the wreck, something fishermen will see on their fish-finders, even if they don't know a 240-year shipwreck is part of the bottom profile.

More work needs to be done mapping these sites, which will include additional scuba diving. Sonar imaging helped create the image (Figure 15) but only by scuba diving can we adequately record parts of the wreck necessary for identification. Diving is still necessary to see, feel and examine wreck construction up close, even in turbid conditions. Our sonar images in Figure 10 show the location of the keelson and two dark rectangles that indicate mast steps, places where the two masts would be anchored into the keel. Highly accurate though this technology may be, only divers can measure the dimensions and discern construction details. We can image hull and deck planking and

measure its length and width but only a diver, whether by sight or by feel can determine the type of construction that holds the hull planking to the frames and the type of fasteners that would indicate the age of construction, thereby dating the wreck.

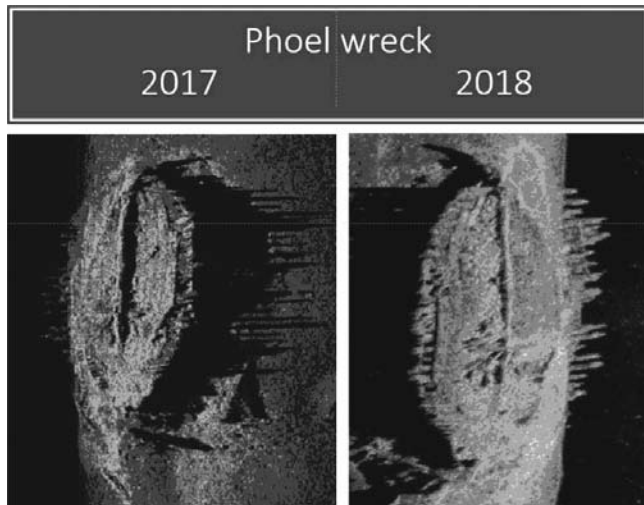


Figure 13. Two-year sonar image comparison of the Phoel wreck. Noticeable damage to the bow section of the shipwreck, likely due to anchoring and natural causes.

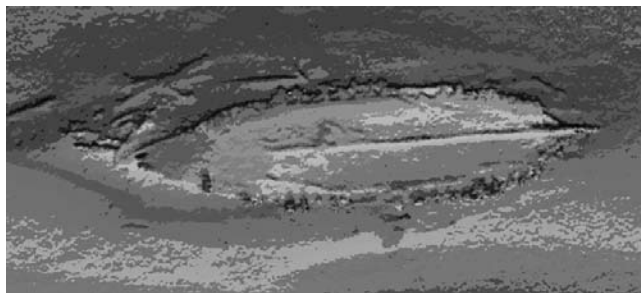


Figure 14. Multibeam image of the Phoel wreck collected with a R2Sonic 2024 during a training exercise conducted for Stockton University (Galloway, NJ) by ECHO81 (Hartwell, GA).

Scuba Diving

Seven scientific dives have been undertaken in the past four months to collect this data. Divers, Steve Nagiewicz, Dr. Peter Straub and Jessica DiBlasi were the first to dive the Phoel wreck. The objectives of those dives are to: 1. collect measurements of frames, planking, 2. take video and close-up photographic records of each wreck where possible, 3. obtain wood samples for testing, and 4. record in place potential artifacts that can help date the wreck and secure the artifact if it is in potential danger of deterioration (Kahanov, 2013).

Artifacts were recovered on subsequent dives at the

bow and amidships. 26 glass shards were recovered at or near the bow on three dives. Each ‘black glass’ shard shows signs of high heat deformation, melting and discoloration. The glass is indicative of the period mid-18th century to early 19th century. Many artifacts are fractured and can be roughly placed together to form their original shape. The base fragments show ‘push-up’ or ‘kick-up’ bases. While the bottles cannot be identified from this the process of this type of bottle base began in the early 17th century. The black glass themselves are typical (Jones & Sullivan 1989, Van den Bossche 2001) of the era, used mostly for inexpensive and multivariate use. The glass is typically a dark olive or green and due to high-heat now show a light blueish tint (itself indicative of high-heat melting) while they cannot be used to “date” the wreck, they are typical of what can be found on merchant ships of this time period (Figure 15).

These artifacts have been recovered along with measurements and data to confirm the wreck as being one of the ten historically noted ships of the battle as those destroyed by British forces in 1778 and it verifies age of the shipwreck through proof of burning, dating by artifacts, situation and circumstance.

The bricks were recovered near the stern and just to the right of the keelson. 14 bricks were counted. (two were recovered). These bricks have a slight magnetic signature and show signs of charring. They were likely part of the ships ‘hearth’ or oven. They were used along with sand to line the base of the oven protecting the wood deck from heat.

The other type of artifacts recovered were pieces of wood. A plank from the hull, samples of wood near the mast steps. Wood was tested at the laboratories of the University of West Florida’s History Department. The wood was determined to be white oak. No age could be determined from the samples. White Oak can be found along the Northeastern coast of the United States up to Canada and in England.



Figure 15. Phoel wreck artifacts. Hand-struck, non-glazed brick (top), black glass melted and deformed bottle shard (center), one of 7 pieces that fit together, and wood sample (bottom) from mast step construction. All show evidence/smell of charring, indicative of high-heat burning. The black glass shard is partially tinted blue not due to any added cobalt but the process of hi-heat changes the structure of the glass. Images by Shannon Chiarel, Archaeology Masters Candidate, Monmouth University.

Two mast steps were confirmed. The only evidence is a deep center gouge for the insertion of the tapered end of the mast and some signs of framed support on either side of the mid ship mast. The hull planking near the stern showed ‘tree-nail’ fasteners which are a very positive indication of the age of the shipwreck and determination of its type. Treenails (trunnels) or wood dowel fasteners were often economical cost-cutting features of building large fleets of merchant ships that were not built to last more than 3- 5 years of heavy use. Their use also dwindled into the 19th century where iron, or steel and bronze and brass were normally used. Some iron fasteners were observed, one wrought iron was recovered with evidence of extreme oxidation near the stern where the keelson is fastened to the frames.

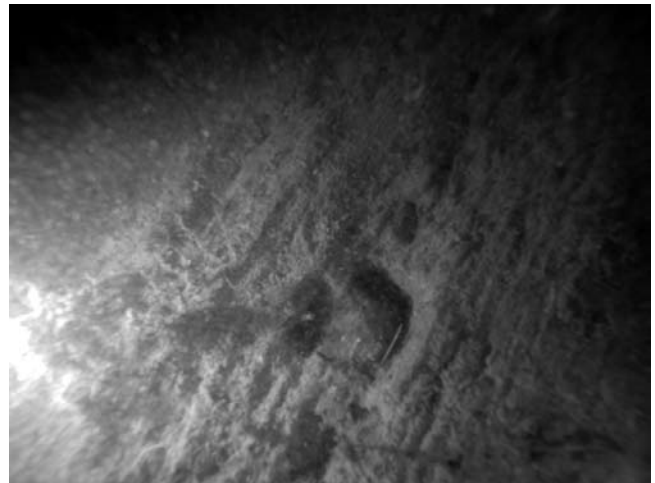


Figure 16. Image of tree nail. Courtesy Stockton University.

A Marine Magnetics ‘Explorer’ magnetometer was deployed to survey the wreck with the intent to measure for magnetic field or signature or iron content of the wreck. The wreck showed an extremely low value in nanoteslas which seems to indicate little iron content on the wreck. Readings do show a slight magnetic field, but this can be explained by some of the iron fasteners and hand-struck red brick. It also means anything of iron or metal had been removed prior to burning and sinking.

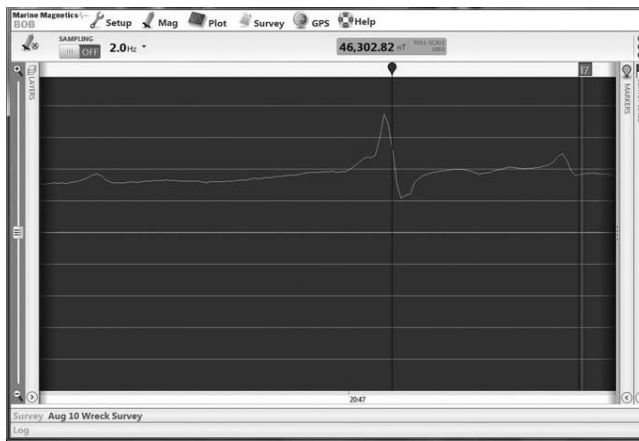


Figure 17. Magnetic field of the Phoel wreck. Courtesy Vince Capone and Stockton University.

The data collected will be used in nominating the Phoel and Cramer to the State and National Registers of Historic Shipwrecks. The Phoel site is currently listed as an archaeological site (Site #28-BU-950) and all are currently protected under the State of New Jersey's Office of Historic Preservation as the Mullica River/Chestnut Neck Archaeological District (ID#385. SR: 10/1-1976. SHPO Opinion: 9/16/2002

It is the goal of this project to provide sonar, observed and historical data that accurately places this wreck into the timeframe of the 1778 Battle necessary to complete the application for historical nomination and in the future, in conjunction with local historical societies to install markers and additional historical interpretation in local museums, online media resources, and perhaps privately funded kiosks placed near the wreck sites, detailing their roles in the Battle of Chestnut Neck on October 6th, 1778.

Acknowledgments

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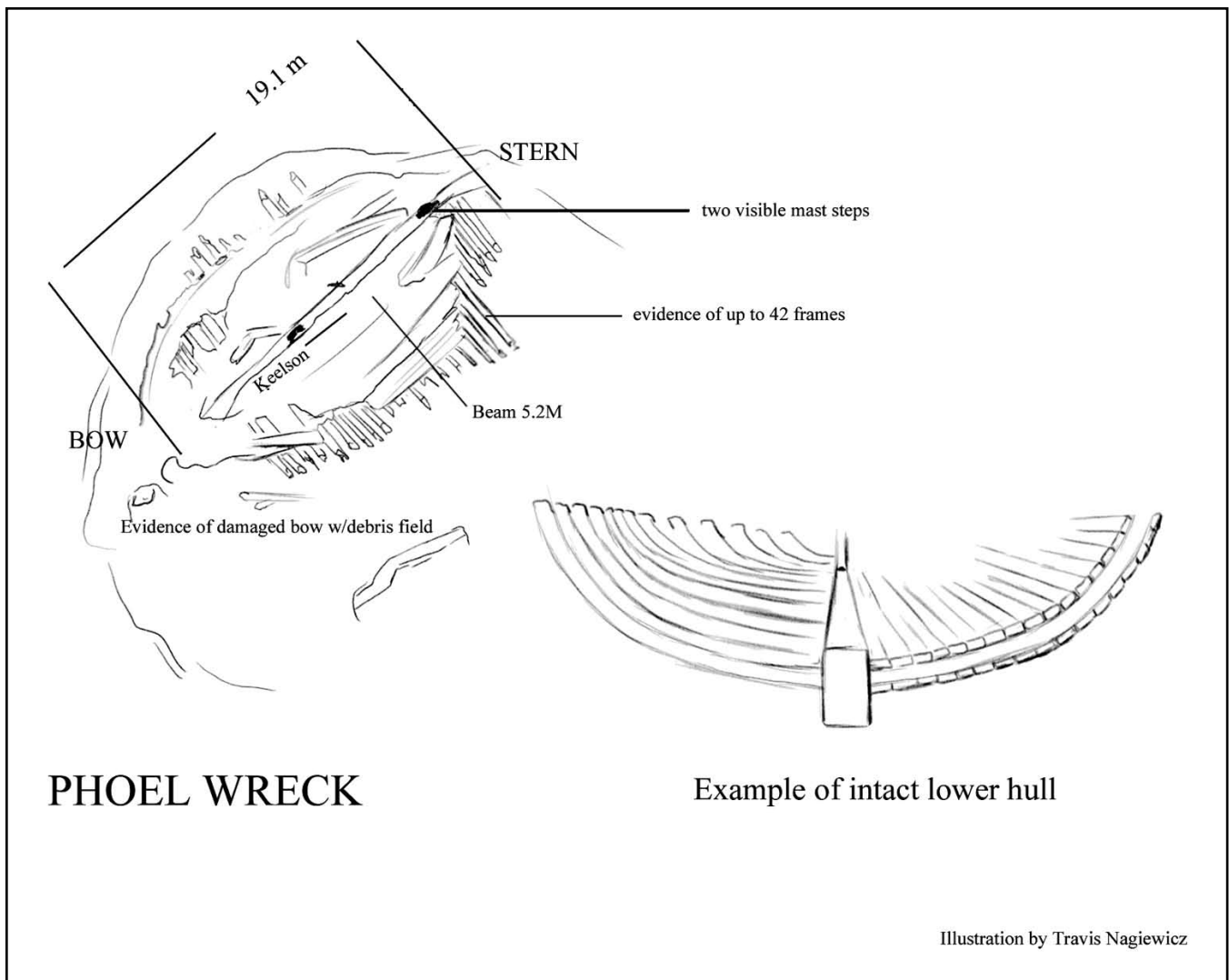


Figure 18. Annotated illustration of the Phoel wreckage, with a comparison to an intact lower hull. Credit: Travis Nagiewicz.

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