RECONSTRUCTING THE RIG OF *QUEEN ANNE'S REVENGE*

A Thesis

by

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ABSTRACT

Queen Anne's Revenge is one of the most infamous pirate vessels from the Golden Age of Piracy and represents multiple historical narratives due to its varied career in the first two decades of the 18th century. The vessel wrecked in 1718 off the coast of North Carolina when it was under the command of Blackbeard, who had used the vessel to blockade the port of present-day Charleston. Before the vessel was used as a pirate flagship, *Queen Anne's Revenge* served as a French slaver, and possibly a privateer. This varied career, during which the vessel extensively traveled the Atlantic, endowed the wreck site with a distinctive artifact assemblage that demonstrates the fluidity of national borders, trade routes, and traditions of Atlantic seafaring during the first decades of the 18th century. A small assemblage of rigging elements was recovered from the wreck, and while the quantity of diagnostic rigging components recovered thus far is smaller than other assemblages from contemporary wrecks, it is still possible to derive useful information to assist in the study of an early 18th century slaver and pirate flagship. The following thesis presents a study of the rigging assemblage of *Queen Anne's Revenge*, as well as a basic reconstruction of the rig, and an overview of the relevant iconographical data. Together, this information describes a vessel that represents a blending of national traditions and demonstrates the changeable nature of a ship's rig from the Golden Age of Piracy.

DEDICATION

"God keep those cheery mariners

And temper all the gales

That sweep against the rocky coast

To their storm shattered sails

And men on shore will bless the ship

That could so guided be

Safe in the hollow of His hand

To brave the mighty sea"

- A prayer at the start of a voyage, from a journal written on board the whaler *Rebecca Sims* in 1854.

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I owe a great deal of thanks to many, many people who assisted me throughout the process of researching and writing this thesis. I feel incredibly lucky to have been able to blend my passion for traditional sailing with my academic interests, and to have had the encouragement of my mentors to do so. I am deeply grateful to all those who have helped me along the way, by generously offering their time, knowledge, and unwavering support. I cannot thank you enough.

My advisor, Dr. Kevin Crisman, has been an academic role model since I first spoke with him about my interest in nautical archaeology when I was an undergraduate student, and it was his suggestion that I pursue my varied maritime interests by researching the hull and rig of *Queen Anne's Revenge*. This project would not have been possible without the benefit of his archaeological expertise and knowledge of maritime history. I am a better scholar, and this thesis is research I am proud of, because of his mentorship.

I am deeply indebted to the staff at the *Queen Anne's Revenge* Conservation Laboratory, particularly Kimberly Kenyon, the Senior Conservator and Co-Principal Investigator. She supported my research needs throughout this entire project in countless ways and was never anything but welcoming and excited about my project. I must also give special thanks to Elise Carroll, QAR Lab Manager and Assistant Conservator, who graciously opened her home to me during my first visit, and to Courtney Page, former QAR Lab Manager, who helped me navigate the administrative structure of such a large state-operated archaeological project.

Dr. Christopher Dostal and Dr. Jonathan Coopersmith, my committee members, provided constant encouragement for my research, and continually challenged me to think bigger, think

deeper, and think outside the box. They provided additional avenues of inquiry, helped me overcome roadblocks when I ran into them, and offered valuable insight from their respective specialties. It takes a village to complete an archaeological project, and I am incredibly lucky and thankful that they were in mine.

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This project involved a great deal of traveling over a number of years which was made possible by grants from the Anthropology Department of Texas A&M University. This project would not have been possible without this financial support, and I am deeply thankful for the opportunities that have been given to me by the Anthropology Department faculty and staff.

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Contributors

This work was supervised by a thesis committee consisting of Dr. Kevin Crisman (advisor) of the Department of Anthropology, Dr. Christopher Dostal, of the Department of Anthropology, and Dr. Jonathan Coopersmith of the Department of History.

All work conducted for the thesis was completed by the student independently.

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CHAPTER I

INTRODUCTION

Queen Anne's Revenge is one of the most infamous pirate vessels from the Golden Age of Piracy, even though the vessel's career as a pirate flagship was relatively short. The vessel, wrecked in 1718 off the coast of North Carolina, is a unique representation of many aspects of this period of history, including slavery and piracy, and its artifact assemblage is distinctive from most other shipwrecks. *Queen Anne's Revenge* represents multiple historical narratives as the vessel served multiple purposes over the course of its career. Historical sources suggest it was originally built as a French privateer; it went on to sail as a French slaver and then an English pirate's flagship. With this varied resume and the extent of the vessel's Atlantic travels before its loss, the artifact assemblage from the wreck site demonstrates the fluidity of national borders, trade routes, and traditions of Atlantic navigation during the first decades of the 18th century.

The period during which *Queen Anne's Revenge* was active was a time of change for the rigs of square-rig vessels. During the early 18th century, the head rig underwent a dramatic transition: the sprit topmast, a vertical mast mounted at the end of the bowsprit, and sprit topsail, were removed and replaced by fore and aft headsails carried by a jibboom, a retractable spar placed on top of the bowsprit and extending forward from the bow.[1] This change had significant implications for both vessel performance and vessel handling which affected not only the ship but also the officers managing maneuvers and the deckhands responsible for sail handling. Fore and aft sails in the head rig changed the balance of the rig of the vessel as a whole, and greatly affected the way a vessel performed through a maneuver, as it introduced different requirements for the head rig for both tacks and wears. Since *Queen Anne's Revenge* was active during this

[1] Boudriot 1993, 340.

transition, the configuration of the head rig is an important unknown when considering the rig of this vessel.

A small assemblage of rigging elements has been recovered from the wreck site, and these items are currently in various stages of conservation. While the quantity of diagnostic rigging components in the assemblage is modest (compared to that of *La Belle,* a French vessel of exploration that sank in 1686), it is still possible to derive insights into the rig and hull, as well as human activity on board the vessel.[2]

This thesis presents a summary of the rigging elements thus far recovered from the wreck of *Queen Anne's Revenge,* and an interpretation of the diagnostic information derived from each artifact.[3] A basic hypothetical reconstruction of the rig is provided with a detailed exploration of the potential future knowledge to be gained through more seasons of excavation at the wreck site and further study of the remaining hull structure.

Queen Anne's Revenge represents an intersection of multiple important historical narratives of the early 18th century, and its career overlaps with an important technical transition in vessel rig design. When all these factors are taken into consideration, *Queen Anne's Revenge* represents a blurring of national traditions, and stands as an important reminder for those studying the Age of Sail of the potential pitfalls that a scholar may encounter when attempting to decipher national traditions from a ship's rig. Practically speaking, especially for the historical period in question, vessel rig design did not fall within neat historical boundaries, and this is an important caveat to keep in mind when using supposed national traditions to reconstruct vessel rigs.

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[2] Corder 2007.

[3] Appendix A contains a complete catalog of the rigging elements discussed in this thesis. A larger number of artifacts were considered, for instance numerous small, non-diagnostic rope fragments, but these were not included as it is impossible to state with certainty that they represent rigging elements.

Primary and Secondary Sources

While a large body of resources exists for scholarly investigation into 19th century Anglo-European seafaring practices, there is substantially less information for the preceding two centuries. When studying seafaring in the 19th century, one has access to contemporary memoirs, as well as a variety of naval publications. These sources are available for the 17th and 18th centuries, but are significantly fewer in number. The French recorded very little about their ships, especially during the 17th century.[4] Most information available to modern scholars for the period of *Queen Anne's Revenge* can be divided into four groups: primary written sources, archaeological sources, iconographical evidence, and evidence from models and model makers. There are benefits and drawbacks for each of these categories, and, when restricted to the evidence provided by just one or two of them, the modern researcher can be left with significant gaps in the story.

One of the most useful sources of information when reconstructing the rig of a vessel comes from archaeological data. This information is on par with contemporary firsthand accounts of sailing on a square-rigged vessel, as the archaeological evidence is a snapshot of how one specific vessel was rigged and the time of sinking. This evidence also has the potential to shed light on how the vessel was probably sailed. The downside of this evidence, however, is the rarity and incompleteness of it. Certain elements of the rig, like mast steps and deadeyes, often turn up on wreck sites, but the majority of the rigging does not survive. When elements do survive, most are not diagnostic (i.e. indicative of period, nationality, etc). For instance, blocks are frequently found on wreck sites but, while broad differences between different types and

[4] Corder 2017, 203.

periods existed, the design of blocks changed little over the course of the late 17th and early 18th centuries. An example of this can be seen in the blocks recovered from both *La Belle* (lost in 1686) and *Machault* (sunk in 1760). Even though three quarters of a century separates these wrecks, the blocks recovered from *Machault* are similar to types recovered from *La Belle*.[5]

Even during the life of the vessel, the rig is an ephemeral construction, constantly moving, and thus wearing out, with parts being modified and replaced. In addition to regular wear and tear, the rig was occasionally subject to alteration, even drastic alteration, as seen in an account by Woodes Rogers in his book *A Cruising Voyage Round the World* describing a privateering voyage undertaken from 1708-1711. He describes making major alterations to the rig of his vessel, *Duke*, within the first few weeks of the voyage.[6] To improve the trim of the vessel, the height and location of the mizzenmast was changed, and the foremast was moved forward. This suggests that the rig of a sailing vessel like *Queen Anne's Revenge* would have been constantly worked and reworked, and moreover that it was possible and even common to alter the rig in such a way. This seems to have been consistent throughout the Age of Sail, demonstrated by a passage included in the autobiography of Charles Tyng, which covers the period 1808-1833. He describes shipping out on a new vessel, the merchant ship *Houqua*, which set sail in 1819. Because the vessel was new, the rigging was "all new from the rigger's hands, and all wanted fixing up." The crew's first few months on board *Houqua* were taken up by a complete overhaul of the rig, and Tyng had the "greatest pleasure" in his work redoing "every splice, and restropping and grafting every block strop on the mizzen mast."[7] Crews frequently salvaged rigging elements from wrecked vessels, seen for example in the account by a Spanish

[5] Sullivan 1986, 16.
[6] Rogers 2018, 4 [1712].
[7] Tyng 1999, 65.

pilot named Barroto who noted the recovery of materials from the wreck of *La Belle* in 1687. It is clear that the rig of a vessel from this period was transient, and rigging elements were subject to frequent reassignment and recycling.[8] While archaeological evidence is potentially the most informative, it first must exist, and second must be considered in light of the factors mentioned above. Rigging elements recovered from wreck sites must be considered as transient elements in the ever-changing machine that is a sailing rig.

The archaeological assemblage most relevant to the rig of *Queen Anne's Revenge* has been that of *La Belle*.[9] The period and nationality render this wreck the most similar known and excavated shipwreck to that of *Queen Anne's Revenge*. The rigging assemblage of *La Belle* also yielded important diagnostic elements, such as parts of the crosstrees and futtock shroud assemblies, both of which are rare discoveries. The most significant rigging assemblage known to nautical archaeologists to date, however, is that of *Vasa*, the Swedish warship which sank in the Stockholm harbor in 1628.[10] Recovered in 1961 in a remarkably well-preserved condition, *Vasa* is often used to supplement knowledge of various vessel rigs, even those that do not match *Vasa*'s nationality or specific period, since there is such a wealth of data concerning this particular rig. Information from the rig of *La Belle* was used extensively for this thesis, while information concerning *Vasa*'s rig was used primarily to inform activities on, and the layout of, the deck.

Key primary written sources useful for the study of the rigging of *Queen Anne's Revenge* can be split into two types: rigging and ship construction treatises, and primary accounts from seafarers. Most of the former used for this thesis are from before the sinking of the vessel in

[8] Corder 2007, 6.
[9] Corder 2017.
[10] Cederlund 2006.

1718, although there are a few notable exceptions, such as the 1737 Blaise Ollivier treatise concerning English, Dutch, and French shipbuilding.[11] The majority of written sources used for the following analysis are from the late 17th century, such as the 1695 treatise *L'Architecture navale* by Charles Dassié and the *Album de Colbert* from 1670.[12] Reason for this focus on sources that are older than the vessel lies in the major shifts in rigging technology that occurred during the first decades of the 18th century. At some point during this period, the sprit topmast was abandoned in favor of the jibboom, and additional fore and aft sails were added to the head rig in place of the sprit topsail.[13] Another fore and aft sail was added over the course of the 18th century, although its use did occasionally occur in the 17th century.[14] There does not exist, to my knowledge, a primary written source that was produced during this period of change. It is important to tread carefully and conservatively when considering features for a vessel such as *Queen Anne's Revenge,* to consider all methods known at the time, and propose possibilities, not absolutes, when there is a lack of definitive archaeological information. For these reasons, the majority of written sources used here originate from periods prior to the vessel, and are used as a baseline of known techniques, with possibilities of rig features drawn from newer sources.

The second type of primary written sources used for this thesis are accounts from the seafarers themselves. Sailor autobiographies dating to the 18th century are relatively uncommon, especially for mariners active early in the century. The benefits and drawbacks of this type of primary source are similar to those of archaeological data. Some can be extremely informative regarding the practical use, maintenance, and alterations of a ship's rig, but these are

[11] Ollivier 1992 [1737].
[12] Dassié 1994 [1695]; Berti 1988 [1670].
[13] Boudriot 1993, 344.
[14] Ibid.

unfortunately rare. A useful source from the period of *Queen Anne's Revenge* is the book by the privateer Woodes Rogers mentioned above. Even though this account focuses more on the macro-level issues encountered by the leader of a lengthy voyage with multiple vessels and less on the practicalities of sailing an early 18th century square-rigger, it still contains descriptive details that are relevant to the use and maintenance of the rig of *Queen Anne's Revenge*.[15]

Models can be an excellent source of information regarding the rig of a vessel, although they come with their own drawbacks that must be recognized. The purpose of the model must be considered: **w**as it created in honor of a specific event? Was it built by a shipyard as a sales tool? For example, a scholarly work studying a model of the French frigate *L'Aurore* from 1697 may seem like an excellent source, since the model itself was built in the 19th century, the study should be considered with a grain of salt.[16] Possible anachronistic restorations must also be kept in mind when considering ship models as examples of rigging techniques.

No discussion of evidence from the world of model-building would be complete without the inclusion of the important and often-cited work by R. C. Anderson, *The Rigging of Ships in the Days of the Spritsail Topmast*. First published in 1927, this is a thorough, technical, and highly detailed discussion of the rig of a square-rigged vessel from 1600-1720. This book is aimed at model builders, which explains the high level of detail, and is based upon the author's study of ship models exemplifying various European national traditions. While seemingly an excellent resource, there are some issues with the text, mainly that Anderson does not rigorously cite his sources. This is perhaps an unfair criticism, given when it was written and the audience

[15] Rogers 2018.
[16] Piouffre, 1994.

the text was intended to serve; however it is important to keep this in mind, especially given the frequency with which modern scholars cite Anderson's work.

Using iconography to supplement research on the rigging of vessels may provide valuable additions, as well as useful correlations of hypotheses generated from other sources, but can also have drawbacks similar to the drawbacks of models. Paintings or drawings depicting square-rig vessels are usually not painted by those with sailing knowledge, and it is always questionable how much the artist used real examples to provide detail in their work. It is also difficult for artists to include a high level of detail, simply due to the complexity of a rig and the high number of components. For instance, in an image (figure 1) included in Jean Boudriot's work on French frigates and thought by the author to be a 17th century work by Chabert Junior, the main elements of the rig are correct for the period, but many details are either missing or inaccurate.[17] Many of the falls for braces, including the fore course braces and the sprit and sprit topsail braces, simply disappear behind other rigging elements and it is not shown where these lines make their way to deck.

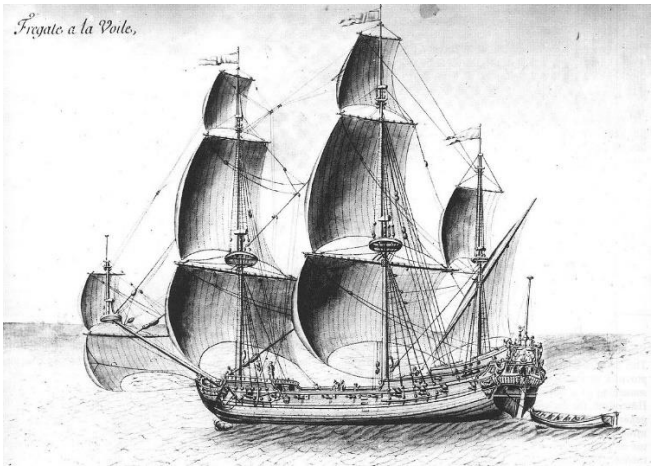

Figure 1. A late 17th century French frigate, attributed to Chabert Junior. (Reprinted from Boudriot 1993, 35).

[17] Boudriot 1993, 55.

An engraving by Guéroult du Pas published in 1710 (figure 2) included in Boudriot's 1993 work, would on first glance seem to be an excellent source for the study of *Queen Anne's Revenge,* as this image overlaps with the career of *La Concorde* and depicts a vessel with a sprit topmast.[18] This would hopefully be useful in answering the question about the head rig configuration of Blackbeard's flagship, however a glaring error suggests otherwise: the "petite fregatte de 10. Cannons" is depicted with a single square yard, a crowjack, on the mizzen mast, above a lateen mizzen sail. Crowjack yards did not carry sails, as the purpose of this spar was to serve as an attachment point for the foot of a square-rigged sail carried on the mast above. The mizzen of the petite fregatte is not shown with a mizzen topsail (the sail that should be in use in conjunction with the mizzen crowjack), which makes the inclusion of this yard inaccurate.

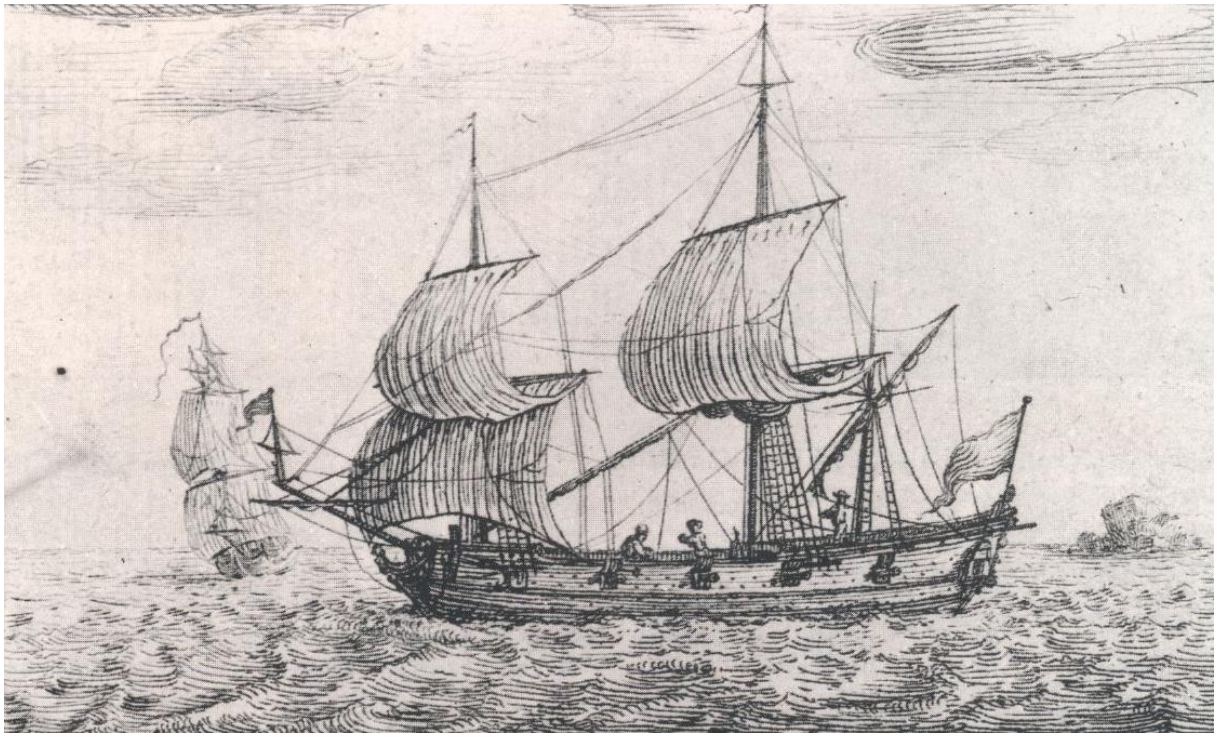

Figure 2. A 1710 engraving of a "petite fregatte de 10. Cannons" by Guéroult du Pas. (Reprinted from Boudriot 1993, 58).

[18] Boudriot 1993, 58.

Given the vagaries of iconographical evidence, it is important to keep in mind the traditional archaeological adage: "absence of evidence is not evidence of absence." Iconographical information should therefore be used in conjunction with, and to support, alternative forms of evidence, and should only be used for evidence of presence, and not evidence of absence.

From *La Concorde* to *Queen Anne's Revenge*

In 1996, the salvage company Intersal Inc. identified a shipwreck site approximately 2.4 km from Beaufort Inlet, North Carolina. Working with representatives from the North Carolina Underwater Archaeology Branch (UAB), Division of Archives and History, the team gave the site a state designation of 31CR314 and UAB designation of 0003BUI.[19] Intersal Inc. was under contract with the state at the time of discovery, and control of the site and direction of the project was turned over to state underwater archaeologists.[20] A year later, the governor of North Carolina announced that the site designated 31CR314 was believed to be that of *Queen Anne's Revenge*, flagship of the notorious pirate Blackbeard. This preliminary identification was based on both archaeological evidence and historical research. On the day the shipwreck site was discovered, divers recovered and/or identified a number of artifacts, including nine cannons, two large anchors, a bronze bell dated 1705, a sounding weight, an English blunderbuss barrel, a cannon apron, and two cannonballs.[21] Archival research into reported shipping losses from the 18th century, relying on contemporary newspaper accounts from major colonial centers, revealed eleven 18th century vessels lost in the area of the site 31CR314. Most were small merchantmen,

[19] Rogers, Richards, & Lusardi 2005, 24.
[20] Wilde-Ramsing & Ewen 2012, 110.
[21] Ibid, 113.

which were unarmed at the time of loss and which did not meet the basic characteristics exhibited by the wreck site and the diagnostic artifacts.[22] Two vessels identified by historical research fit the archaeological profile: the sloop *Adventure*, and *Queen Anne's Revenge*. Both vessels were sailing under the command of the pirate Blackbeard, and both were lost on the same day, *Queen Anne's Revenge* after running aground and *Adventure* after attempting to provide aid to the stranded vessel. The size of the anchors and the number of guns found at the site, however, disqualified the sloop as a candidate, as the anchors were too large and the cannons too plentiful to have belonged to the diminutive *Adventure*. The most suitable candidate for the shipwreck site was Blackbeard's flagship *Queen Anne's Revenge*.[23] The initial retrieval of artifacts from 1997-2004 focused on objects likely to reveal the origin, age, or ownership of the vessel (there was, as well, an emergency recovery of articulated hull remains exposed by a hurricane).[24] While no single artifact has been recovered that unequivocally confirms the site is *Queen Anne's Revenge*, no evidence has been recovered to dispute the identity, and in the words of two project archaeologists, the body of evidence that has been gathered to date "demonstrates beyond a reasonable doubt that it represents Blackbeard's flagship, *Queen Anne's Revenge*."[25]

Before *Queen Anne's Revenge* was captured by Blackbeard and repurposed as a pirate ship, it was owned by French merchant René Montaudoin and sailed under the name *La Concorde de Nantes* as a slaving vessel out of Nantes.[26] The vessel is believed to have originally operated as a privateer during the War of Spanish Succession, or Queen Anne's War (1702-1713). The earliest archival record of *La Concorde* dates to 1710. At this time, *La Concorde*

[22] Wilde-Ramsing & Ewen 2012, 113.
[23] Ibid.
[24] Wilde-Ramsing & Carnes-McNaughton 2016, 28.
[25] Ibid.
[26] Wilde-Ramsing & Ewen 2012, 113.

completed a privateering voyage to Africa and the Americas, and was recorded as a vessel of 280 tons with 26 guns.[27] The end of the war in 1713 reduced the need for privateers, and so Montaudoin outfitted *La Concorde* to serve as a slaver in the African trade. The vessel completed two slaving voyages in 1713 and 1715 from the Port of Nantes. It sailed to the west coast of Africa where captive Africans were purchased. They were taken to the West Indies (after a voyage of about two months) and sold, and cargoes consisting mostly of sugar were loaded and taken to Nantes.[28] *La Concorde* was on the second leg of a third voyage in 1717 when it was captured by pirates. Eyewitness accounts cited in a letter from the governor of Martinique, Charles Mesnier, written on November 28, 1717, identify the pirate who captured *La Concorde* as Edouard Titche, also known as the pirate Blackbeard.

The earliest mention of Blackbeard by name is in the 1717 editions of the *Boston News-Letter*, the first continually-published newspaper in British North America. Before that date, he was likely sailing as a crew member under Benjamin Hornigold, another infamous name from the Golden Age of Piracy.[29] His real name has been variously recorded as Edward Teach and Edward Thatch, and his origins are unknown and the subject of much academic speculation. It is known that he was English, although his birthplace has not been conclusively identified. Blackbeard becomes much more visible in the historical record after he and Hornigold captured *La Concorde* just west of Barbados in the Windward Islands of the Caribbean.[30] Blackbeard was given command of the vessel, at which point he increased the number of guns on board to a reported 40 and renamed the vessel *Queen Anne's Revenge*. The crew, under the command of

[27] Wilde-Ramsing & Ewen 2012, 113.
[28] Ibid.
[29] Moore 1997, 32.
[30] Ibid.

Blackbeard after the departure of Hornigold on another vessel, sailed through the Caribbean plundering merchant vessels.[31] By April of 1718, the flotilla, which consisted of the flagship and three sloops, was sailing north toward the North American mainland, and in May 1718, the crew reached present-day Charleston, what was then the Colonial British city Charles Town.[32] Colonial officials described this unpleasant surprise:

> In June last we were again visited by the same pirate [Stede Bonnet], but in a more formidable manner, having by that time increased their number to between three and four hundred fighting men, and had with them a large ship, mounted with forty guns, their former sloop the *Revenge*, which was now called their privateer, and two other sloops, prizes, which served them as tenders. The ship they called the *Queen Anne's Revenge*; and all were under the Command of one Capt. Thatch, but better known by the name of Black-Beard. Major Bonnet was on board, but in no command.[33]

The flotilla blocked the entrance to the harbor and detained and plundered half a dozen ships and their passengers. The governor of South Carolina paid a ransom of liquor, food, medicine, and about 1500 pounds sterling to buy back the safety of his town. In modern currency, the ransom totaled nearly half a million dollars.[34]

After receiving the ransom, Blackbeard led his flotilla north to North Carolina. This area was frequently used as a hideout for pirate crews in the 17th and 18th centuries; it had many inlets, waterways, and deep water harbors in which ships and crews could shelter, as well as close proximity to a major coastal shipping lane.[35] Six days after leaving Charleston, the flotilla was attempting to cross the bar through Beaufort Inlet (then known as Topsail Inlet) to reach the

[31] Wilde-Ramsing & Ewen 2012, 113.
[32] Ibid, 114.
[33] The Tryals of Major Stede Bonnet and Other Pirates 1719, iii.
[34] Wilde-Ramsing & Ewen 2012, 114.
[35] Wilde-Ramsing & Carnes-McNaughton 2016, 28.

safety of Beaufort harbor, when disaster befell the flagship. The most detailed account of the grounding and subsequent loss of *Queen Anne's Revenge* comes from a captain and sailor David Harriot, who was captured and stood trial for piracy several months after the incident, and who described the event in his deposition:

> That about six days after they left the Bar of Charles-Town, they arrived at Topsail-Inlet in North Carolina, having then under their command the said ship *Queen Anne's Revenge*, this sloop [*Revenge*] commanded by Richards, this Deponent's Sloop [*Adventure*] commanded by one Capt. Hands, one of the said pirate crew, and a small empty sloop which whey found near the Havana. That the next morning after they had all got safe into Topsail-Inlet, except Thatch, the said Thatch's ship *Queen Anne's Revenge* run a-ground off of the bar of Topsail-Inlet, the said Thatch sent his Quarter-Master [William Howard] to command this Deponent's Sloop to come to his assistance; but she run a-ground likewise about gun-shot from the said Thatch, before his said sloop could come to their assistance, and both the said Thatch's ship and this Deponent's Sloop were wreck'd; and the said Thatch and all the other Sloop's companies went on board the *Revenge*, afterwards called the *Royal James*, and on board the other sloop they found empty off the Havana.[36]

Both vessels were abandoned, and Blackbeard met his own fate a few months later on 22 November, 1718, at the hands of Royal Navy Lieutenant Robert Maynard on orders from Governor of Virginia Alexander Spotswood.

While it is possible to trace the history of *La Concorde* (later *Queen Anne's Revenge*) from 1713 to 1718, the origins of the vessel are unclear, some have speculated that the vessel was originally constructed in England. This theory is based on the existence of an English vessel named *Concord* that was captured by the French in 1711.[37] The vessel kept the name *Concorde* and was outfitted for service in the French Royal Navy, after which it was sold in 1713 in South

[36] The Tryals of Major Stede Bonnet and Other Pirates 1719, 45.
[37] Winfield & Roberts 2017, 234.

America, then reacquired by a French owner in 1716. After the capture of the French slaver *Concorde* by pirates, the French governor of Martinique identified the stolen vessel by name as the slaving vessel owned by René Mountaudoin.[38] Archival research conducted by the French historian Jacques Ducoin proved that the English-built *Concorde* mentioned above is not the same *La Concorde* captured by Blackbeard.[39] None of the dates or circumstances match other than the early references to both vessels having wartime or privateering careers.

Ducoin has proposed three possible origins for *La Concorde de Nantes*. The first is that the vessel was originally a naval vessel that was later sold into commercial service; the second is that, like the theory mentioned above, *La Concorde* was a foreign vessel captured by privateers. The third option, and the option that Ducoin believes is the most likely, is that *La Concorde* was privately built in a commercial yard but was purpose-built for service as a privateer.[40] This would fit with the wider context regarding French naval activity at the time, as the War of Spanish Succession saw a rise in the reliance on privateers for the naval powers involved, including the French. Several elements from the wreck site lend credence to the theory of *La Concorde* being of French origin, which are covered thoroughly in other sources so shall not be detailed here.[41] Further detailed investigation of the remaining hull structure may provide more answers regarding the national origin and age of the vessel.

[38] Ducoin 2001, 16-17.
[39] Ibid.
[40] Ibid.
[41] For further reading, see Wilde-Ramsing & Carnes-McNaughton, "Blackbeard's *Queen Anne's Revenge* and Its French Connection", 2016.

CHAPTER II

THE RIGGING ARTIFACT ASSEMBLAGE

The assemblage of artifacts related to the rig of *Queen Anne's Revenge* is relatively small, and consists of deadeyes and chainplates, rope fragments, sail cloth, and metal rigging elements, which are mostly hooks or fragments of hooks. The site has thus far not yielded any more complex or diagnostic rigging elements, such as blocks or hearts, or any artifacts (except for the sail cloth, bolt rope, deadeyes, and chainplates) that can be positively identified as part of the rig.

The reason for the limited state of preservation has to do with the site itself. The vessel suffered a low-impact grounding and was lost because it was impossible to free the ship from the sandbar upon which it sat, not because of any damage suffered due to the initial wrecking event. *Queen Anne's Revenge* sat exposed to the wind and waves, and gradually heeled over to port, where the vessel deteriorated in place.[42] This type of wrecking event, that resulted in little to no initial damage to the vessel, might leave modern-day researchers hopeful for a high level preservation, but unfortunately the location of the wreck has resulted in elevated levels of deterioration instead. Situated near the main inlet channel (the very channel Blackbeard was aiming for), the site has been repeatedly exposed to wave energy and scour since its abandonment in 1718.[43] The main inlet channel has shifted, migrating across the site several times since 1718, causing strong currents to erode the sea floor surrounding the site to depths of at least 5-6 meters. The dynamic nature of the site has thwarted any hope for a high level of

[42] Wilde-Ramsing & Ewen 2012, 119.
[43] McNinch, Wells, & Drake 2005, 24.

preservation that may have been made possible for the gentle grounding of *Queen Anne's Revenge*.

Even though the preservation of materials related to the rig of the vessel was poor, the artifact assemblage of rigging elements is small and many of the recovered elements are not diagnostic, the assemblage can still yield insights into the ship's features and history.

Deadeyes and Chainplates

The largest and most diagnostic artifact assemblage related to the rigging of *Queen Anne's Revenge* is comprised of wooden deadeyes, and iron deadeye straps and chainplates. The majority of the deadeyes and chainplates are still covered by concretion and in wet storage, while some have been tagged in situ and given artifact numbers but remain on the wreck site. Most artifacts from this group represent lower deadeye straps and associated chainplates, as the wood of most of the deadeyes has completely decayed. Only one complete deadeye (artifact number 2385.000) has been recovered and conserved to date, although one other deadeye strap (artifact number 3303.000) still has most, if not all, of the wooden deadeye present, and another (artifact number 1941.000) has a small wooden fragment remaining.[44]

All deadeyes, deadeye straps, and chainplate assemblies were associated with lower deadeyes (see figure 3). Deadeyes were part of a ship's standing rigging (the fixed lines that supported the masts). They were used in pairs at the lower end of shrouds to allow for tension to be taken into the shroud, which would in turn provide structural stability for the associated mast.

[44] Artifact 3303.000 is still covered by concretion, so while the visible face of the deadeye appears complete, it is impossible to know whether the deadeye is complete within the concretion until further tests and conservation are completed. Artifact 1914.000 only has a small fragment of wood remaining, but it appears to be the edge of the deadeye. If this is the case, after conservation it may be possible to recreate the original diameter of the deadeye using the curvature of the fragment.

Shrouds were fitted in pairs around and extended down to the rail, where they were spliced around the upper deadeye. Each upper deadeye was connected to a lower deadeye with a lanyard that passed through the holes in the deadeyes. Each lower deadeye was attached to a chainplate, which was bolted to the outside of the hull to distribute the force exerted by the sails carried by the mast into the hull. Made of a single piece of wood, each deadeye was scored around most of its circumference for either a shroud strop or a deadeye strap. The area of the deadeye circumference without scoring corresponded to either the neck of the deadeye strap or the splice of a shroud. If a deadeye was strapped, the score was typically square in cross-section to accept the iron strap that connected the deadeye to its chainplates. If a deadeye was stropped, the score was round to accept the rope splice of the shrouds.[45]

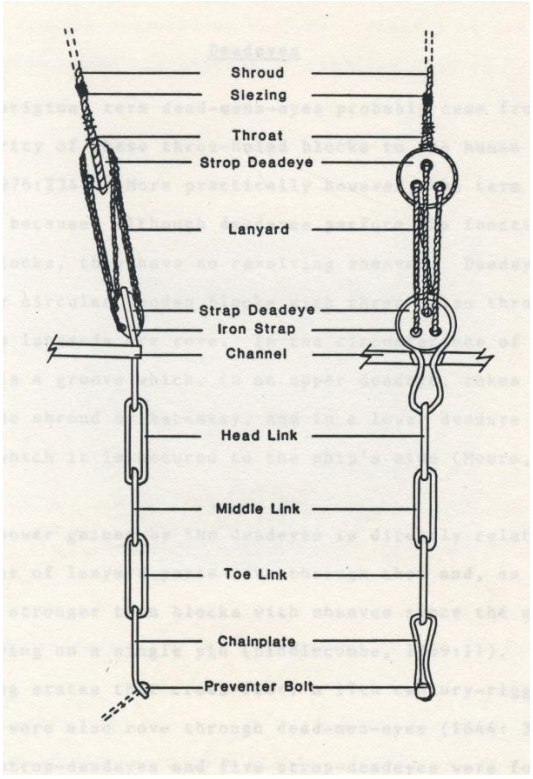

Figure 3. Labelled diagram of a deadeye and chainplate assembly from the *Santo Antonio de Tanna*. (Reprinted from Thompson 1998, 62).

[45] Corder 2007, 34.

Deadeyes went through very little change throughout the centuries, as their function remained unchanged, however the general shape varied slightly. Early 17th century deadeyes had flat faces, and were more angular, such as those seen on *Vasa*.[46] Deadeyes recovered from the 16th century *Mary Rose* (sunk in 1545) were an elongated tear-drop shape.[47] Deadeyes recovered from *La Belle*, *Kronan* (lost in 1676), and the Jutholmen Wreck (1700) had rounded faces with slightly tapering shapes, similar to, but not as elongated as, earlier shapes, while by 1760 with the wreck of *Le Machault*, deadeyes seem to be entirely round.[48]

Figure 4. QAR 2385.000, the sole deadeye conserved to date from *Queen Anne's Revenge*. (Image courtesy of the *Queen Anne's Revenge* Conservation Laboratory, Department of Natural and Cultural Resources, North Carolina).

[46] Observations regarding *Vasa*'s rigging elements obtained during a research visit to the Vasamuseet in Stockholm, Sweden, March 2018.
[47] Fisher 2002, 41-3.
[48] Corder 2007, 37; Sullivan 1986, 15.

Interestingly, the one deadeye (artifact number 2385.000, figure 4) conserved to date from *Queen Anne's Revenge* matches more closely with the deadeyes recovered from *Le Machault* (figure 5) than with those recovered from *La Belle, Kronan,* and the Jutholmen Wreck, even though it is closer in time to the earlier wrecks. The deadeye has a completely rounded face, measuring 17.5 cm in diameter, and has three lanyard holes. The deadeye has visible black stains on the face, possibly from tar used to treat the rig, and appears to have visible wear from a lanyard. There are two obvious differences between the deadeye recovered from *Queen Anne's Revenge* and the later deadeyes recovered from *Le Machault*. First, the deadeye from *Queen Anne's Revenge* is made of ash, while the deadeyes from *Le Machault* are made of elm. Second, the neck of the iron deadeye strap from *Queen Anne's Revenge* closes under the base of the deadeye, while the straps of *Le Machault*'s deadeyes do not touch at the neck. The difference in material is not necessarily significant as it can be attributed to accessibility, and the difference in the neck of the strap only indicates broad trends over a large range of time.

Figure 5. A deadeye and chainplate assembly from *Le Machault* (1760), similar in type as those recovered from *Queen Anne's Revenge*. (Reprinted from Sullivan 1986, 15).

The neck of the strap would have extended through channels, the protruding timber shelves attached to the hull at a wale which served as an attachment point for the lower end of shrouds and backstays. The strap was likely secured to the channels with a strip of wood that could be removed from the outer edge of the channel to allow access to the deadeye strap in case repairs or replacement were needed.[49] The chainplates attached to the neck of the deadeye strap would then have been bolted to the hull at a wale underneath the channels.

Conserved deadeye 2385.000 is smaller than most of the deadeye straps recovered from *Queen Anne's Revenge*, as the only other mostly complete wooden deadeye (artifact number 3303.000) measures approximately 24.75 cm in diameter.[50] For every other deadeye it is only possible to take a range of possible diameters, since every other deadeye strap is still concreted. Some deadeye straps may be as small or smaller than 2385.000. Table 1 represents the range of possible deadeye straps diameters for unconserved examples. To obtain these measurements, the diameter of the strap was taken on the inside boundary of the concretion, and then again on its outside boundary, yielding minimum and maximum possible diameters.

[49] Corder 2007, 50.

[50] This deadeye is still concreted and in wet storage, so while there is a fair degree of certainty with these measurements, it is possible that they may change slightly following the conservation of this artifact.

Table 1. Range of possible deadeye diameters.

Artifact Number	Minimum Possible Diameter	Maximum Possible Diameter
0366.075	22.9 cm	35.0 cm
1941.000	19 cm	*[51]
2385.000	17.5 cm	17.5 cm
3099.000 Deadeye #1	16.6 cm	27.1 cm
3099.000 Deadeye #2	25.6 cm	34.1 cm
3099.000 Deadeye #3	21.9 cm	31.4 cm
3099.000 Deadeye #4	18.2 cm	30.2 cm
3099.000 Deadeye #5	19.4 cm	29.4 cm
3170.000	21.7 cm	33.0 cm
3303.000	24.8 cm	24.8 cm
3284.000 Deadeye #1	20.8 cm	29.4 cm
3284.000 Deadeye #2	17.0 cm	26.8 cm
3329.000	17.5 cm	30.0 cm
3691.000	20.3 cm	26.3 cm
3692.000	13.1 cm	32.2 cm
3743.000	25.6 cm	35.5 cm
3748.000	18.2 cm	28.6 cm
3838.000	22.4 cm	36.0 cm
3942.000 Deadeye #1	20.4 cm	35.3 cm
3942.000 Deadeye #2	12.1 cm	23.1 cm

Until the rest of the deadeye straps are conserved and x-rayed, it is impossible to know for certain, but the recovered deadeye straps appear to represent a variety of sizes. Given the fact that most of them were recovered in close proximity, and many of those of different sizes are concreted together, it seems highly likely that these deadeyes were not in use at the time of the wreck and were being stored as spares.

An exception to this seems to be deadeye 2385.000, the intact deadeye discussed above. This deadeye was discovered 25-30 meters away from most of the other deadeye strap and chainplate concretions. This deadeye was found near the stern area of the wreck site, and, given its smaller size, this could be a lower deadeye from the mizzen mast.

[51] Due to the nature of the concretion and storage of this deadeye, it was not possible to obtain a maximum diameter measurement.

Chainplates

All the recovered chainplates are still encased and obscured by concretion, so it is difficult to provide detailed descriptions or measurements. However, for some it is possible to identify the presence of chain links (confirmed by x-rays, figure 6).[52] This differs from the chainplates recovered from *La Belle*, which were flat iron straps.[53] Chain links were commonly used for chainplates early in the 17th century, and then later during the 18th Century. *Batavia*, sunk in 1628, carried chain links for chainplates, while the Danish Church Model (ca. 1680, figure 7) shows flat iron bars similar to those on *La Belle*.[54] A more precise date range for this transition is unknown, as the only other known French shipwrecks close in date to *La Belle* are the vessels from the Battle of Saint Vaast La Hougue in 1692.[55] While excavation of these vessels yielded rigging elements, research regarding these elements is not available. The next major French shipwreck to yield an important assemblage of rigging elements is *Le Machault* (1760). *Le Machault* confirms the use of chain links as chainplates nearly a century after *La Belle* sank with flat iron bars for chainplates, leaving a large gap as a possible transition period.[56] The discovery of chain links from the wreck of *Queen Anne's Revenge* narrows this gap dramatically, as it shows that by 1718 at least some vessels of French origin were using chain links for chainplates. Even though it is likely that most of the chainplates recovered from *Queen Anne's Revenge* were spares, and so were not purpose-built for the vessel, it is still significant that there is no evidence of solid bar chain plates.

[52] The chainplates are folded up and concreted to such a degree that length is difficult to estimate.
[53] Corder 2007, 52.
[54] Ibid.
[55] Guérout 2002, 443.
[56] Sullivan 1986, 15.

Figure 6. An x-ray of 3329.000, a deadeye strap and chainplate assembly, clearly showing the chain links of the chainplate. (Image courtesy of the *Queen Anne's Revenge* Conservation Laboratory, Department of Natural and Cultural Resources, North Carolina).

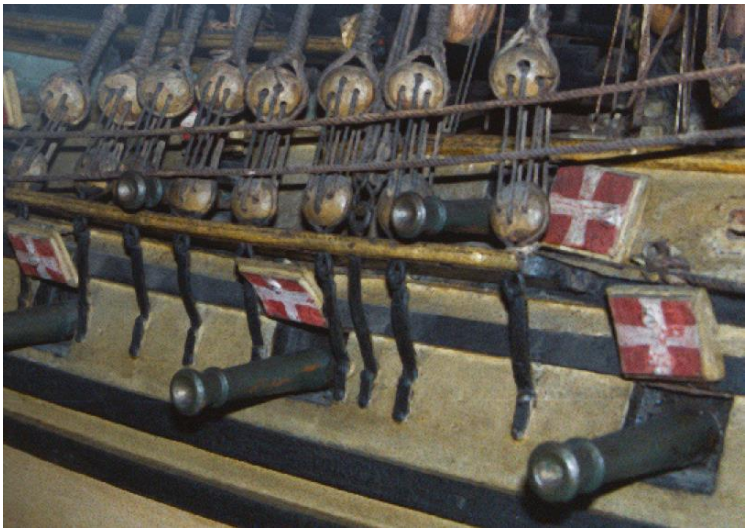

Figure 7. The main channels of the Danish Church model (ca. 1680) showing chainplates constructed from a single iron bar. (Reprinted from Corder 2007, fig. 27).

Rope

Very little rope was recovered from the wreck site, and what has been recovered to date is extremely fragmentary. A significant number of cordage fragments have also been recovered from cannon concretions, and at present it is difficult to determine whether these fragments represent remains from the rig or gun tackle. Two portions of cordage have been identified, however, that inarguably represent the rig: portions of boltrope. This was cordage used to line the outside edges of a sail to provide a stiff edge as well as a point of attachment for any necessary lines or other rigging elements. Artifact numbers 0387.017 and 0387.018 were found in the same area of the wreck site, and both represent portions of three strand right-hand lay hawser with remnants of sail cloth attached to the cordage with marlin hitching. Hawsers are three-stranded ropes with a right-hand lay (i.e. when viewed vertically the strands appear to angle downwards from left to right). This is opposed to shroud-laid rope, which is made up of four strands instead of three.[57]

Both sections of bolt rope have been served (wrapped in an external layer of marlin twine), but not wormed and parceled, a process often done before serving, whereby a single piece of marlin twine was laid into the groove of the rope, which was then wrapped in cloth. This is an interesting feature that was also seen on the served cordage recovered from *La Belle*.[58] The process provided extra protection against chafing and wear, as well as stiffened the rope for additional stability. Before service, the diameter of both sections of rope is approximately 25 mm, and the space between the marlin hitching is approximately 25 mm. 0387.017 has four marlin hitches remaining, while 0387.018 has five. Both sections of bolt rope still have remnants

[57] Lever 1819, 2.
[58] Corder 2007, 58.

of sail cloth within the marlin hitches. Because the bolt rope is served and was marled to the sail, this suggests that it most likely represents the foot or clews of the sail, as other portions of bolt rope would not have been served and would have been stitched directly into the canvas.[59]

As both sections of bolt rope were found in the stern area of the wreck site, and are the same diameter with the same features, it is likely that they represent the same sail, and that this area was used for storage for spare sails on the vessel. In future, after thorough examination of the remaining hull features to estimate diameters of the masts, it may be possible to identify the sail based on the diameter of the bolt rope.

Sail Cloth

A variety of fragmentary textiles have been recovered from the wreck site, and it is possible to identify a number of them as sail cloth based on the weave pattern of the textile. Five recovered fragments can be confidently identified as sailcloth, although it is impossible to rule out other textile fragments as sailcloth barring other diagnostic data. Three of the five fragments were also recovered with a different type of textile, possibly representing sail cloth with lining.

Artifact number 0347.006 is the best representative of the group of recovered textile artifacts.[60] It consisted of eight fragments, of which fragment 8 is the largest. Six fragments represent a 1/2 basket weave, with 2 warps and 1 weft, while two fragments show a plain weave, with 1 warp and 1 weft. Two colors of textile strands, buff and brown, can be seen in the fragments, which is the same throughout the other textile fragments that can be positively identified as sail cloth based on the weave. Fragment 8 shows a running stitch and double round

[59] Pers. Comm. Dr. Fred Hocker, Director of Research, Vasamuseet April 2017.
[60] Textile analysis performed by Dr. Runying Chen of East Carolina University.

seam, another fragment shows stress wear from use, and a plain selvage edge can be seen on both fragments. The stitching pattern and the weave confirm the use of the textile as sail canvas.

Metal Rigging Elements

The metal artifacts recovered that potentially belong to the rig consist of seven iron hooks with eyes.[61] All are between 133 mm and 177.8 mm in length, and are in varying states of preservation. The hooks are similar in form, consisting of a single arched hook with a teardrop-shaped eye, or the remnants of an eye, on a perpendicular plane. These are similar in size and shape to the hooks recovered from *La Belle*.[62]

Figure 8. QAR 1263.024, a well-preserved example of the hooks found on board *Queen Anne's Revenge*. (Image courtesy of the *Queen Anne's Revenge* Conservation Laboratory, Department of Natural and Cultural Resources, North Carolina).

[61] It must be noted that gun carriage tackle also required blocks with hooks, so it is possible that the hooks were used in this manner.
[62] Corder 2007, 191.

The hook numbered 0461.002 is in a poor state of preservation, but was the only example recovered with an attached thimble, and was also recovered with rope fragments. Darcy Lever describes the process of stropping a block with a hook and thimble.[63] Once the strop for the block was wormed, parceled, and served, it was reeved through the eye of the hook and over the groove of the thimble. The strap was then spliced together at the end of the block opposite where the rope reeved over the sheave and on the opposite side a round seizing was tied between the thimble and block to cinch the strop tight.

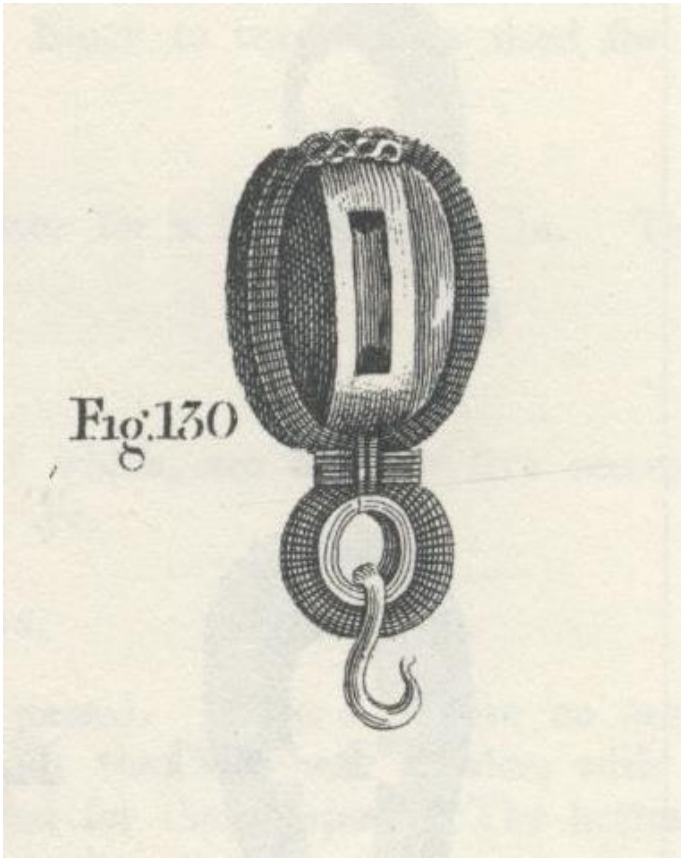

Figure 9. A depiction of a block stropped with served rope, attached to a thimble and hook. (Reprinted from Lever 1819, 15).

[63] Lever 1819, 15.

Artifact Distribution

While the assemblage of artifacts related to the rigging of *Queen Anne's Revenge* is small, their location and concentration on the wreck site yield important information about the ship and its contents, including vessel size and layout, crew organization, and potentially origins for certain artifacts. For instance, the size of the deadeye straps may provide clues to the beam of the vessel. The location of artifacts such as spare sails and spare rope may indicate storage areas and thus the organization and layout of the vessel. They may also reveal unique organizational differences between *Queen Anne's Revenge*, a pirate ship, and typical merchant or naval vessels of comparable size. While a complete site plan for the wreck site does exist, it does not differentiate between artifact types, and includes all of the thousands of artifacts that have been recovered or identified on the sea floor. It is therefore difficult to use this site plan to examine the relationship between the hull and rig remains. For these reasons, spatial analyses of the distribution of the assemblage of rigging artifacts were conducted using R, a statistics program. The goal of these analyses is to map these categories of artifacts in such a way as to reveal any significant patterns or correlations within the *Queen Anne's Revenge* site.

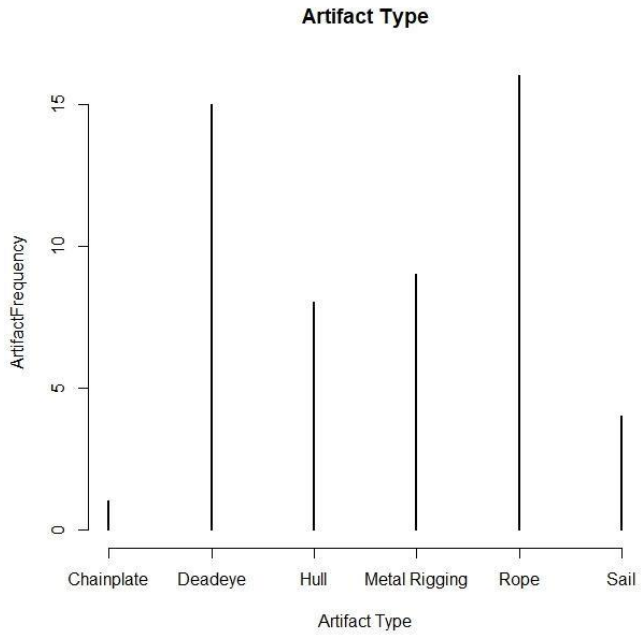

Figure 10. A graph depicting the recovered rigging elements by frequency.

Figure 10 represents the artifacts under study by frequency. The highest artifact counts are pieces of rope, all of which are fragmentary, and some of which only a few yarns remain to indicate the historical presence of cordage. Only two of these fragments are included in this analysis, as they represent bolt rope from a sail, while it was impossible to definitively conclude that the other rope fragments were part of the rigging. Deadeyes and deadeye straps represent the second highest artifact count, the majority of which are still covered by concretion. Some have been identified and recorded but remain on the sea floor for future recovery and conservation. Most artifacts from this group represent deadeye straps, as most of the wooden deadeyes have completely decayed. All recovered deadeyes represent lower deadeyes, as they are strapped with metal, and most were recovered with the chainplates still attached. Deadeyes without chainplates are not differentiated, although the single lone chainplate is shown (artifact number 3877.000).

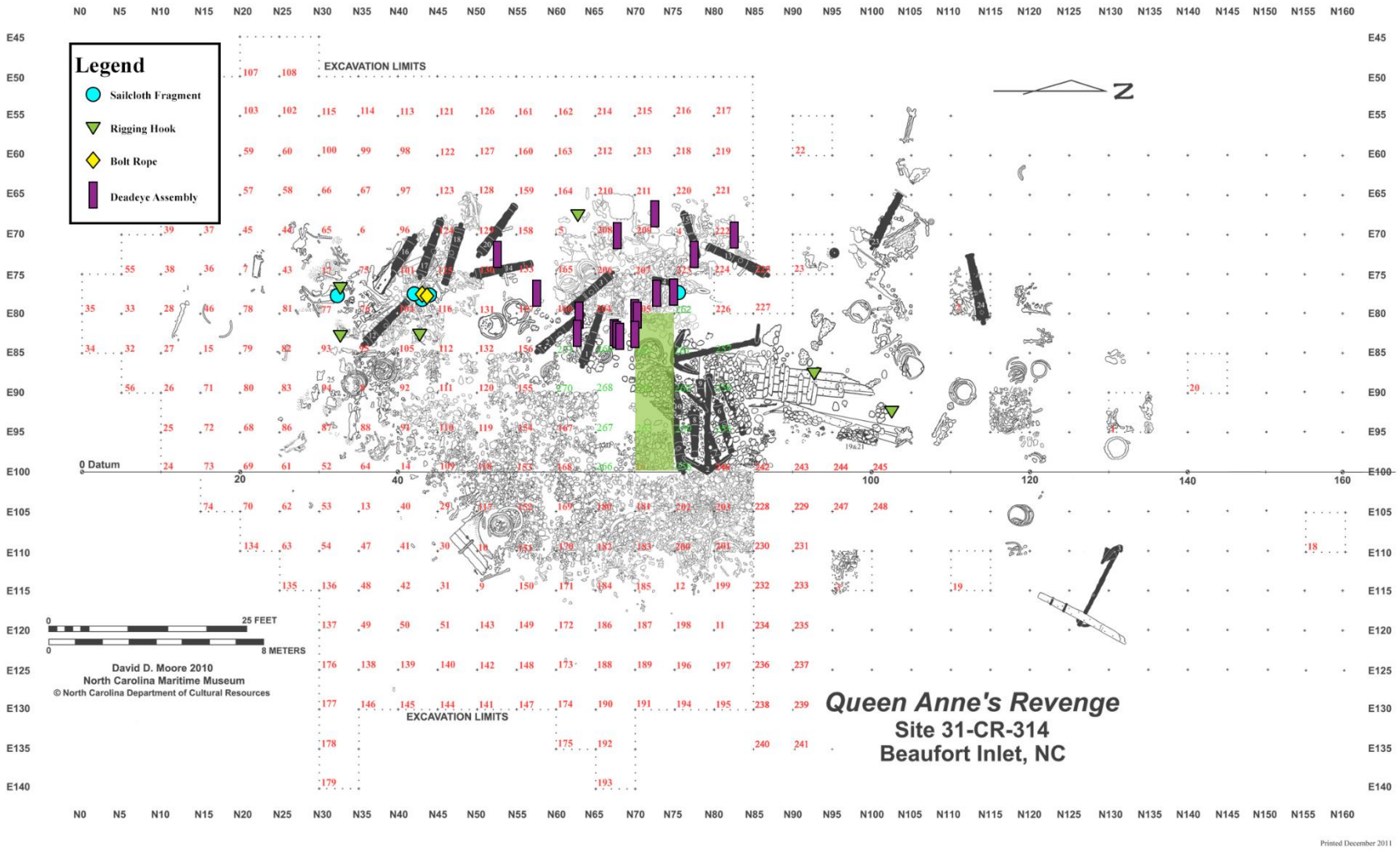

Figure 11. Plan of the wreck site with the rigging elements identified by the author. (David D. Moore 2010, North Carolina Maritime Museum, Department of Natural and Cultural Resources, North Carolina).

Figure 11 represents a plot of the entire wreck site showing the locations of rigging artifacts. This plot reveals the overlap of certain artifact types. On the left side of the plot, for instance, where rope and sail artifacts were found in close proximity. Figure 12 provides a detail of the site plan with the artifacts identified in the same manner.

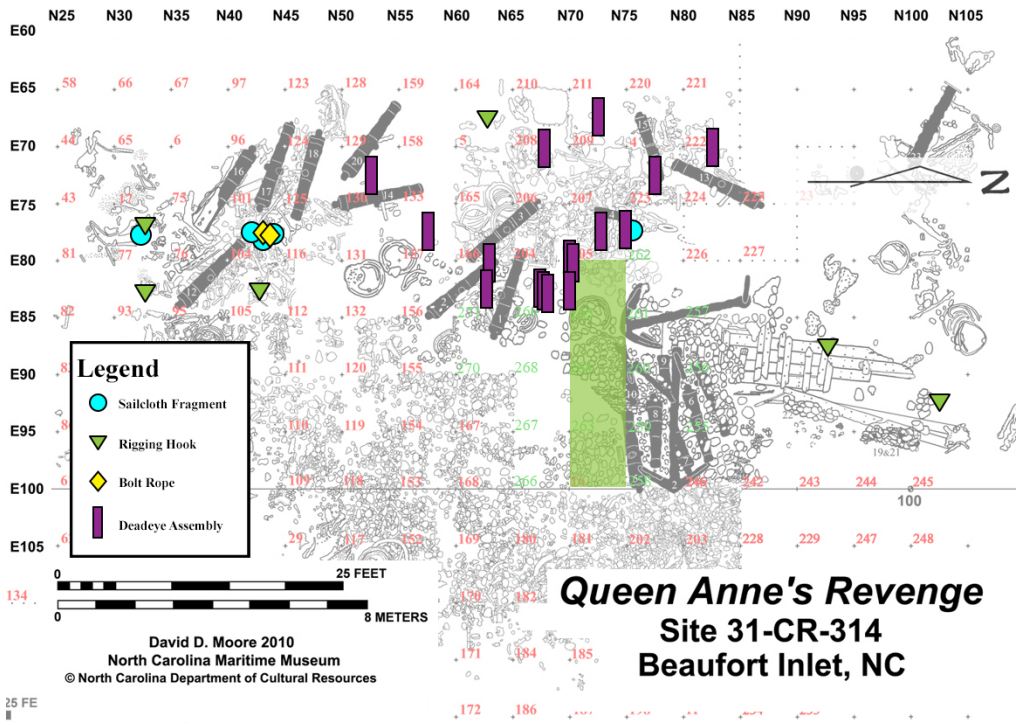

Figure 12. Close up of the rigging elements identified by the author on the site plan. (David D. Moore 2010, North Carolina Maritime Museum, Department of Natural and Cultural Resources, North Carolina).

While the above plan is useful for analyzing the locations of artifact types in relation to one another, it does not fully reveal their concentrations. To address this, separate plots for each type revealing their count in each location were created. While this was performed for each individual artifact type, it was only revealing for some of them.

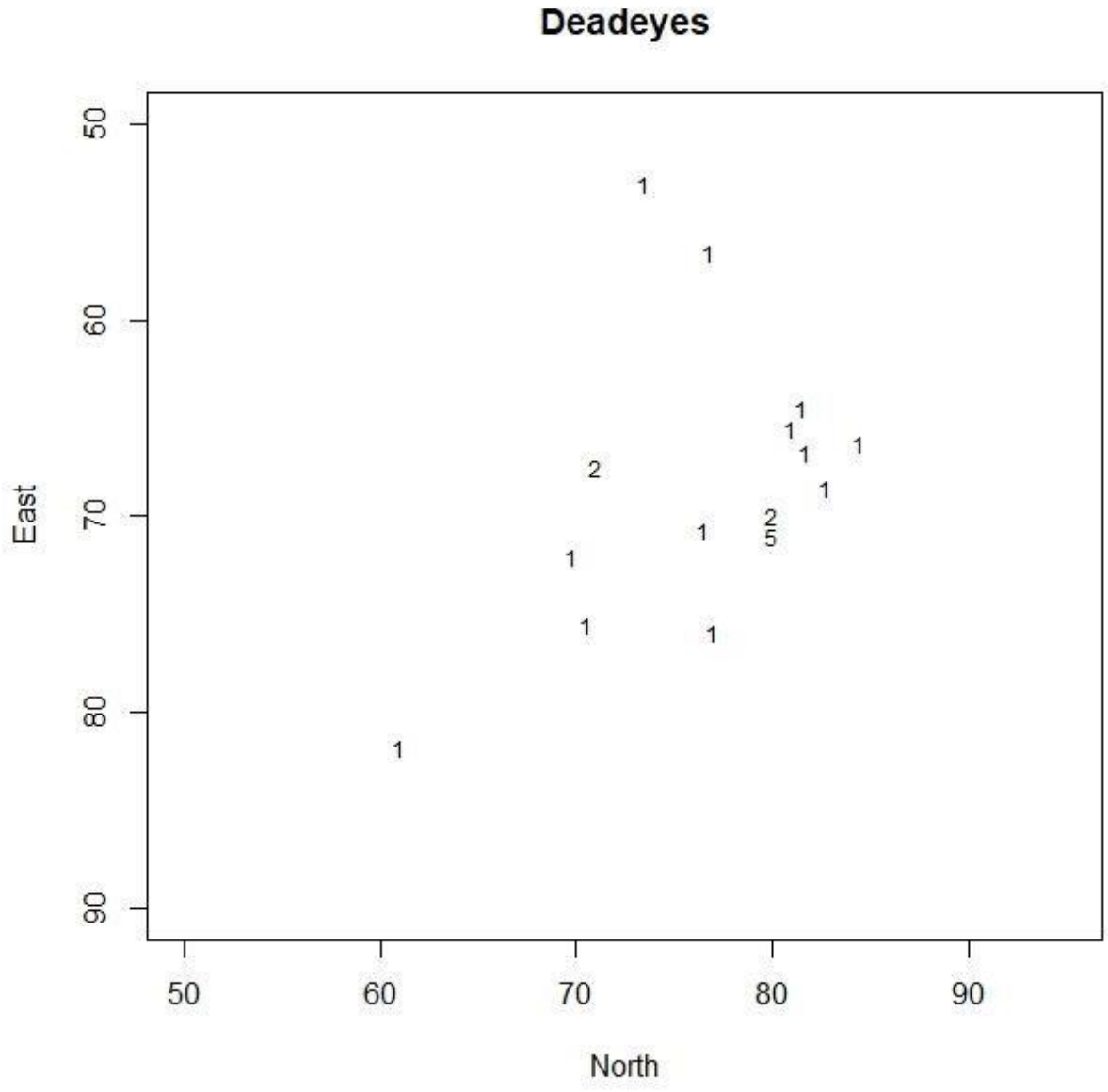

Figure 13. Deadeye straps and deadeyes shown in relation to each other by concentration.

When the deadeye straps are plotted in such a way, as seen in figure 13, it is obvious that the majority of the deadeyes were found in close proximity to one another on the wreck site. This,

at face value, is not shocking, as career deadeyes (those in use on the vessel at the time of sinking) would naturally be at least somewhat grouped together. However, the specific pattern of the grouping is key – it is significant that such a large number of deadeye straps and chainplate assemblies are found so close together. Even at the channels (the attachment point at the hull for the shrouds) of the mainmast, which represents the largest concentration of lower deadeyes actively in use on the vessel, there should be less than ten lower deadeyes.[64] The fact that fifteen were found grouped together, then, is significant. Additionally, many were found concreted together, with the chain links folded, crumpled, and tangled together. If these artifacts represented career deadeyes and chainplates, it stands to reason that, as the vessel decayed on top of them, the artifacts would concrete more or less straightened out and in a row. It is therefore likely that the majority of the deadeyes recovered from the site were in storage as spare parts when *Queen Anne's Revenge* sank. If this is the case, it is less likely that the deadeyes were constructed specifically for *La Concorde*, and so are less reliable in determining the vessel's size and rig type.

Viewing the remnants of sail cloth by concentration at the wreck site is also revealing, even though there are only five pieces. This strongly suggests that each piece of sail cloth came from the same sail. The presence of boltrope in the same location strengthens this conclusion. In fact, when viewing all artifact types in this area up close, but with taken into account, the spatial analysis suggests a vital piece of information for understanding the wreck site. Figure 14 is an enlarged portion of the left-hand cluster of artifacts seen in figure 12. The concentration

[64] Based on iconographical comparisons of vessels of similar size, such as the late 17th century French frigate attributed to Chabert Junior and included in Boudriot, which shows five lower deadeyes on the mainmast; Boudriot 1993, 55.

and type of artifacts in this area (metal rigging elements, sail cloth, and bolt rope), suggest that this is potentially a storage area towards the stern that was used to carry supplies for shipboard repair, spare pieces of equipment, as well as spare sails. The presence of a sail, the concentration of metal rigging elements (mostly rigging hooks), and pieces of cordage in such a small area, as well as their location near the stern of the vessel, indicate that this area may in fact be a bosun's storage area of *Queen Anne's Revenge*. If this is the case, it would differ from the organization of French vessels shown by the *Album de Colbert*, which depicts the sail locker and bosun's storage in the bow of the vessel, with no similar storage areas towards the stern.[65]

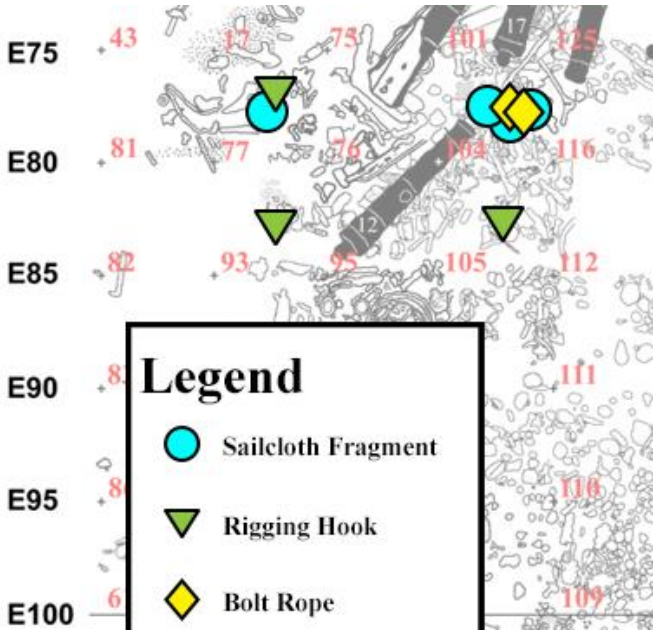

Figure 14. Expanded view of recovered sail cloth fragments, show by a blue circle. The fragment on the left represents one recovered fragment, while the grouping on the right represents the remaining four. (Artifact indicators added to stie plan by author; David D. Moore 2010, North Carolina Maritime Museum, Department of Natural and Cultural Resources, North Carolina).

[65] *Album de Colbert*, plate 46 and 47

A similar concentration of artifacts was recovered from the wreck of *Santo Antonio de Tanna*, a Portuguese frigate which sank in 1697.[66] A sail bundle, presumably undergoing repairs at the time of the sinking, along with associated artifacts such as a sail needle and sailmakers palms, was found in the stern area of the vessel, indicating that this area served as some form of sail locker.[67]

[66] Thompson 1988, 3.
[67] Ibid, 124-141.

CHAPTER III

RIG RECONSTRUCTION

As previously discussed, the assemblage of rigging elements recovered thus far from the wreck site of *Queen Anne's Revenge* is quite small. Many of the artifacts recovered, such as the rope fragments, are not diagnostic, and others only suggest possible explanations, while no artifact yet identified can be positively placed in the rig in terms of its location and function at the time of the sinking. Even though the wreck site has not yet provided a wealth of rigging elements and a theoretical reconstruction of *Queen Anne's Revenge* must rely on alternative sources, it is still a useful endeavor. It provides us with a working hypothesis to be tested and augmented with new information. The process of reconstructing is also helpful for formulating questions that might not otherwise occur to researchers.

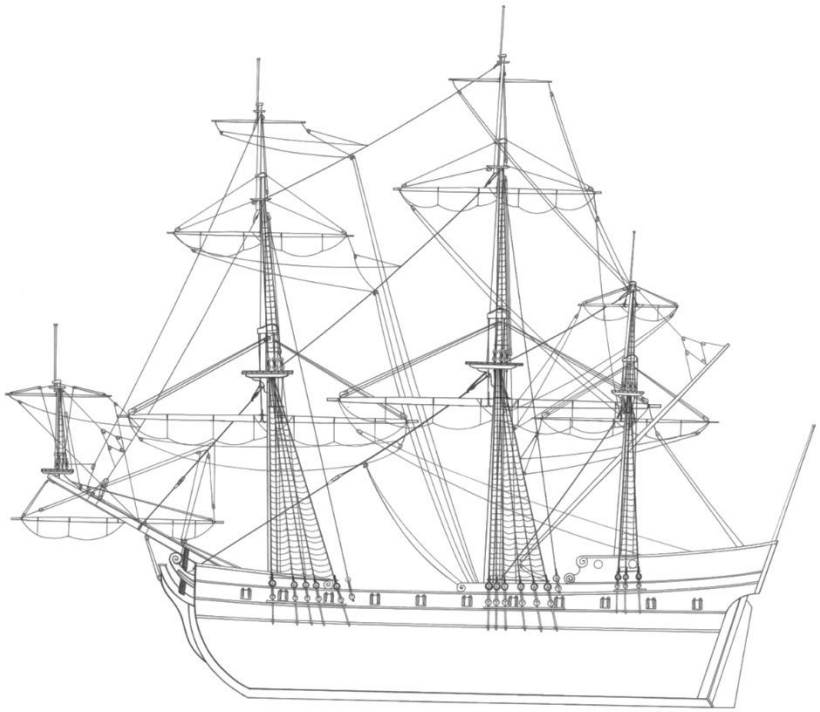

Figure 15. A theoretical reconstruction of the rig of *Queen Anne's Revenge* with a sprit topmast. (A. Dempsey.)

The sailing rig is a complex, vital, yet ephemeral component of historical vessels. It is the source of power and maneuverability, and is also the principal point of interaction between the individual sailor and his ship. The rig of a sailing vessel is how the sailor communicates with, and harnesses, the elements, and as such, it shapes the majority of his day-to-day life. Given the importance of the rig to sailing vessels and the people who crewed them, there is a decided lack of academic discussion regarding both the larger narrative of rig design and mechanics, as well as the everyday practicalities of how the rig impacted the sailor. This is especially true for the period preceding the 19th century, when books, guides, and sailor autobiographies become more common. Trends in rigging are often relegated to the world of model builders, while archaeologists discuss rig specifics for individual vessels, as shown by the (usually few) artifacts the rig has left behind. It is important to broaden this perspective to include not just the technical details but also how those details shaped the life of the sailor.

Academic discussions of ships rigs are often dominated by sources geared towards model builders and by detailed evidence from shipwrecks. An excellent example is the work done by Corder for the rigging of *La Belle.* A significant archaeological assemblage was studied in depth with supplemental information from models and texts written for model builders, like the work by Anderson. The research conducted by Corder is thorough and informative, and is a foundational text for those studying ships rigs of the 17th century, and yet still reflects the bias towards the world of model building that permeates academic discourse of ships rigs. This results in a discussion that treats the rig and the entire vessel as a static object – a conglomeration of wood, string, and canvas sitting on a desk that must be constructed in the right order. Technical discussions of the static rigging of vessels are important, and it is understandable that studies resulting from the analyses of ship models produce such discussions, but for

archaeologists this must only be part of the story of wooden, square-rigged ships. The missing element of this story is motion, for no square-rigged sailing vessel can be truly understood while it is arrested in movement. This is the element that communicates to the modern scholar the force a 17th century sailor needed to apply to a halliard to overcome the friction of the halliard tie on a mast cap, or how high the waves could reach before an 18th century sailor furling a spritsail was plunged into the ocean underneath the bowsprit, or how the height of a yard above a footrope affect**ed** the muscle groups used by a sailor laid aloft to reef a topsail snapping in forty knots of wind. Such an analysis, in addition to creating a theoretical rig reconstruction of *Queen Anne's Revenge,* can contribute to the scholarly and popular discussions of square-rigged vessels and of the sailors aboard them to provide a springboard for further discussions regarding potential variation, operation, and human impact. The following reconstruction of *Queen Anne's Revenge* will provide important caveats to keep in mind when considering the rig of a square-rigged vessel during an archaeological investigation.

Due to the lack of archaeological evidence, the following reconstruction of the rig of *Queen Anne's Revenge* draws heavily on a handful of written primary and secondary sources. The Texas A&M University Master's thesis by Catherine Corder detailing the rigging elements and rig reconstruction of *La Belle* serves as an important template, as does the *Album de Colbert*, the rigging treatise by Dassié, and modern works on French vessels of this period by Jean Boudriot, such as *History of the French Frigate: 1650-1850*. The reconstruction will not include theoretical reconstructed measurements, except in one case which considers the halliard system of the vessel. The reason for this omission stems from the lack of archaeological evidence. Measurements for rigging elements, from masts to cordage, are usually based on a ratio of another element, proceeding in a kind of domino effect. The first element given measurements,

one of the masts, is taken from a ratio of a feature of the hull (such as breadth). It is possible, in theory, to use another rigging element, like the deadeye straps recovered from the site, and reverse engineer the measurements to arrive at the original mast measurement, but even in the best of circumstances this measurement would be *highly* theoretical. It could be useful as a necessary step to recreating other aspects of the rig, however recreating the dimensions of the vessel this way would be too theoretical to be reliable as archaeological data. Because the majority of the deadeye straps that could potentially be diagnostic are still obscured by concretion, theorizing measurements for the rig is not worthwhile. It is best to wait until in-depth study of the surviving hull features is conducted, so that the hull and the rig can be studied together as a single unit.

Another goal of this preliminary reconstruction is to highlight important features to be identified and studied for future excavation seasons. One of the major questions regarding the rig of *Queen Anne's Revenge* involves the head rig – specifically, whether the vessel carried a sprit topmast and sprit topsail, or a jibboom and associated fore and aft sails. Since the forward half of the shipwreck site, representing the bow of the vessel, has yet to be excavated, a detailed analysis of the difference between these two types of head rigs may provide an important summary for the types of diagnostic artifacts that future excavators should seek.

The Ship

The earliest archival record of *La Concorde* dated 1710 describes the ship as a French frigate of 300 tons and twenty-six 26 guns.[68] The armament included 17 six pounders, 4 four

[68] Wilde-Ramsing & Carnes-McNaughton 2016, 18.

pounders, 5 small carriage mounted guns, and one brass swivel.[69] This armament conforms to that of a contemporary English sixth rate or a French light frigate.[70] Throughout the remainder of its career, it is variably listed as between 200 to 300 tons. The French historian Ducoin considers it likely that *La Concorde* was built in a private yard and intended for service as a privateer.[71]

French frigates built for this purpose were designed for speed and thus lightly constructed, which is supported by the section of articulated hull remains recovered from the wreck site. The remains of twenty-four frame components have so far been recovered, which were bolted in pairs, with a relatively large amount of room and space.[72] Jean Boudriot gives dimensional ratios of French merchant vessels for this time period, and in a 1999 article, David Moore used the ratios, the recorded tonnage of the vessel, and four different tonnage formulae from French shipwrights to calculate hypothetical dimensions of the vessel.[73] The hypothesized measurements are:

Length: 90.4 French feet (approx. 29.3 m)

Keel: 76.4 French feet (approx. 27.8 m)

Beam: 25.5 French feet (approx. 8.2 m)

Tonnage: 300 tons

[69] Wilde-Ramsing & Carnes-McNaughton 2016, 28.
[70] Ibid, 36.
[71] Ibid.
[72] Ibid, 37.
[73] Moore 1999, 136; Boudriot 1993.

The Rig Plan

French vessels of this period were notorious for having a wide rig plan, with broad lower sails, narrowing topsails, and topgallant sails forming what was referred to as a "French pyramid".[74] However it is important to realize that rigging a vessel during the 17th and early 18th century was not purely a scientific application of mathematical ratios (no matter how strict the treatises sound) – suggestions were followed based on ratios of basic proportions of the vessel, but the variations between the few extant contemporary written sources show that these suggestions were were not hard and fast rules, but simple guidelines that came with the reminder that rigging a vessel was a skill built from experience and trial and error.[75]

French frigates in the 17th and early 18th century carried a main course, a fore course, a spritsail, a lateen-rigged mizzen sail, a main topsail, a fore topsail, and a mizzen topsail, and possibly a sprit topsail.[76] A vessel comparable in size to *Queen Anne's Revenge* also carried topgallants on the main and foremasts, a third square sail placed above the tops and courses. While larger vessels, such as a ship of the line like the vessel depicted on Plate 50 (figure 16) of the *Album de Colbert* carried standing topgallant yards, smaller vessels likely had carried flying topgallants. This sail was set from deck by sending aloft the entire yard with the sail bent on; when it was time to take in sail, the entire yard and sail were brought down to the deck again.

[74] Boudriot 1993, 55.
[75] Corder, 2017, 217.
[76] Boudriot 1993, 344.

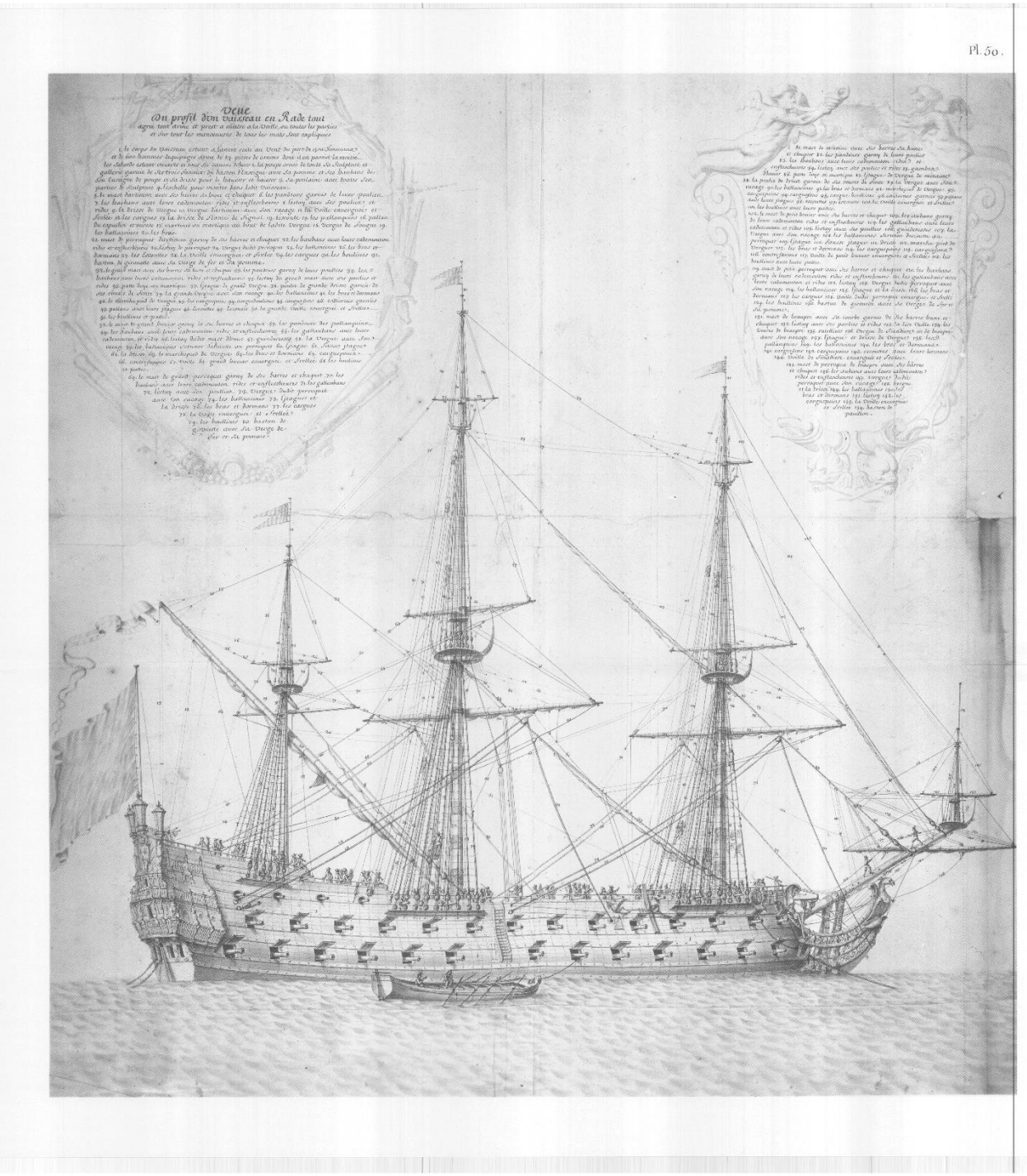

Figure 16. Plate 50 of the *Album de Colbert*.

Masts

In contemporary rigging treatises applicable to *Queen Anne's Revenge*, the dimensions of masts and spares were determined by a proportion to hull dimensions, often the ship's beam, and occasionally depth of hold and length of hull.[77] Demonstrating how variable the practice of rigging a vessel was, Sutherland in 1711 also writes that when considering mast diameter, attention must be given not only to the size of the vessel, but also the strengths of the timber type in use as well as the "Nature of the Soil from which [the timber] is produced."[78] French ships in the 17th century had longer mainmasts compared to English vessels, but these proportions were similar by the 18th century.[79] The proportions between the main and foremasts remained relatively consistent between the 17th and 18th centuries, although there was an increase in the height of the foremast, largely due to the shifting location of the foremast step.[80] The height of the mizzen was ultimately determined by the mainmast, as the length was dependent upon where the mizzen was stepped, a location which rigging treatises agree was variable.[81]

While many 16th and 17th century ship models exaggerate the mast rake of French vessels, by the late 17th century French rigging treatises depict three vertical masts.[82] The *Album de Colbert*, the 1679 treatise by Jouve, and a 1685-1690 painting of a French man-of-war ascribed to Puget all depict three vertical masts, and through the 18th century French works continued to show three vertical masts.[83]

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[77] Corder 2007, 72.
[78] Sutherland 1711, 109.
[79] Corder 2007, 76.
[80] Ibid, 79.
[81] Ibid, 85.
[82] Ibid, 91.
[83] Jouve 1971, plates 3, 6, and 7; Corder 2007, 91.

During the first half of the 17th century, topmasts were only about half the length of lower masts, however with the introduction of reefs in the latter half of the 17th century, the masts lengthened to allow for longer sails.[84] When discussing the proportions for the fore topmasts, most sources agree that the same proportions should be used for both the fore and main.[85]

Yards

Most continental European treatises used the fore yard as the primary yard when calculating yard dimensions, which differed from English sources which calculated the main yard first then derived all other yards.[86] Dassié states that the fore yard is the primary yard and is based on an equation taken from the ship's beam, while the main yard is a proportion of the fore yard. The French manuscript SH 144 (1670) and the treatise by Bouguer differ slightly in that both lower yards are based on calculations using the beam.[87] All the sources show a general trend towards shortening the lower yards compared to the main and foremasts in the early 18th century, thereby reducing the French pyramid of the 17th century. French topsail yards are calculated using the beam of the vessel, which result in proportionally longer topsail yards.[88]

Standing Rigging

The standing rigging for a vessel of this period included shrouds, futtock shrouds, stays, and backstays. The lower masts had shrouds attaching to the channels outside the hull, as well as stays, which were drawn from the masthead forward on the vessel, as seen on Plate 50 of the

[84] Corder 2007, 97.
[85] Ibid.
[86] Ibid, 101.
[87] Bouguer 1746; Corder 2007, 101.
[88] Corder 2007, 104.

Album de Colbert. During this period, the channels for vessels similar to *Queen Anne's Revenge* size and in number of guns were placed on a wale below the gunports, with the chainplates reaching to the wale below that.[89] As noted above, the chainplates of *Queen Anne's Revenge* were made of chain links, and not of iron bars as seen on *La Belle*. The shrouds had to be spaced to fit the gun ports between them, and so might be evenly placed. Images included in Boudriot's *History of the French Frigate, 1650-1850* show that contemporary light frigates comparable to *Queen Anne's Revenge* typically had six shrouds on the mainmast, five on the foremast, and three on the mizzenmast.[90] The shrouds were the attachment point for ratlines, the ladder-like horizontal lines of cordage that allowed sailors to climb the shrouds. Some attention is given in various sources to the spacing of the ratlines, which would have been about 13 English inches (about 33 centimeters) apart when starting at the futtock stave and rattling down, although some sources say 12 inches, while others say 15 to 16.[91] Given the physical implications of the spacing of ratlines on the sailor, the larger of these numbers seem unlikely. Ratlines were subject to a great deal of wear during the course of daily operations and had to be replaced often and by different hands, and so their spacing likely did not follow a hard and fast rule.

The topmasts had futtock shrouds, shrouds, stays, as well as backstays, which were unique to the topmasts during this period on French vessels.[92] Plate 50 of the *Album de Colbert* (figure 16) shows a vessel with standing topgallant yards permanently fixed to the topgallant masts and thus would require shrouds; the *Album de Colbert*, however, depicts a vessel much larger than *Queen Anne's Revenge.* A vessel with flying topgallant sails (a possibility for *Queen*

[89] Boudriot 1993, 55.
[90] Ibid.
[91] Marquardt 1992, 63.
[92] Corder 2007, 128.

Anne's Revenge due to size) did not have topgallant shrouds but only topgallant mast stays. The backstay for the sprit topmast (if the vessel had one) was led to the foretopmast stay starting at about 1680 until the sprit topmast fell out of use. This change was due to the introduction of the foretopmast staysail, a fore and aft sail hung on the foretopmast stay.[93]

The mainstay was likely split in two through the use of a block and collar and run around the foremast from the mainmast head to attach to a reverse knee outboard of the bow, while the forestay ran from the foremast head and attached to the bowsprit.[94] The main topmast stay ran from the main topmast head to the foremast top just aft of the foremast, through a leader block, and down to deck.[95] The fore topmast stay ran from the mast head to a fairly complex tackle that secured it to the bowsprit. This arrangement of three blocks and a fiddle block can be seen in the Danish Church Model (ca. 1680) in the Orlogsmuseet, Copenhagen, and a model of a Danish frigate (ca. 1691-1725) currently in Ellsinore Castle in Denmark.[96]

The mizzen stay is drawn to the base of the mainmast a few feet above deck and attached with deadeyes or blocks. The main topgallant stay and the mizzen topmast stay are brought to the next mast forward in a manner similar to the main topmast stay, while the fore topgallant stay is led through a series of blocks attached to the sprit knee and bowsprit, then brought aft, as seen in the *Le Louis XV* model (ca. 1715).[97]

The backstays during this period were standing, and attached at or above the channels like shrouds.[98] For the *Queen Anne's Revenge* reconstruction, the backstays for the topmasts are

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[93] Anderson 1994, 128-9.
[94] Corder 2007, 128.
[95] Ibid, 132.
[96] Ibid, 133.
[97] This model is identified by Anderson as the *Royal Louis* model, but Corder identifies the model as the *Le Louis XV*, housed and identified as such in the *Musèe de la Marine*.
[98] Boudriot 1993, 55.

drawn aft and slightly above the channels and attached to the hull through a bolt and hook, as seen in Boudriot.[99] There was a set for each mast, one on each side. The sprit topmast backstay, if *Queen Anne's Revenge* carried a sprit topmast, was led to the fore topmast stay from about 1680-1710, instead of the forestay as had been typical in previous years, to allow for the fore topmast staysail, and was attached through a series of crowsfeet that led to a block at the masthead with a fall abaft the mast.[100]

The model *Le Louis XV* includes a bobstay, with a block on the cutwater and a block underneath the bowsprit, with the bobstay running between them and then drawn inboard.

Running Rigging

The running rigging for the yards involved two basic principles: hoisting or holding a yard aloft, and adjusting the placement of the yards. French ships of this period used ties and halliards to raise and lower their yards, as opposed to jeers which were in use on English vessels, which kept yards suspended in one place.[101] Halliards and ties were used in conjunction with lifts, which would hold the yards suspended when in their lower position with the halliards slacked. On lower yards, the halliard tie, the part of the halliard system which was directly attached to the yard, passed over the rounded mast cap seen on French vessels. English mast caps during this period were flatter than continental mast caps and included a block hung beneath the cap for the ties and halliards or jeers.[102] The English system did not involve as much friction of rope on wood, as did the French system. Ties on continental vessels for main yards passed

[99] Boudriot 1993, 55.
[100] Anderson, 1994, 128-129.
[101] Ibid, 134.
[102] Ibid.

through a hole on the forward edge of the mast cap, over the rounded top of the cap, then down abaft the mast to the halliard block. When the halliard was in use, the halliard tie passed across bare wood. Similar mast caps may be seen on the so-called Ghost Ship, a 17th century Dutch fluyt discovered in the Baltic Sea, and it is even possible to see the groove of the halliard tie.[103]

It seems odd that the French included such an obvious inefficiency in their rigging as pulling the tie over bare wood, since it increased the force needed to raise and lower the yard as well as increased the amount of wear on both elements by a significant factor. It is possible to calculate the force needed to overcome the static friction of a yard for both these systems to analyze their relative efficiency. Starting with the estimated dimensions for *Queen Anne's Revenge* (summarized by Moore's article), and then using Anderson's calculations for the length and diameter of the main top yard the estimated mass of the main top yard of *Queen Anne's Revenge* can be calculated at 201.365 kg by multiplying the volume of the yard by the average density of pine.[104] Using the mass of the yard, the weight in newtons can be calculated by multiplying the mass by the impact of Earth's gravity (9.8 m/s^2), which results in 1973.377 newtons. With this number, the capstan equation (used to calculate the load and friction of a line passing around a cylinder) can be used to obtain the load force necessary to overcome the friction and inertia of the tie and yard. The equation is as follows:[105]

$$\text{Force} = (\text{weight of yard})(\boldsymbol{e})^{(\boldsymbol{coefficient\ of\ friction})(\boldsymbol{\pi})}$$

Where the weight of the yard is given in newtons, and the coefficient of friction of hemp rope on wood is .5.[106] Converting the resulting force into pounds from newtons, to overcome inertia and

[103] Pers. Comm. Dr. Fred Hocker, Director of Research, Vasamuseet, 2018.
[104] Moore 1999, 136; Anderson 1994, 134; Miles & Smith 2009, 8-9; It must be noted that the volume was calculated without taking into account the taper of the yard however the added weight of the sail and additional gear and rigging elements were also disregarded.
[105] Mann 2005
[106] Heisler 1998, 113.

the static coefficient of friction of the theorized main top yard on *Queen Anne's Revenge* would require 2,134.09 pounds of force (approximately 968 kg). Using the English system of running the tie through a block instead of directly over a rounded mast cap would only require approximately 444 pounds of force (approximately 201 kg). These numbers only reveal the difficulty in getting the yard moving – it would take a considerable amount of additional strain to continue to move the yard into place. In addition to the sheer amount of force needed to overcome static friction with the French system, the high amount of force involved in the system would cause considerably more wear with the materials involved. In light of this discrepancy in efficiency, one wonders if the French had methods to ameliorate this situation in ways that have not yet been discovered in the historical or archaeological record. An alternative possibility is that the French found this to be an acceptable economical choice, since the height of the lower yards would not have been adjusted often, and so this was a place in the rig plan where expensive hardware requiring regular service like blocks could be omitted.

French topsail halliards used a single tie around the center of the yard, which traveled through a sheave in the mast, to a fiddle block, through a block with a long strop attached to the trestletrees, back to the fiddle block, then down to deck.[107] Topgallant yards were rigged in a similar manner.

The lifts of the lower yards of the *Le Louis XV* model are attached through blocks just under the mast cap on port and starboard, and are run to pear-shaped blocks at the yardarms, back to the block at the mast cap, and down to deck. The pear-shaped blocks had two sheaves placed at right angles, and allowed for the lower lift block and the topsail sheet block to be

[107] Anderson 1994, 183.

combined. Similar lift blocks were recovered from the wreck of *La Belle*.[108] The lifts for the topmast yards are attached to the center of the mast cap, run to a block at the yardarm, then back to a block stropped between the trestletrees and cap that hangs below the trestletrees, then down to deck. Since the topgallant yards are flying, they do not have lifts, only halliards and braces. The lifts for the sprit yard run from blocks at the yardarms to blocks at the end of the bowsprit, then inboard.

The braces, used to adjust the yards on a horizontal plane, were led aft on both the main and fore yards, while the mizzen braces were led forward. The braces on the main course yard were led aft to the quarter, although various sources show differences in the details of the attachment point of the standing end of the main course braces, while all sources depict the working end led inboard behind the bulwarks towards the quarter. The *Album de Colbert* (figure 16) depicts both working and standing ends of the braces disappearing behind the bulwarks, while other sources show the standing end bolted to the outboard side of the bulwarks, seen in figure 17.

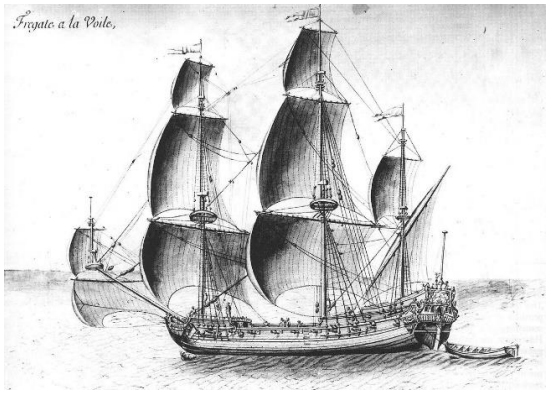

Figure 17. A late 17th century French frigate, attributed to Chabert Junior, showing the standing end of the main course braces bolted to the outboard side of the upper bulwarks. (Reprinted from Boudriot 1993, 55).

[108] Corder 2007, 144.

This bracing system, with the main course braces being led so sharply down and aft, would have had interesting implications for the operation of the vessel on deck. Braces led in such a manner resulted in an inefficient hauling angle when compared with the other braces which were led aft much more horizontally to a stay before they fell to deck. This resulted in the force on the braces matching, more or less, the plane of movement of the yards. With the braces of the main course coming directly to deck however, the force of the braces would be pulling them downwards while at the same time pulling the yard aft. The main course yard is also the largest and heaviest yard in the rig, which, when combined with the inefficient lead on the braces, required a system of mechanical advantage to aid in the smooth tacking of the yard.

Another important consideration lies with the sources which describe the main course braces. While some iconography depicts the standing end attached to the outboard side of the bulwark near the quarter, and some depicts both standing and working ends disappearing inboard of the bulwark, key mechanisms behind the bulwarks, invisible in iconography, must not be forgotten. Anderson describes the main course braces as passing through a leader block inboard of the bulwarks at the quarter, and belaying "on a cleat a little way forward, sometimes far enough forward to come on to the next step in the after decks".[109] The weight of the yard and the angle of the braces required a large leader block to aid the crew with the movement of the main course yard, with the belaying point of the brace's working end potentially far forward of the block. This also has important implications for the organization of a crew on deck. This set of braces required the most deckhands during a maneuver, on one of the smallest spaces on deck. Even without the command staff or weapons that often occupied this space, it would be quite crowded. It is important to keep in mind the nuances of the operation of these braces going

[109] Anderson 1994, 151-152.

forward with the excavation and artifact processing of *Queen Anne's Revenge*, and with any vessel of this period, as wreck sites may reveal subtle clues to the arrangement of the main course braces and their operation on deck.

The braces on the sprit yard are led from the forestay to a block at the yardarm, back to a block on the forestay, thence to a block on the bowsprit near the gammoning, and finally inboard, as seen on the *Le Louis XV* model. The braces for the sprit topsail, if *Queen Anne's Revenge* carried one, are led in a similar manner, except they originated on the fore topmast stay.

The Changing Head Rig

There was little change in the height of the lower masts, topmasts, or bowsprits from the 17th to the 19th centuries, although the height of the topgallants increased significantly in the last quarter of the 18th century.[110] The disappearance of the sprit topmast was complete by the second decade of the 1700s, although this was not the end of square sails in the head rig. The sprit topmast became the jibboom, an extension of the bowsprit, and the spritsail topsail was slung under the end of the jibboom, resulting in two square sails underneath the bowsprit. The addition of the jibboom allowed for fore and aft sails, in addition to the fore topmast staysail, to be added to the head rig.[111] The new spar also required additional rigging, such as the jibboom guys, lengths of rope run from the tip of the jibboom, to the outer ends of the spritsail yard, and then inboard, and which provided the jibboom with tension to counter the force of the jibs.[112] The jibboom could also be run in and out, and so required an outhauler, which was rove over a sheave in the jibboom heel, to a block hooked to the cap, then back inboard. The jibboom was

[110] Boudriot 1993, 340.
[111] Ibid, 344.
[112] Marquardt 1992, 53.

also fitted with a traveler, to which was connected the jib stay, and would be hauled out in order to set the jib.

If *Queen Anne's Revenge* carried a soon-to-be-obsolescent sprit topmast, the mast required shrouds, and most likely carried two on each side, with the smallest deadeyes in the rig used here. Deadeyes were generally paired to masts that were about twice their diameter in thickness, and so once further study of the hull remains is undertaken, it may be possible to generate estimates for the mast diameters, and match recovered deadeyes with their original masts.[113] The sprit topsail required gear similar to the other loose-footed square sails in the rig, but given the nature of the wreck site and the limited preservation elsewhere, it seems unlikely that any of these pieces of hardware survived in the as-yet unexcavated bow section of the site. The most likely smoking gun that would answer the question regarding *Queen Anne's Revenge*'s headrig would be the presence of small deadeyes in this area. Given their secure attachment to the bowsprit, and the metal straps on the lower deadeyes the most likely rig elements to survive in concretion are probably the lower deadeye straps. Future excavators should keep this in mind when recovering and excavating concretions from the bow area of the wreck.

Queen Anne's Revenge sunk in the period of transition for the head rig, and so it is not possible to rely on iconography for clues to the vessel's head rig. Iconographic representations of vessels with jibbooms were made before the sinking of *Queen Anne's Revenge*, and there are paintings of vessels with sprit topmasts after the sinking of the vessel. For instance, as discussed above, the picture of a "little frigate" (figure 2) included in Boudriot's *History of the French*

[113] Corder 2007, 125.

Frigate dated 1710 has a sprit topmast, but mistakenly includes a crossjack on the mizzen with no mizzen topsail, so perhaps this representation is not reliable.[114]

Figure 18 is an image from 1705 which depicts a fleet of Dutch whalers with headrigs comprised of jibbooms and jackstaffs, with no sprit topmasts in sight. This configuration is repeated in a pen and ink drawing (figure 19) by Willem van de Velde the Younger, dated approximately 1700. This drawing depicts the bowsprit of a vessel from the starboard side, including the attachment of the jackstaff, and a furled jib.

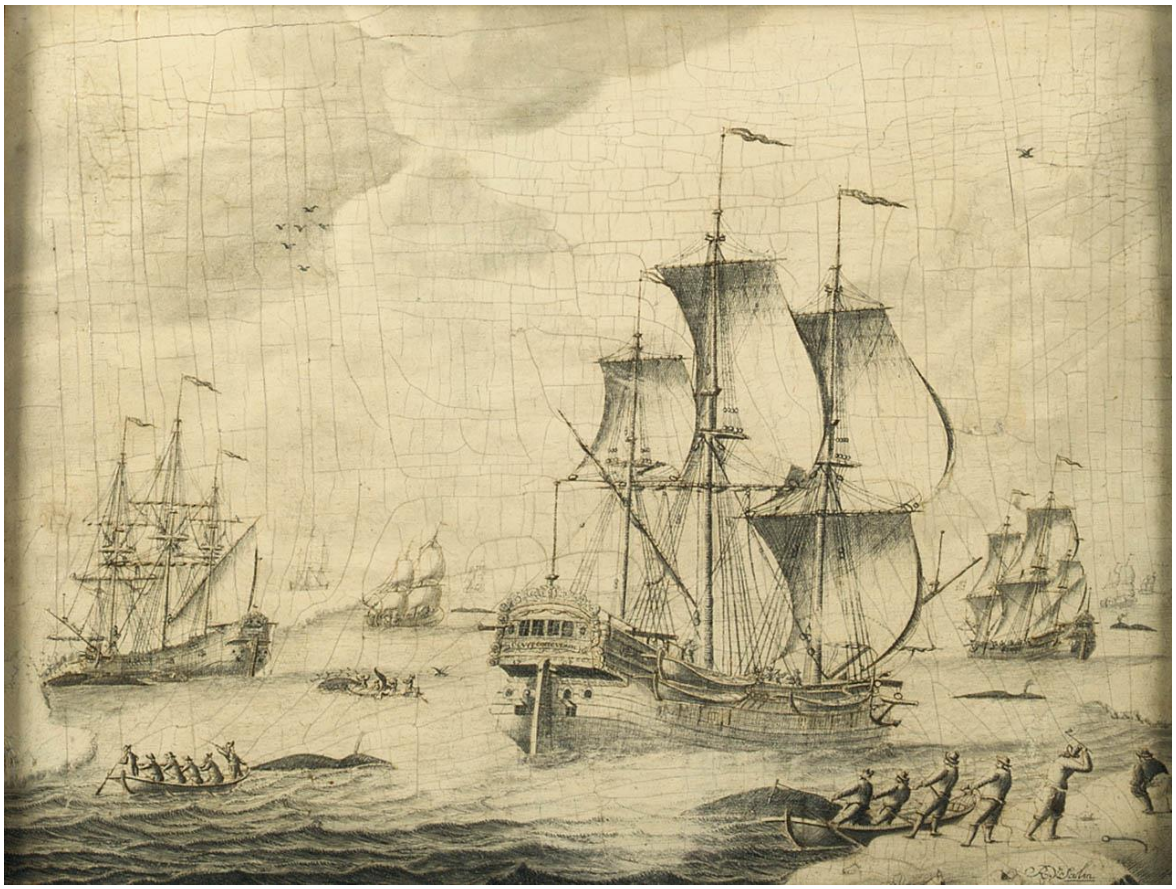

Figure 18. Grisaille on panel by Roelof van Salm, dated 1705. The vessel in the foreground is depicted with a jackstaff and a jibboom. (Royal Museums Greenwich, object ID BHC0939)

[114] Boudriot 1993, 58.

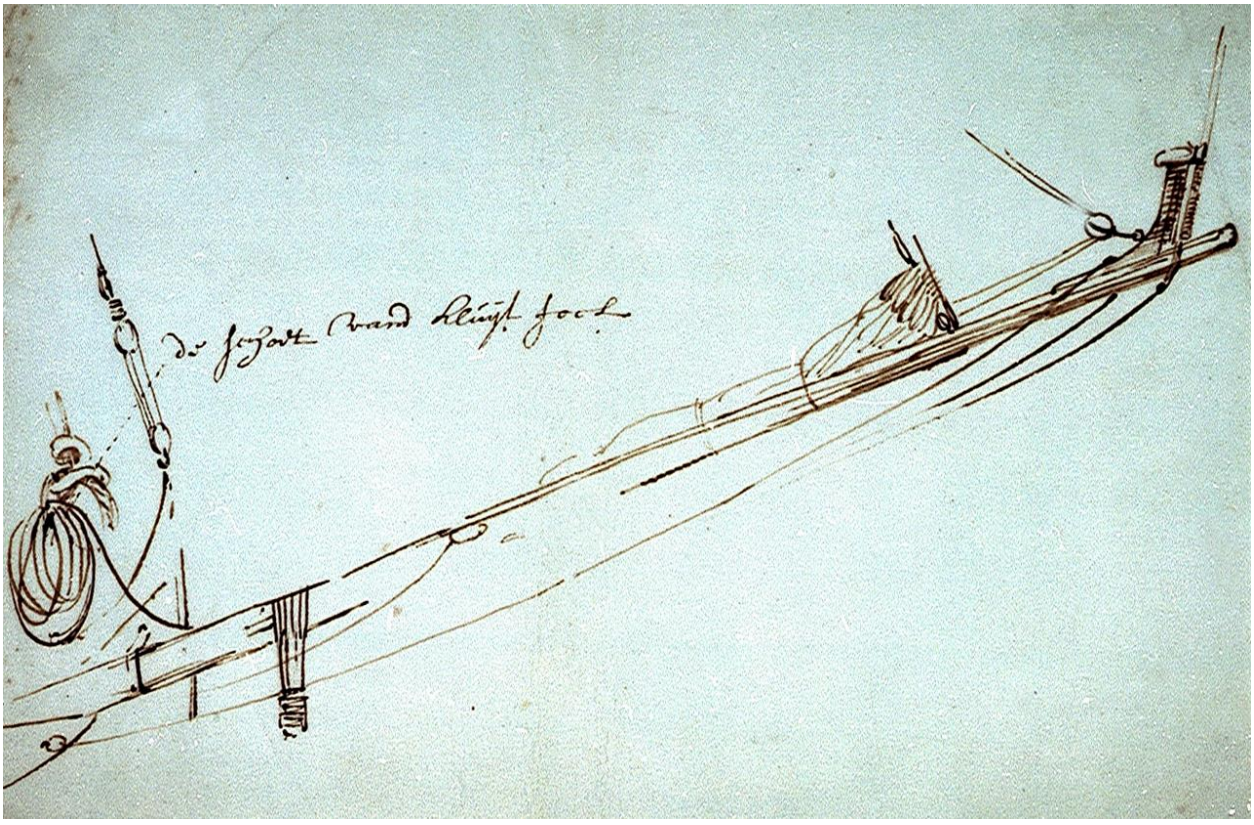

Figure 19. Pen and ink drawing by Willem van de Velde the Younger depicting a jibboom, furled jib, and a jackstaff. (Royal Museums Greenwich, object ID PAF6705).

A model of a 20-gun vessel, circa 1710, (figure 20) with dimensions similar to the reconstructed measurements of *Queen Anne's Revenge*, shows a jibboom with a jackstaff, and is rigged for at least one jib. Due to the high quality of the model, museum officials believe that it was made for a high-ranking official. There are some questionable elements in the rig, such as the deeply impractical belaying points for the course braces (almost directly below the yards themselves), and so this model may not be reliable for details, but at the very least can be used as confirmation for the use of jibs and jibbooms by the first decade of the 1700s.

Figure 20. 20 gun sixth-rate warship rigged with a jib and jibboom, circa 1710. (Royal Museums Greenwich, object ID SLR0398).

Contrary to these iconographical or scale model examples which depict the use of a jibboom within the first decade of the 18th century, there are examples which show continued use of a sprit topmast. A model (figure 21) of a 50-gun fourth-rate warship confirms the use of these elements through the end of the century, as the royal arms and "WR" monogram on the stern confirms a date range of 1695-1702.

Figure 21. 50 gun fourth-rate warship, circa 1695, rigged with a sprit topmast. (Royal Museums Greenwich, object ID SLR0381).

Another warship model, this time of a first-rate of 100 guns seems to extend the use of the sprit topmast into the second decade of the 18th century. The model (figure 22) dates from 1715-1719, but there are some indications (e.g. inconsistent size and tonnage ratios, and highly personalized decorations) that this was an imaginary vessel, and that the model was built for presentation purposes.[115]

[115] Royal Museums Greenwich object description.

Figure 22. 100 gun first-rate warship rigged with a sprit topmast, 1715-19. (Royal Museums Greenwich, object ID SLR0401).

Figure 23. A model of *Victory* (1737) depicting both a sprit topmast and a jibboom with associated headsails. (Royal Museums Greenwich, object ID SLR0449).

There is an interesting subset of iconography that depicts *both* a jibboom and a sprit topmast on the same vessel, as seen in figures 23 and 24. Figure 23 is a model of *Victory* (1737) which was commissioned in 1740 by the British Admiralty, and shows a vessel equipped with both a jibboom and associated rigging for at least one jib, as well as a sprit topmast and sprit topsail yard. It is important to note that this model depicts a vessel constructed at least three decades after the sprit topmast began to be replaced by the jibboom. A similar headrig arrangement (the sails themselves can be identified along with the spars) can be seen in the painting of the Battle of Cape Passaro, which took place in 1718 (figure 24). With the addition of the visible sails, the combination of sprit topsail and jibs seems incredibly inefficient; these sails could not have been used concurrently (as one would always be in the wind shadow of the other), and it is easy to imagine the level of frustration that would have been caused by attempting to tack each sail around the other. It would have been relatively simple to continue to use the sprit topsail without the jib set, but if the situation was reversed, the sprit topmast and yard would have provided many opportunities for the jib sheets to become fouled. While the date of the battle (1718) suggests some vessels carried both styles of headrig. The painting is not contemporary with the battle, however, (it wasn't painted until 1767), and may represent the work of an artist who had a limited understanding of the change in head rigs.

Figure 24. The Battle of Cape Passaro, 11 August 1718. Painted in 1767 by Paton Richard. (Royal Museums Greenwich, object ID BHC0351).

Written sources from this period do not provide additional clarity to this question either, as to my knowledge, there are no rigging treatises that directly address this switch. An English treatise by William Sutherland (1685-1740; an English master caulker at Sheerness) written in 1711, only a year after the first known historical mention of *La Concorde*, describes a sprit topmast.[116] Rigging treatises in this period were usually not meant to serve as instructional texts for riggers, and were more intended for avocational hobbyists. What appears, then, to be the case, is that there is a lag regarding the inclusion of new rig techniques in written sources.[117] In addition, when analyzing the iconography, it appears that the rigs of larger warships reflected a higher degree of conservatism when to adopting new rigging techniques. Given the sizeable investment that these warships represent, it follows that officials were unwilling to take risks.

[116] Sutherland 1711, 110.

[117] Barring discovery of informative archival resources that have yet to be rediscovered and studied.

When considering the historical context of the vessel, there are also arguments for both sides of the head rig question. As *La Concorde*, the vessel was making long voyages to tropical waters as a merchant vessel. Merchant vessels sought to economize as much as possible, and so perhaps might not have employed the latest technology if it required an extensive overhaul of the rig. While the slave trade was a high-value economic endeavor, all aspects of the trade would have been conducted as cheaply as possible, including the construction and outfitting of the vessels. However, it was important for *La Concorde* to make a swift passage during the second leg of a slaving voyage, when the vessel was carrying a cargo of imprisoned humans. This was a notoriously deadly trip for captives on board, and it was vital that the Middle Passage of the trans-Atlantic slave trade be as short as possible to reduce the number of deaths. It is possible that *La Concorde*'s rig was upgraded to improve the vessel's performance. The return of *La Concorde* after each voyage to Nantes allowed for maintenance and improvement of the vessel. Considering the likely origin of the vessel as a purpose-built privateer, it is possible the original rig was the newest and most efficient style in terms of maneuverability.

Unless new historical sources come to light which describe the rig of *Queen Anne's Revenge* in detail, or a smoking gun artifact like the discovery of deadeyes suited only for use with a sprit topmast, it is likely that we will only be able to speculate on the arrangement of the vessel's head rig.

CHAPTER IV

CONCLUSION

The wreck site of Blackbeard's flagship *Queen Anne's Revenge* has been excavated continuously since 1996, and every year more artifacts are discovered and added to the already-large artifact assemblage. The wreck's assemblage of rigging artifacts thus far consists of deadeyes, deadeye straps, chainplates, rope fragments, sail cloth fragments, and iron hooks. The rig of any wooden sailing vessel is one of the most ephemeral parts and is often one of the first parts to float away or decay after a wrecking event. *Queen Anne's Revenge* appears to be typical in this regard, and thus far has yielded only a small assemblage of rigging elements. In addition, the wreck site is incredibly dynamic, which has resulted in limited preservation of the artifacts that did remain.

The deadeye straps, deadeyes, and chainplate assemblies represent the largest group of artifacts that was, without question, part of the rig. While most are still concreted and in wet storage, it is clear that the chainplates were made up of chain links and not the iron bars seen on *La Belle.* The single deadeye recovered intact and fully conserved revealed more similarity to deadeyes recovered from *Le Machault* of 1760 than deadeyes recovered from wrecks that occurred before the 1718 loss of *Queen Anne's Revenge*.[118] Most of the deadeye straps and chainplate assemblies were found grouped together on the wreck site, possibly suggesting that they were in storage at the time of the wreck. As the deadeye straps continue to go through conservation, study of their assembly styles and diameters may reveal a range of dimensions, suggesting that they were not made specifically for *Queen Anne's Revenge*, and were spares

[118] Sullivan 1986.

likely scavenged by the pirates from other ships. Such a scenario could confound researchers attempting to assign a national identity to a shipwreck based on rigging characteristics.

Two portions of bolt rope and fragments of sail cloth were recovered from the same area of the wreck site, suggesting that these artifacts originated with the same sail. Future study of the hull remains may lead to estimations of hull dimensions which may be able to identify the sail based on the size of the bolt rope. The location of the sail, likely in storage towards the stern of the vessel, also carries important implications for shipboard organization of boatswain's stores which may be significant clues for study of the hull remains.

Seven iron hooks with eyes, and one with an attached thimble, were recovered from the wreck and match the general size and shape as the rigging hooks recovered from *La Belle*.[119] However, it is important to keep in mind that gun tackle also required many hooks of this nature.

One of the biggest questions regarding the rig of *Queen Anne's Revenge* involves the head rig. *Queen Anne's Revenge* was active in the second decade of the 18th century, during which square-rigged vessels were changing their head rigs from a sprit topmast and associated sprit topsail to a jibboom with fore-and-aft sails. It is not currently known whether *Queen Anne's Revenge* carried a sprit topmast or a jibboom, as there are no authenticated contemporary references that specify either feature, or any contemporary iconography of the vessel. Future excavation in the bow area of the wreck site, an area where no excavation has yet taken place, may reveal diagnostic artifacts that confirm the presence of either a sprit topmast or a jibboom.

Future study of the remaining hull structure may provide enough evidence regarding the hull for a thorough rig reconstruction that includes the dimensions of the rigging elements. Such a reconstruction could provide important information regarding the sailing characteristics of the

[119] Corder 2007.

vessel, the organization of the work force on deck, and the impact of rigging characteristics of the sailors on board.

Queen Anne's Revenge is an important wreck for the early 18th century, as it represents a nexus of many different historical narratives: possibly a French privateer during the War of Spanish Succession, a French slaver, and an English pirate's flagship, *Queen Anne's Revenge* is the convergence of multiple key historical events of this period. The rigging assemblage, though small, provides additional insight into the operation of the vessel, and through future study will continue to provide valuable information regarding the vessel and those who sailed on board.

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APPENDIX

ARTIFACT CATALOG

The following catalog includes the rigging artifacts discussed in this thesis. All artifact numbers and provenience locations were assigned by the *Queen Anne's Revenge* Project. For those artifacts still covered by concretion, measurements were taken as accurately as the concretion allowed.

Appendix Key

QAR Artifact # Provenience

Description Type

Material

Dimensions in inches (cms)

Conservation Status

Comments

Boltrope

QAR 0387.017 Unit #104 E75 N40

Portion of boltrope
with sailcloth Type 1

Organic-Plant Fiber

Pres. l. (19.70); pres. w. (3.63)

Conservation complete

Comments: three strand right-hand by hawser; 4 marlin hitches remaining

QAR 0387.017.01 Unit # 104 E75 N40

Detached fragment
of boltrope *QAR* 0987.017

Organic-Plant Fiber

Pres. l. 1.33; pres. w. 0.44

Conservation complete

Boltrope

QAR 0387.018 Unit #104 E75 N40

Portion of boltrope
with sailcloth Type 3

Organic-Plant Fiber

Pres. l. 9.38; pres. w. 2.01

Conservation complete

Comments: three strand right-hand lay hawser; five marlin hitches

Deadeye/Chainplate Assembly

QAR 1941.000 Unit #130 E70 N50

Deadeye strap with
partial preserved deadeye(?)

Metal-Iron, Wrought

Concretion l. 38.00; concretion w. 24.25; dia. inside concretion (19.00-20.00); dia. outside concretion N/A

Conservation on-going

Comments: still in concretion which obscured any outside diameter measurement; deadeye strap appears to have a part of deadeye remaining underneath concretion

Deadeye/Chainplate Assembly

QAR 2385.000 Unit #157 E75 N55

Deadeye with strap

Metal-Iron, Wrought

Pres. l. (including iron strap) 16.00; pres. w. (including iron strap) 10.00; dia. of deadeye face (17.50)

Conservation complete

Comments: wood species *Fraxinus* (ash)

Deadeye/Chainplate Assembly

QAR 0366.075 Unit #205/262 E75 N70

Deadeye strap

Metal-Iron, Wrought

Concretion l. 48.00; concretion w. 24.00; dia. inside concretion (22.90); dia. outside concretion (35.00)

Conservation on-going

Deadeye/Chainplate Assembly

QAR 3099.000 Unit #204/205/265/269
E75 N65

Deadeye Strap

Metal-Iron, Wrought

Dia. inside concretion (16.6); diameter outside concretion (27.1)

Conservation on-going

QAR 3099.000 Unit #204/205/265/269
E75 N65

Deadeye strap

Metal-Iron, Wrought

Dia. inside concretion (25.6); diameter outside concretion (34.1)

Conservation on-going

QAR 3099.000 Unit #204/205/265/269
E75 N65

Deadeye strap

Metal-Iron, Wrought

Dia. inside concretion (21.9); diameter outside concretion (31.4)

Conservation on-going

QAR 3099.000 Unit #204/205/265/269
E75 N65

Deadeye strap

Metal-Iron, Wrought

Dia. inside concretion (18.2); diameter outside concretion (30.2)

Conservation on-going

QAR 3099.000 Unit #204/205/265/269
E75 N65

Deadeye strap

Metal-Iron, Wrought

Dia. inside concretion (19.4); diameter outside concretion (29.4)

Conservation on-going

Comments: five deadeye straps observed in conservation that have yet to be separated and assigned individual numbers

Deadeye/Chainplate Assembly

QAR 3170.000 Unit #205 E75 N70

Deadeye with strap

Metal-Iron, Wrought

Concretion l. 26.25; concretion w. 19.00; concretion th. 14.75; dia. inside concretion (21.70); dia. outside concretion (33.00); concretion wght. (58.46)

Conservation on-going

Deadeye/Chainplate Assembly

QAR 3284.000 Unit #206/208 E65 N65

Deadeye strap with
chainplate

Metal-Iron, Wrought

Concretion l. 39.00; concretion w. 26.00; concretion th. 12.00; dia. inside concretion (20.80); dia. outside concretion (29.40)

Conservation on-going

QAR 3284.000 Unit #206/208 E65 N65

Deadeye strap with chainplate

Metal-Iron, Wrought

Concretion l. 39.00; concretion w. 26.00; concretion th. 12.00; dia. inside concretion (17.00); dia. outside concretion (26.80)

Conservation on-going

Comments: two deadeye straps with chainplates still in concretion that have yet to be separated and assigned individual numbers

Deadeye/Chainplate Assembly

QAR 3303.00 Unit #209 E65 N70

Deadeye with strap & chainplate

Metal-Iron, Wrought

Concretion l. 40.00; concretion w. 21.00; concretion th. 8.75; dia. of deadeye face (24.8); concretion wgth. (71.56)

Conservation on-going

Deadeye/Chainplate Assembly

QAR 3329.000 Unit #222/224 E65 N80

Deadeye strap with chainplate

Metal-Iron, Wrought

Concretion l. 56.00; concretion w. 11.00; concretion th. 9.50; dia. inside concretion (17.50); dia. outside concretion (30.00); concretion wght. (40.68)

Conservation on-going

Deadeye/Chainplate Assembly

QAR 3353.000 Unit #223 E70 N75

Deadeye strap

Metal-Iron, Wrought

Concretion l. N/A; concretion w. N/A

Comments: has not yet been recovered from wreck site

Deadeye/Chainplate Assembly

QAR 3691.000 Unit #166/204/269/271 E75 N60

Deadeye strap

Metal-Iron, Wrought

Concretion l. 41.00; concretion w. 33.00; concretion th. 14.00; dia. inside concretion (20.30); dia. outside concretion (26.30)

Conservation on-going

Deadeye/Chainplate Assembly

QAR 3692.000 Unit #271 E80 N60

Deadeye strap

Metal-Iron, Wrought

Concretion l. 22.50; concretion w. 17.00; concretion th. 13.25; dia. inside concretion (13.10); dia. outside concretion (32.20); concretion wgth. (42.58)

Conservation on-going

Deadeye/Chainplate Assembly

QAR 3743.000 Unit #269 E80 N65

Deadeye strap

Metal-Iron, Wrought

Concretion l. 27.00; concretion w. 19.00; concretion th. 10.50; dia. inside concretion (25.60); dia. outside concretion (35.50); concretion wgth. (50.23)

Conservation on-going

Deadeye/Chainplate Assembly

QAR 3748.000 Unit #269 E80 N65

Deadeye strap

Metal-Iron, Wrought

Concretion l. 35.00; concretion w. 27.00; concretion th. 12.00; dia. inside concretion (18.20); dia. outside concretion (28.60)

Conservation on-going

Deadeye/Chainplate Assembly

QAR 3838.000 Unit #269 E80 N65

Deadeye strap with chainplate

Metal-Iron, Wrought

Concretion l. 26.50; concretion w. 17.50; concretion th. 16.00; dia. inside concretion (22.40); dia. outside concretion (36.00); concretion wgth. (36.58)

Conservation on-going

Deadeye/Chainplate Assembly

QAR 3877.000 Unit #265/269 E80 N65

Chainplate

Metal-Iron, Wrought

Concretion l. 22.50 (57.15); concretion w. 20.00 (50.80); concretion th. 10.50 (26.67)

Conservation on-going

Deadeye/Chainplate Assembly

QAR 3942.000 Unit #204/205/265/269
E75 N65

Deadeye Strap

Metal-Iron, Wrought

Dia. inside concretion (20.40); dia. outside concretion (35.30)

Conservation on-going

QAR 3942.000 Unit #204/205/265/269
E75 N65

Deadeye strap

Metal-Iron, Wrought

Dia. inside concretion (12.10); dia. outside concretion (23.10)

Conservation on-going

Comments: two deadeye straps still in a single concretion

Sailcloth

QAR 0326.015 Unit #77 E75 N30

Textile Fragment Type I

Organic-Plant Fiber

Pres. l. 0.51; pres. w. 0.42

Conservation complete

Sailcloth

QAR 0347.004 Unit #104 E75 N40

Textile fragments Type 1 & 2 (?)

Organic-Plant Fiber

Pres. l. 2.60; pres. w. 1.49

Conservation complete

Sailcloth

QAR 0347.006 Unit #104 E75 N40

Textile fragments Type 1 & 2(?)

Organic-Plant Fiber

Pres. l. 2.14; pres. w. 2.05

Conservation complete

Comments: fragments 1, 3, 5-8 are Type 1 and 2 & 4 are Type 2 (?); sailcloth with lining (?); basket weave & plain weave stitching

Sailcloth

QAR 0366.086 Unit #205/262 E75 N70

Textile fragment Type 1

Organic-Plant Fiber

Pres. l. 1.86; pres. w. 0.95

Conservation complete

Sailcloth

QAR 0387.014 Unit #104 E75 N40

Textile fragments Type 1 & 3(?)

Organic-Plant Fiber

Pres. l. N/A; pres. w. N/A

Conservation complete

Comments: app. 8 small fragments all measuring less than an inch