

ABSTRACT

Kimberly M. Smith. COMPARATIVE ANALYSIS OF CASK MATERIAL FROM LATE SIXTEENTH THROUGH EARLY NINETEENTH CENTURY SHIPWRECKS (Under the direction of Dr. Charles R. Ewen) Department of Anthropology, July 2009.

This thesis examined cask material, including cask staves, heads, hoops, bungs and other components that casks consist of, recovered from 13 eighteenth century, three nineteenth century, one seventeenth, and two sixteenth century shipwrecks in an effort to discern a pattern in the types of cask material recovered within different types of vessels (e.g. pirate, merchant, and naval). Literature reviews were conducted and numerous archaeological, anthropological, and historical journals; namely, the *International Journal for Nautical Archaeology*, *Historical Archaeology*, *The Australian Journal of Historical Archaeology* were consulted. Published and unpublished theses and dissertations, proceedings from maritime and historical archaeological conferences for reports on shipwrecks containing cask material, and Parks Canada and National Park Service publications were also reviewed. Cask materials were studied and compared using bar graphs, histograms, and pie charts. Several potential patterns were identified, but none were definitive. This was not because they may not exist, but rather due to the inconsistent reporting methods creating a lack of available data to conduct comparative analysis. The inconsistent nature of the data obtained influenced the need to establish a standard reporting method. The final product of this research was the introduction of a standard reporting method and associated terminology and reporting forms. While the

data set was too inconsistent to make conclusive statements, this type of comparative analysis should begin to establish a framework for the interpretation of cask materials from future excavations.

COMPARATIVE ANALYSIS OF CASK MATERIAL FROM LATE SIXTEENTH
THROUGH EARLY NINETEENTH CENTURY SHIPWRECKS

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Master of Arts in Anthropology

By

Kimberly M. Smith

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SHIPWRECKS

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INTRODUCTION

Casks were a type of staved container, comprised of staves, hoops, and two heads that close each end. Throughout their history of use, up until their replacement by modern shipping containers, they were the universal container responsible for carrying ships provisions, repair supplies, and much additional cargo. Essentially, casks were the equivalent of their modern antecedent, the cardboard box. As such, they were recovered from numerous archaeological contexts, including shipwrecks. Unfortunately, cask material, including staves, heads, hoops, bungs, and other components casks were comprised of, recovered from archaeological sites have received minimal examination and report space. Their key components and features were often overlooked or misunderstood, and site reports often omit important information. Many site reports described a single “representative” cask as an example of all casks identified *in situ*, or recovered. Some reports, however, provided an in depth description of the cask material identified throughout the wreck that can be used to help better interpret the ship as a whole. Such exemplary site reports included the cask materials reported on *Betsy*, *LaBelle*, *Mary Rose*, the Millecoquins wreck, *San Juan*, and *William Salthouse*, which is one of the many reasons why they were utilized in this study (Broadwater et. al 1984; Shackleford 1996; Meide 1997; Rodrigues 2005; Mitchell 1996a; Ross 1981; and Staniforth 2000).

Adequate information obtained from cask material can enlighten archaeologists on the livelihood of coopers, sailors, and others; as well as trade practices and much more. Specifically, the scientific study of cask material can aid in determining: the diets

of sailors as well as others; trade routes and trade goods; what part of a voyage was a ship on (outward bound or return); the technological methods used to manufacture and assemble staved containers; the cultural variations in construction, size, function, wear and repair; the technological complexity of the coopers who produced these containers, and, if possible, correlate the temporal period and cultural ascription of the coopering technology. There is no question that cask materials should be studied in detail when identified within archaeological sites, as they have the potential to contain a wealth of information.

This thesis had two main objectives. The initial objective was to identify the inherent patterns present amongst cask materials recovered from different categories of vessels (e.g. naval, merchant, privateer, and slave). The original focus was on eighteenth century shipwrecks located along the eastern coast of North America, but limited or inconsistent data created the need to research vessels dating to a wider time period and geographic locations. For the most part, shipwrecks with informative cask descriptions within their reports were utilized in this study. The general purpose of conducting comparative analysis between shipwrecks was to determine if patterns existed in cask materials pertaining to an individual vessel type. For example, did a slave vessel carry more tuns of water than a merchant ship due to the greater amount of people on board the ship? Did a merchant vessel carry more barrels of nails or iron cask hoops than another vessel, as both were a significant commodity? The artifact class alone was compared amongst varying vessel types. There was no attempt to find ship manifests for identified vessels (e.g. the vessel *DeBraak*), as the purpose was to determine if a vessel's function

could be identified based solely on the cask material present, not the vessel's identity. This analysis was conducted inductively, with the potential patterns presenting themselves. The hypothesis was that if a ship's cask assemblage can be determined, archaeologists could then research the potential identity of the wreck by reviewing local shipping documents and ship manifests and all other pertinent local documents.

The second objective of this research was to establish a standard method for reporting cask material. Other archaeological studies have found it useful to produce an established recording and reporting method for various artifact classes. Examples of such studies include skeletal remains (Buikstra and Ubelaker 1994), artillery (Roth 1989), and perishable artifacts (Adovasio 1977). Buikstra's and Ubelaker's (1994) *Standards for Data Collection from Human Skeletal Remains: Proceedings of a Seminar at the Field Museum of Natural History* is used by virtually every bioarchaeologist when analyzing and recording human remains. This book provided worksheets for recording which skeletal remains were present and information on how to determine the age and sex of the remains. Roth's (1989) "A Proposed Standard in the Reporting of Historic Artillery" was less extensive than the book for human skeletal remains, but nevertheless was an informative journal article when analyzing and recording cannon recovered from historical locations. Adovasio's (1977) *Basketry Technology: A Guide to Identification and Analysis* was a book that was very similar to Buikstra's and Ubelaker's (1994), however, it dealt with basketry and perishable artifacts. This book was extremely useful for analyzing and recording basketry assemblages, especially since it included data recording forms that contained lines for recording significant information pertaining to

each component. In fact, the standardization report forms contained within this thesis (Appendix B) were modeled on these forms.

To date there was no reporting method for cask material and data recorded on cask materials from shipwrecks is inconsistent. It is imperative that all necessary data is available for future researchers so that they may be able to study the data, test the hypotheses presented, and identify other peculiarities in the archaeological record. The standardization presented herein will aid in the effort to make such data available in the future, as well as aid in the preservation of the archaeological record.

There was, additionally, a third and tacit purpose of this research: to create a body of data that will serve as a corpus for future researchers investigating cask material recovered from shipwrecks from the eastern coast of North America dating to the eighteenth century. Such a body of work will be extremely useful for future researchers to conduct comparative analyses on materials recovered from different sites. This corpus also serves to demonstrate the inherent problems in the cask data previously reported, including the inconsistent nature in which data was obtained and the lack of pertinent information obtained.

In completing this research, 19 archaeological sites (13 eighteenth century, three nineteenth century, one seventeenth, and two sixteenth century shipwrecks) yielding cask material were examined. The material identified from each site was collated into tables to make it more accessible. The data was then compared in search of patterns. It was during the course of this compilation that the inconsistencies in the data found within site

and cask reports suggested the need to establish a standard reporting form found in the appendices of this thesis.

This thesis is divided into five chapters and two appendices. The first chapter, Historical Background, contains information concerning the craft and history of coopering, and was subdivided into seven subchapters: Coopering and Cask Construction; Cask Repairs; Disassembly and Reassembly; Stowage of Casks; Coopers and Casks; Cask Function; and Eighteenth-Century Legislation. Coopering and Cask Construction discusses who coopers were, where they can be found, and how long the art of coopering had been in existence. It also discusses how casks were made, and their components, in great detail and introduces the reader to the types of coopering (e.g. tight, slack, and white). Cask Repairs provides a discussion on the types of repairs one may expect to find on cask material, including examples of the types of repairs found within data analyzed for this thesis. Disassembly and Reassembly provides information pertaining to shooks, casks that were knocked down and disassembled for transport purposes, and provides examples of shook casks encountered in the archaeological record. Stowage of Casks discusses the many methods of stowage including the: bilge and cantline, bilge and bilge, a-burton, and vertical methods. This subchapter also provides examples of the stowage methods found in the archaeological record. Coopers and Casks provides a discussion on coopers and coopering solely on sailing vessels. Cask Function informs the reader of the different materials used for coopering purposes and how to deduce the function of the cask based on the materials present in the

archaeological record. Eighteenth-Century Legislation provides a discussion on the known laws concerning cask dimensions and capacity during the eighteenth-century.

Chapter Two, Archaeological Background, contains information on both the historical and archaeological background for each of the nineteen sites analyzed for this thesis. These sites include the: Beaufort Inlet Wreck; *Betsy* (Yorktown Wreck 44YO88); a British Merchant Vessel found off Chub Heads Cut; Bermuda; *Defence*; a Federal Period Vessel found in Oriental, NC; *Henrietta Marie*; HMS *Charon*; HMS *DeBraak*; HMS *Fowey*; HMS *Invincible*; HMS *Sirius*; *La Belle*; *Le Machault*; *Lossen*; *Mary Rose*; Millecoquins wreck; *San Juan*; *William Salthouse*; and *Whydah*. Each site is the title of a subchapter which discusses the aforementioned data; however, the cask material recovered from each of these sites is not provided in this chapter. These are discussed in the Data Sets chapter.

Chapter Three, Methodology and Data Sets, discusses the methods used to obtain all data found throughout the remaining chapters of this thesis. It also contains all cask data obtained on the cask material recovered from the nineteen shipwrecks analyzed for this thesis. The majority of these data were obtained from theses, research reports, the occasional personal communication, and by the author herself. This chapter presents all raw data, unmanipulated, to demonstrate the information available for analysis.

Chapter Four, Observable Patterns and Conclusions/Discussions, analyzes the material presented in Chapter Three and compares that material between the types of vessels. The first part of the chapter, the observable patterns subchapter, serves to discuss the general types of data obtained on particular categories of vessels and the

patterns identified within the material recovered. The second part of this chapter, the conclusions and discussions subchapter, summarizes the patterns observed. It discusses why definitive patterns were not observed and provides a discussion concerning the locations where cask material was most likely to be identified within shipwrecks, based on the minimal data obtained for this thesis.

This thesis concludes with Chapter Five, Recommendations and Conclusions. As mentioned above, the data available concerning cask material was found to be rather limited and inconsistent, making it extremely difficult to conduct comparative analyses for this thesis. A standard terminology and a minimum set of required information was established and presented as a result. This chapter provides an at length discussion as to why a standard reporting and analysis method was needed and presents one for future researchers.

The two appendices are essentially a continuum of Chapter Five. These appendices present a list of standard terminology for future researchers to use, so that there would be minimal confusion as to what part of a cask one was referring to in the future. Five forms are provided for future researchers to use when analyzing cask assemblages. These forms ensure that adequate and uniform data will be obtained from each cask component and will allow future researchers a chance to conduct comparative analyses on all material identified.

This thesis provides a detailed background to understand the basics of cooping and cooping aboard ships. Examples and descriptions are provided in a manner in which a researcher should be able to identify their assemblage. Properly analyzed,

described, and interpreted cask assemblages can yield a wealth of information on the historic population. This information is encoded into each specimen and only requires the proper keys for decipherment. The following chapters present the necessary keys. This thesis will allow future researchers to disseminate adequate information, which will be capable of being used in future comparative analyses; and to borrow from Adovasio (1977:5), “if it accomplishes nothing else, I hope this [thesis] discourages the publication of descriptions of [cask assemblages] which state only that [a barrel was present].”

CHAPTER 1: HISTORICAL BACKGROUND

A cask, commonly and inaccurately referred to as a barrel, is a general term for all vessels formed of staves and heads and held together with hoops (Figure 1.1) (Kilby 1989:37; Boudriot 1986:108). Throughout history there have been many different cask sizes (Table 1.1 and Figure 1.2), all with different names, including, but not limited to: monkey, firkin, kilderkin, barrel, tierce, hogshead, puncheon, pipe/butt, and tun. The range of cask types, capacities, stave length and thickness, and minimum and maximum bilge diameters from the eighteenth century were collated and summarized in Table 1.1 (adapted from Watkins-Kenney 2006). The wine gallon or US gallon of 231 cubic inches was represented, rather than the imperial gallon of 277.3 cubic inches adopted by England in 1824 ((1) Walsh 1999:151-154, (2) Boudriot 1986:108-109; Babits 2005, pers. comm.; Rowlett 2005; (3) Shackelford 1996:21; (4) Bradley 1983, (5) Mitchell 1996b).

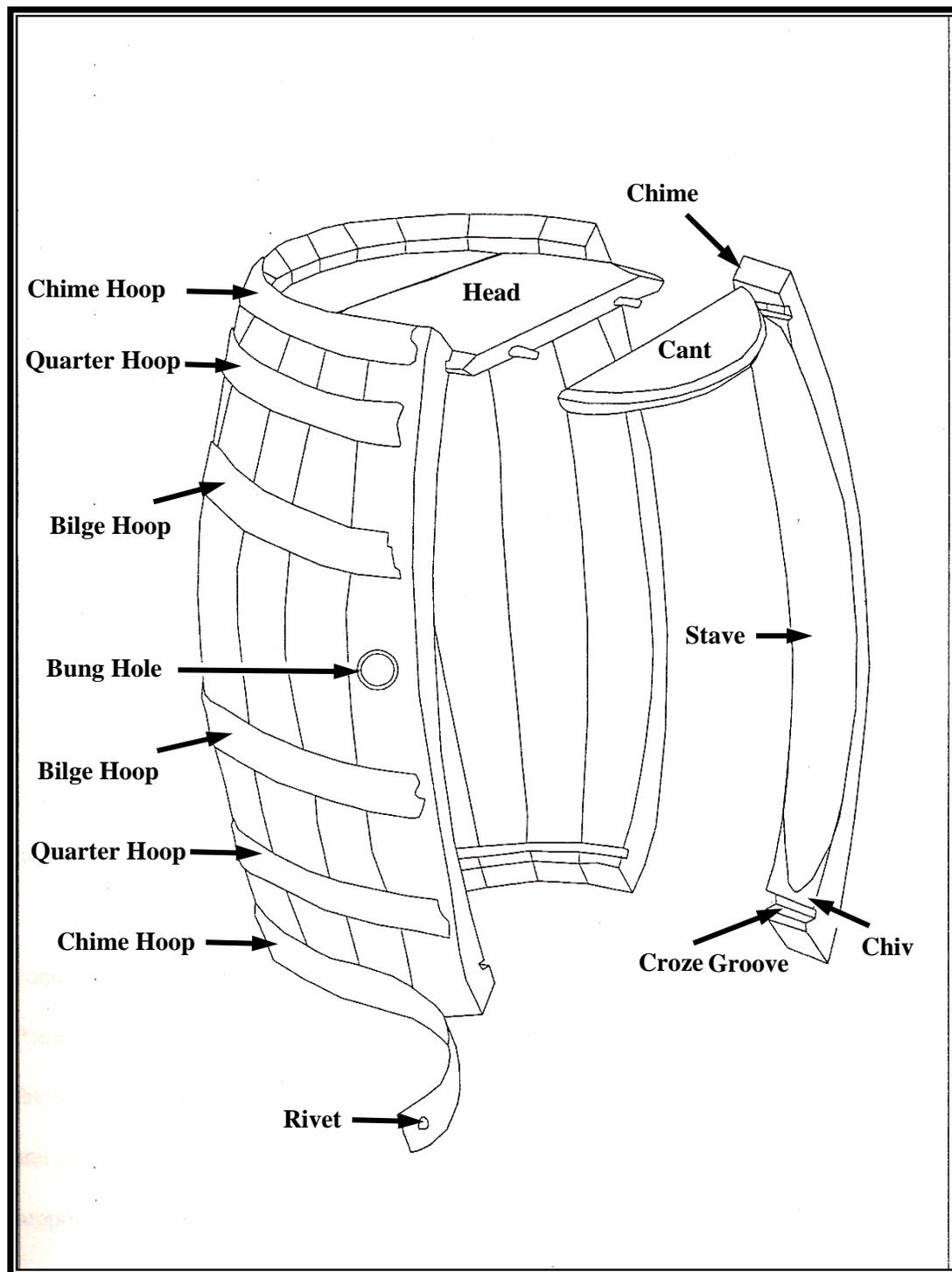


FIGURE 1.1. The components of a cask (after Shackelford 1988).

Type of Cask	Other names by which they were known or equivalent	Capacity of Wine (US gallons)	Number of Hoops	Head diameter (inches)	Bilge diameter (inches)
Mess-kid	-	-	2 (2)	8.5 – 10.5 (2)	-
Monkey	-	-	2 (2)	6 - 9 (2)	-
Small shot keg	-	1.85 (4)	-	9.5 (4)	10 (4)
Bidon	-	5 (4)	-	5 (4)	-
Baril (musket shot)	-	5.5 (4)	-	-	-
Quintal (pork)	-	6.3 (4)	-	11 (4)	-
Barricoe	-	-	-	9 (2)	12 (2)
Firkin	Quarter barrel, or Half Kilderkin	8 (1)	4 (1) 6 (2)	10.5 (2) 13 (1)	12.5 (2) 16 (1)
Anker	-	12 – 13 (5)	-	14 (5)	-
Kilderkin	Half barrel, or Equivalent of 2 firkins	16-21 (1)	6 (1)	16 – 16.5 (1)	19 - 20 (1)
Rundlet	-	18 (3)	8 (2)	16 (2)	19 (2)
Nail Keg	-	22 (4)	-	17 (4)	-
Quart	-	21-23 (4)	-	-	-
Quarter of Salt-Pork	-	-	18 (2)	18 (2)	20 (2)
Quarter of Flour	-	-	18 (2)	19 (2)	21 (2)
Barrel of gunpowder	-	100 lb (3)	-	-	-
Barrel of beer	-	34 (1) 36 (3)	-	23 (3)	24 (3)
Barrel (flour, pork, or beef)	Half a hogshead, demi-barriques were very similar in size	31.5 (1) 196 lb flour (1) 220 lb pork (1)	6 (1) 8 (2)	18 – 22 (1) 19 (2) (3)	22.5 (2) 21 – 26 (1) 23 (3)
Tierce	Standard Barrel, tiercons/third-hogsheads were very similar in size (Identical to a present day Petroleum Barrel)	42 (1)	8 (2)	20 (2) 22 – 28 (1)	23.5 (2) 27 – 37 (1)
Hogshead (wine/barrique)	Equivalent of 2 barrels	63 (1) 64 (2) 62 – 63 (4)	8 (2)	23 (3) 25 (2) 27 – 30 (1)	27 (3) 28 (2) 31.5 – 36 (1)
Hogshead tobacco (barrique of sugar)	-	1250 lbs ca (1) 1100 lbs (3)	-	30 – 34 (1)	37 – 41 (1)
Tertian/Puncheon	Equivalent of 2 tierces or 1/3 of a tun	84 (1)	-	25 (1) (3)	30 (1) (3)
Pipe/Butt	Equivalent of 2 hogsheads	126 (2) 128 (1)	10 (2)	26 (3) 28 (2) 32 (1)	30 (2) 32 (3)
Double Puncheon	Equivalent of 3 hogsheads	192 (2)	10 (2)	32 (2)	37 (2)
Tun	-	255 (2)	10 (2)	35.5 (1) 38 (2)	40.5 (1) 43 (2)

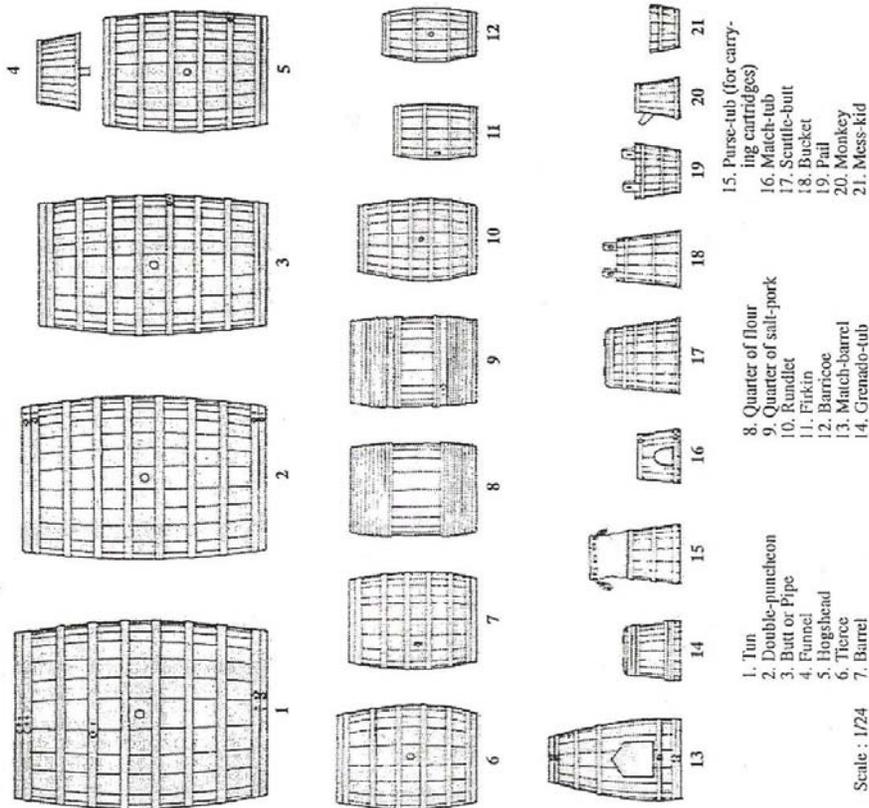
TABLE 1.1. An overview of the names, sizes, and capacities of eighteenth-century casks (adapted from Watkins-Kenney 2006). (1) Walsh 1999:151-154, (2) Boudriot 1986:108-109; Babits 2005, pers. comm.; Rowlett 2005; (3) Shackelford 1996:21; (4) Bradley 1983, (5) Mitchell 1996b).

A hogshead contains 242 litres, and the casks used on board contain multiples of hogsheads: 2 hogsheads = 1 butt; 3 hogsheads = 1 double-punchion; 4 hogsheads = 1 tun. Casks can be knocked down for transportation into bundles of staves and head-pieces, in which case they are called *shockes*.

The external dimensions of all these items are shown in the following Table.

	DIMENSIONS*			
	Length or Height	Diameter at the Head	Diameter at the other Head [if different]	Diameter at the Bilge
Tun	4'7"	2'11 1/2"	[0.962]	3'4 1/2" [1.096]
Double-Punchion	4'5"	1.436	[0.813]	2'11" [0.948]
Butt	4'1"	1.328	2'2"	[0.704]
Hogshead	2'11"	[0.948]	1'11"	[0.623]
Funnel	9"	[0.244]	1'1 3/4"	[0.370]
Terce	2'7"	[0.800]	1'7"	[0.515]
Barrel	2'4"	[0.758]	1'6"	[0.488]
Quarter of Flour	2'4"	[0.758]	1'6"	[0.488]
Quarter of Salt-Pork	2'4"	[0.758]	1'5"	[0.461]
Rundlet	2'11"	[0.948]	1'3"	[0.406]
Firkin	1'7 1/2"	[0.528]	10 1/2"	[0.284]
Barrique	1'10"	[0.596]	9"	[0.244]
Match-barrel	2'6"	[0.813]	1'5"	[0.461]
Grenado-tub	1'0"	[0.325]	1'1"	[0.352]
Carriage-box	1'0"	[0.325]	1'1"	[0.352]
Match-tub	1'4"	[0.433]	1'1 1/2"	[0.312]
Scuttle-butt	1'2"	[0.380]	1'6"	[0.488]
Bucket	10 1/2"	[0.284]	1'0"	[0.284]
Pail	11"	[0.293]	6"	[0.163]
Monkey	7 1/2"	[0.203]	8 1/2"	[0.210]
Mess-kid				

* The first set of numbers in each column is in French feet and inches; the second is the metric equivalent.



- 1. Tun
- 2. Double-punchion
- 3. Butt or Pipe
- 4. Funnel
- 5. Hogshead
- 6. Terce
- 7. Barrel
- 8. Quarter of flour
- 9. Quarter of salt-pork
- 10. Rundlet
- 11. Firkin
- 12. Barrique
- 13. Match-barrel
- 14. Grenado-tub
- 15. Purse-tub (for carrying cartridges)
- 16. Match-tub
- 17. Scuttle-butt
- 18. Bucket
- 19. Pail
- 20. Monkey
- 21. Mess-kid

Scale: 1/24

FIGURE 1.2. Casks and coopers' work (after Boudriot 1986).

Coopering and Cask Construction

Coopering, the art of constructing wooden casks, or staved containers, is an ancient craft believed to have been developed at approximately the same time people first began to build ships (Elkington 1933:216; Kilby 1989:15; Staniforth 1987:69). Herodotus was amongst the first to mention casks in his early writing, and describes Armenian ships ca. 900-800 B.C. carrying large palm wood casks of wine (Elkington 1933:216). Pliny, ca. A.D. 79, attributed the origin of coopering to the Alpine Valleys and was the first to provide an in-depth description of cask construction (Elkington 1933:220-221). In general, though coopering technology changes over time, the art of coopering remains the same and American colonial coopers practiced techniques that were much the same as those from over 1,000 years earlier (Stringfield 1996:50).

By A.D. 1298, coopers were organizing in Europe, and in 1439 the Cooper Company in England began to keep formal records (Elkington 1933:13). The quality of their work was deeply important to coopers, which led them to write expositions that dictated the construction and capacities of various casks. For example, *The Art of Practical Gauging: or Plain and easie Directions for the Guaging of Casks and Brewers Tuns* (Newton 1669) and *Several Useful and Necessary TABLES, for the Gauging of CASKS* (Beilby 1694) were two of the manuals coopers utilized during the seventeenth century. Coopers of the Cooper's Guild followed additional regulations including the refusal to use inferior woods and were required to have and register their own signs, signatures composed of a circle and straight lines produced by a scribe, to mark their work (Shackelford 1988:42).

By the sixteenth century, coopers were found in virtually every town. They were more concentrated in port cities due to the demands of the shipping industry, which constantly needed new containers and damaged ones repaired. Coopers were also aboard the European ships exploring the coast of the New World, and were undoubtedly present in many of the first settlements (Coyne 1940:8-9).

There are three different types of coopering: dry, wet, and white coopering. Dry coopering, also known as “slack work”, produces casks capable of holding dry goods, namely, salted or dried meats, bottles, lead items, flour, gunpowder, and seeds (Kilby 1989:46-53; Staniforth 1987:70; Nightingale 1997:31). Wet coopering, also known as “tight work”, is used to construct casks capable of holding liquids, such as beer, wine, water, sauces, jams, syrup, vinegar, meats packed in a liquid or brine solution, and tar (Kilby 1989:61-64; Staniforth 1987:69). White coopering produces items such as buckets and tubs. White coopering containers held water, butter, and soaps, and were built in a similar fashion as wet casks in the sense that they used staves and hoops and were meant to hold liquid; however, they typically only had one head instead of two (Kilby 1989:43; Staniforth 1987:70). Knowing the different types of coopering is essential to understanding the types of casks and contents in which they contain.

Stave and Head Cask Construction

Casks consist of three major structural components, regardless whether they are constructed by the tight, slack, or white cooperage process. These components include

staves, heads and hoops. Mark Staniforth summarized these components succinctly in stating,

“A stave was a curved plank of wood made to fit tightly on two sides against other staves to form the sides of a cask. A head was the circular end of a cask made up of one or more pieces of timber. Hoops were narrow strips of wood or iron placed around the circumference of a cask” (Staniforth 1987:70).

The staves and heads are shaped initially, a process referred to as dressing the staves (Kilby 1989:19-21). Rough staves and heads are formed from unseasoned wood that is quartered by a saw (Arnold 1968), which were observed on staves from the 1781 wreck of the British Navy victualler *Betsy* (Yorktown wreck 44YO88). (Shackelford 1996:10) The wood is then carefully inspected to ensure it was of good quality, lacking blemishes, shakes or sap. Blemishes on the convex side may cause the stave to crack when bent and shaped to the cask. Green wood contained too much sap, made the wood soft, and caused it to rot (Townsend 1975), making it necessary to set aside blanks to season prior to dressing (Kilby 1989:21).

Many different types of wood are used for cask heads and staves. White oak (*Quercus* sp.) is used for most tight work because it was close-grained, allowing for greater flexibility and strength (Crews 2003; Howard 1996). North Carolina played a large part in the production of oak staves. According to *The North Carolina Magazine* (New Bern, N.C., 1764), between October 1, 1763 and October 1, 1764, the Port of Beaufort, North Carolina exported 253,161 staves. At this time, staves were typically sold by the thousand, and in October 1764, in the Carolinas, white oak hogshead staves were selling at four pounds per thousand, white oak pipe staves at six pounds, and white

oak barrel staves at 35 shillings (*The North Carolina Magazine* 1764). The staves recovered from *Le Machault*, a French privateer wrecked in Calcutta Bay, India in 1760, are primarily constructed of white oak, with a few examples of beech (*Fagus sp*) used for staves and heads (Bradley 1983). Staves recovered from the *Betsy* are primarily white oak with the exception to several made from red oak (*Quercus rubra*). The Virginia statutes of 1705 mandated oak, either white or red, as the timber for tobacco, corn, and wheat casks (Henning 1823:235-236). By 1752, casks for beef and pork made in or imported to Virginia were required by the Virginia Assembly to be made of white oak (Henning 1823:258-259; Shackelford 1988:44). Other common woods used for cask construction included: chestnut (*Castanea sp.*), elm (*Ulmus sp.*), hemlock (*Tsuga sp.*) and yellow pine (*Pinus sp.*) (Crews 2003, Howard 1996; Shackelford 1996:8; 1988:44). Red oak although porous, works well for dry containers or slack work, while pine and chestnut were good for ships stores such as tar and turpentine as well as dry goods (Shackelford 1996:9; Kilby 1989:69-76).

Once seasoned, staves are listed, a process of creating an angle to and tapering the edges of the staves (Figure 1.3), done using first a side axe, and then a plane. It is essential to leave a portion of the sawn edge present; taking too much, “robbing the stave,” renders it useless (Kilby 1989:22-23; Shackelford 1988:44). Tight casks are listed slightly differently, in that, the booge, or the center of the stave is wider than the ends or the chime (Shackelford 1996:10). They also have a wider booge on the bung stave in order to accommodate a bung (Arnold 1968; Ross 1980b:103). The bung hole is centered on the stave, both lengthwise and according to the width, and is bored using a

regular and a tapered auger to produce a tapered hole (Kilby 1989:18; Shackelford 1996:15). The bung, or the stopper, is cut from a radial section of wood, making its growth rings parallel to those found on the stave, and ultimately provided it with the ability to swell and fill the hole (Shackelford 1996:15). Listing the staves is essential to ensure tight joints; thus, it is a key skill a cooper acquired. Having listed the staves, the cooper proceeds to back the staves.

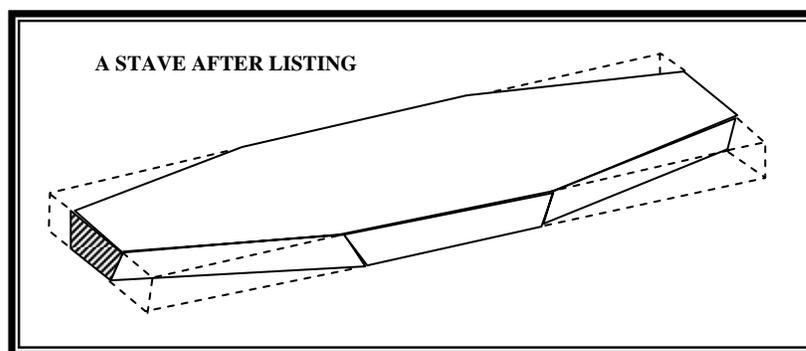


FIGURE 1.3. A drawing showing how a stave is listed. Note the dashed lined areas; these are the areas removed during listing (after Kilby 1989 and Kilby 2004).

Backing the staves consists of shaping the outside, or the back, of the stave using a backing knife. This ultimately bevels the outside of the cask, creating the well known rounded exterior of the stave. Next, the interior of the stave is hollowed using a hollowing knife, again leaving a portion of the sawn edges present, in order to not rob the stave (Kilby 1989:22-23). Sometimes the interior surfaces are not hollowed as seen in several staves recovered from the *Betsy*, and the British Naval vessel, HMS *DeBraak*, wrecked near Lewes, Delaware, in 1798 (Shackelford 1996:10; 1988:44). Shackelford (1996) proposed that the “practice of leaving the interior of the containers un-shaped had

become more common in the latter part of the eighteenth century.” On the other hand, such staves possibly represent slack casks, as slack cask staves often lack interior and exterior curves because they were not intended to be watertight. In general, slack staves are often made from thin, and in many cases, poor quality stock (Shackelford 1996:11; 1988:45).

During the manufacturing, assembly, and inspections, staves are often marked with lines and symbols (Figures 1.4 and 1.5). These include anything from assembly marks, coopers’ grading, inspection marks, shippers’ marks, and unknown marks that probably represent graffiti. Assembly marks are located on both the interior and the exterior of the staves and consist of lines, circles, and Roman numerals. These are engraved or branded in the cask to assist with the final assembly of the cask. Coopers’ marks (Figure 1.4) are the equivalent of maker’s marks and varied in shape, often with the cooperage name that constructed the cask branded into its head. On *San Juan*, a Spanish Basque whaling vessel wrecked in 1565 off the coast of Red Bay, Labrador, the coopers’ marks “consisted of a fine single curved line or double fine curved lines forming an “X”, “Y” or an “eye” shape” (Ross 1980b:101). Inspection marks also vary in shape or design, and are used to designate that the cask and contents had been inspected and approved. Shippers’ marks are typically located on the bilge area of the cask, the portion not covered by hoops, and are used to signify the owner of the cask and contents. Casks typically have several markings ranging from assembly marks to shippers’ marks. Often, additional marks are present which lack a purpose or may represent graffiti (Ross 1980b:101-102).



FIGURE 1.4. A stave recovered from the *Betsy* showing possible maker's, shipper's marks, assembly marks, and graffiti from the late eighteenth century (the scale shown above is in inches). (Photo by author 2006.)

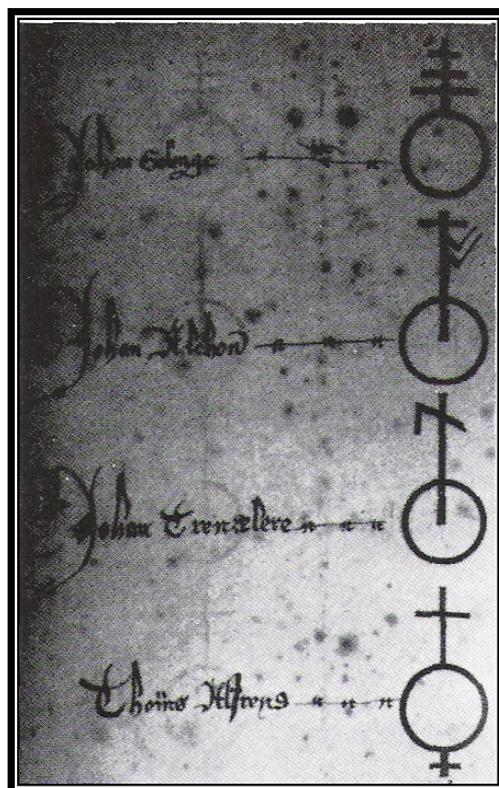


FIGURE 1.5. Examples of cooper's marks from the fifteenth century (Kilby 1989).

Cask heads are made in one or more sections, depending on the size of the cask (Butler 1998:105; Kilby 1989:38; Ross 1980a:3; 1980b:104; 1985:3). For example, the quart cask heads recovered from the French Privateer *Le Machault* consisted of four pieces; while the bidon consisted of a single head piece, and the shot kegs consisted of three pieces (Bradley 1983). Outer head pieces were named cants, inner pieces were named middle pieces, and center pieces were center pieces (Figure 1.6) (Ross 1980b:104), all of which are typically joined together by dowels; typically of beech wood (Kilby 1989:38-39). Cant pieces are typically cut to create a more ovoid shape of the head. This allows for shrinkage to occur, and as a result compresses the head together to create a tighter seal. According to Kilby, “a head will squeeze as much as half an inch on the cants in the course of wear over the years; it never squeezes the other way, against the grain of the wood” (Kilby 1989:39). The joints of the head are straight flush joints created by a jointer. It is particularly crucial to make sure that the joint is square; if it is not, the head could have lifted or dropped during the course of wear, subjecting the cask’s contents to the elements. Once the head pieces are constructed and jointed, the cooper shaves the surface of the head using a plane-like tool. The cooper then ‘cut in’ the cant pieces, creating the beveled edges of the head that are placed into the croze groove of the staves (Kilby 1989:40).

Once the heads are constructed, a chime, the beveled surface of the interior top portion of the stave, is created using the adze, allowing the heads to fit into the cask’s ends. A chiv, a concave surface on the inside of the chime, is created as a byproduct of the chime. A croze groove is then cut into the chiv, allowing the heads to be fitted.

There are three types of croze grooves (Figure 1.7): the hawksbill, a deep wide groove associated with casks for liquids; the scratch groove, a shallow groove used only in casks for dry provisions; and the V-groove for tight casks used with semi-liquids such as salt pork. Shackelford proposed that tight casks tend to have deeper and wider grooves, while slack casks had a narrow and shallow, or perhaps no groove at all (Shackelford 1996:12-13). Casks that lack a croze groove often have nailed liner hoops on the inside of the staves, such as several casks recovered from *Betsy* (Shackelford 1996:12). According to Shackelford there are several eighteenth-century references to heads being nailed into the casks, or to a nailed liner hoop found inside of the casks (Shackelford 1996:12). For example, Robert Gordon of the Victualling Office in England reported in 1779 that “for want of linning[sic] hoops in the heads, the heads sometimes work in, by which means whole barrels [of flour] were lost” (Shackelford 1988:47; Syrett 1970:142). Tobacco inspectors in Virginia were required to open and examine each cask of tobacco, requiring them to remove the old nails and then replace them to secure the head after inspection. William Allason, a merchant in Flamount, Virginia, documented in his record books the numerous occasions in which an inspector purchased a quantity of tenpenny nails “for heading up tobacco” (Allason Papers, M-1144). One cask from *Betsy* depicted this technique. The staves of *Betsy* Cask Assemblage (CA) 206 (a grouping of staves, heads, and hoops believed to be a single collapsed cask) had no groove; rather it had a series of nail holes around the chime indicative of liner hoops to hold the head in place.

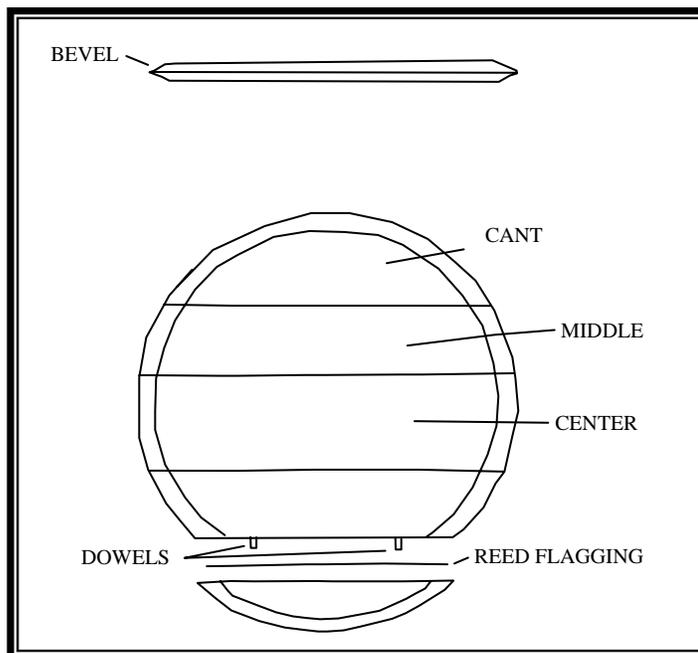


FIGURE 1.6. Cask head components (after Shackelford, et al. 1986).

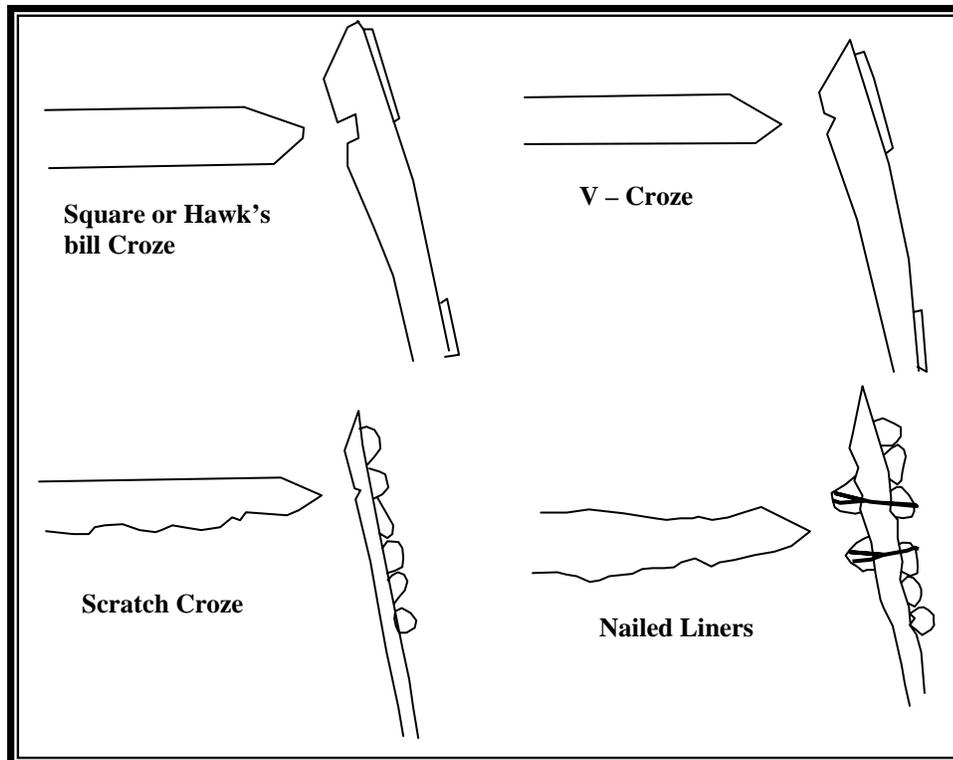


FIGURE 1.7. The four different types of croze found on staves recovered from eighteenth century shipwrecks (after Shackelford 1988).

Once the staves and heads are constructed, the staves are raised using wooden trusses, which provide the cask with its familiar shape. Raising the cask (Figure 1.8) involves placing the staves in a wood or metal truss hoop together and working them together (Kilby 1989:24). The raised staves are then shaped by burning a fire inside the cask, creating pressure and forcing the staves to succumb to the shape in which the trusses were forcing upon them. The interior surfaces of tight casks are typically scraped to prevent the taste of smoke from being transferred to the materials inside; however, this is not always the case. Tight cask staves recovered from the *Betsy* exhibit “everything from a light brown color to charred areas on the interior” as a result of such firing (Shackelford 1996:11; 1988:47). Slack casks are either fired to make the wood more pliable, but typically not scraped, or are not fired at all (Shackelford 1996:12; 1988:46). Tight casks are fired to hollow out the staves and are almost always scraped to prevent the tainting of the cask’s contents with a smoky taste or scent (Shackelford 1996). While the cask is still warm, the heads are worked in (Kilby 1989:24-25).

Once the heads were in place, the hoops were fitted to the cask (Arnold 1968, Kilby 1989:24-36). Cask hoops are essential to complete the cask, as they bind the cask together, and each hoop on the cask was specifically named (Figure 1.2). The hoops that fit around the ends of the cask are called chime hoops. These are typically the widest and strongest of the hoops, because the chime is the most vulnerable part of the cask. If the chime suffers a blow, the cask tends to crack across the stave to the groove; therefore, the wide hoop provided a considerable amount of protection. One-third of the way down the cask is the bilge hoop, also inaccurately referred to as the bouge, booge, or bulge hoop.

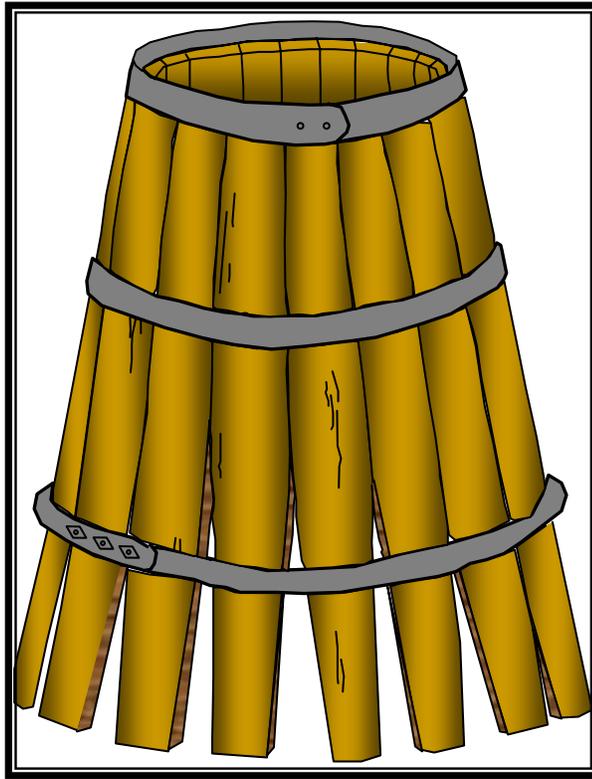


FIGURE 1.8. A drawing of a raised cask (after Kilby 1989; 2004).

Technically the bilge area of the cask is the bulging, curved portion of a cask equidistant from each head; while the booge area is the center width of a stave, usually the widest portion of the stave. Every cask has chime and bilge hoops on both ends. Barrels, a cask of 31.5 gallons or larger, are fitted with quarter hoops, located between the chime and the bilge hoops on both ends. Less tension is placed upon this hoop, which was why it is sometimes thinner. With casks that are larger, sometimes as small as 54 gallons hogsheads, a pitch hoop is fitted near the center (the belly or pitch) of the cask. This is done for added strength and stability of the cask (Kilby 1989:36-37). Marshal Scheetz, an apprentice cooper with the Colonial Williamsburg Foundation, however,

suggested that this hoop is temporary and is removed prior to its sale (Scheetz 2006, pers. comm.). As the hoops are placed on the cask, the overlaps, the portion of the hoop that binds the two ends together, are lined up on the bung stave.

Hoops, Hoop Material, and Construction

Throughout history, cask hoops have been made of two different types of materials; wood and metal. Wood hoops are used primarily on slack casks. Although not as tight as metal hoops, wood supplies enough pressure to hold the cask together and is more affordable. Wooden hoops are constructed from many different types of woods, such as, alder (*Alnus* sp.), chestnut (*Castanea* sp.), ash (*Fraxinus* sp.), hazel (*Corylus* sp.), beech (*Fagus* sp.), and willow (*Salix* sp.) (Bradley 1983; Hariot 1588; Kilby 1989:136; Watkins-Kenney 2006:2). They are created by cutting and splitting the branch, or hoop pole, with an adze, trimming it with a draw knife, soaking it to make it pliable, and then coiling them on a horse; a frame with upright pegs. Once the hoops are prepared, the cooper makes them to size in one of two manners: a simple overlapped notch, or a lashed hoop (Figure 1.9). During the eighteenth century, lashed hoops appear in prints and engravings more often than any other kind of wood hoop closure. Though the simple overlap notch appears infrequently in prints and engravings; it was the most common type found during the excavations of *Betsy* (Jackson 1993:188; Kilby 1989:136; Nightingale 1997:32; Ross 1980a:3; Shackelford 1996:14; 1988:49). Locking notch withy, however, is more prominent on casks recovered from *Defence*, a Revolutionary War privateer scuttled in 1779 in the Penobscot River, Maine (Switzer 1998:41).

Metal hoops are typically iron, steel, and copper or copper alloy (Kilby 1989:146). They are created from straight strips of metal which were splayed slightly conical in shape, which allowed the hoop to correspond with the curvature of the cask. The ends of the hoops are riveted together once they are shaped to the cask to create an overlap (Kilby 1989:35, 46). Copper hoops are typically used for gunpowder barrels because they provide ample pressure to keep the powder from getting wet, and copper alloys is a metal that does not spark (Razzolini 1978:1). Iron hoops are primarily used on tight casks and are recovered from several eighteenth-century shipwrecks, including the Beaufort Inlet Wreck, *Henrietta Marie*, *HMS Charon*, and *HMS Fowey*. These hoops are stronger than wooden ones which created a better seal, preventing the contents from rotting.

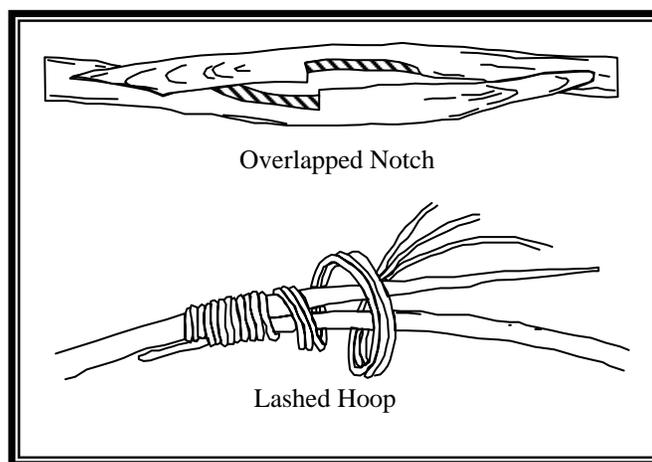


FIGURE 1.9. A drawing showing the two different types of wood hoop ends (after Shackelford 1988).

During the eighteenth century, iron hoops were far more expensive and likely to be in shorter supply than wooden ones. For example:

“In 1764 hoop iron was costing between £23 [today this would be \$211,510.45 with the added inflation] and £24 [\$220,706.56] a ton. A statement of costs issued by the Cooperage Office of the Victualling Board for 1805, when coke-smelting must have made iron somewhat less costly, gives the cost of old iron hoops as 3d. [\$114.95] each, and new iron hoops as 10d. [\$383.17] each, whereas wooden hoops were 3s. 9d. [\$919.61], and smaller ones 2s. 6d. [\$613.07] per ‘hundred of six score’. This was called a long hundred, and was derived from the time of Danelaw, when counting was always in multiples of six. A new barrel cost 3s. 3d. [\$689.71], but if it were to be bound with iron hoops these alone would cost 5s. [\$957.93]” (Kilby 1989:146-147; Levick 2003).

The high cost of iron made iron hoops the “hot commodity” of this time period. William Winterbotham (1795) reported that between October 1, 1789 to October 1, 1791, 79 ¼, 1000 feet groupings, or a total of 790,250 feet, of hoops were exported from the port of Pascataqua (now Portsmouth), NH to the West Indies. He also reported that one ton of iron hoops were exported from the State of Massachusetts between October 5, 1790 and September 31, 1791. Anthony Tournay (1650 – 1726), an investor for the English slaver the *Henrietta Marie* (1700), earned his fortune selling iron hoops and barrels to the Royal Navy during the war of 1689-1697, further demonstrating the value of iron hoops during the late-seventeenth and early-eighteenth centuries (Mel Fischer Maritime Heritage Inc. 2006). Although iron by its nature is susceptible to corrosion, and is more expensive than wooden hoops, the expense is justified as it is more reliable, stronger, and less likely to leak (Howard 1996, Shackelford 1996:15, Stringfield 2006, pers. comm.). In a letter dated July 10, 1799, William Reynolds of Yorktown wrote to John Ball complaining about the use of wooden hoops, rather than iron ones, on his shipment of goods. He

wrote that his hogshead of rum, which should had had a capacity of ca. 45-50 gallons (Kilby:1989:64), had “leaked out to about 30 gallons, which on review appears to be owing to the badness of the cask and not any fault in the stowing. Let me beg you never to ship me any Rum again, but in Iron bound Casks. The difference in the price of the Cask was by no means equal to the risk” (Reynolds 1799). In the eighteenth century, the British Navy held the same sentiment, and insisted on having iron-bound casks for watering their ships due to its reliability (Kilby 1989:146; Nightingale 1997:32).

Cask Repairs

Casks are often repaired and reused, as evident by those recovered from *Betsy*, due to their overall value. There are many historical documents indicating the desire to repair and reuse casks as it was cheaper than purchasing new ones. For example, according to the Navy Board Journal, Cornelius Deforest, a baker in Williamsburg who sold ship’s biscuits to the Virginia Navy in casks, offered on several occasions to pay for returned barrels if “they were not wanting [repair]” (Navy Board Journal, July 23, 1776 – Feb. 27, 1779, f. 387; Shackelford 1996:15). Aboard *San Juan* (Ross 1985:10), “parts of one barrica [the Spanish term for a medium sized cask and similar to the French barrique] were reused with parts of another barrica, and new barricas often consisted of a conglomerate of new and used staves and head pieces.” Shackelford reported that many casks recovered from *Betsy* consisted of several different materials, which indicated that repairs were made. He concluded that they were not original because the hallmark of

proper cooperage was consistency in materials, and these examples lacked such consistency (Shackelford 1988:44).

Repairs, seen often among cask assemblages, were necessitated due to poor storage, poor quality workmanship, damage, or normal wear. Repairs indicated that the cask was fixed at some point to accommodate further use of it. Therefore, repair is typically indicative of reuse. Signs of repair included anything from flagging, replacing hoops that have broken or corroded, plugging holes from toredo worm damage, sealing the bung in place via the use of lead sheets and cork, cropping the staves to remove damaged portions, recrozing staves due to cropping, and much more. Reuse, on the other hand, does not mean that the cask was repaired. A cask could have remained in good form allowing it to be used to ship other products. A modern example of this would be the reuse of Kentucky bourbon casks for aging scotch and Irish whiskey (Heaven Hill Distillery, pers. comm.). Signs of reuse included several different interior stains indicative of different contents and several brands or markings indicative of the different cask contents and shippers' marks.

Flagging was used to combat overexposure to the elements during transport. The cask may sit at the dock for an unknown period of time allowing the weather to affect on the wood, and develop leaks around the croze and between the staves. Thus, flagging, a split reed harvested specifically for coopers, was used for caulking, and was often found packed in leaky joints to prevent loss of contents (Butler 1998:105; Kilby 1989:18; Ross 1985:9; Shackelford 1996:16; 1988:50). According to Scheetz, however, flagging was not always used when repair was needed; rather it may be placed in the joints of larger

casks during construction in order to provide more pressure and therefore prevent the cask from leaking in the future (Scheetz 2006, pers. comm.).

The most common repair found among casks recovered from the *Betsy*, as well as the *San Juan*, was recrozing, or cutting a new croze groove for the head (Ross 1980b:103; Shackelford 1996:16; 1988:50). The life of a cask could be considerably extended by cutting a second groove and replacing or reshaping the head.

If the cask is still in good condition or in need of minor repairs it might easily be reused. In this case, the old brands or marks are typically scraped off or marked over in order to avoid confusion concerning the cask's contents, and the inside of the cask may be scraped clean and recharred (Kosmerl 1987:71; Shackelford 1996:16; 1988:50). Examples of such cases were recorded on the material recovered from the *Betsy* (Shackelford 1996:16; Shackelford 1988:50).

Cask hoops often need replacing or repair; for example, staves recovered from the *Betsy* show signs of using both wood and iron hoops on a single cask. Iron hoops are repaired in several manners, including; splicing, resplaying, and cutting to fit a different size. Splicing, connecting two separate pieces of iron together with a rivet, occurs when an iron strip is not long enough to fit around the cask. This may occur during initial construction; however, it is often a sign of repair as there is typically a lack of hoop iron aboard ships; hence all iron was reused. Once a hoop was cut or refitted to size, it often needs to be resplayed to the shape of the new cask. Iron hoops recovered from the Beaufort Inlet Wreck showed possible signs of repair. Although it was common practice to round the ends or overlaps of iron hoops, in order to prevent injury while binding and

stowing the cask, many overlaps appeared carelessly splayed outward creating a more circular end (Figure 1.10). Several hoops recovered from the Beaufort Inlet Wreck also showed no sign of rounding the overlaps which possibly indicated a quick repair, or at the least, sloppy coopering (Scheetz 2006, pers. comm.).



FIGURE 1.10. A cask hoop recovered from the Beaufort Inlet Wreck, showing a proper hoop overlap, with a nicely rounded end. (Photo Courtesy of NC Dept. Cultural Resources 2006.)

The use of lead sheets and cork were also recorded among the remains from *Betsy*. The head of CA 515 was found with sections of cork in a hole in the stave with a piece of lead sheet covering the cork to hold it in place. Shackelford wrote that this was not a typical repair, and was probably not done by a cooper, rather by a shipboard repairman (Shackelford 1996:17). The coopers at the Colonial Williamsburg Foundation, especially Jim Pentengell, however, witnessed this repair on casks from a London Brewery, and described the repair as acting like a gasket. The hole was first be filled with cloth or cork and then covered with a lead sheet that was tacked into place. The tacks were placed nearly on top of one another in order to prevent any air from entering or escaping the cask, thus creating a seal, or gasket. It was possible that this method of

repair had only recently been adopted by coopers, and that during the eighteenth century, other repairmen, such as a ship's carpenter, conducted such a technique (Scheetz 2006, pers. comm.).

Another example of repair is the presence of pegs or sawn wood of different species plugging holes in staves on several shipwrecks, including *Betsy*. Again, Shackelford believed this to be repair work aboard the ship, not done by a cooper (Shackelford 1996:17); although Ross mentioned that pegs were placed by a cooper after drilling a sampling hole to "sample" the cask contents or to repair worm holes (Figure 1.11) (Ross 1980b:141; 1985:9;). Pegs may also had been placed to plug insect holes, as it was documented that eighteenth-century French coopers often plugged insect and worm holes with thorns from a wild alum tree (Townsend 1975).

If certain portions of the cask are irreparable, particularly at the chime end, the cask is cut down or cropped to a shorter size (Bradley 1983; Shackelford 1996:17; Townsend 1975). Cask remains from *Betsy* depict this occurrence. For example, after examining the bilge diameter and overall shape of CA 516 with the dimensions mentioned in Steel's *Element of Rigging*, it was concluded that it was reduced by an overall length of 1.8-1.9 ft on each end (Shackelford 1996:17). Two containers recovered from *Le Machault* indicated that they were fashioned from larger staves, and similarly two cants were fashioned from stave ends (Bradley 1983).

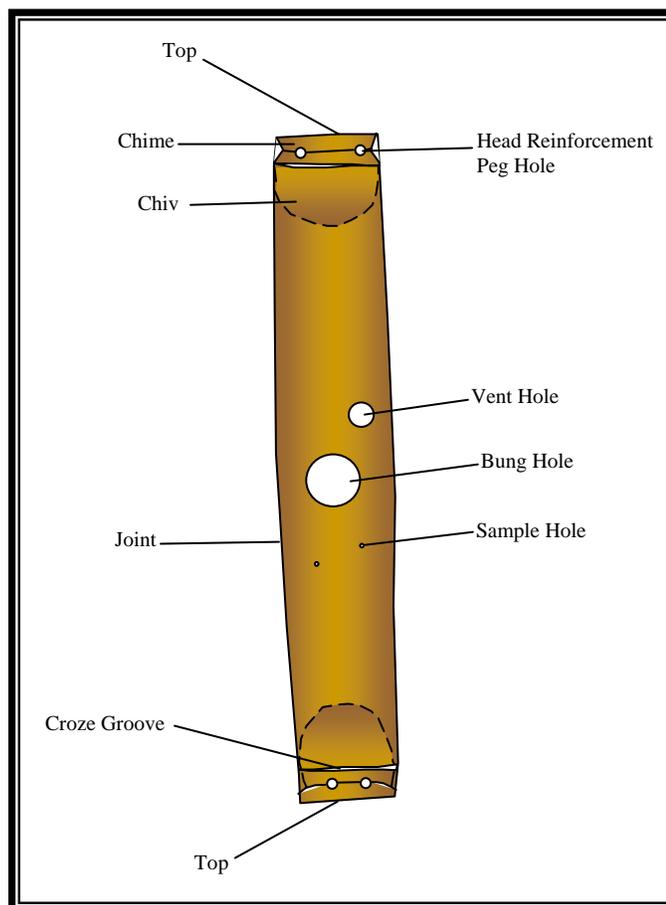


FIGURE 1.11. A drawing of a stave recovered from the *San Juan*. Note the vent hole and sample hole (after Ross 1985).

Disassembly and Reassembly

Casks can be knocked down for transportation into bundles of staves, head-pieces, and hoops, in which case they are called shooks (Boudriot 1986; Kilby 1989:58; Ross 1985:3). It was common practice for ships to have a cooper aboard to disassemble and then reassemble their casks, depending on the amount of cargo. This was believed to allow more room to stow other goods and items. For example, from at least the sixteenth

century through the nineteenth century, whalers carried a number of shooks on the outward journey to be assembled by shipboard coopers as needed, to be filled with whale oil (Howard 1996:443; Loewen 2004:175). Warships, however, were subject to laws that allowed them to carry only a certain number of shook casks. On March 6, 1776, the U.S. Continental Congress declared that a vessel could carry shaken or knocked down casks for molasses, but only the amount that the ship could carry if the casks were assembled and filled with molasses (U.S. Continental Congress 1776).

One particular set of hoops recovered from the Beaufort Inlet Wreck, QAR 015.002, contained four different hoop fragments nesting on top of one another and had nearly the same diameter of 41-42 inches (Figure 1.12). The difference of one inch was nearly insignificant, as a single hoop varied by one inch depending on whether the minimum or maximum diameter was measured. In addition, this set of hoop fragments also contained a small fragment of rope between the hoops; thus, it may have represented a shook or a bundle of hoops at the least.



FIGURE 1.12. Cask hoops recovered from the Beaufort Inlet Wreck, all of which share the same diameter and may represent a shook, or at least a bundle of hoops. (Photo Courtesy of NC Dept. Cultural Resources 2006.)

Shooks are also considered a commodity, as they are an easy way to transport both staves and hoops to market. In fact, many historical shipping documents declare shooks as exports rather than for provisions or provisioning (Winterbotham 1795). William Winterbotham reported that between October 1, 1789 to October 1, 1791, 2,079 shook hogsheads were exported from the port of Pascataqua (now Portsmouth), NH, to the West Indies. He also reported that 29,895 shooks were exported from the State of Massachusetts between October 5, 1790 and September 31, 1791 (Winterbotham 1795).

Stowage of Casks

During the eighteenth century, casks were the equivalent of today's cardboard box, and were used to transport all types of commodities. Casks are particularly suitable for stowage due to their shape and ease of handling, especially if the cask dimensions were regulated in size and capacity according to their contents. There is several different methods of stowing casks in vessels: the most common being the bilge and cantline method; however, the bilge and bilge, a-burton, and vertical methods were also employed to store casks. Stowing casks is very important as improper techniques caused the casks to fall and break open. Quoins, billets, or beds are typically placed on the floor for the ground tier casks to rest on. The purpose of this is to support the thickest part of the cask and to prevent the cask from buckling under the weight of the casks placed on top. "Bung up and bilge free" is a popular phrase used to describe the use of billets for stowing casks, meaning that the bungs should be up, and the bung staves should be resting on billets so as to raise the bilge or middle of the cask clear of the deck (Ringer

and Audy 1982:24). The bilge and cantline stowage method consists of placing a ground tier, or lower level of casks on beds, then placing the next tier of casks so that the bilge of each cask lay in the cantline, the hollow created by the four casks on which it was resting (Figures 1.13 and 1.14) (Staniforth 2001:70). The bilge and bilge method, alternatively, places the casks on top of one another so that, rather than having the upper tiers rest in the cantline, they were laid sideways so that the bilge of each cask touched. A-burton, is a term applied to the stowage of casks athwartship, in line with the deck beams. The vertical method of stowage consisted of placing the casks upright next to one another. The aim is to stow as many casks of water, wine, salt beef or pork, etc., as possible in a way in which they were readily accessible below decks and at the same time took up the least space.

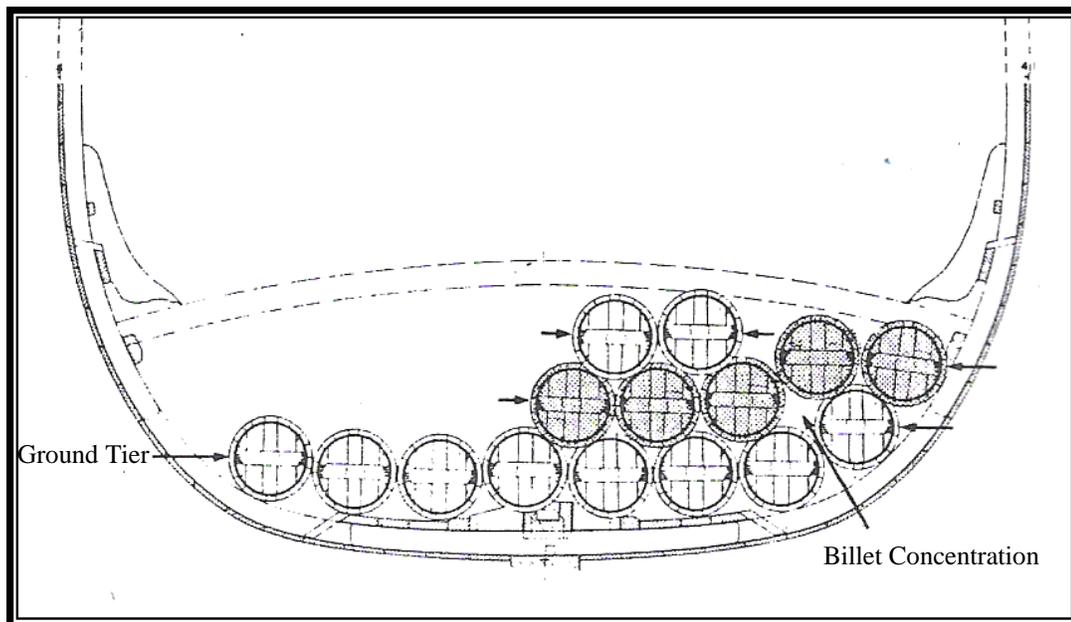


FIGURE 1.13. Picture showing the bilge and cantline cask stowage pattern (after Ringer and Audy 1982).

The stowage method used on several eighteenth-century wrecks survived the wrecking process and can, therefore, be reconstructed. On *William Salthouse*, a British merchant vessel wrecked in Port Phillip, Australia, in 1841, puncheons of whisky and hogsheads of vinegar were stored vertically, a firkin next to the main-mast was stowed across the vessel, or a-burton, and the remaining casks were stowed by the preferred method of bilge and cantline (Staniforth 1987:70). On *Charon*, a British naval vessel wrecked in the York River just upriver from *Betsy*, casks were stowed side by side athwartship and stowed end to end (Steffy 1981:120). Similarly, casks aboard *Defence* were found arranged on their long axis and stacked in tiers approximately three feet from the stem aft to the port and starboard frames (Switzer 1978:41).

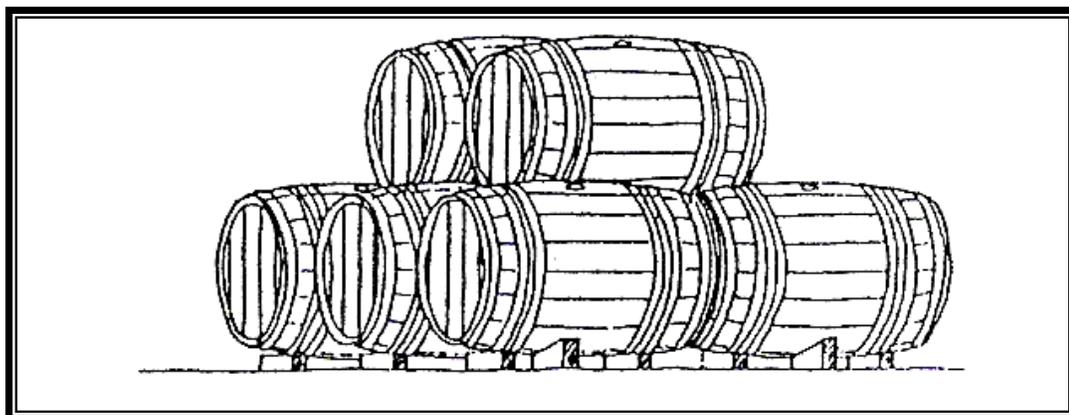


FIGURE 1.14. Picture showing the bilge and cantline cask stowage pattern (after Staniforth 1987).

Casks recovered from *San Juan* were oriented in a bilge and cantline method. They were found, “laid on their sides in rows across the hull of the vessel, bung stave uppermost,” and there were at least three tiers of casks, with possibly a fourth tier represented by a single cask (Figure 1.15) (Ringer and Audy 1982:22). Mark Howard’s

research supports the findings of *San Juan*. He suggested that in the whaling trade, oil casks were constructed by journeyman coopers at the docks and were initially filled with water to preserve the wood and to provide ballast. The upper tier casks were originally stored as shooks to save space, and assembled later when needed. The completed casks were rolled onto the ship into beds of sand, gravel, and stone ballast where they were stored to rest on their sides with their bungs uppermost, with the largest, heaviest, and strongest casks forming the ground tier. From there, casks were progressively smaller in the upper tiers, to fit the sloping hull of the ship, and created a level surface for the next tier of casks to rest upon. In order to keep casks stable and to prevent them from rolling about the hold, casks were stored in a bilge and cantline method, and dunnage was placed between the casks and the hull to prevent abrasion and added support (Howard 1996:438-441). Casks recovered from the Millecoquins wreck, an American merchant vessel wrecked in the Millecoquins River, Michigan in the 1830s, were stowed similarly, and still maintained dunnage packed around them (Mitchell 1996a:143).

Coopers and Casks

Coopers played an important role in the organization of port cities, as they had daily links to merchants, ship captains and timber merchants as part of the supply and demand chain. They practiced their trade in a capitalistic and industrial manner, and by the sixteenth century, they were able to establish large cooperages in port towns, and employ an extensive division of labor and machines. Moreover, naval cooperages in

Rochefort, France, were partially mechanized by 1680, as were many Dutch and French workshops in the 1740s and 1750s (Loewen 2004:171).

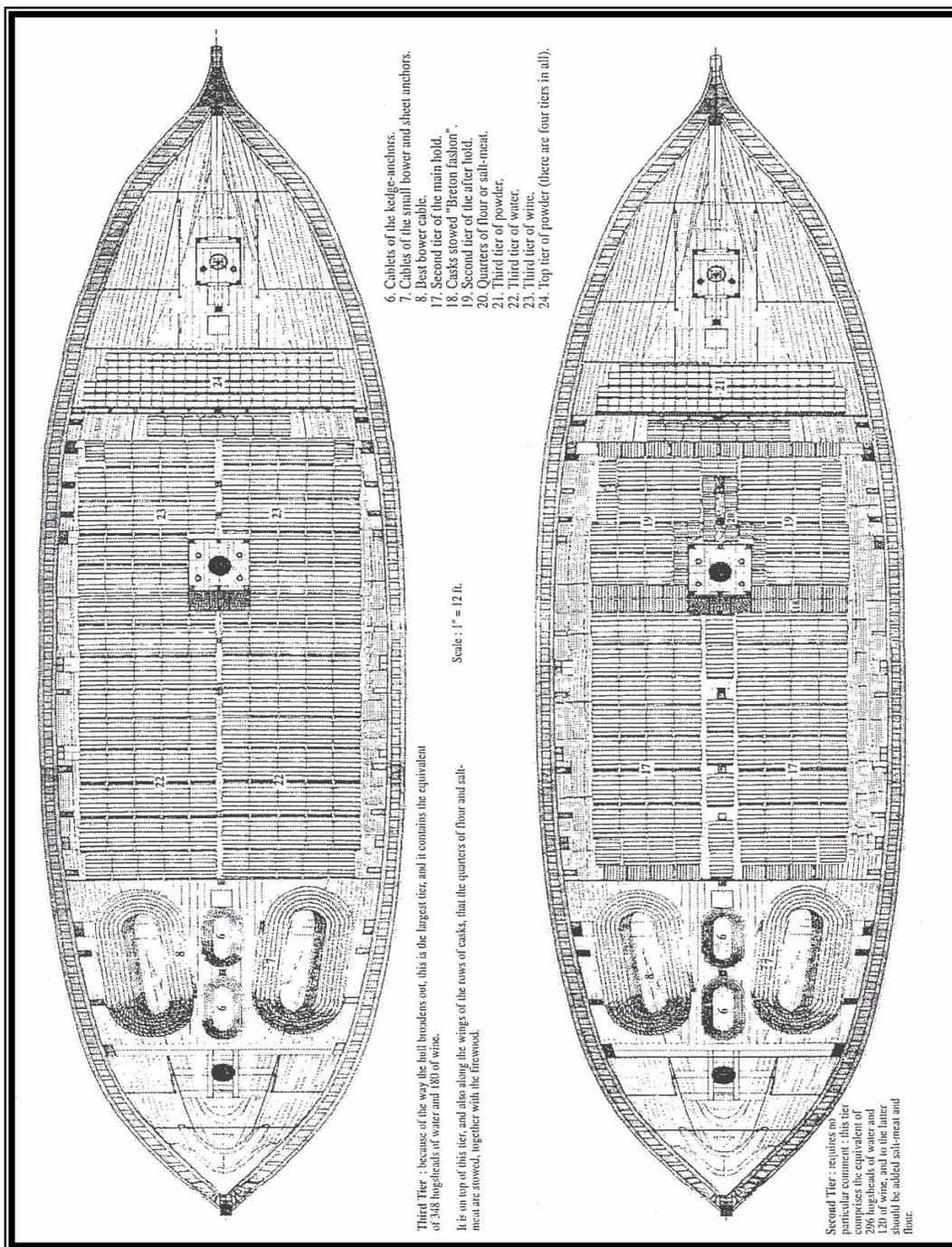


FIGURE 1.15. A picture showing the stowage of casks in a ship's cargo hold (after Boudriot 1986).

Coopers also played a significant role aboard sailing vessels; in fact, on whaling vessels, coopers were the most important tradesmen after the harpooners (Loewen 2004:171-172). They were also commonly found on naval ships (Boudriot 1986) and slaver ships (Stein 1979). In the eighteenth century, captains in the Royal Navy recommended two coopers on first and second rate ships, and one on ships of smaller sizes (Lavery 1989:139). The typical duties of the cooper aboard slaver vessels included constructing, repairing, and the general maintenance of the casks, as well as maintain a water supply for the crew, passengers, and slaves (Stein 1979:69). They were in charge of reassembling casks from shooks on the homeward journey, as it was quite common for slave ships making the trade triangle from Europe to Africa with trade goods, Africa to the Caribbean with slaves, and then returning to Europe with goods such as coffee and sugar, to carry dismantled casks on the outward journey (Stein 1979:69).

The number of coopers aboard a ship was dependent on the number of casks to be carried just as the number of casks carried depended on the ship's size, purpose, and the number of crew and passengers. During the sixteenth century, a captain of a whaling vessel hired one cooper for every 50 tons, or 200 casks; therefore, a ship that contained 1,000 barriques required five coopers to make and maintain them (Loewen 2004:172). According to Staniforth (1987:76, 2000:17), during the mid-nineteenth century, one seaman was expected to consume ca. $\frac{1}{12}$ of a tierce of beef and $\frac{1}{10}$ of a barrel of pork per month. The 250 ton brig *William Salthouse* had a crew of 10 to 12, and would have needed at least four tierces of beef and four barrels of pork for its journey of four to five months from Canada to Australia. In 1779, the British Navy specified that a mess of five

men were to be allotted seven pounds of beef and four pounds of pork weekly. Consequently, casks were packed to be convenient, with each cask of beef shipped with the capacity of 30 seven-pound pieces for a total of 210 pounds, and pork at 52 four-pound pieces for a total of 208 pounds (Shackelford 1996:5). Archaeological excavations of *Betsy*, conducted between 1983 and 1988, yielded remains of ca. 38 casks of which 21 were intact. Upon further examination, it was determined that the recovered casks were constructed to contain rum, meats, grain, and pine tar. Several buckets and tubs for shipboard use were also recovered between 1983 and 1988 (Shackelford 1996:1).

Cask Contents, Function, and Cultural Variation

In the archaeological record, cask function has been determined by the cask construction or components, interior stains, bones, pollens or microbotanicals, and the condition of the interior of the cask. Cask construction was a key indicator for cask function. Iron hoops were indicative of tight casks and the lack of interior staining or other clues may indicate the cask was a water cask. Copper hoops were used to bind gunpowder barrels since copper did not strike a spark. Slack casks typically were bound by wooden hoops and lacked interior beveling. Cask markings also provided clues to cask contents. Cooper's marks and shipper's marks found on casks recovered from the Millecoquins wreck all aided in determining the cask contents as salt (Cantelas 1993; Coble 1994; Mitchell 1996a; 1996b). All of these lines of evidence provided a general indication of use; however, they are not as definitive as residues, bones, and microbotanical remains found in direct association with casks.

Interior staining and residues provided a nearly definitive answer concerning cask contents on numerous sixteenth through eighteenth-century shipwrecks. Purplish stains, indicative of red wine, were identified on the interior of staves recovered from *La Belle* (Meide 1997:38). Remnants of tar were found on staves recovered from *Mary Rose*. Fatty acids were identified on staves from both *Le Machault* and *San Juan*, indicative of whale oil and animal fats or tallow (Bradley 1983; Ross 1981). Tar remnants were also identified on the *Mary Rose* staves (Kilby 1982:42).

Animal bones, plant pollens, and microbotanicals have also been found in casks recovered from several sixteenth through eighteenth-century shipwrecks. Fish bones were found in casks from the Millecoquins wreck (Cantelas 1993; Coble 1994; Mitchell 1996a; 1996b). Pig (*Sus scrofa*) bones were found in casks found on the HMS *Sirius*, a British naval vessel wrecked off the island Mauritius in the SW Indian Ocean in 1810 (Von Arnim 1998:12). To date there is no case study to provide, but the analysis of cask material at a microscopic level could also yield pollens or plant materials not visible to the naked eye. These microbotanicals could then be studied to determine the cask contents.

The function of casks containing non-perishable goods was easier to determine as they were more likely to survive, and did not rely on the analysis of trace elements such as fine residues, or microbotanicals to determine the contents. For example, a complete nail cask was found on *Whydah*, notorious pirate Sam Bellamy's flagship that was wrecked off the coast of Cape Cod, Massachusetts, in 1717 (Figure 1.16) (Hamilton 1992:348). Lead shot casks were found on *La Belle* (Figure 1.17) (Meide 1997:138). If

the non-perishable item did not survive, cask contents can possibly still be determined based on indentations on the interior of staves. Small round indentations most likely indicated lead shot, while small punctations indicated nails, and long slash-like indentations indicated axes (Meide 1997; Bruseth and Turner 2005; Ross 1980b)..

There were many different cask functions, indicated by the varying residues, markings, and remains previously discussed. Casks not only varied in function but also between culture. The French navy used measures such as the *barrique*, the rough equivalent of an English hogshead which held 242 liters or ca. 64 US gallons.

“There was some problem translating French to English terms, as the English in the late-eighteenth century used different measures for wine, ale, beer, and dry goods, none of which correspond exactly to French measures. The closest (about 2.5% smaller) was the English measure used for wine; this therefore was the English equivalent used by Boudriot's translator (Boudriot 1986b: 108)” (Meide 2005).

Typically, the French water casks were available in multiples of *barriques*, between two and eight. They were rated as *pièces de 2* (482 liters) through *pièces de 8* (1,936 liters), with the larger sizes, larger than *pièces de 4* (968 liters, ca. 254 US gallons, and the closest equivalent of the English tun) used exclusively on slave ships (Meide 2005). The Spanish used *barricas*, *barrils*, *quartillos* and other sizes. A *barrica* contained the equivalent of approximately 52.5-61 US gallons, a half-*barrica* contained approximately 26 US gallons, and a one-third *barrica* 17.5 US gallons. A *quartillo* (pre-1801) contained the equivalent of approximately 1.25 US gallons (Ross 1981). Knowledge of the varying cask sizes allows researchers to place casks with the correct cultural ascriptions.



FIGURE 1.16. A picture showing a cask containing nails recovered from the *Whydah* (McNair-Lewis 2006, pers. comm.).

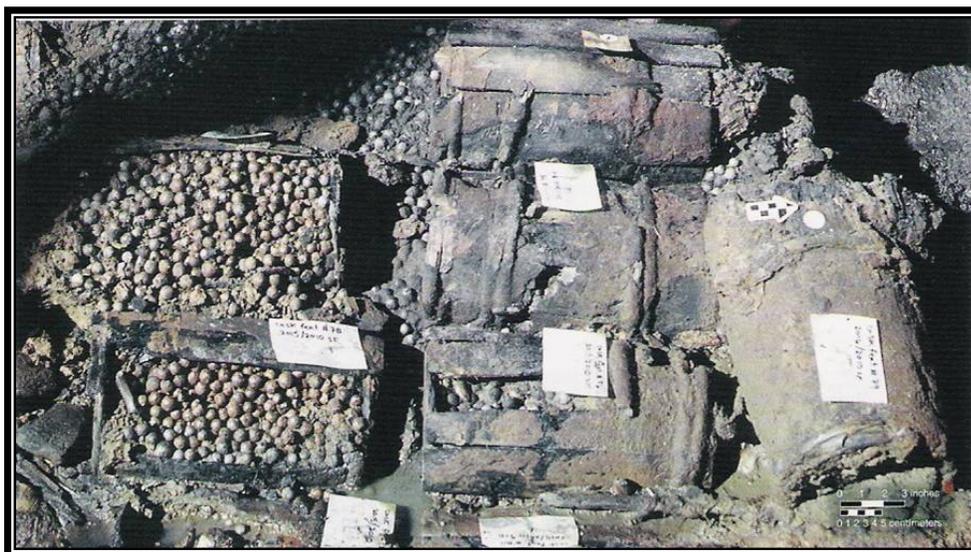


FIGURE 1.17. A picture showing casks recovered from the *La Belle* containing lead shot (Bruseth and Turner 2005).

In 1707, the London Assize was passed, standardizing the capacities of the different types of casks (Table 1.1) (Walsh 1999:151-154). These capacities, though established in Britain, were also used in the colonies; however, the colonies also passed their own legislation. In 1715, the Proprietors of the Province of Carolina enacted, “An Act for Ascertaining the Gauge of Barrels & to prevent Fraudes in pork, beefe, Pitch and Tar” (Clark 1904:56). According to this act, barrels were to have a capacity of 31.5 gallons and were to be made from timber seasoned for at least six months. Staves were to be “not less than half an inch thick when wrought” and heading was to be “not less than $\frac{3}{4}$ of an inch thick & well dowed.” “Twelve, good substantial hoops” were to be used on each cask (Clark 1904:56). Failure to obey these standards resulted in the forfeiture of six shillings and eight pence per offence. Failure to brand a cask resulted in a fine of twenty shillings (Butler 1998:115; Clark 1904:56; Jackson 1993:186).

In 1779, the British Army Victualling Office ordered containers for beef and pork to be bound by iron hoops (Robinson 1779). Shackelford stated, “The invoice of the *Favourite* stated that casks for pork and beef had “four iron hoops on each”. The requirement for iron hoops suggested that British meat casks were constructed as tight casks to hold the brine preservative solution (Shackelford, et. al 1986:222-223).

As throughout much of the rest of history, the size, dimensions, and attributes of casks varied greatly during the eighteenth century and was primarily dependent upon the maker and colonial or state legislation. James I. Walsh’s (1999) *Capacity and Gauge Standards for Barrels and Casks of Early America*, provided several eighteenth century mandates from the colonies/states of Virginia, New York, Maryland, and Pennsylvania.

For example, in the early part of the eighteenth century, a hogshead of wine in New York was required to have a head diameter of 27 inches and a bilge diameter of 33 inches. Virginia, however, required them to have a head diameter of 30 inches, and Pennsylvania required a 27 inch head diameter and a 31.5 inch bilge diameter. The difference in the laws made it terribly hard to gauge and standardize the distribution of provisions and goods sold in casks, and as a result, several authors published guides to gauging so that buyers were able to determine the amount of product they were purchasing and to ensure a fair price (Walsh 1999). In 1788, Benjamin Workman published such a helpful manual and entitled it *Guaging Epitomized: A short Treatise of Guaging, in which that Branch was rendered familiar to the Meanest Capacity* (Workman 1788). Not only did the dimensions of casks vary from state to state, they also changed from time period to time period. In 1656, Maryland mandated the dimensions of a tobacco hogshead at 43 inches for staves and a 26 inch head diameter; however, by 1704 the dimensions were changed to 48 inches for staves with a 33 inch head diameter. By 1747, these had changed again to 48 inches for staves and 30 inches for a head diameter (Walsh 1999:153-154). Standardization throughout North America did not occur until railroad workers complained about the ability, or lack thereof, to pack casks varying in dimensions, and in 1924, Congress directed the Bureau of Standards of the U.S. Department of Commerce to establish national standards for the cask dimensions in order to facilitate interstate commerce and trade (Walsh 1999:154).

Similarly, specifications for French cask capacities were determined by individual towns, and varied greatly throughout the sixteenth through eighteenth centuries. During

the eighteenth century, the capacity for a wine barrique in Bordeaux was set at the equivalent of ca. 59.5 US gallons (262.2 liters); but in Rouen it was ca. 51.00 US gallons (197.57 liters) (Ross 1983:72-74). Specifications for slack casks varied even more than that of the tight casks. Not only did different towns set their own specifications, but such specifications were also determined by the casks contents (Ross 1983:64).

There were many different types of casks, which in more recent times have been inaccurately referred to as barrels. By the eighteenth century, coopering, the art of constructing casks, was more than just a craft, it was an industry established to support the shipment and containment of goods (Loewen 2004). All casks are comprised of several staves, two heads, and hoops, but their materials, size, and overall construction varies depending upon their function and local legislation. They were used to carry dry goods, wet or liquid goods, as well as general cargo. Due to the high construction cost of casks, they were often repaired and reused, as evident by the numerous casks recovered from several sixteenth through eighteenth-century shipwrecks previously discussed. Overall, the study of casks can be very beneficial as they have the ability to provide much information on shipping practices and shipboard life.

CHAPTER 2: ARCHAEOLOGICAL BACKGROUND

Cask remains were discovered on numerous eighteenth-century shipwrecks found along the east coast of North America (see Table 2.1 and Figure 2.1). These shipwrecks included, but were not limited to the: Beaufort Inlet Wreck; *Betsy*; British merchant vessel from Chubs Head Cut, Bermuda; *Defence*; a Federal period vessel from Oriental, North Carolina; *Henrietta Marie*; HMS *Charon*; HMS *DeBraak*; HMS *Fowey*; HMS *Invincible*; *Le Machault*; and *Whydah*. Although, the main focus of this research was eighteenth-century vessels found along the east coast of North America, several data sets from other geographical locations and time periods have also been used; such as HMS *Sirius*, *La Belle*, *Mary Rose*, the Millecoquins Shipwreck, *San Juan*, and *William Salthouse* (Broadwater et. al 1984; Shackleford 1996; Meide 1997; Rodrigues 2005; Mitchell 1996a; Ross 1981; and Staniforth 2000) (see Figure 2.2). These additional data sets were used because the material was analyzed in greater detail than most of the material from the eighteenth-century sites located along the east coast of the United States, and have produced the best examples of cask reports in maritime archaeology. This chapter, nonetheless, will not discuss the cask material recovered from each individual wreck site (for this information see Chapter 3); rather it will discuss each wreck's historical and archaeological backgrounds.

<u>Name of Wreck</u>	<u>Location of Wreck</u>	<u>Date of Wreck</u>	<u>Type of Vessel</u>	<u>Function of Vessel</u>
Beaufort Inlet Wreck (Probable Queen Anne's Revenge)	Beaufort Inlet, North Carolina	Early-Eighteenth Century	Possibly a Ship or a French Guinea-man	Potentially a Pirate
<i>Betsy</i> (Yorktown Wreck 44YO88)	Yorktown, VA	October 1781	Collier Brig	British Merchant (used as Naval transport)
British Merchant Vessel	Chubs Head Cut, Bermuda	Mid- to Late-Eighteenth Century	Possibly a Collier	British Merchant
<i>Defence</i>	Stockton Springs Harbor, Maine	14 August 1779	Brig	Privateer
Federal Period Vessel	Oriental, North Carolina	Late-Eighteenth Century	Schooner	Undetermined
<i>Henrietta Marie</i>	Off Florida Keys	Ca. 1700	French "frigate – built" with Dutch fluyt influences 3 masted, square sterned, with a keel length of about 60 feet	British Merchant/Slaver
HMS <i>Charon</i>	York River, VA	10 October 1781	44-gun ship of the 5 th rate (Frigate)	British Naval
HMS <i>DeBraak</i>	Off coast of Delaware	25 May 1798	Brig	British Naval
HMS <i>Fowey</i>	Gulf of Florida	27 June 1748	5 th rate man-of-war	British Naval
HMS <i>Invincible</i>	Portsmouth, England	19 February 1758	French 74-gun ship/ British 74-gun "cruiser"	British Naval
HMS <i>Sirius</i>	Near the Island Mauritius (SW Indian Ocean)	25 August 1810	36-gun 5 th rate Frigate	British Naval
<i>La Belle</i>	Matagorda Peninsula, TX	February 1686	Barque	French Explorer
<i>Le Machault</i>	Caleur Bay, Quebec	22 June 1760	Frigate of War	Privateer
<i>Lossen</i>	Hvaler, Norway	23 December 1717	Frigate	Norwegian Naval
<i>Mary Rose</i>	Wight, England	18 July 1545	Carrack	British Naval
Millecoquins Wreck	Millecoquins River, Michigan	Ca. 1830's	N/A	French Merchant
<i>San Juan</i>	Red Bay, Labrador	Ca. 1565	Galleon	Whaling ship
<i>William Salthouse</i>	Melbourne, Australia	27 November 1841	Brig	British Merchant
<i>Whydah</i>	Cape Cod, Massachusetts	April 1717	Three-mast galley	Pirate

TABLE 2.1. An overview of the shipwrecks compared within this research.

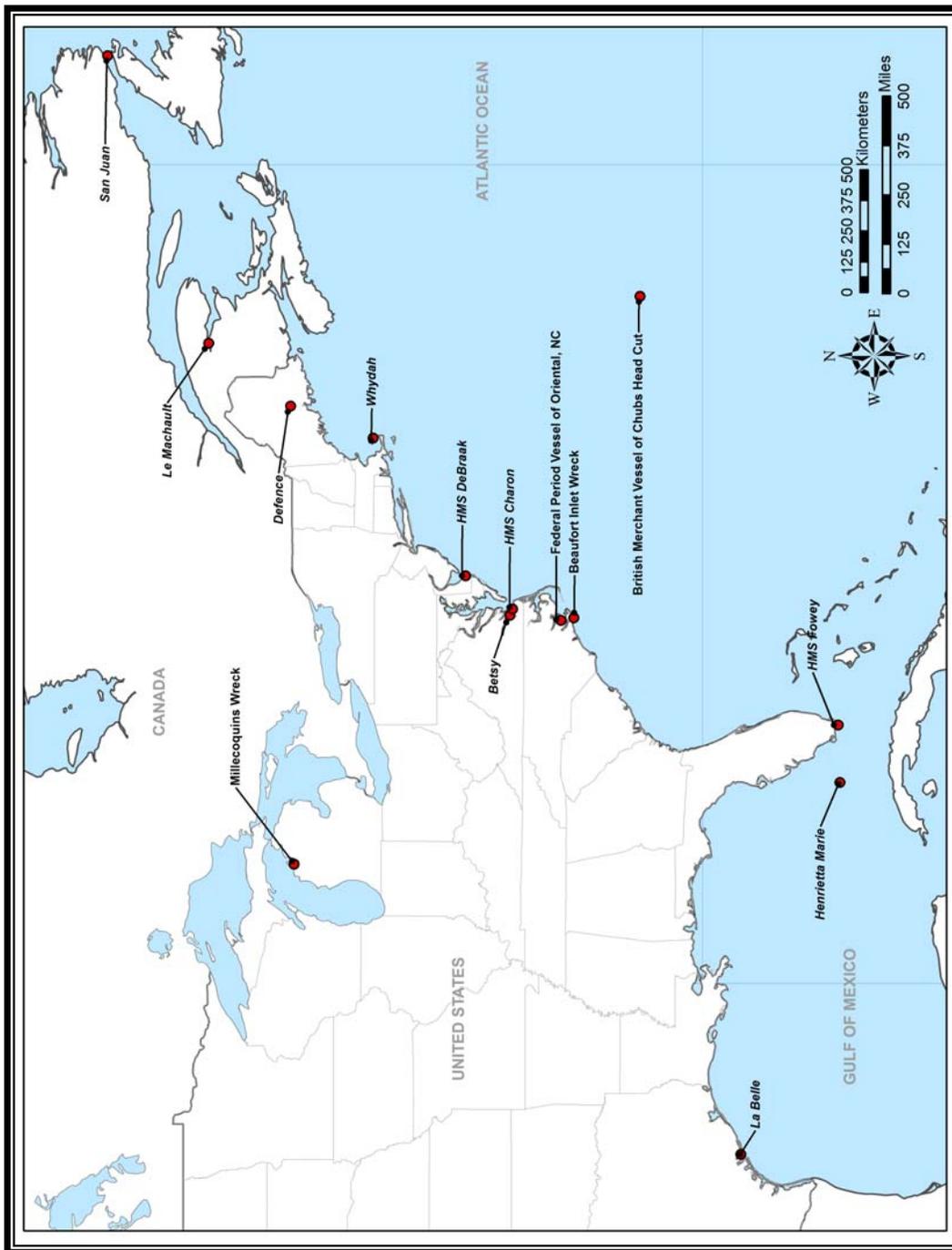


FIGURE 2.1. Map showing the location of North American shipwrecks used in this study.

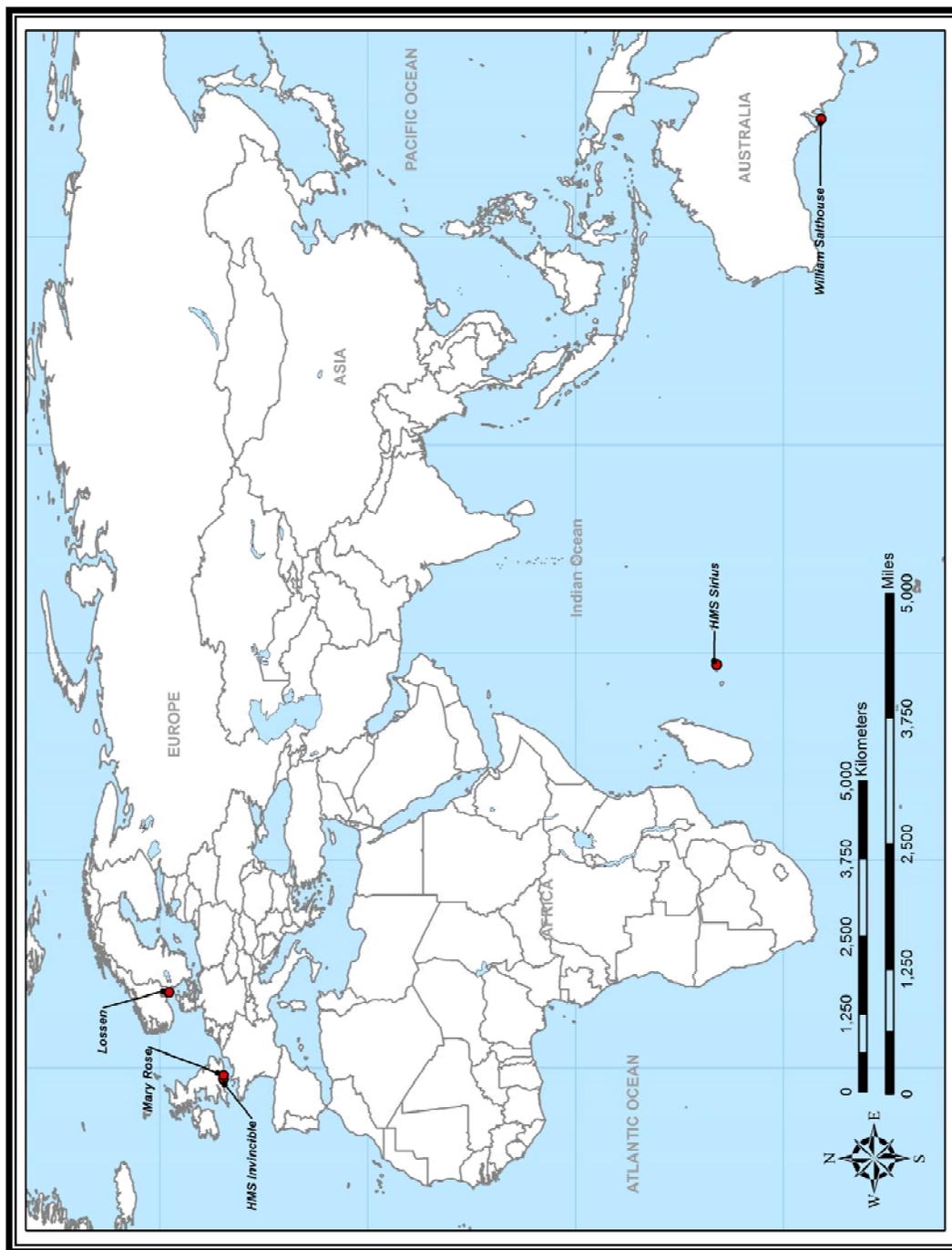


FIGURE 2.2. Map showing the location of foreign shipwrecks used in this study.

Beaufort Inlet Wreck (*Queen Anne's Revenge*)

The exact identity of the Beaufort Inlet Wreck (31CR314) is uncertain but is most likely that of the pirate Blackbeard's flagship, the *Queen Anne's Revenge* (QAR) (Wilde-Ramsing 2006). Some believe that its identity is still unknown and only more archaeology will determine its identity (Lusardi 2006). Hereafter this wreck will be referred to as the Beaufort Inlet Wreck, named after the place in which it was found (see Figure 2.1), although it is assumed to be the remnants of the QAR. No matter its identity, the artifacts date this wreck to the early- to mid-eighteenth century, thus making it relevant to this research.

Archaeological investigations began on 11 November 1996 when a private research firm in Beaufort, North Carolina, Intersal, Inc, conducted a magnetometer survey in Beaufort Inlet, North Carolina. On 21 November 1996, divers reported a 20-foot by 30-foot mound of artifacts, such as cannon, anchors, and ballast, as well as portions of a wooden hull buried in the sea bed (Southerly 2001; Wilde-Ramsing 2006:160-165; Lusardi 2006:197). Artifacts recovered that first day included: a lead cannon apron, two iron cannonballs, a bronze bell inscribed with the date of 1705 or 1709, a brass blunderbuss barrel (circa 1690 – 1710), and a lead sounding weight (Lusardi 2006:197).

By 1997, the Underwater Archaeology Branch (UAB) of the North Carolina Department of Cultural Resources began excavating the Beaufort Inlet wreck site. Investigations ranged in time from several days to several weeks. Since 1997, numerous archaeological investigations were conducted; including "field expeditions" in the fall of

1998, fall of 1999, spring and fall of 2000, spring and fall of 2001, fall of 2003, spring and fall of 2004, spring and fall of 2005, and the spring and fall of 2006, 2007, and 2008 (Southerly 2001; Wilde-Ramsing 2006; Lusardi 2006:198-200; www.QARonline.org). As of 2008, a total of 207 5 x 5 ft test units were excavated, with the expectation that the entire site would be excavated over the next several years. All artifacts are being conserved at the QAR Conservation Lab at East Carolina University West Research Campus. (ECU-WRC) The artifacts are also being analyzed and data is constantly updated on the artifact database located at the QAR Conservation Lab

Betsy (Yorktown Wreck 44YO88)

Built in 1772 in Whitehaven, Cumbria, England, *Betsy* was a 170 ton collier brig and British merchant vessel. *Betsy* was part of the British force at the Siege of Yorktown (see Figure 2.1). General George Washington and French General Comte de Rochambeau heard news of the British encampment in Yorktown and consequently gathered troops. In late September, the allied French and American forces began bombarding the British forces both on land and sea and by 19 October 1781 General Cornwallis, after losing the majority of the fleet, surrendered effectively ending the Revolutionary War and establishing the United States as an independent nation (Broadwater 1981:33-34; Broadwater et. al 1984:169-170).

The terms of the Articles of Capitulation stated that all shipping and boats, including their cargo, would belong to the allies. Washington transferred all ownership to the French in recognition of their role in the Siege of Yorktown. The ships still afloat

were used as prisoner transports; however, the majority of the fleet sunk and needed to be raised in order to salvage. The French were successful in salvaging several British ships; however, they left behind HMS *Charon* and an indeterminate number of British transports and merchant vessels (Broadwater 1981:35).

After the French attempts to salvage the wrecks, interest in them waned until nearly fifty years later. In 1852, Thomas Ashe of Gloucester Point was granted exclusive salvage rights for a period of ten years by the Commonwealth of Virginia. It was uncertain whether he was successful. The 1881 centennial celebration of the surrender stirred interest in the wrecks and a number of artifacts were raised from the river. In 1934, the Mariners Museum of Newport News, Virginia undertook efforts to salvage Cornwallis' fleet. They removed numerous artifacts from at least two wrecks on the Yorktown side of the river and one on the Gloucester Point side. They did not distinguish which artifacts were recovered from which shipwreck nor did they evaluate the ship structures or create a report with any pertinent information (Broadwater 1981:35).

In 1978, nine ships from Cornwallis' fleet were located and evaluated, including HMS *Fowey* and HMS *Charon*. Yorktown shipwreck 44YO88, later determined to be *Betsy* due to both the artifacts recovered and the ship's construction, was found to be the most intact and consequently became the main focus of the then newly established Yorktown Shipwreck Archaeological Project. In 1982, a cofferdam was constructed around the ship to enable a complete excavation (Broadwater 1981:39-41). Archaeological investigations of the Yorktown shipwreck were ongoing from 1978 to

1990. By 1990, when bottom of the wreck was finally exposed the project was cancelled due to a State budget crisis. This forced John Broadwater, the state's first and only state underwater archaeologist, to mobilize as many volunteers as possible to complete the excavation (although the site was never fully excavated) and to report the findings of the 12 year long excavations. By the end of that year, the site was covered using the cofferdam components and backfilled with the intention to aid in the preservation of the site. In 1996, a final report was printed but had limited distribution (Powell 1996:24-25). The conserved artifacts were housed at the Virginia Department of Historic Resources (VDHR) in Richmond, where they can be accessed by future researchers to conduct their own studies on the artifact collection.

British Merchant Vessel from Chubs Head Cut

An unknown British merchant vessel was located in 1992 off Chubs Head Cut, Bermuda, (see Figure 2.1) by graduate students from East Carolina University's Program in Maritime History. Since this particular eighteenth-century wreck was determined to be relatively intact, the Bermuda Maritime Museum applied for a permit from the Receiver of Wrecks to investigate and document the remaining hull components (Krivor 1998:7-9). Investigations of the wreck took place from 4 September to 30 September 1993, and were sponsored by the Bermuda Maritime Museum and East Carolina University. This investigation did not, however, consist of a complete excavation. Rather, it consisted of mapping the exposed elements of the ship and recovering artifacts on the sea floor. The keel, hogging piece, garboard strakes, hull planks, floors, futtocks, top and bottom fillet

pieces, a short section of the keelson, the remains of a bulkhead, bilge ceiling, and limber planks were all exposed, and consequently documented in both photographs and maps (Krivor 1998:16-25). Artifacts recovered included redware ceramics, creamware, gin case bottles, pewter buttons, lead shot, and cask material (Krivor 1998:32-52). In general, although the identity of the shipwreck was unknown, the artifact assemblage helped to date the site to the mid- to late-eighteenth century.

Defence

In June 1799, during the fourth year of the American Revolution, the British forces gained control of Majabagaduce, Massachusetts (presently Castine, Maine). News of this occupation quickly reached Boston, which led to the largest combined army and naval effort mounted by the Americans during the War for Independence, the Penobscot Expedition. This expedition consisted of 1,000 militia and a fleet of forty-three vessels, including three Continental Navy vessels, three Massachusetts State naval vessels, twelve privateers and nearly twenty supply and transport vessels (Switzer 1998:182). The privateer *Defence*, on her maiden voyage, was part of this ill-fated expedition. On 14 August 1799, the approach of the Royal Navy fleet forced the American fleet to flee to the Penobscot River (Switzer 1978:39; Switzer 1981:76; Switzer 1998:182-183). HMS *Camilla* pursued *Defence* which caused her crew to torch her. *Defence* sunk which left the British with only two of the forty-three American vessels (Wyman 1981:85).

In 1972, the remains of *Defence* were discovered in Stockton Harbor, Maine during a sonar survey of the inlet (Figure 2.1). This survey was conducted by Dean

Mayhew, a professor at Massachusetts Institute of Technology (MIT). With the permission of the Maine State Museum, a team of students from MIT were given a permit to conduct an “exploratory survey of the site” (Switzer 1998:182; Wyman 1981:85). This survey indicated that much of the hull structure was still intact, but buried deeply beneath an overburden of silt and mud. Excavations were conducted throughout the next several years “by a consortium of the Maine Maritime Academy, responsible for logistical and technical support; the Institute of Nautical Archaeology (INA); the Maine State Museum; and MIT.” By 1975, the investigations proved the wreck to be that of the *Defence* (Switzer 1998:182). Further excavations were conducted between 1975 and 1978. These excavations focused on the “human dimension” of the vessel, particularly galley-related items and provision storage (Switzer 1978:39). Overall, excavations were completed by late 1978. The artifacts were conserved and housed at the Maine State Museum and Maine State repository (Switzer 1981:85).

Federal Period Vessel from Oriental, North Carolina

The identity of this wreck was uncertain. The artifacts recovered, however, designated it as a late-eighteenth-century shipwreck. It was located in Otter Creek, a tributary of Greens Creek (see Figure 2.1). In December 1986, Mr. J. Ken Davis applied for a Coastal Area Management Act (CAMA) permit from the Underwater Archaeology Branch (UAB that proposed to excavate an access channel in Otter Creek. In response, the UAB sent two staff members to Otter Creek to conduct a magnetometer survey to assess the area’s potential for containing submerged cultural resources. Several magnetic

anomalies were detected, with one identified by the iron fasteners of a sunken wooden vessel of possible archaeological significance. Consequently, the UAB recommended that the vessel be investigated to determine its integrity and that historical research be conducted (Jackson 1991:41).

On 14 May 1987, Richard Lawrence and Mark Wilde-Ramsing, both staff of the UAB, and Geoffrey Scofield of the North Carolina Maritime Museum, revisited the Otter Creek wreck, with orders to record the overall measurements, framing patterns, and scantling dimensions (“the dimensions of a timber when reduced to its standard size”) (Smyth 1996:595) of the wreck. They determined that the wreck was a wooden vessel fastened with iron spikes and wooden tree-nails that probably dated to the late-eighteenth century. As a result, they recommended further archaeological investigations before granting Mr. Davis a CAMA permit (Jackson 1991:42).

The recommended investigation was conducted on the vessel during a two-week period in August 1988. Claude V. Jackson, four staff members of the UAB, and 20 international high school students from an organization known as Operation Raleigh (often referred to as the Venturers), assisted in excavating two trenches, one athwartship and the other longitudinal. Additional excavations were conducted in the stern area and starboard side of the vessel (Jackson 1991:51-57). All artifacts were analyzed and a site report was written, on file at East Carolina University. To date, this shipwreck has not been revisited, and has most likely been heavily disturbed, if not destroyed, due to alterations to the Otter Creek waterways.

Henrietta Marie

This ship was first found by Armada Research Corporation, a subsidiary of Treasure Salvors, Inc. owned by Mel Fischer, in 1972 ca. 34 miles west of Key West (see Figure 2.1). At that time, the site was minimally excavated because the company was looking for the Spanish galleon *Nuestra Señora de Atocha*, and brief excavations of this site indicated that it was much later than the *Atocha*, as well as English in origin. Consequently, the site lay untouched for the next decade (Moore 1989:2-3).

On 22 April 1983, Neptune Explorations, under the direction of Henry Taylor subcontracted with Treasure Salvors, Inc. to investigate the site, and in July 1983, a ship's bell, bearing the inscription "The Henrietta Marie 1699," was recovered as well as many iron bilboes, a type of shackle, and other historic artifacts (Moore 1989:3, 27). Researchers were able to find documentation of a vessel named *Henrietta Marie* amongst Jamaican shipping returns. Although no Jamaican shipping records were found from 29 September 1700 to April 1703, documentation does exist for the periods 1698-1700 and 1703-1705. Amongst those records, *Henrietta Marie* was entered into the return on 25 June 1700, sailing under the command of Thomas Chamberlain, and was registered in and holding a clearance certificate from London dated 5 September 1699. Furthermore, it was documented that she left Jamaica carrying a cargo of logwood, cotton, indigo, and 81 hogsheads of sugar, and that she was a foreign-built vessel of 120 tons, though the exact commissioner was unknown (Moore 1989:27).

Between 1983 and 1985, archaeological investigations were conducted on *Henrietta Marie*, although little documentation exists, besides Dave Moore's thesis and

possibly site records, concerning the excavations, which were unavailable. These excavations yielded enough information and artifacts to determine the ship's function as an English slaver. Research did not indicate that she was a part of the Royal African Company; therefore it was believed that she was sailing as an interloper or separate trader. Furthermore, historical documents were recovered dating to ca.1699-1700, which supported the theory that *Henrietta Marie*, captained by William Deacon, did not sail under the Royal African Company when it brought a cargo of 188 slaves into Barbados in July 1698. Overall, the ship was not fully excavated and the artifacts recovered were still undergoing analysis and conservation efforts (Moore 1989:27-32).

HMS *Charon*

The *Charon* was built in Harwich, England in 1778 as a 44-gun 5th rate ship. In July 1781 she joined Lord Earl Cornwallis' support fleet, and subsequently sailed up the York River to Yorktown, Virginia, where Cornwallis used the ship as a firing platform to harass the French Army constructing earthworks about a half-mile upriver from Yorktown. By 10 October 1781, the French completed their earthworks and returned fire toward the *Charon* and all other ships firing at them. With only a skeleton crew onboard to free them from the anchor lines to avoid the incoming fire, the *Charon* caught fire. Shortly thereafter, she began drifting downriver, setting two other ships afire, and eventually sank off Gloucester Point (see Figure 2.1) (Steffy 1981: 114-115).

There were no immediate plans to recover the *Charon*, in fact, interest in the ship faded until 1852, when Thomas Ashe petitioned the Virginia Assembly for salvage rights

“for a ship of large class, off Gloucester Point.” This ship was believed to be the *Charon*; however, all other documents concerning this salvage attempt were lost when the Gloucester County records were destroyed during the Civil War (Steffy 1981: 115).

In the mid-1930s, The Mariners Museum (TMM) and the National Park Service (NPS) located three York River wrecks, one of which was the *Charon*. They managed to recover several artifacts before work halted a short time later (date of which was unknown). In the fall of 1978, the *Charon* wreck (this time designated GL136) was rediscovered, this time by members of the Nautical Section of the Virginia Research Center for Archaeology (VRCA). There was a lack of funding to focus on the excavation of GL136, and it was put off until 1980. In the spring of 1980, Texas A&M University conducted a five week archaeological field school at the site under the direction of Dr. Richard Steffy. Artifacts retrieved during that season were analyzed and reported upon with the conclusion that the wreck was indeed that HMS *Charon* (Steffy 1981:115).

HMS *DeBraak*

HMS *DeBraak* has a rather convoluted historical background, as it changed ownership several times. Originally believed to have been commissioned by the British Navy, the examination of its hull and the lack of papers in the British Admiralty records have led many historians to believe it was an English privateer. In the latter half of the American Revolution, the French captured the ship from the British and renamed it *Le Patrocle*, and in 1781 the French sold it to the Dutch Admiralty of Maas (now Rotterdam), who renamed it *deBrak* (Beard 1989:2-3). Throughout the 1780s, *deBrak*

sailed against England under the Dutch flag, operating with a Mediterranean squadron out of Toulon, France. In 1793, *deBrak*, under the command of Lieutenant Grotenray, took part in the defense of Willemstad, Curaçao, against a French Revolutionary army, and at the end of 1794, *deBrak* was ordered to escort a convoy of East Indiamen to Batavia. In January 1795, “revolutionary fever” broke out in Holland, and William V, the Prince Orange, was forced into exile in England. Not knowing that their country was again at war with England, *deBrak* put into Falmouth Harbor, where it, along with five other Dutch men-of-war and one Dutch East India ship, were detained by HMS *Fortune*. At this point an English crew was “put aboard” *deBrak*, and on 27 June 1795 set sail for Plymouth. Once in Plymouth, the Prince of Orange decided to adopt the detained ships into the Royal Navy and on 1 September 1796 *deBrak* and the five Dutch men-of-war were ordered to be surveyed and evaluated. In May 1797, it was recommended that *DeBraak*, the new British name, be converted from a single-masted cutter to a two-masted brig, have copper sheathing placed on the hull to protect it from the effects of toredo worms, and be fitted with sixteen, 24-pounder carronades (Beard 1989:4-12).

DeBraak entered service under Captain James Drew on 13 June 1797 and remained on duty until she sprung a mast near the end of the year. In the early spring of 1798, *DeBraak* was assigned to a convoy bound for North American ports. The convoy was under the command of Captain Pender and was to stop at ports in the Chesapeake Bay, Delaware River, New York, and New England and then proceed to Halifax for trade and commerce (Beard 1989:11-14). Less than a week into the voyage, Captain Pender ordered *DeBraak* to “investigate strange sails observed on the horizon” (Beard 1989:14).

On April 2, the weather began to deteriorate and *DeBraak* was unable to rejoin the convoy. Captain Pender continued with his orders, and on 25 May he arrived off the Delaware Capes and prepared to set sail for Halifax (Beard 1989:12-14). *DeBraak* was in dire need of drinking water, and on that same day, she arrived off Cape Henlopen, Delaware in order to fill her water casks in Lewis Town (now Lewiston). *DeBraak* was not alone; she had with her a Spanish prize, *Don Francisco Xavier*. During the short visit, "a sudden flaw of wind" capsized *DeBraak* and she sank with the loss of thirty-five of her crew, including Captain Drew, and twelve Spanish prisoners (Beard 1989: x).

Many surviving *DeBraak* crew members circulated tales of Spanish treasure around the port of Lewis Town. Though these tales were, "most likely the products of ample intoxicating spirits and the company of willing female listeners in this town then known for its brothels," the stories were reinforced by the sailors spending Spanish gold and silver coins. During August and September 1798, the British attempted to lift *DeBraak*, but were unsuccessful. Had there been "treasure", one can be certain that the British would have conducted several intensive searches in order to recover it. Many still believed the tall tales and consequently, no fewer than ten major expeditions were organized to search for it (Beard 1989:xi).

In the spring of 1984, Sub-Sal Inc., a Reno, Nevada, based salvage firm, applied for and received a permit to search for shipwrecks off the Delaware coast. Using side-scan sonar, they methodically searched a large area east of Cape Henlopen. The original British salvage records stated that the wreck lay in thirteen fathoms of water, which was

why Sub-Sal Inc. searched along the 80-foot contour lines off the coast. Using this method, they located six wrecks, one of which was *DeBraak* (Beard 1989: 38-39).

Upon finding these wrecks, several reconnaissance dives were conducted to visually inspect the sites, and Sub-Sal found the site believed to be *DeBraak*, located ca. 1 mile east-southeast of the Cape Henlopen lighthouse near the town of Lewes, Sussex, County, Delaware (see Figure 2.1). Artifacts dated to the right period and included bottles, ceramics, and rigging elements. The structural ship elements, however, were buried in bottom sediments and not visible for age determination. The state of Delaware owned the bottom lands in which the wreck was buried, therefore, Sub-Sal applied for a salvage lease from the Delaware Department of Natural Resources and Environmental Controls (Beard 1989:38-39). Archaeological excavations were conducted by the Delaware Division of Historical and Cultural Affairs in the summer to fall of 1984, summer of 1985, and the summer of 1986. The 1986 excavations saw the near destruction of the site by raising the hull structure and excavating it using a clamshell (Beard 1989:41-58). All artifacts and associated structural elements are currently housed with the Delaware Archaeological Collections with the Delaware Division of Historical and Cultural Affairs.

HMS *Fowey*

Commissioned on 27 August 1744 in Hull, England, HMS *Fowey* was a fifth rate man-of-war, with a 20-gun lower deck battery of 18-pounders; a 22-gun upper deck battery of 9-pounders; and 2 6-pounder bow chasers on the forecastle. In the early part of

1746, she was sailing with the vessels *Devon* and *Torrington*, and was responsible for escorting troop transports from Gibraltar to Fort Louisburg in New France. After only eight days in Louisburg, she was dispatched “to protect the trade colony of Virginia” (Skowronek and Fischer 1984:52). That winter, *Fowey* left for the Caribbean, although her exact reasons were unknown. In the fall of 1747 she was back to sailing along the North American coast from Massachusetts to Virginia. By January 1748, she returned to the Caribbean once again. On 3 June 1748, she captured a French ship and later, while on her way to her summer duty station in Virginia, she captured *St. Judea*, a 20-gun, 108-man Spanish ship in the Gulf of Mexico. *St. Judea* reportedly carried cocoa, indigo, and between 50,000 and 190,000 “pieces of eight.” While in the Gulf of Mexico she was joined by a brig from Rhode Island and a scow, *Jane*, from New York forming a convoy for the journey through the hostile waters surrounding Spanish Cuba and Florida (Skowronek and Fischer 1984:53).

On 26 June 1748 HMS *Fowey* set a course northward through the Florida Straits; by morning of June 27, both she and Collins’ brig from Rhode Island grounded on the Florida coast. The brig was freed by the morning of June 28, but *Fowey* remained grounded. This led Captain Francis William Drake of HMS *Fowey* to disable his two, 6-pounder bow chasers and move his lower deck guns (18-pounders) aft. This did not do the trick and by that evening he authorized the two quarterdeck 6-pounder stern chasers, two 9-pounders, and one 18-pounder thrown overboard. In this attempt she also lost one of her anchors. Finally, after 13 to 14 hours on the reef, she floated free. Minutes later she and *St. Judea* grounded. This time she bilged and began to take in water. All hands

(including 80 Spanish prisoners and 14 men from *Jane*) were ordered to bailing and pumping (Skowronek and Fischer 1984:53)

The crew was unsuccessful and the water rose to more than two feet deep by the following morning. Drake and his officers concluded that *Fowey* was lost, and determined that it would be better to force the ship onto the reef rather than allow her to sink in four fathoms (24 feet) of water and possibly lose sailors from drowning (Skowronek and Fischer 1984:53). With this decision, the second anchor line was cut and she drifted into the reef. She broke over the reef, lost her rudder, and continued to drift, causing Drake to set small sails and steer her towards land. At 4:30 a.m., he released his last sheet anchor and ordered all guns spiked, and the small arms, with exception to 33 muskets, thrown overboard, and the longboat began to transport the crew to *Jane*. Ending *Fowey's* career forever, the carpenter cut the foremast and bowsprit and scuttled the ship. The HMS *Fowey* was last seen lying on her starboard beam ends (Skowronek and Fischer 1984:53-54).

In October 1979, a sailing vessel was found within the Legare Anchorage, Biscayne National Park (see Figure 2.1) by a sport diver from Miami, Florida. This particular diver filed a complaint in Admiralty Court requesting title to the wreck, which would ultimately provide him with the rights to salvage it. The shipwreck, although not its exact location, was previously known by George Fischer, a Southeast Archaeological Center archaeologist, when he conducted research in 1975. Consequently, the United States decided to become the defendant in this law suit, and was seeking title arguing that

the shipwreck was public property in a National Park and should be preserved as “a part of the nation’s patrimony” (Skowronek et. al. 1987:313).

On 28 July 1983, the law suit was found to be in favor of the United States in the U.S. District Court, Southern District of Florida, and later upheld by the United States Court of Appeals, Eleventh District. An injunction of the suit also required the salvor to surrender all artifacts and documents concerning the wreck to the Park Service. In 1980, the National Park Service personnel relocated the site. They immediately mapped it, conducted a surface survey and collection, and made a thirty-minute video tape documenting the site’s physical condition. That fall they analyzed the guns and iron ballast, as well as both the salvor’s and Southeast Archaeological Center’s extensive artifact collection to determine cultural affiliation. The analysis suggested the site dated to ca. 1730-1750. Because of the close proximity to the remains of the 1733 Spanish Flota and the given time frame, this site was initially assigned a Spanish affiliation, and believed to be the *Nuestra Señora del Populo*. In 1981, further examination of the artifact assemblage and historic record suggested a second possible identification for the wreck, HMS *Fowey*. Upon further historical research, Skowronek found this identification most likely (Skowronek et. al. 1987:315).

As a result of further looting and other site destruction processes, the National Park Service felt it necessary to conduct excavations with the goal for the maximum amount of data recovered (Skowronek et. al. 1987:315). In the summer of 1983 archaeological investigations and were conducted. The archaeology conducted was largely non-destructive in nature. A total of 90 3 x 3 meter test units were excavated with

an additional 1104 probes conducted within the minimally excavated test units. The test units were only excavated to the base of the overburden soil and the probes were excavated to a maximum depth of one meter to search for deeper deposits. Most artifacts were left *in situ* due to the lack of money for curation and conservation. Metal detection was also utilized to locate buried iron concentrations. Although several anomalies were detected, none were visibly recognized (Skowronek et. al. 1987:316).

HMS *Fowey* was not fully excavated. Only “diagnostic” artifacts were recovered with the intention to aid in the shipwreck’s identity. All artifacts that were collected were analyzed and conserved at the Southeastern Archaeological Center in Tallahassee, Florida, where they can still be found (Skowronek and Fisher 1984; Skowronek et. al 1987).

HMS *Invincible*

Originally *L’Invincible*, she was built as one of a new line of superior 74-gun ships for the French Navy at Rochefort, France in 1744. At that time, she was larger than the British 100-gun ships, and was capable of speeds over 13 knots, faster than a British frigate, and her lowest gunports were six feet above the waterline, whereas most British 1st Rate ships’ gun ports were only three feet, making them only operable in calm water. She was the very latest in French ship design and when captured on 3 May 1747 by the British Admiral Lord Anson off Cape Finisterre, she was renamed HMS *Invincible*, became the flagship for numerous British expeditions, and eventually became the

prototype of a new generation of 74-gun 'cruisers' and the future backbone of Nelson's Navy (Bingeman 1982:154; Bingeman 1985:193; Bingeman 1998:168).

HMS *Invincible* had a series of unfortunate events, the first being in 1752 when she nearly blew up, and was thus out of commission for the next four years. By 1757, she was part of the unsuccessful campaign to drive the French out of Canada, during which she lost her rigging and was towed to Portsmouth by the *Windsor*. After being repaired, she was ordered to be with Admiral Boscawen's fleet carrying General Amburst's troops to Fort Louisburg in Canada. At 2:30 am on Sunday 19 February 1758, the fleet was ordered to weigh anchor. *Invincible*, normally taking two hours to weigh anchor, had complications. The anchor refused to break free from the seabed, and after several attempts and a documented nearly 400 men, the anchor finally raised, only to break through the bottom of the ship (Bingeman 1982:154). Unable to free the anchor, the ship was blown north-east and eventually grounded on Horse Sand Tail, just off Portsmouth, (see Figure 2.2) causing her hold to be flooded with up to 12 feet of water. Although the ship was flooding, there was an attempt to salvage the ship. This attempt was virtually ended when two of the chain pumps broke. All of the crew and much of the cargo were saved as they were unloaded by the long boats from the *Royal George* and *Royal Sovereign* (Bingeman 1982:155; Bingeman 1998:169).

While trawling, a method of fishing involving actively pulling fishing net through the water behind one or more boats, in the Solent in May 1979, Arthur Mack snagged a timber with a treenail. Later that year, Jim Boyle and John Broomhead dived the area in which the timber was found, and identified the remains of an old wooden vessel. The

pair recovered numerous artifacts throughout that first summer, before deciding to seek archaeological advice and aid for conservation, ultimately leading them to Commander John Bingeman in March 1980 (Bingeman 1982:156; Bingeman 1985:210).

May 1980 was spent setting up a grid on site and mapping the surface and exposed areas of the wreck. After the site survey was conducted, a trench was dug across the site which determined that the hull was still mostly intact. The excavation of the trench revealed the location of the keel and two decks, as well as that the vessel was lying over on her starboard side at an angle of 46 degrees. The excavation also yielded a vast array of artifacts including ship components such as rigging, dead eyes, fiddle blocks; personal effects including square plates, bowls and jugs, and buttons; and provisions such as casks, musket flints, hand grenades, and cannons (Bingeman 1982:156). Positive identification of the wreck was established when a wooden tally attached to a spare sail was found with the words “*Invincible*, Flying jib 26x26 No. 6” (Bingeman 1985:193). Excavations continued from 1980 to 1990 when all visible artifacts were recovered (Bingeman 1998:172). Many of the nearly 3,000 artifacts recovered were analyzed and conserved at the historic dockyard at Chatham in Kent, where they can still be found (Jackson 2009).

HMS *Sirius*

HMS *Sirius* was a 36-gun fifth-rate frigate of the Royal Navy. The Admiralty ordered her construction on 30 April 1795, and her construction began at Dudman’s yard

on the Thames at Deptford in September of that year. Designed after the Spanish *San Fiorenzo*, she was launched on 12 April 1797 (Von Arnim 1998).

Between 1797 and 1805 she was engaged in maintaining the blockade of Napoleonic Europe. In 1798, in her first action, under the command of Richard King, she captured two Dutch ships, the *Furie* and the *Waakzaamheid*, and in 1801 she captured the French frigate the *Oiseau* in the North Sea. By 1802 she was under the command of Captain William Prowse, and participated in the blockade of Brest. On 21 October 1805, she joined the British fleet under Vice Admiral Lord Nelson for the Battle of Trafalgar, and only a few cable lengths from HMS *Victory*. Between 1806 and 1808, HMS *Sirius* served in the Mediterranean and captured the French corvette *Bergere* (Von Arnim 1998).

In the summer of 1810, HMS *Sirius* was involved in a campaign against the French Indian Ocean possessions. In July she captured *Ile de Bourbon* (Reunion), and by August she was instructed to focus on the Island of Mauritius, where the British attempted to land troops to destroy coastal batteries and signals. This attempt turned sour when two French forty-gun frigates, the *Bellone* and the *Minerve*, the 18-gun corvette *Victor*, and two East Indiaman prizes entered the harbor, took defensive positions at the head of the main channel entrance, and moved the channel markers to confuse the enemy. On 23 August 1810, the British squadron entered the channel, following the moved channel markers. HMS *Sirius* was the first to run aground and was followed by *Magicienne* and *Nereide*, allowing all French fire to focus upon these vessels. On 24 August 1810 the French boarded the defenseless *Nereide*, causing *Magicienne* and *Sirius*

to focus their attention upon it. By that evening the *Magicienne* had to be abandoned and consequently was sacrificed by setting her on fire. Numerous efforts were made to kedge *Sirius*; which failed. As a result, Captain Samuel Pym ordered all stores and provisions to be transferred to *Iphigenia* and upon completion, all men abandon ship. At about eleven o'clock on 25 August 1810, the last of the crew set fire to the frigate causing her to explode (Von Arnim 1998).

HMS *Sirius* was located in ca. 20-25 meters of water (see Figure 2.2). The wreck was slightly on her port side, broken in three distinct parts, and was oriented on an east-west axis. The bow, buried deeply under the muddy seafloor, rested in shallow water and formed a large swelling on the slope of the coral shoal. Approximately, 27 meters in length, the main portion of the site consisted of the part of the ship from the fore to the mizzen mast,. The mainmast was demarcated by the presence of numerous cannon balls, ropes, two bronze pipes, representative of the shot locker, and cable tiers and pump housings. The stern, the third distinct portion of the wreck site, was located 15 meters away from the main site. Although the wreck was broken up, due to both salvors as well as her unfortunate scuttling, the site was considered to be of great archaeological interest due to both its structural and material culture elements. .

The site was initially found in 1964 by a team of amateur divers from the Mauritius Underwater Group. At that time, a survey of the wreck indicated that it was eroded, but still retained intact components. A portion of the deck still remained intact with twelve cannons, one carronade, two cylindrical bronze pump housings with their lead deck seals intact, and numerous copper clench bolts. It appeared to the divers that

this wreck was the only one of its kind to be found in such a good state of preservation, consequently causing them to initiate a project to “refloat” a part of the *Sirius*. In 1968, a group of divers, unaware of the historical value of the wreck, dynamited part of the ship’s remains in order to retrieve numerous bronze elements, including the pump housings and the rudder pintles and gudgeons (Von Arnim 1998).

In 1979 archaeological work was initiated. This included a photographic study, enabling archaeologists to create a detailed plan of the wreck, and the establishment of a grid across the site. Site survey did not begin until 1987 when magnetometer and side scan sonar studies took place. Between 1989 and 1990 one of HMS *Sirius*’ bow anchors was located and retrieved. Since 1991 archaeological investigations have continued intermittently (Von Arnim 1998).

La Belle

On 1 August 1684, the French explorer Robert Cavelier, Sieur de La Salle, departed France with four ships in an attempt to establish a colony at the mouth of the Mississippi River (Bruseh and Turner 2005:20). *La Belle*, built at Rochefort in 1683, was a barque long and a navy ship assigned to La Salle for this particular adventure (Weddle 2001:3-5). *La Belle*, however, was not alone. She was accompanied by the 180-ton storeship *L’Aimable*; a 34-gun man-of-war, *Le Joly*, which was to transport the colonists to their new home; and the ketch *Saint-François* carrying additional supplies. While the small fleet was ready to stop in the West Indies in late September, Spanish pirates seized the *Saint-François*, along with its supplies (Bruseh and Turner 2005:3;

Weddle 2001:6). Then at Cuba's western cape, a sudden squall caused *La Belle* to tangle rigging with the *L'Aimable*, causing her to lose one of her two anchors (Weddle 2001:7). In late November, they continued in their attempt to find the mouth of the Mississippi. On 18 February 1685 La Salle ended up in Matagorda Bay, Texas, having overshot the Mississippi by some 400 miles (Bruseth and Turner 2005:3-6; Weddle 2001:6-9; Meide 1997:135).

On 20 February 1685, the *L'Aimable* ran aground, and was ultimately destroyed, while attempting to enter the bay through the narrow channel. Many supplies were lost, including arms, medicines, trade goods, casks of wine and brandy, bacon, beef, and much of the clothing (Weddle 2001:8). By mid-March *Le Joly* returned to France as planned; however many of the colonists were aboard for the return journey because they were not satisfied with the Texas coast and wanted no part of it. Only 200 people were left to establish the French colony on the Gulf, which was first established on Matagorda Island, although this was only a temporary settlement (Weddle 2001:8-9).

La Salle was convinced that he reached the western arm of the Mississippi and on 24 March, left the temporary camp, accompanied by 52 men in five canoes, to find a site for the colony to be established. The location he chose was on a low hill circa four and a half miles inland from the mouth of Garcitas Creek in today's Victoria County (Bruseth and Turner 2005:8, 28; Weddle 2001:8). By April, construction begun, and in mid-June, 70 settlers arrived at the colony, named Fort St. Louis. By July, half of the colonists were dead due to disease and malnutrition (Weddle 2001:8-9).

In October, La Salle set out with a group of 50 men in canoes to search for the Mississippi. He ordered *La Belle* to be loaded with items that would be needed in the new colony, such as trade goods for the natives, a forge, hand tools, muskets, cannon and barrels of powder, and food, and to follow him and his party. Although traveling alongside one another, there was no contact between the two groups for a month while La Salle pursued a band of “hostile” natives. In December, La Salle returned to *La Belle* to find that the pilot and five men were murdered while they were sleeping ashore (Bruseth and Turner 2005:3; Weddle 2001:9-11).

In January 1686, La Salle set out to explore again, this time by land. He ordered the crew to stay aboard the ship until he returned, which turned out to be two months rather than ten days (Bruseth and Turner 2005:31). During this time, drinking water aboard the ship became scarce, but the ship’s master refused to move the ship. The crew, weak from thirst and disease, nonetheless, attempted to sail *La Belle* toward Fort St. Louis in search for water and food. In February, a stiff wind caused *La Belle* to be blown across Matagorda Bay, which caused her to run aground, stern-first, into Matagorda Peninsula (see Figure 2.1). At the time of her demise, *La Belle* was heavily laden with trade goods, weaponry, and other supplies. Both the French and the Spanish attempted to salvage the wreck unsuccessfully, although the Spanish did manage to carry away several cannons, the anchor, several tools, and some of the rigging (Bruseth and Turner 2005:5; Weddle 2001:3, 9-10).

Barto Arnold and Kathleen Gilmore, searched for *La Belle* since the early 1970s. They read the diaries kept by some of the survivors as well as the Spanish accounts of

encountering the wrecked *La Belle*, leading them to focus upon Matagorda Bay. In 1978 Arnold convinced the Texas Historical Commission to launch a search using a helicopter, boat, and a magnetometer. This survey yielded the location of several interesting “old wrecks”, but not *La Belle* (Bruseth and Turner 2005:32-37).

In the summer of 1995, Arnold was able to obtain enough donations to organize several companies and individuals for a two-month project. Focusing on the anomalies discovered in 1979, he limited his search to about three dozen sites. On the first dive of the first anomaly a hand-made wooden plank was found. The second dive yielded cast lead shot and the third dive a bronze belt buckle. The fourth dive, conducted by Chuck Meide, a member of the Texas Historical Commission team of archaeologists, yielded the most significant data. Meide found a bronze cannon, a six-foot-long four pounder, weighing 793 pounds with elaborate decorations on the barrel. The team discovered and began limited excavation of *La Belle*. All on that first day, divers found ceramic vessels of various sizes, a stack of 22 pewter plates, hawk bells, straight pins, several wooden staves from casks, and numerous personal objects, all of which were taken to the museum in Corpus Christi, TX (Bruseth and Turner 2005:38-46).

In the summer of 1996, the Texas Historical Commission contracted with marine engineers to begin the La Salle Shipwreck Project, a multimillion dollar excavation employing an octagonal, double-walled cofferdam to pump the site dry for archaeologists to fully recover the shipwreck. By September 1996, the cofferdam was complete and the excavation began, in a similar manner to terrestrial archaeology. Archaeologists came from all over the United States. There were typically 16 to 20 archaeologists at work on

the site at a time, all under the direction of the project director, Dr. Jim Bruseth, a deputy state historic preservation officer with the Texas Historical Commission. Excavations continued until April 1997 when the site was fully excavated (Bruseth and Turner 2005: 63; Meide 1997:135).

Le Machault

Built in 1757 in Bayonne, the southernmost port of France, *Le Machault* was originally a 550-ton merchant frigate. By the winter of 1760 she was altered to a 500-ton frigate-of-war and was commissioned to lead a fleet of six ships carrying relief supplies and munitions from Bordeaux to Montreal. In mid-May, the fleet (only three of the original vessels and several small prize ships) reached the mouth of the St. Lawrence River to learn that a small British fleet was present just up river. Not seeking confrontation, the small French fleet decided to hide in Chaleur Bay at the mouth of Restigouche River. The fleet remained there for about a month, when another British fleet sailed through the bay and spotted them. Shortly thereafter, the British, following the French fleet into the Restigouche River, attacked. On 22 June 1760 the captain of *Le Machault* ordered her to be burned, and sunk in order to prevent her from falling into the hands of the British (see Figure 2.1). This was the last naval engagement of the British-French Seven Years War (Ross 1981:56).

Le Machault was discovered in 1969 by Parks Canada. Shortly thereafter, Parks Canada began a four-year excavation of the French fifth-rate frigate (Ross 1981:56). The site was not fully excavated. The artifacts recovered were conserved, extensively

studied, and reported upon, and were housed at the Battle of the Restigouche National Historic Site of Canada and their repository.

Lossen

Under the supervision of Harman Thiessen, a Dutch shipwright, the Norwegian frigate *Lossen* (the Nordic word for lynx) was built in Fredrikstad, Norway, in 1684. She was ca. 28.7 meters in length and had a beam of 7.5 meters and carried 18, six-pound and six, three-pound guns. By 1686, she was completed and ready for naval service, after which she performed various duties from the transportation of Norwegian conscripts to Denmark to acting as a convoy escort during the Great Nordic War (Molaug 1998:159-160).

By 1717 the Great Nordic War (1700-1721) was well under way. Peter Wessel Tordenskiold, the Danish-Norwegian admiral, fell out of grace with the monarch causing the kingdom's navy to weaken. Swedish privateers took advantage of that situation and became more active and aggressive, making it necessary for the Norway and Denmark to have convoy protection. In December 1717, *Lossen* was assigned to a group of 65 transport vessels and merchant ships leaving Stavern, Norway, and heading toward Frederikshavn, Denmark. On 22 December the convoy was headed for Kattegat; but a storm that evening blew *Lossen* nearly 21 nautical miles from Marstrand, Sweden. The very next day another storm raged and on Christmas Eve, the crew was forced to throw overboard the forward guns in order to lighten the front of the vessel. The deck was repeatedly swamped, and by noon, when the wind shifted yet again, *Lossen* found herself

nearing an extremely dangerous lee shore. An effort was made to turn the vessel around, but she was struck by a heavy wave which forced her over on her beam-ends (Molaug 1998:159). That evening, Commander Bruun navigated *Lossen* towards the Store Faerder beacon marking the western entrance of Oslofjord, but struck a cliff on the north-west side of Hvaler head-on, smashing her stem. *Lossen's* masts went overboard, and caused her to sink in five fathoms of water (Molaug 1998:159).

In 1963 the wreck was discovered in Stolen Bay about a mile south of Papperhavn on Vesteroy, Hvaler, a group of islands on the eastern side of the Oslofjord entrance (see Figure 2.2). Excavations began in 1967 and were conducted between 1967 and 1968, and then in then in 1974. Full excavations did not occur and all artifacts recovered were analyzed, conserved, and housed at the Norwegian Maritime Museum in Oslo, Norway (Molaug 1998:159).

Mary Rose

Due to the diplomatic position of England in the early-sixteenth century, that was England's alliance to Spain and the Netherlands rather than France, Henry VIII embarked on a mission to build a large navy. Of the many ships constructed, *Mary Rose*, named after the King's sister and the Tudor emblem, was the first built and became the flagship of Henry VIII (Rule 1982:20-23). The King ordered *Mary Rose* and *Peter Pomegranite* to be constructed, along with nine other ships to be built, two to be rebuilt, and ten other ships that he captured or purchased to be refitted, all of which was done in Portsmouth, England (Rule 1982:22-23).

On 29 July 1511, Mary Rose was ordered to the Thames by the Clerk of the King's Ships, Robert Brygandyne. That September she was fitted with supplies, thirty-eight coats of white and green (the King's colors) for the twenty-four soldiers, six masters, four quartermaster, and four boatswain that were to be a part of this voyage from Portsmouth to the Thames. By Christmas 1511, *Mary Rose* was situated on the Thames, read for war (Rule 1982:24).

During the construction of Henry VIII's warships, the Pope and the King of Aragon allied against Louis XII of France, and on 25 January 1512 the English Parliament decided to join this alliance. As a result of this alliance, in April 1512, Admiral Edward Howard and the *Mary Rose* were ordered, along with 17 other warship and two supply vessels, to clear the English Channel, a task which took nearly two months. By 10 August she and the Admiral set sail once again. This time she led a fleet in an attack on the major French fleet anchored at Brest (Rule 1982:24-25).

Over the next several years, Mary Rose fought at sea with the fleet, until 1536, when she was partially rebuilt and refitted. Little was known about this rebuild, however, the list of ordnances between 1514 and 1545 suggest that modifications were made to her gundecks to enable her to house more cannon. Although previously England and Spain were allies, in 1533 King Henry VIII heavily insulted Spain with the annulment of his marriage to Catherine of Aragon, Holy Roman Emperor Charles V's aunt, and, consequently, the Pope urged Francis I and Charles V to ally against Henry VIII. Knowing this threat, England introduced an intensive program of coastal defense,

building castles to protect fleets in the Downs, Rye, and in the Solent, amongst many other locations (Rule 1982:28-30).

In July 1545, Henry VIII received intelligence reports of a threatened invasion on Portsmouth by France. Consequently, England's ships were ordered to Portsmouth harbor. England's fleet of nearly 100 ships and 12,000 men was outmatched by the French fleet of 225 ships and nearly 30,000 men, forcing them to be defensive. They left the harbor for Horse Sands. The channel to Portsmouth and Horse Sands was a narrow one guided by buoys, but in order to confuse the French the buoys were removed and the English were forced to rely on their local knowledge (Rule 1982:37).

On 17 July 1545 there was no wind, which immobilized the English carracks. The French Admiral, D'Annebault, took advantage of the English misfortune, and ordered his galleys to advance upon the English ships. The French engaged in battle and within the first hour sunk the *Mary Rose* (see Figure 2.2). The English version however differed and blamed poor seamanship for the cause of sinking. Either way, *Mary Rose* sunk in the Solent at that time (Rule 1982:36-38).

Immediately after her sinking the King ordered the recovery of her hull. Venetians Peter de Andreas and Simon de Marine were hired to recover the sunken ship, but were unsuccessful when they ripped the mainmast from its original position when they attempted to drag her from her resting place. Over the next four years, guns were recovered from the wreck by Italian, Peter Paul (Rule 1982:40-41).

In 1836, while working on the wreck of the *Royal George* which sunk nearly 54 years previously in ca. 75 feet of water at Sptihead, John and Charles Deane, one of the

original inventors of helmet diving, were visited by local fisherman asking them to investigate an area where their lines frequently tangled due to some seabed obstruction. On 16 June they dived the site to determine the obstruction and found old timbers protruding from the seafloor and a large bronze gun. That August, three more guns were recovered. All artifacts were turned over to the Board of Ordnance, who established a committee to determine the identity of the wreck. The committee, under the chairmanship of Major General Sir William Miller, determined the site to be the resting place of *Mary Rose*. Over the course of the next six years the Deanes and William Edwards excavated portions of the wreck and recovered cannons, long bows, pottery, cloth, timber, and several human skulls (Rule 1982:46).

In 1971 *Mary Rose* was relocated using sonar. Between 1972 and 1978, the excavations of *Mary Rose* were conducted and in 1979 the Mary Rose Committee (formed in 1967) decided it was best to fully excavate the shipwreck due to the ongoing scouring process destroying it. This resulted in the formation of the Mary Rose Trust on 19 January 1979. The trust determined that the ultimate goal was to raise the hull of the ship and conserve her while on display in the town of Portsmouth. In order to do so, archaeologists had to remove the secondary silts in and around the hull, remove all contents from between the decks as well as the collapsed timbers in the surrounding scourpit, and reinforce the hull by replacing all necessary iron fittings. The trust hired a team of professional archaeologists and excavations occurred daily from early spring to late fall from 1979 to 1982 (Rule 1982:73-102). On 11 October 1982, the hull of *Mary Rose* was raised (Rule 1982:214).

“Active conservation” of Mary Rose has been ongoing since September 1994. Excavations of the remaining portions of the wreck began in 2003. The purpose of these excavations was to recover the artifacts left behind in the surrounding silt. These excavations were ongoing since 2003 (Mary Rose Trust 2005).

Millecoquins Wreck

Located at the mouth of the Millecoquins River (see Figure 2.1) in the Upper Peninsula of Michigan, this shipwreck was first identified in the fall of 1990 (Cantelas 1993:13; Coble 1996:1; Whitesides 2003:18). In 1990 Michigan State Archaeologist John Halsey and Canal Park Museum curator Patrick Labadie investigated the findings (Whitesides 2003:19). The ship was believed to date to the mid-nineteenth century and it was recommended that it be more extensively studied and excavated. In the fall of 1991, East Carolina University began investigations of the wreck site (Coble 1996:1). These excavations focused on the vessel’s bow and stern sections and uncovered personal effects, general stores, and two barrels (possibly trade goods or provisions). Probing at this time revealed that the cargo area was still fully laden and mostly intact (Mitchell 1996b:2; Whitesides 2003:21-23).

In the fall of 1994, this research was furthered by East Carolina University’s Program for Maritime History and Nautical Archaeology. At this time they conducted field research that focused on the excavation of the starboard midsection and recovered the remains of twenty-four casks (Mitchell 1996b:2; Whitesides 2003:24). This was the last of the excavations conducted on this wreck, but it was enough to determine that the

ship dated to the mid-nineteenth century and was a merchant or trade ship of its time. The exact identity of the ship was not identified (Cantelas 1993).

San Juan

In the early part of the sixteenth century, *San Juan*, a Basque whaling *galleon* or *nao*, was situated in Buttus (now Red Bay) with the intention to return to Spain with whale oil. During the Middle Ages, the Basques were the first Europeans to establish a whaling industry, mostly due to their position of close proximity to the Bay of Biscay. By the sixteenth century they began to venture away from the Bay, for cod fishing expeditions. Eventually they inhabited Iceland and Newfoundland. While in Newfoundland, the Basque people continued whaling and established the largest industrial center in the New World at that time, and were very successful. In 1565, *San Juan* was ready for return to Passajes, Spain laden with nearly a thousand casks of whale oil, used to illuminate homes across Europe. *San Juan* never completed this voyage when in September 1565 she got caught in a northerly storm which threw her against the rocks of Saddle Island. It was there that she sunk (Loewen 2004; Howard 1996; Ross 1980a).

At the Society for Historical Archaeology meetings in 1976, Selma Barkham reported that she identified the location of a Spanish Basque whaling establishment known as Buttus on the shores of Red Bay, Labrador, as well as the information that a large Spanish Basque whaling vessel sunk just off shore and was associated with the activity in Buttus. In the summer of 1977 James Tuck, an anthropologist at Memorial

University of Newfoundland, began to survey the area in which Buttus reported to be located. The following year, in September 1978, a Parks Canada team under the command of Robert Grenier surveyed the harbor of Red Bay, Labrador, and exposed a shipwreck believed to be *San Juan* (see Figure 2.1) (Ross 1980a; Ross 1980b).

Initially, one of the main goals of the excavations was to aid in understanding cask construction and the technological complexity of the Basque culture in Newfoundland. In doing so, archaeologists intended to recover and examine each cask from the wreck; however, by the beginning of the excavations in 1978, it was determined that there were too many casks. Due to the excess number of casks, a researcher with in depth knowledge of casks and cask construction was hired to examine all remains *in situ* and to select a representative sample to be exhumed and analyzed in the lab (Ross 1980a; Ross 1980b).

Excavations of San Juan took place between the fall of 1978 and early winter of 1985. Each field season was five to six months long and consisted of 14,000 hours of diving. The end product was the full excavation of the shipwreck (Grenier n.d.; Ross 1980a, Ross 1980b).

William Salthouse

Owned and operated by the Green and Company of Liverpool, England, *William Salthouse* was a small trading brig that originally operated in the West Indies. When the company heard of the burgeoning settlement of Port Phillip (Melbourne), New South Wales they directed *William Salthouse* there. Before setting sail for Port Phillip she

sailed from London to Montreal for trade goods and then set out for Port Phillip (Staniforth 2000:2-3). *William Salthouse* never made it, when on 27 November 1841 she struck a submerged rock of Point Nepean while entering Port Phillip Heads, the entrance to the port of Melbourne (see Figure 2.2). The rudder was ripped from the ship and the holds began to gradually fill with water. She sunk on a sandbank known as the Pope Eye Bank near the small town of Queenscliff. (Staniforth 2000:5-7)

There was no initial effort to salvage the ship (Staniforth 2000:5-7). In fact, the wreck was virtually forgotten until 1982 when SCUBA divers accidentally relocated it. That December the wreck site was declared a historic shipwreck and was protected under the guideline of the Historic Shipwreck Act of 1981. Although protected by legislation, the site still suffered damage by visiting SCUBA divers and environmental factors. This caused the Maritime Archaeological Unit (MAU) of the Victoria Archaeological Survey (VAS) to conduct archaeological excavations in March and April 1983 in an effort to mitigate some damage (Staniforth 2000:8). These excavations consisted of two shallow trenches, one forward and one aft of the main mast. It was the intention to determine the extent of the wreck and the damage caused by sport divers; however, once complete casks were encountered the excavations were halted due to the lack of money to excavate and conserve them (Staniforth 1987:71). In 1991, archaeologists revisited the site with the intention to obtain the contents of several casks (Staniforth 2000:8).

In 1993, amnesty was granted by the Commonwealth and Victorian Governments which resulted in many artifacts being turned in to Heritage Victoria (the successor to the Victoria Archaeological Survey). Since 1993, research concerning both the historical

and archaeological aspect of the wreck of *William Salthouse* has occurred and has produced reports on the cask material, bone remains of the salted meat, and bottles and their contents recovered (Staniforth 2000:8).

Whydah

Whydah, named for the West African port Ouidah (pronounced WIH-dah), now known as Benin, was a hundred-foot, 300-ton, three-mast galley built in London, England. She was first launched in 1715 as a slave ship under the command of Lawrence Prince. As a slave ship, she carried cloth, liquor, hand tools, and small arms from England in which the crew bartered for up to 700 slaves from West Africa. She later transported the slaves to the Caribbean, where they were sold for gold, silver, sugar, indigo, and cinchona (the last source of the medicine quinine). The goods were then returned to England for trade, and thus completed the “triangular trade” connecting England, Africa, and the West Indies (Hamilton 2006:131; Webster 1999).

Whydah was a fast ship, but not fast enough to outrun two pirate vessels. In February of 1717, pirate vessels *Sultana* and *Mary Anne* chased her down near the Bahamas. The pirate captain, Samuel “Black Sam” Bellamy, overpowered *Whydah*’s crew and claimed her as his flagship, allowing Prince and a dozen of his men to take the *Sultana*. In early April, *Whydah* was headed north along the east coast, capturing and robbing vessels along the way, with the destination of Richmond Island off the coast of Maine.

According to Cape Cod legend, Bellamy diverted their trip so that he may see his mistress, Maria Hallett, in the town of Eastham, located near the tip of Cape Cod. During this diversion, *Whydah* encountered a nor'easter (Webster 1999). The storm, according to eyewitness accounts, brought winds of up to 70 miles an hour and waves of over 30 feet. *Whydah* was caught in the surf zone, which slammed her stern first into a sand bar. She immediately broke apart. *Whydah* split into two: bow and stern, and spilled her contents across the sea floor near the shore of Cape Cod (see Figure 2.1) (Webster 1999).

After learning of Sam Bellamy's wreck, the Massachusetts' Governor, Samuel Shute, dispatched Cyprian Southack, a salvor, to Wellfleet, Cape Cod, to attempt recovery of "Money, Bullion, Treasure, Goods and Merchandizes taken out of the said Ship" (*Boston News Letter* May 4, 1717). Many of the locals, however, beat him to it. Southack arrived on 3 May 1717 to find the portion of the wreck that was beached scattered in many pieces with nearly 200 men plundering the booty. Locals even burned the beached hull in order to retrieve the iron fittings. Although unsuccessful at obtaining "treasures," Southack's experience as a salvor and cartographer allowed him to document the status of the wreck upon his arrival in such a manner that in 1983 three different salvage groups were certain of the location of the *Whydah* wreck (Hamilton 2006:132; Cembrola 1987).

In the latter portion of 1983, Barry Clifford and his salvage team, Maritime Explorations, Inc. (MEI), found what they believed to be the *Whydah*. Many people questioned the identity of the ship, including a local historian William P. Quinn, who wrote many counter arguments to Bob Cembrola's papers on the finding of the *Whydah*.

However, in the fall of 1985 a bell inscribed with “The Whydah Galley 1716” was recovered, providing nearly conclusive evidence that they indeed found the *Whydah* (Hamilton 2006:131; Quinn 1987; Cembrola 1987). By early 1987, Rolland Betts and Tom Bernstein with MEI formed the Whydah Joint Venture and in 1988, once they received approval of their Data Recovery Plan from the state and federal government, began a complete excavation of *Whydah*. Excavations continued for the next several years, and by the end of the 1989 field season more than nearly 35 percent of the site was excavated (Hamilton 2006:134). To date, excavations of *Whydah* were not completed. Artifacts recovered were housed at the Expedition Whydah Sea-Lab & Learning Center in Provincetown, Massachusetts (Clifford and Perry 1999).

Nineteen individual shipwrecks were discussed within this chapter, thirteen of which date to the eighteenth century, two to the sixteenth, one to the seventeenth, and three to the nineteenth. Each of these sites were excavated, either partially or fully, and yielded cask material. Although this material was not discussed within these pages, as the focus of this chapter was to provide both historical and archaeological backgrounds of the ships, it will be presented in the pages that follow.

CHAPTER 3: METHODOLOGY AND DATA SETS

This study was conducted via several methods, beginning with a literature review on casks and coopering aboard vessels. Archaeological, anthropological, and historical journals were utilized. These included, but were not limited to: the *International Journal for Nautical Archaeology*, *Historical Archaeology*, *The Australian Journal of Historical Archaeology*. Parks Canada and National Park Service documents were also utilized, in addition to published and unpublished theses and dissertations. Proceedings from maritime and historical archaeological conferences with reports on shipwrecks containing cask material were also exploited. Eighteenth century cask construction and use was also extensively researched via journals, books, and published theses, dissertations, and cask reports.

Although the main focus of this research was coopering and coopearage identified on eighteenth century vessels found along the east coast of North America, several data sets from shipwrecks from other geographical locations and time periods. These included the wreck of *Mary Rose* (1545 Portsmouth, England), *San Juan* (1565 Red Bay, Labrador), *La Belle* (1686 Matagorda Bay, Texas), the Millecoquins' Shipwreck (Late 1830's Millecoquins River, Michigan), and *William Salthouse* (1841 Port Phillip, Melbourne, Australia) were utilized. These data sets were used due to their abundance of data concerning cask materials.

All cask material encountered during the literature review was tabulated, in an effort to establish standard report forms found in Appendix B; paying careful attention to the cask's archaeological context within the site, material from which it was constructed,

dimensions, and the methods used to obtain such dimensions. If the report lacked such information, attempts to contact the author for further details about the casks were made, in an effort to obtain the maximum amount of information concerning each find. The Virginia Department of Historic Resources Archaeological Collections was visited to access materials from *Betsy*. Chuck Fithian, Delaware State Archaeologist, was contacted to obtain information concerning *DeBraak*; and David Switzer was contacted to obtain information concerning *Defence*. Attempts to contact other archaeologists, authors, museums, and conservationists were made, but were unsuccessful.

Once the literature review was completed and the artifact information was tabulated, pie charts, histograms, and bar graphs were created. These were generated to aid comparative analysis of materials recovered from the different vessels in this study. The cask material from each vessel was evaluated to determine the cask sizes represented in the assemblage. For the analysis, a single hoop fragment, stave fragment, and head fragment was identified as a single representative cask. Although this is misleading, since a cask is comprised of many hoops, staves, and head pieces, this was the most feasible way to determine a general assemblage. Sizes were determined based on head diameters. If these data were unavailable, the size was determined by the reported cask capacity. Occasionally, the cask capacity and the head diameters did not agree, and at this time the contents, diameter, and capacity were used to determine probable cask size. Head diameters were visually represented in the form of bar graphs and histograms for sites when available. The histograms showed the head diameters present, or inferred head diameter; if a diameter was not available than those particular data were not

represented. In order to determine the cask sizes probably represented, the histograms were compared to the graph provided in Figure 3.1. This graph represents the varying cask sizes, determined by the head diameters found in Table 1.1.

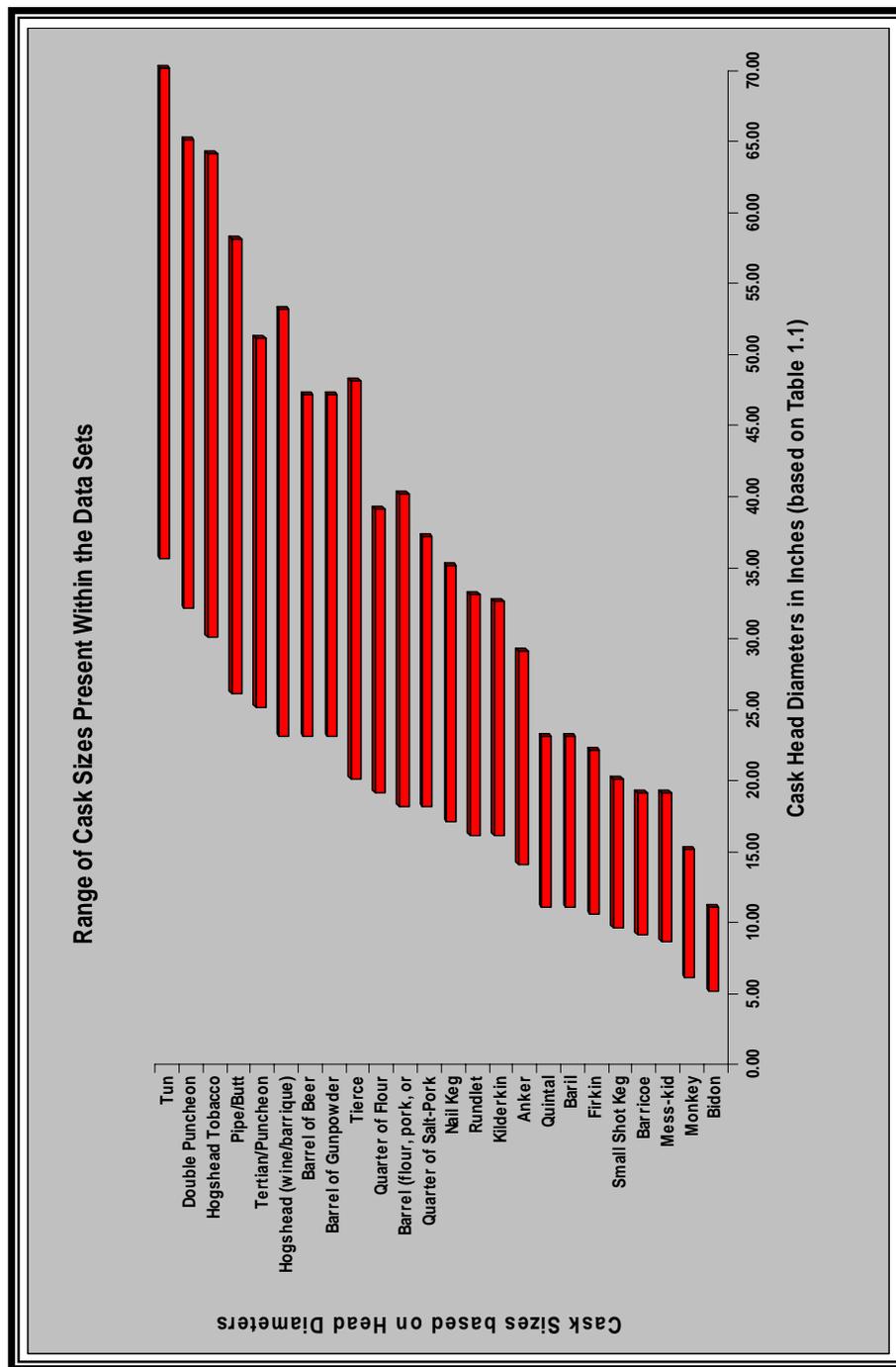


FIGURE 3.1. Graph showing the range of cask sizes, based on head diameters, represented on the varying shipwrecks utilized in this study (Cask head diameters were taken from Table 1.1).

A pie graph was created for each site that showed the percentage and ratio of the different sized casks represented. The pie graph colors did not coordinate with those of Figure 3.1 since several head diameters often overlapped making it difficult to identify the cask size represented (this was evident in Figure 3.1 as many bars overlapped one another). Casks that did not have a reported head diameter or any other dimension necessary for sizing were included, but were labeled unknown.

The histograms, bar graphs, and pie charts provided the necessary analytical tools to discern patterns in the cask material recovered from the different types of vessels. Ship manifests were not consulted as the purpose of this study was to determine if a vessel's function could be identified based solely on the cask material present, not the vessel's identity. The analysis was conducted inductively, with the potential patterns presenting themselves via the aforementioned charts and graphs.

A standardized format for reporting cask material from archaeological sites was an additional product of this research. A reporting standard was established by determining the key components of casks, determined by researching how casks were made and learning the individual components of a cask. When tabulating data discussed in each report, this research revealed gaps in the data sets which aided in establishing the key components. These components included head diameters, number of head pieces, number of staves, stave length, number of hoops, hoop material, type of croze groove, interior hollowing, and much more.

The remainder of this chapter contains all data obtained on cask material recovered from the shipwrecks presented in the previous chapter. The majority of these

data were from theses, research reports, and personal communications, with exception to the data concerning the cask materials from the Beaufort Inlet Wreck, which was obtained by the author while serving as a graduate assistant with the QAR Project. This chapter presents all raw data to demonstrate what was available for analysis.

Beaufort Inlet Wreck (Probable *Queen Anne's Revenge*)

From 2004-2006 the author was a Graduate Assistant at the NC Department of Cultural Resources QAR Shipwreck Project Conservation Laboratory, located at East Carolina University. During this period, data on the Beaufort Inlet Wreck cask assemblage, as recovered to the end of 2005, were collected by Watkins-Kenney and the author. Table 3.1 summarizes data on this cask material as held on the QAR Artifact Database at the QAR Conservation Lab as of 2006. By the end of 2005, approximately 5% of the site had been excavated. A preliminary analysis of the material was reported by Watkins-Kenney (2006). The assemblage was comprised of highly fragmented material, including fragments of 13 possible cask staves, four possible cask heads, two possible wood cask fragments, and 146 iron cask hoop fragments or cask hoop groupings (Table 3.1). The majority of the iron cask hoops was found within concretions and was highly corroded, and consequently, the archaeologists and conservators were unable to obtain the actual artifact. Instead, the cavity in which the artifact resided was cleaned and an epoxy resin cast of the cavity and thus the artifact was casted. All but two cask hoops were epoxy resin casts of the hoop.

TABLE 3.1 Cask material recovered from the Beaufort Inlet Wreck (NC Department Cultural Resources QAR Artifact Database 2006).

Specimen Number	Provenience	Completeness	Count	Diameter (in inches)	Length (in inches)	Width (in inches)	Thickness (in inches)	Weight (in grams)	Material
009.007	Surface	Cask Hoop	1	28.0	3.69	1.08	0.25	130.9	Metal - Synthetic (Casting)
009.009	Surface	Cask Hoop	1	N/A	6.12	1.3	0.5	13.0	Metal - Synthetic (Casting)
014.001	Surface	Cask Hoop, splice, 2 rivets	1	30.0/31.0	9.42	1.86	0.32	163.6	Metal - Synthetic (Casting)
015.002	Surface	Cask Hoop, 3 splices, 5 rivets	4	41.0/42.0	25.5	1.58	0.27	749.3	Metal - Synthetic (Casting)
016.000	Surface	Cask Hoop	8	N/A	4.88	1.36	0.16	18.3	Metal - Synthetic (Casting)
028.001	Test Unit 1, Level 2 (Aft)	Cask Hoop	1	42.0	3.35	0.89	0.15	N/A	Metal - Synthetic (Casting)
033.000	Test Unit 1, Level 2 (Aft)	Cask Hoop	1	N/A	7.5	1.35	0.3	47.6	Metal - Synthetic (Casting)
037.002	Test Unit 1, Level 2 (Aft)	Fastener Driftpin & Cask Hoop	2	36.0/38.0	8.75	1.49	0.27	584.9	Metal - Synthetic (Casting)
039.001	Test Unit 1, Level 2 (Aft)	Cask Hoop, splice, rivet	1	25.0/26.0	9.15	1.84	0.25	98.0	Metal - Synthetic (Casting)
041.001	Test Unit 1, Level 2 (Aft)	Cask Hoop, 2 splice, 2 rivets	4	28.0/30.0	13.42	1.29	0.21	534.3	Metal - Synthetic (Casting)
042.000	Test Unit 1, Level 2 (Aft)	Cask Hoop	1	N/A	4.13	1.38	0.19	242.2	Concretion
044.000	Test Unit 1, Level 2 (Aft)	Cask Hoop	1	N/A	3.0	1.25	0.12	8.0	Metal - Synthetic (Casting)
045.000	Test Unit 1, Level 2 (Aft)	Cask Hoop	1	N/A	2.0	1.0	0.12	5.2	Metal - Synthetic (Casting)
046.000	Test Unit 1, Level 2 (Aft)	Cask hoop Fragment	1	N/A	2.12	1.25	0.12	10.3	Metal - Synthetic (Casting)
052.000	Test Unit 1, Level 2 (Aft)	Cask hoop fragment with wood sections	1	29.0	8.15	1.64	0.24	99.5	Metal - Synthetic (Casting)
053.001	Test Unit 1, Level 2 (Aft)	Cask hoop	1	N/A	4.72	1.22	0.24	18.5	Metal - Synthetic (Casting)
053.002	Test Unit 1, Level 2 (Aft)	Cask Hoop, splice, 1 rivet	2	41.0/42.0	5.95	1.52	0.26	91.0	Metal - Synthetic (Casting)
054.001	Test Unit 1, Level 2 (Aft)	Cask Hoop	2	42.0	5.20	1.69	0.27	106	Metal - Synthetic (Casting)
056.000	Test Unit 1, Level 2 (Aft)	Concretion/Cask Hoop Fragment Completely corroded	1	NA	4.63	1.13	0.19	216.1	Concretion
060.007	Test Unit 1, Level 2 (Aft)	Cask Hoop	1	28.0	2.66	1.27	0.14	11.4	Metal - Synthetic (Casting)
060.010	Test Unit 1, Level 2 (Aft)	Cask Hoop	1	35.0	3.18	1.05	0.15	14.3	Metal - Synthetic (Casting)
070.001	Test Unit 1 Level 2 (Aft)	Concretion/Cask Hoop Dimensions: 1.63" x 1.02" x 0.2"	N/A	N/A	1.63	1.02	0.21	N/A	Concretion
110.002	Test Unit 2, Level 2 (Midship)	Cask Hoop, splice, 2 rivets	3	41.0/42.0	15.19	1.48	0.28	513.0	Metal - Synthetic (Casting)
111.001	Test Unit 2, Level 2 (Midship)	Cask Hoop fragment with Fastener rivets or Nails Dimensions: 8.5" by 1.5" by 0.25"	1	42.0	7.10	1.62	0.27	83.8	Metal - Synthetic (Casting)
111.002	Test Unit 2, Level 2 (Midship)	Cask hoop	1	N/A	3.0	1.18	0.15	19.7	Metal - Synthetic (Casting)
111.003	Test Unit 2, Level 2 (Midship)	Concretion/Cast - Cask Hoop Fragment	1	N/A	3.5	1.13	0.13	N/A	Concretion
112.001	Test Unit 2, Level 2 (Midship)	Cask Hoop	1	33.0/33.0	5.25	1.25	2.0	294.84	Metal - Synthetic (Casting)
113.001	Test Unit 2, Level 2 (Midship)	Cask Hoop	3	37.0/38.0	6.0	1.17	0.27	104.7	Metal - Synthetic (Casting)

TABLE 3.1 Cask material recovered from the Beaufort Inlet Wreck (NC Department Cultural Resources QAR Artifact Database 2006).

Specimen Number	Provenience	Completeness	Count	Diameter (in inches)	Length (in inches)	Width (in inches)	Thickness (in inches)	Weight (in grams)	Material
114.003	Test Unit 2 Level 2 (Midship)	Concretion - Cask Hoop	N/A	N/A	3.62	0.74	0.24	N/A	Concretion
115.001	Test Unit 2, Level 2 (Midship)	Cask Hoop	1	40.0/40.0	2.66	1.17	0.19	7.3	Metal - Synthetic (Casting)
115.002	Test Unit 2, Level 2 (Midship)	Cask Hoop	1	30.0/29.0	4.0	1.60	0.28	41.2	Metal - Synthetic (Casting)
116.001	Test Unit 2, Level 2 (Midship)	Cask Hoop Fragment	1	42.0	7.25	1.87	0.37	111.9	Metal - Synthetic (Casting)
119.002	Test Unit 2, Level 2 (Midship)	Cask Hoop	3	33.0/34.0	8.5	1.52	0.39	132.2	Metal - Synthetic (Casting)
121.001	Test Unit 2, Level 2 (Midship)	Cask hoop	1	34.0	3.5	1.53	0.20	27.1	Metal - Synthetic (Casting)
122.002	Test Unit 2, Level 2 (Midship)	Cask hoop	1	40.0/41.0	4.35	.14	1.34	34.4	Metal - Synthetic (Casting)
123.001	Test Unit 2, Level 2 (Midship)	Cask hoop	1	36.0/38.0	8.25	1.32	0.26	62.4	Metal - Synthetic (Casting)
124.001	Test Unit 2, Level 2 (Midship)	Cask hoop	1	32.0/34.0	8.63	1.51	0.20	65.2	Metal - Synthetic (Casting)
181.000	Test Unit 1, Level 2 (Aft)	Concretion and Cask Hoop fragment Concretion: 6.5"x3.67"x2.55", 0.66grams Fragment: 5.5"	1	N/A	5.5	N/A	N/A	N/A	Concretion
182.000	Test Unit 1, Level 2 (Aft)	Cask hoop Fragment	1	N/A	4.37	1.6	0.26	33.0	Metal - Synthetic (Casting)
183.000	Test Unit 1, Level 2 (Aft)	Cask hoop Fragment	1	N/A	5.15	1.7	0.25	36.0	Metal - Synthetic (Casting)
184.000	Test Unit 1, Level 2 (Aft)	Cask hoop Fragment	1	N/A	6.1	1.22	0.22	23.0	Metal - Synthetic (Casting)
186.000	Test Unit 1, Level 2 (Aft)	Splice of cask hoop with possible rivet	1	N/A	3.73	1.67	.36	103.8	Metal - Synthetic (Casting)
191.000	Test Unit 1, Level 2 (Aft)	Cask Hoop Fragment/Cast Dimensions: 1.75"x1.63"x1.25" Cast: 2.03"x1.87"x1.33", 61.1grams	1	N/A	1.75	1.63	1.25	N/A	Concretion
195.000	Test Unit 1, Level 2 (Aft)	Cask Hoop Fragment	1	N/A	3.5	1.2	0.19	13.2	Metal - Synthetic (Casting)
196.001	Test Unit 1, Level 2 (Aft)	Cask Hoop	1	35.5	4.87	1.57	0.19	166.8	Metal - Synthetic (Casting)
199.000	Test Unit 1, Level 2 (Aft)	Cask Hoop Fragment	1	N/A	3.27	1.0	0.25	9.7	Metal - Synthetic (Casting)
210.000	Test Unit 1, Level 2 (Aft)	Cask Hoop Fragment/Concretion Dimensions: 3.5"x0.75"x1.06", Concretion: 3.39"x1.67"x1.48", 64.8 grams	1	N/A	3.5	0.75	1.06	N/A	Concretion
214.001	Test Unit 1, Level 2 (Aft)	Cask hoop	1	35.0/36.0	3.07	1.28	0.21	34.9	Metal - Synthetic (Casting)
214.002	Test Unit 1, Level 2 (Aft)	Cask Hoop	5	42.0	13.88	1.74	0.23	553.6	Metal - Synthetic (Casting)
219.001	Test Unit 1, Level 2 (Aft)	Cask Hoop	1	42.0	2.77	1.54	0.24	28.5	Metal - Synthetic (Casting)
219.002	Test Unit 1, Level 2 (Aft)	Cask Hoop	1	40.0	4.38	1.15	0.18	17.7	Metal - Synthetic (Casting)
219.003	Test Unit 1, Level 2 (Aft)	Cask Hoop	1	18.0	5.09	1.12	0.23	44.3	Metal - Synthetic (Casting)
219.004	Test Unit 1, Level 2 (Aft)	Cask Hoop	1	42.0/42.0	3.56	1.05	0.18	14.1	Metal - Synthetic (Casting)

TABLE 3.1 Cask material recovered from the Beaufort Inlet Wreck (NC Department Cultural Resources QAR Artifact Database 2006).

Specimen Number	Provenience	Completeness	Count	Diameter (in inches)	Length (in inches)	Width (in inches)	Thickness (in inches)	Weight (in grams)	Material
232.026	Cannon C-2 (Aft Hold)	Cask hoops	3	32.5	6.80	1.55	0.32	460.0	Metal - Synthetic (Casting)
232.027	Cannon C-2 (Aft Hold)	Cask Hoops	1	40.0/40.0	4.26	1.13	0.21	20.4	Concretion
233.004	Test Unit 2, Level 1 (Midship)	Cask hoop	1	42.0	5.5	1.43	0.44	60.6	Metal - Synthetic (Casting)
233.006	Test Unit 2, Level 1 (Midship)	Cask Hoop	1	42.0	5.56	1.38	0.22	27.0	Metal - Synthetic (Casting)
233.012	C-3 (Midship)	Cask Hoop Concretions	N/A	N/A	N/A	N/A	N/A	N/A	Concretion
236.001	Test Unit 2, Level 1 (Midship)	Cask Hoop Concretion	1	42.0	N/A	N/A	N/A	N/A	Concretion
247.001	Test Unit 9 UFO (Bow)	Cask Hoop	1	43.0	5.43	1.27	0.28	35.7	Metal - Synthetic (Casting)
247.002	Test Unit 9 UFO (Bow)	Cask Hoop, 1 rivet	1	42.0	3.78	1.23	0.16	23.9	Metal - Synthetic (Casting)
247.004	Test Unit 9 UFO (Bow)	Cask hoop with two rivets	1	N/A	6.54	1.19	0.29	67.0	Metal - Iron, Wrought
247.005	Test Unit 9 UFO (Bpw)	Cask Hoop	1	N/A	9.90	1.26	0.20	64.2	Metal - Synthetic (Casting)
248.002	Test Unit 9, UFO (Bow)	Cask Hoop	1	43.0	7.5	1.24	0.17	32.1	Metal - Synthetic (Casting)
252.000	Test Unit 9, UFO (Bow)	Concretion - from Cask Hoops	2	N/A	3.5	0.99	N/A	N/A	Concretion
278.001	N120, E80-90 (Bow)	Cask Hoop	1	N/A	2.35	1.32	0.10	6.0	Metal - Synthetic (Casting)
280.004	N122, E79 (Bow)	Cask Hoop	1	40.0/42.0	6.36	1.44	0.22	37.3	Metal - Synthetic (Casting)
280.005	N122, E79 (Bow)	Cask Hoop	1	33.0/34.0	9.25	1.29	0.48	139.8	Metal - Synthetic (Casting)
280.006	N122, E79 (Bow)	Cask Hoop	1	N/A	3.51	1.74	N/A	6.9	Metal - Synthetic (Casting)
280.007	N122, E79 (Bow)	Cask Hoop fragment with rivet	1	.20.0	4.67	1.48	0.17	91.0	Metal - Iron, Wrought
284.003	N120, E80 (Bow)	Cask Hoop, 1 rivet	1	26.0/27.0	3.68	1.6	0.22	29.5	Metal - Synthetic (Casting)
311.001	N33, E81 (Stern)	Cask Hoop	5	28.0/29.0	8.25	1.12	0.13	21.2	Metal - Synthetic (Casting)
340.006	East side C4 (Midship)	Cask hoops, 3 splices, 4 rivets	4	33.0/33.5	12.60	1.59	0.25	840.7	Metal - Synthetic (Casting)
349.002	N40 E75.5 (Stern Hold)	Cask Hoop	1	38.0/36.0	4.25	1.20	0.20	19.4	Metal - Synthetic (Casting)
349.003	N40, E75.5 (Stern Hold)	Cask Hoop	1	39.0	6.13	1.03	0.21	26.3	Metal - Synthetic (Casting)
349.004	N40, E75.5 (Stern Hold)	Cask piece?, Group V	1	N/A	6.5	6.1	1.62	508.7	Organic - Wood
350.008	near muzzle cannon C-12 (Stern)	Cask Hoop with one rivet	2	34.0/36.0	1.39	1.12	0.17	9.8	Metal - Synthetic (Casting)
350.022	near muzzle C-12 (Stern)	Cask Hoop	1	36.0	4.80	1.39	0.31	37.1	Metal - Synthetic (Casting)
350.028	near muzzle C-12 (Stern)	Cask Hoop	1	N/A	1.54	0.91	0.15	N/A	Concretion
356.001	N75 E 75 (Midship)	Cask Hoop	1	N/A	6.75	1.13	0.15	27.3	Metal - Synthetic (Casting)
360.001	near cannon C-4 (Midship)	Cask Hoop	1	36.0	13.14	1.54	0.28	126.2	Metal - Synthetic (Casting)
360.002	near cannon C-4 (Midship)	Cask Hoop	1	N/A	2.0	1.18	0.21	16.9	Metal - Synthetic (Casting)
360.003	Near cannon C-4 (Midship)	Cask Hoop, 1 splice, 2 rivets	1	28.0/30.0	8.88	1.3	0.33	91.3	Metal - Synthetic

TABLE 3.1 Cask material recovered from the Beaufort Inlet Wreck (NC Department Cultural Resources QAR Artifact Database 2006).

Specimen Number	Provenience	Completeness	Count	Diameter (in inches)	Length (in inches)	Width (in inches)	Thickness (in inches)	Weight (in grams)	Material
									(Casting)
366.077	Cannon C-4 (Midship)	Cask Hoops, 3 splices	8	30.0/31.0	23.48	1.53	0.22	1794.9	Metal - Synthetic (Casting)
366.078	Cannon C-4 (Midship)	Cask Hoops	2	26.0	14.88	1.32	0.20	196.4	Metal - Synthetic (Casting)
366.092	Cannon C4 (Midship)	Cask Hoop ?? & wood	0	4.5/5.0	3.72	1.35	0.18	188.2	Metal - Synthetic (Casting)
366.096	C-4 QAR366.000 (Midship)	Cask head fragment?, Oak, Group V	1	N/A	8.25	2.5	1.75	291.7	Organic - Wood
366.097	C4 QAR366.000 (Midship)	Cask head fragment? Group V	1	N/A	12.75	3.0	1.5	548.0	Organic - Wood
366.098	C4 QAR366.000 (Midship)	Cask stave fragment? Group V	1	N/A	5.0	1.0	0.6	33.7	Organic - Wood
366.106	C-4 concretion 366.078 (Midship)	Cask Hoop	1	29.0/29.0	9.75	1.84	0.25	101.3	Metal - Synthetic (Casting)
366.107	C-4 concretion 366.078 (Midship)	Cask Hoop	1	29.0/30.0	6.10	1.40	0.19	39.3	Metal - Synthetic (Casting)
366.108	C-4 concretion 366.078 (Midship)	Cask Hoop, 1 splice, 1 rivet	1	18.0/19.0	13.31	1.45	0.20	139.9	Metal - Synthetic (Casting)
366.109	Concretion 366.001 (Midship)	Cask stave fragment? And organic tie, Group V	1	N/A	4.0	3.8	1.2	114.0	Organic - Wood
366.110	Concretion 366.001 (Midship)	Cask stave fragment? Group V	1	N/A	4.15	2.38	0.86	75.2	Organic - Wood
366.112	C-4 concretion 366.076 (Midship)	Cask Hoop, 1 splice, 1 rivet	1	N/A	2.74	1.21	0.31	10.3	Metal - Synthetic (Casting)
366.116	Concretion 366.076 (Midship)	Cask stave fragment & tie? Group V	1	N/A	5.07	1.25	0.65	79.9	Organic - Wood
366.117	Concretion 366.076 (Midship)	Cask stave fragment ? Group V	1	N/A	17.0	2.7	1.1	639.7	Organic - Wood
366.120	Concretion 366.076 (Midship)	Cask stave fragment? Group V	1	N/A	1.7	1.3	0.7	19.1	Organic - Wood
366.121	Concretion 366.076 (Midship)	Cask stave fragment? Group V	1	N/A	2.6	1.2	0.6	21.9	Organic - Wood
366.122	Concretion 366.076 (Midship)	Cask stave fragment? Group V	1	N/A	3.4	1.4	0.7	42.5	Organic - Wood
366.123	Concretion 366.076 (Midship)	Cask stave fragment? Group V	1	N/A	7.9	1.9	0.9	256.4	Organic - Wood
366.124	Concretion 366.076 (Midship)	Cask head fragment? Group V	1	N/A	10.4	2.7	1.3	544.6	Organic - Wood
366.126	Concretion 366.076 (Midship)	Cask stave fragment, Group V	1	36.0	26.5	6.0	1.5	3320	Organic - Wood
366.126.01	366.076. Sample of 366.126 (Midship)	Sample - Cask stave fragment, Group IV	1	N/A	1.59	1.13	0.63	7.9	Organic - Wood
418.044	concretion 418.000 C19 & C21 (Forward Hold)	Cask Hoop	1	N/A	2.14	0.93	0.15	N/A	Concretion
418.052	concretion 418.000 C19 & C21 (Forward Hold)	Cask Hoops	1	40.0/41.0	3.56	1.09	0.16	13.6	Metal - Synthetic (Casting)
418.054	concretion 418.000 C19 & C21 (Forward Hold)	Cask Hoop	1	42.0/42.0	1.80	1.30	0.24	11.7	Metal - Synthetic (Casting)
418.062	concretion 418.000 C19 & C21 (Forward Hold)	Cask Hoops	2	N/A	6.92	1.45	0.25	204.2	Metal - Synthetic (Casting)
418.064	concretion 418.000 C19 & C21 (Forward Hold)	Cask Hoop with wood and rivet	4	N/A	3.91	1.61	0.39	153.2	Metal - Synthetic (Casting)

TABLE 3.1 Cask material recovered from the Beaufort Inlet Wreck (NC Department Cultural Resources QAR Artifact Database 2006).

Specimen Number	Provenience	Completeness	Count	Diameter (in inches)	Length (in inches)	Width (in inches)	Thickness (in inches)	Weight (in grams)	Material
418.076	Concretion QAR418.000 (Forward Hold)	Cask piece?, White Oak, Tooled, Group V	1	N/A	2.90	1.95	0.71	35.0	Organic - Wood
418.121	concretion 418.000 C19 & C21 (Forward Hold)	Cask Hoop	1	N/A	3.26	1.16	0.17	N/A	Concretion
418.142	concretion 418.062 (Forward Hold)	Cask Hoop	1	42.0/42.0	3.77	1.31	0.26	50.6	Metal - Synthetic (Casting)
418.145	concretion 418.052 (Forward Hold)	Cask Hoop	1	N/A	2.95	1.38	0.22	17.5	Metal - Synthetic (Casting)
418.146	concretion 418.052 (Forward Hold)	Cask Hoop	1	30.0/30.0	3.16	1.43	0.14	17.2	Metal - Synthetic (Casting)
418.147	concretion 418.052 (Forward Hold)	Cask Hoop	1	31.0	3.5	1.16	0.16	8.5	Metal - Synthetic (Casting)
418.159	concretion 418.000 C19 & C21 (Forward Hold)	Cask Hoop, 1 splice, 2 rivets	4	42.0/43.0	7.21	1.49	0.32	240.9	Metal - Synthetic (Casting)
451.002	SE Unit, N90-95, E90-95 (Forward Hold)	Cask Hoop	1	24.0/22.0	2.12	1.23	0.21	12.5	Metal - Synthetic (Casting)
462.001	NW unit N95-100 E85-90 (Forward Hold)	Cask Hoop, 1 splice, 2 rivets	1	28.0/29.0	21.90	1.09	0.22	140	Metal - Synthetic (Casting)
462.002	NW Unit: N95-100, E85-90 (Forward Hold)	Cask Hoop, 1 splice, 2 rivets	1	N/A	25.39	1.27	0.27	244.3	Metal - Synthetic (Casting)
464.001	NW unit N95-100 E85-90 (Forward Hold)	Cask Hoop	1	36.0	3.93	1.26	0.34	34.5	Metal - Synthetic (Casting)
464.002	NW Unit, N95-100, E85-90 (Forward Hold)	Cask Hoop, 1 splice, 1 rivet	1	N/A	3.54	1.40	0.21	42.3	Metal - Synthetic (Casting)
465.000	NW Unit: N95-100, E85-90 (Forward Hold)	Cask Hoop	1	N/A	3.5, 3.0	1.41, 1.14	0.18, 0.35	N/A	Concretion
470.001	NE Unit: N95-100, E90-95 (Forward Hold)	Cask hoop, 3 splices, 2 rivets	6	40.0	14.0	1.10	0.26	701.9	Metal - Synthetic (Casting)
471.005	NE Unit: N95-100, E90-95 (Forward Hold)	Cask Hoop, 1 splice, 2 rivets	1	44.0	13.41	1.20	0.21	114.5	Metal - Synthetic (Casting)
472.000	NE Unit: N95-100, E90-95 (Forward Hold)	Cask Hoop concretion	1	N/A	N/A	N/A	N/A	N/A	Concretion
472.001	NE Unit: N95-100, E90-95 (Forward Hold)	Cask Hoop	1	34.0/31.0	4.62	1.05	0.22	26.8	Metal - Synthetic (Casting)
477.001	NW Unit: N95-100, E85-90 (Forward Hold)	Cask hoop	1	38.0/39.0	6.25	1.83	0.36	97.0	Metal - Synthetic (Casting)
478.001	NW Unit, N95-100, E85-90 (Forward Hold)	Cask Hoop	1	31.0/31.0	3.06	1.04	0.15	12.3	Metal - Synthetic (Casting)
478.002	NW Unit, N95-100, E85-90 (Forward Hold)	Cask Hoop	2	N/A	2.29, 2.33	1.19, 0.82	0.17, 0.16	N/A	Concretion
478.003	NW Unit, N95-100, E85-90 (Forward Hold)	Cask Hoop	1	41.0/41.0	2.21	1.33	0.21	14.1	Metal - Synthetic (Casting)
478.004	NW Unit: N95-100, E85-90 (Forward Hold)	Cask hoop	1	N/A	4.71	1.20	0.11	17.3	Metal - Synthetic (Casting)
479.004	NW Unit, N95-100, E85-90, conc 479.000 (Forward Hold)	Cask head fragment, Oak, Group V	1	N/A	1.5	2.0	0.4	22.1	Organic - Wood
479.006	NW Unit, N95-100, E85-90 (Forward Hold)	cask hoop & ballast stone	3	35.0/36.0	10.11	1.73	0.21	1325.7	Metal - Synthetic (Casting)
479.007	NW Unit: N95-100, E85-90 (Forward Hold)	Cask Hoop, 1 splice	14	35.0/36.0	24.50	1.42	0.30	2.72	Metal - Synthetic (Casting)
491.002	SW Unit N90-95 E85-90 (Forward Hold)	Cask Hoop	1	60.0/61.0	3.00	1.41	0.22	15.9	Metal - Synthetic (Casting)
491.010	SW Unit N90-95 E85-90 (Forward Hold)	Cask stave fragment? Group V	1	N/A	7.25	1.76	0.9	148.8	Organic - Wood

TABLE 3.1 Cask material recovered from the Beaufort Inlet Wreck (NC Department Cultural Resources QAR Artifact Database 2006).

Specimen Number	Provenience	Completeness	Count	Diameter (in inches)	Length (in inches)	Width (in inches)	Thickness (in inches)	Weight (in grams)	Material
491.011	SW Unit N90-95 E85-90 (Forward Hold)	Cask stave fragment? Group V	2	N/A	1.6	1.2	0.4	12.8	Organic - Wood
491.012	SW Unit: N90-95, E85-90 (Forward Hold)	Cask Hoop, 1splice	12	40.0	20.4	1.5	0.31	4.36	Metal - Synthetic (Casting)
491.013	SW Unit: N90-95, E85-90 (Forward Hold)	Cask Hoop	5	41.0	12.86	.18	1.10	1407.0	Metal - Synthetic (Casting)
491.014	SW Unit: N90-95, E85-90 (Forward Hold)	Cask Hoop	2	27.0	12.80	1.21	0.23	121.6	Metal - Synthetic (Casting)
491.015	SW Unit: N90-95, E85-90 (Forward Hold)	Cask Hoop	1	36.0	3.43	1.31	0.23	30.1	Metal - Synthetic (Casting)
491.016	SW Unit: N90-95, E85-90 (Forward Hold)	Cask Hoop	1	36.0	35.86	1.47	0.20	39.2	Metal - Synthetic (Casting)
492.002	SW Unit N90-95 E85-90 (Forward Hold)	Cask Hoop	1	37.0/38.0	2.81	1.30	0.22	19.5	Metal - Synthetic (Casting)
496.026	Mound East (Midship)	Cask Hoop	1	38.0/40.0	5.21	1.48	0.27	31.4	Metal - Synthetic (Casting)
517.000	75E, 103N (Forward Hold)	Cask Hoop Concretion	4	N/A	3.96	2.45	1.67	412.2	Concretion
533.000	Unit 05/05 #01 E90 N130 (Bow)	Concretion - cask hoop	1	N/A	9.0	3.5	1.5	0.76	Concretion
539.000	Unit 05/05 #01 E90 N130 (Bow)	Concretion - cask hoop, Nail	1	N/A	11.25	8.0	5.0	3.08	Concretion
541.000	Unit 05/05 #02 E75 N110 (Bow)	Concretion - cask hoop? Under chase C24	1	N/A	14.5	5.75	4.0	3.40	Concretion
566.000	Unit 05/05 #03 E110 N95 (Forward Hold)	Concretion, Cask Hoop	1	N/A	3.5	2.25	1.75	0.2057	Concretion
581.000	Unit 05/05 #03 E110 N95 (Forward Hold)	Concretion - cask hoop?	2	N/A	17.0	10.5	4.75	004.06	Concretion
584.000	Unit 05/05 #01 E90 N130 (Bow)	Concretion -cask hoop broken 2 pieces	2	N/A	37.0	4.5	6.25	007.22	Concretion
586.000	Unit 05/05 #02 E75 N110 (Bow)	Concretion -cask hoop	1	N/A	2.0	1.75	1.5	0.0813	Concretion
588.000	Unit 05/05 #02 E75 N110 (Bow)	Concretion - cask hoop	1	N/A	3.5	2.75	0.75	0.1468	Concretion
593.000	Unit 05/05 #02 E75 N110 (Bow)	Concretion -cask hoop	1	N/A	6.5	5.5	3.75	1.28	Concretion
602.000	Unit 05/05 #04 E65 N75 (Midship)	Concretion - cask hoop	1	N/A	11.25	2.75	2.0	0.8689	Concretion
611.000	Unit 05/05 #04 E65 N75 (Midship)	Concretion - cask hoop	1	N/A	19.0	10.5	6.5	6.16	Concretion
613.000	Unit 05/05 #04 E65 N75 (Midship)	Concretion - cask hoop	1	N/A	3.0	1.75	0.75	0.1227	Concretion
614.000	Unit 05/05 #04 E65 N75 (Midship)	Concretion - cask hoop	1	N/A	3.5	2.25	1.25	0.1468	Concretion
619.000	Unit 05/05 #04 E65 N75 (Midship)	Concretion -cask hoop?	1	N/A	6.0	2.5	2.75	0.452	Concretion
625.000	Unit 05/05 #05 E65 N60 (Aft Hold)	Concretion - cask hoops	1	N/A	30.25	10.5	6.0	13.96	Concretion
659.000	Unit 05/05 #08 E85 N35 (Stern)	Concretion - cask hoop	1	N/A	20.0	9.0	5.0	5.68	Concretion
660.000	Unit 05/05 #08 E85 N35 (Stern)	Concretion - cask hoops	1	N/A	27.0	9.0	5.0	12.02	Concretion
661.000	Unit 05/05 #08 E85 N35 (Stern)	Concretion - cask hoop set complete	1	36.0	N/A	N/A	N/A	0.6859	Concretion
692.000	Unit 05/05 #08 E85 N35 (Stern)	Concretion - cask hoop	1	N/A	18.0	1.75	3.0	2.06	Concretion

TABLE 3.1 Cask material recovered from the Beaufort Inlet Wreck (NC Department Cultural Resources QAR Artifact Database 2006).									
Specimen Number	Provenience	Completeness	Count	Diameter (in inches)	Length (in inches)	Width (in inches)	Thickness (in inches)	Weight (in grams)	Material
694.000	Unit 05/05 #08 E85 N35 (Stern)	Concretion - cask hoop	1	N/A	10.0	5.0	3.0	1.2515	Concretion

Betsy (Yorktown Wreck 44YO88)

Archaeological investigations of 44YO88 yielded significant cask material, including complete casks, tubs, buckets, single staves, and head pieces. This material was analyzed by Kerry Shackelford and Shelli O. Smith and others from the Betsy project. A minimum vessel count of 38 staved containers was determined (Table 3.2). Of the 38, twenty one were intact. Those that were not intact were pieced together in the lab by project archaeologists, including Shackelford and Shelli O. Smith, by matching stains, brands, inscriptions, wood, and much more. This material was not only well preserved, but also showed signs of repairs, providing archaeologists with extensive information on the manufacture, use, repair, and reuse of eighteenth-century cask material (Shackelford 1996:N-1 through N-5).

Housed at the Virginia Department of Historic Resources curation facility, this material was accessed by the author for reanalysis. Due to time constraints, all cask material was not reanalyzed, only a small 10% sample was, and unfortunately, most of this material was in a poor state of preservation as a PEG solution was seeping out of the wood obscuring many of the markings. The data obtained were very similar to that acquired by Shackelford and Smith and was subsequently not used as part of the raw data presented herein, but it was used to aid in the creation of the standard reporting forms located in Appendix B.

TABLE 3.2. Cask material recovered from *Betsy* (Shackleford 1996).

Specimen Number	Cask Type or Size	Material	Length (in inches)	Stave and Head Thickness (in inches)	Head Diameter (in inches)	Completeness	Markings	Cask Contents	Comments
CA200	N/A	Wood (oak)	29.16	0.60	19.68	<ul style="list-style-type: none"> ▪ Mostly complete ▪ Five-piece head (only one cant and two middle pieces survived) 	<ul style="list-style-type: none"> ▪ "NEW MESS BEEF" branded on the head (perpendicular to the cants) ▪ The head was also marked or incised with other numbers and graffiti 	Beef	<ul style="list-style-type: none"> ▪ Split wood staves ▪ Hoops were comprised of hickory wrapped with willow ▪ Small square or scratch groove croze present ▪ Flagging was present between the staves and heads ▪ Cask was believed to have been reused based on the high number of additional marks located both on the head and staves
CA201	N/A	Wood (oak)	30.60	0.54	N/A	<ul style="list-style-type: none"> ▪ Two staves survived (one of which was the bung stave) 	<ul style="list-style-type: none"> ▪ None 	Beef	<ul style="list-style-type: none"> ▪ Sawn wood staves ▪ Bound by hickory hoops ▪ The staves were hollowed out and thinned in cross section at the booge ▪ Square croze present
CA202	N/A	Wood (oak)	24.96	0.71	14.40	<ul style="list-style-type: none"> ▪ Complete with all heads and staves ▪ Three-piece head 	<ul style="list-style-type: none"> ▪ None 	N/A	<ul style="list-style-type: none"> ▪ Split wood staves ▪ Small square croze ▪ Bound by Chestnut hoops ▪ No evidence of repairs ▪ Cask was burned inside and out
CA203	N/A	Wood (oak)	N/A	N/A	N/A	<ul style="list-style-type: none"> ▪ N/A 	<ul style="list-style-type: none"> ▪ None 	N/A	<ul style="list-style-type: none"> ▪ Split Wood
CA204	N/A	Wood (oak)	N/A	N/A	N/A	<ul style="list-style-type: none"> ▪ N/A 	<ul style="list-style-type: none"> ▪ None 	N/A	<ul style="list-style-type: none"> ▪ Split Wood
CA205	N/A	Wood (pine)	28.80	1.08	16.44	<ul style="list-style-type: none"> ▪ Fully Intact 	<ul style="list-style-type: none"> ▪ "272" branded on the head ▪ "HC" branded on the staves 	N/A	<ul style="list-style-type: none"> ▪ Sawn wood staves ▪ Bound by Chestnut hoops ▪ Light scratch groove present ▪ No evidence for repair
CA206	N/A	Wood (oak)	15.0	0.67	N/A	<ul style="list-style-type: none"> ▪ 16 staves 	<ul style="list-style-type: none"> ▪ None 	N/A	<ul style="list-style-type: none"> ▪ Split wood staves ▪ No evidence of a croze groove, rather nails to fasten liner hoops to hold the heads in place ▪ Bound by iron hoops ▪ One stave was cut perpendicular to the joint, creating a rectangular hole between two staves
CA207	N/A	Wood (oak)	28.80	0.948	17.40	<ul style="list-style-type: none"> ▪ 20 staves ▪ Three-piece head 	<ul style="list-style-type: none"> ▪ "MESS BEEF" branded on the head ▪ "X131" scratched on the head ▪ X's marked on one stave 	Beef	<ul style="list-style-type: none"> ▪ Split wood staves (production made cask) ▪ Staves were curved on the interior and exterior surfaces ▪ Square croze
CA208	N/A	Wood (oak)	38.76	0.96	28.80	<ul style="list-style-type: none"> ▪ Four iron hoops 	<ul style="list-style-type: none"> ▪ "HMC" and "TC" branded on 	Liquids	<ul style="list-style-type: none"> ▪ Split wood staves ▪ Flagging present ▪ Square croze

TABLE 3.2. Cask material recovered from *Betsy* (Shackleford 1996).

Specimen Number	Cask Type or Size	Material	Length (in inches)	Stave and Head Thickness (in inches)	Head Diameter (in inches)	Completeness	Markings	Cask Contents	Comments
							<ul style="list-style-type: none"> the staves X's and "25" inscribed on the head and staves 		<ul style="list-style-type: none"> Bung wrapped in cloth driven into a stave and cut off
CA210	N/A	N/A	N/A	N/A	N/A	N/A	<ul style="list-style-type: none"> None 	N/A	
CA213	N/A	Wood (oak)	10.8	0.60	10.8	<ul style="list-style-type: none"> 13 staves Two-piece head doweled together 	<ul style="list-style-type: none"> None 	N/A	<ul style="list-style-type: none"> Split oak staves Square croze Rope attached to staves (handle)
CA495	N/A	Wood (oak)	9.6	0.72	18	<ul style="list-style-type: none"> Three staves One head 	<ul style="list-style-type: none"> None 	N/A	<ul style="list-style-type: none"> All staves have nail holes possibly indicated their use to hold wood hoppers in place. Square and moderately deep croze
CA515	N/A	Wood (oak)	38.40	1.14	28.44	<ul style="list-style-type: none"> Six iron hoops 	<ul style="list-style-type: none"> Rodent teeth marks around a semi-circular hole in the head "WJ 8oN" inscribed on the head Numbers, Letter, and 2 diamonds (one large the other small) located on the staves 	Liquids	<ul style="list-style-type: none"> Split Oak Originally a Wine Pipe (126 gallons) but cut down by at least half Inside shows sign of burning during construction Square, moderately deep croze (2) **Repair using two patches from lead and cork and using 60 nails to hold it in place**
CA516	N/A	Wood (oak)	30.0	0.67	22.32	<ul style="list-style-type: none"> Only a few complete staves and one head Bound by iron hoops (only stains remain) 	<ul style="list-style-type: none"> "— THORALE" branded on head "B" "X" and an inverted "B" were inscribed on the head 	Liquids	<ul style="list-style-type: none"> Sawn wood Flaggin located between head pieces Lead and cork repair on one stave Cask was cut down due to repairs
CA517	N/A	Wood (oak)	29.28	0.684	17.76	<ul style="list-style-type: none"> 18 staves found articulated with the two heads Three wooden hoops on the chime 	<ul style="list-style-type: none"> "32/2" inscribed on the heads 	Beef	<ul style="list-style-type: none"> Split Wood Boundy by wooden hoops (ghosting visible for 12 hoops/ three each on the chime and quarter) Hoops were notched and unwrapped Interior was axed or adzed leaving a rough surface (possibly sign of repair)
CA518	N/A	Wood (pine)	36.0	0.948	24.0	<ul style="list-style-type: none"> Three-piece head 	<ul style="list-style-type: none"> "S" and "B" along with slash marks forming X's across several staves 	Tar	<ul style="list-style-type: none"> Split Wood Staves were not backed and hollowed (flat both inside and out) Shallow square croze Ghosts of wood hoops
CA520	N/A	Wood (oak)	27.96	0.384	16.80	<ul style="list-style-type: none"> 16 staves, two head, iron hoops (three on each ends, though only stains remain) Two bung 	<ul style="list-style-type: none"> "NEW PRIME OX MESS BEEF 26 PC P R LONG WATERFO" 	Beef	<ul style="list-style-type: none"> Split Wood Staves were back but not hollowed Moderately deep square croze

TABLE 3.2. Cask material recovered from *Betsy* (Shackleford 1996).

Specimen Number	Cask Type or Size	Material	Length (in inches)	Stave and Head Thickness (in inches)	Head Diameter (in inches)	Completeness	Markings	Cask Contents	Comments
						<ul style="list-style-type: none"> staves (one corked) 	<ul style="list-style-type: none"> RD" branded on the head Many other mark inceised over this "— TABOR" branded with a series of small circles incised under the letters "CAR" on one stave "B" incised on two more staves 		
CA521	N/A	Wood (pine)	30.48	0.36	N/A	<ul style="list-style-type: none"> Eight wooden hoops No heads Only a few staves (not complete) 	<ul style="list-style-type: none"> None 	N/A	<ul style="list-style-type: none"> Sawn wood Similar to CA 518 Hoops werenotched together with four on each end Nails found along hoops
CA522	N/A	Wood (oak)	41.16	1.08	27.72	<ul style="list-style-type: none"> Nearly complete Pegs located between boogie and quarter areas on staves Two five-piece heads 	<ul style="list-style-type: none"> None 	Liquids	<ul style="list-style-type: none"> Sawn wood Iron hoop stains present Deep square croze with flagging
CA524	N/A	Wood (oak)	39.60	0.96	28.20	<ul style="list-style-type: none"> 24 staves (only four complete) Two five-piece heads Ghosts of two iron hoops on each end 	<ul style="list-style-type: none"> "M"s and "W"s and the number 32 inscribed on the head "N 32" also inscribed on the head "WE N" branded on one stave 	Liquids	<ul style="list-style-type: none"> Split Wood Deep square croze
CA525	N/A	Wood (tropic)	42.0	0.60	35.76	<ul style="list-style-type: none"> Six-piece head with no dowels, rather a batten in which they were nailed or pegged to (runs perpendicular to head pieces) Liner hoop (rather than croze groove) 	<ul style="list-style-type: none"> "TW" with a diamond overhead were branded into one stave 	Grain	<ul style="list-style-type: none"> Split Wood Backed but not hollowed staves Iron hoops held in place by 39 Nails Steeply sloped chime
CA526	N/A	Wood (tropic)	40.32	0.54	27.24	<ul style="list-style-type: none"> Wooden notched hoops Liner hoops used rather than croze groove Seven-piece head supported by pegs and a batten 	<ul style="list-style-type: none"> "GP" with a heart overhead inscribed across 3 staved at a right angle to the joints "X"s inscribed across many other staves 	Grain	<ul style="list-style-type: none"> Split Wood Similar to CA525 Nails (139) used to hold heads and hoops in place Page (70) were found in heads and staves
CA528	N/A	Wood (tropic)	41.28	0.648	N/A	<ul style="list-style-type: none"> No heads Ca. half complete 21 staves 	<ul style="list-style-type: none"> "Y*" inscribed on three staves 	Grain	<ul style="list-style-type: none"> Split Wood Similar to CA526 and CA524 Abundant nail holes throughout staves Staves were not

TABLE 3.2. Cask material recovered from *Betsy* (Shackleford 1996).

Specimen Number	Cask Type or Size	Material	Length (in inches)	Stave and Head Thickness (in inches)	Head Diameter (in inches)	Completeness	Markings	Cask Contents	Comments
									<ul style="list-style-type: none"> ▪ dressed or hollowed ▪ Nail holes around chime suggest use of liner hoops (not present) ▪ Impression of light scratch croze located on some staves ▪ Cask may have been shook prior to vessel sinking
CA529	N/A	Wood (oak)	40.80	0.348	N/A	<ul style="list-style-type: none"> ▪ Several Staves 	<ul style="list-style-type: none"> ▪ Roman Numeral inscribed on each stave in order (for shaking) 		<ul style="list-style-type: none"> ▪ Split Wood ▪ Bound by wood hoops (no longer present) ▪ Cask was burned during construction ▪ Moderately deep square croze ▪ Many pegs and nails especially around the quarter and chime areas. ▪ Cask was repaired (extra croze groove, as well as numbers marked in different locations on several staves indicated that they came from another cask).
CA530	N/A	Wood (oak)	41.16	0.60	N/A	<ul style="list-style-type: none"> ▪ Two heads and a few staves 	<ul style="list-style-type: none"> ▪ "W" inscribed on one stave 	Liquids?	<ul style="list-style-type: none"> ▪ Sawn wood ▪ Bound by four iron hoops (two at each end, none survive) ▪ Shallow square croze
CA532	N/A	Wood (oak)	20.76	0.48	18.0	<ul style="list-style-type: none"> ▪ Two heads and several staves ▪ Complete? 	<ul style="list-style-type: none"> ▪ "S" inscribed on one stave ▪ "EA" branded on another 	Meat	<ul style="list-style-type: none"> ▪ Split Wood ▪ Staves made from split oak, the heads were made from mixed woods (including pine) ▪ Narrow but deep square croze groove
CA548	N/A	Wood (oak)	29.52	0.60	20.04	<ul style="list-style-type: none"> ▪ Two heads, and several staves ▪ Complete? ▪ Bung stave with bung 	<ul style="list-style-type: none"> ▪ "TY" inscribed on one stave 	Meat	<ul style="list-style-type: none"> ▪ Split Wood ▪ Originally had iron hoops, but later replaced by wood one (neither survived) ▪ Staves were dressed inside and out ▪ Nails for Nailing iron hoops located ▪ No signs of repair
CA550, 551, 552	N/A	Wood (Chestnut)	16.68	0.72	9.84	<ul style="list-style-type: none"> ▪ Three nearly complete casks 	<ul style="list-style-type: none"> ▪ None 	Musket balls	<ul style="list-style-type: none"> ▪ Sawn wood ▪ Moderately deep square croze groove ▪ Bound by eight wood hoops from Chestnut (none survive) ▪ Hoops nailed in three staves, but only at chime ▪ Head had a large

TABLE 3.2. Cask material recovered from *Betsy* (Shackleford 1996).

Specimen Number	Cask Type or Size	Material	Length (in inches)	Stave and Head Thickness (in inches)	Head Diameter (in inches)	Completeness	Markings	Cask Contents	Comments
									hole (ca. 1.68 in in diameter) that was plugged with a wood plug (intended for loaded cask with musket balls)

British Merchant Vessel from Chubs Head Cut

According to Krivor (1998:45) a single copper “barrel hoop” was recovered near the ship’s hull. The hoop had three broad arrows stamped into it, which indicated it belonged to the British Royal Navy and Army. The dimensions of the hoop were not available. In addition to the copper hoop, the remains of several staved containers were also uncovered. Half of a representative cask was recovered and analyzed to determine the function of the casks uncovered at the wreck site. This cask was constructed from oak and measured 44.5 in (113.0 cm) in length and 30.0 in (76.2 cm) in diameter at the bilge. The staves measured 4.0 to 5.5 in (10.2 to 14.0 cm) in width. The head pieces ranged from 4.0 to 5.0 inches (10.2 to 12.7 cm) in width and had double-beveled cants which were inserted into a V-croze. Based on this information, along with pink stained wood cells, and information provided by George Pettengell, Master Cooper at Colonial Williamsburg, it was determined that this cask was the remains of a 125.0 gal. (568.26 liters) pipe/butt, typically used to haul red wine in the late eighteenth century. Upon further examination of this specimen, roman numerals made by a race knife were noted on the inside of the staves. These numerals were not in sequential order and probably identified replaced and reused staves (Krivor 1998:48-49).

Defence

According to Switzer (1998:182-193; 1978:41-44) casks were identified in several sections of the ship: the bow area; an area located aft of the bow storage; and an athwartship trench excavated forward of the main mast. Casks located in the bow were arranged on their sides, not their heads, and stacked in tiers. The casks were constructed with a varied amount of staves ca. 28.0 in (71.1 cm) in length and had a diameter of ca. 18.0 in (45.7 cm) at the head. Estimated to have contained nearly 32.0 gal. (145.47 liters) of provisions, they were identified as barrels. Bones inside several, both porcine and bovine, were the only clue to the original contents. The remaining had no contents, and were believed to have once contained either water or bread in the form of hardtack, since the ship's provision records stated that the *Defence* carried 50 barrels of meat and 20 casks of bread (Switzer 1978:41). All casks recovered from this area of the ship were bound by locking notch withy (wood hoops) and had their heads sealed with rush (Switzer 1998:190). Based on their dimensions and the knowledge that the headroom below decks was no more than 66.0 in (167.6 cm), Switzer concluded that they could have been stacked no higher than three barrels or three tiers (Switzer 1978:41).

These casks were found resting directly on ballast, and in between the casks and some of the ballast, laid split oak and birch dunnage billets. The billets were as long as the casks and were found to be chocked in place to prevent further movement. Wooden wedges, 15.0 in (38.1 cm) in length, were found jammed between the outermost casks and the hull ceiling planks to prevent the cargo from shifting even (Switzer 1978:41).

Several casks were identified aft of the bow storage, near the galley. These casks were smaller than those in the bow, although their dimensions were not available. Switzer (1978:41) believed these casks contained vinegar.

Additional casks were recovered from the midship hold. These appeared to have been either dismantled or at least were no longer intact, and dimensions were not available. This area also yielded a number of dunnage billets, loose staves, and barrel head pieces (Switzer 1978:41).

No markings were found on the barrels recovered from the bow. One of the several smaller casks recovered aft of the bow storage near the galley, had IV carved on its head. One head recovered from the midship hold was incised with "PORK 32 PIECES" and "E A FORD", and another oak head piece was inscribed with what appeared to be "722" (Switzer 1978:41). The buckets recovered (the number of which was unknown) were etched with graffiti in the form of symbols or initials on their base. One particular bucket was incised with initials and the date 1779. Many of the messkits (the number of which was unknown) were incised with the same initials found on the different buckets, pewter spoons, and ceramic mugs, which possibly indicated ownership. In addition to the buckets and messkits, one small intact firkin was recovered. The bottom head of the firkin was marked with a broad arrow and what appeared to be a crudely formed star (Switzer 1978:41-44).

Federal Period Vessel from Oriental, NC

Six cask head pieces representing six individual heads, three cask hoops, and 40 cask staves were recovered from the Federal Period Vessel located near Oriental, NC (Jackson 1991:180-205). Table 3.3 provides information concerning the dimensions, markings, and location where these specimens were found. Two specimens 18NUR30 and 18NUR185, 0.75 in (1.9 cm) in length, were identified as cask bungs. Specimen 18NUR30 had a diameter of 1.375 in (3.5 cm) and was faceted on many sides. The base (the inside end) was cut parallel to the head (the outside end). This particular artifact was recovered near the bow, nearly 15 ft (4.57 m) from the nearest cask fragment, found near the waist. Specimen 18NUR185 had a diameter of 1.00 in (2.5 cm). It was faceted on a few sides; the incomplete base appeared to have been rounded. This particular artifact was recovered near three staves near the back end of the waist of the ship, closer to the stern.

Specimen Number	Cask Component	Material	Length (in inches)	Width (in inches)	Thickness (in inches)	Distance from Croze to end (in inches)	Croze Widths (in inches)	Croze Depths (in inches)	Comments	Provenience
18NUR58	Cant head piece	Wood	5.375	1.625	0.3125	N/A	N/A	N/A	<ul style="list-style-type: none"> Charred interior One face of the curved edge was tapered to fit a croze 	Near the waist of the ship (ca. 28 ft from the bow)
18NUR67	Cant head piece	Wood	13.0	2.0	0.75	N/A	N/A	N/A	<ul style="list-style-type: none"> One face of the curved edge wastapered to fit a croze 	Near the waist of the ship (ca.27 ft from the bow)
18NUR108	Cant head piece	Wood	12.0	1.875	1.0	N/A	N/A	N/A	<ul style="list-style-type: none"> Curved surface in flat and did not taper to fit into a croze Appears to have been held in place by either liner hoops or Nails 	Near the bow of the ship (ca. 19 ft from the bow)
18NUR110	Cant head piece	Wood	10.5	3.75	0.50	N/A	N/A	N/A	<ul style="list-style-type: none"> Curved surface in flat and did not taper to fit into a croze 	Near the bow of the ship (ca. 18 ft from the bow)
18NUR119	Middle head piece	Wood	28.0	5.625	0.75	N/A	N/A	N/A	<ul style="list-style-type: none"> Contains a bevel to fit into a croze 	Near the bow of the ship (ca. 18 ft from the bow)
18NUR137	Cant head piece	Wood	5.0	1.75	0.313	N/A	N/A	N/A	<ul style="list-style-type: none"> Curved surface in flat and did not taper to fit into a croze 	Near the bow of the ship (ca. 14 ft from the bow)
18NUR104	Cask hoop/ withy	Wood/ hickory	36.0	N/A	1.0	N/A	N/A	N/A	<ul style="list-style-type: none"> Constructed from hoop poles and lack bark 	Near the waist of the ship (ca.27 ft from the bow)
18NUR105	Cask hoop/ withy	Wood/ hickory	17.0	N/A	1.0	N/A	N/A	N/A	<ul style="list-style-type: none"> Constructed from hoop poles and lack bark 	Near the waist of the ship (ca.27 ft from the bow)
18NUR146	Cask hoop/withy	Wood	N/A	N/A	N/A	N/A	N/A	N/A	<ul style="list-style-type: none"> Possible example of a overlapped lashed end hoop 	N/A
18NUR45	Cask Stave	Wood	37.25	2.75	0.563	N/A	N/A	N/A	None	N/A
18NUR46	Cask Stave	Wood	41.0	3.50	.075	2.0 1.75	0.188 0.188	0.125 0.063	None	N/A
18NUR47	Cask Stave	Wood	38.875	2.625	0.625	1.75 -	0.188 -	0.125 0.125	None	N/A
18NUR48	Cask Stave	Wood	41.438	3.0	0.625	2.063 1.1.625	0.125 0.188	0.125 0.125	None	N/A
18NUR49	Cask Stave	Wood	38.75	2.25	0.625	1.75 -	0.25 -	0.188 0.188	None	N/A
18NUR50	Cask Stave	Wood	38.75	3.25	0.563	1.75 -	0.188 -	0.125 0.125	None	N/A
18NUR51	Cask Stave	Wood	41.313	3.375	0.625	2.125 1.125	0.188 0.188	0.125 0.125	None	N/A
18NUR52/72	Cask Stave	Wood	37.125	2.875	0.625	None -	- -	- 0.125	None	N/A
18NUR53/71	Cask Stave	Wood	39.375	2.813	0.625	1.75 -	0.188 -	0.188 0.125	None	N/A
18NUR54	Cask Stave	Wood	N/A	N/A	N/A	1.563 -	0.188 -	0.125 -	None	N/A

TABLE 3.3. Cask material recovered from a Federal Period vessel from Oriental, NC (Jackson 1991).

Specimen Number	Cask Component	Material	Length (in inches)	Width (in inches)	Thickness (in inches)	Distance from Croze to end (in inches)	Croze Widths (in inches)	Croze Depths (in inches)	Comments	Provenience
18NUR55	Cask Stave	Wood	N/A	N/A	N/A	N/A	N/A	N/A	None	N/A
18NUR56	Cask Stave	Wood	N/A	N/A	N/A	N/A	N/A	0.188 -	None	N/A
18NUR57	Cask Stave	Wood	N/A	N/A	N/A	N/A	N/A	0.25 -	None	N/A
18NUR80	Cask Stave	Wood	32.125	2.875	0.75	1.75 -	0.188 -	0.188 -	None	N/A
18NUR96	Cask Stave	Wood	41.25	3.375	0.75	2.0 2.0	0.188 0.188	0.125 0.125	None	N/A
18NUR97	Cask Stave	Wood	38.75	2.75	0.75	1.875 -	0.25 -	0.125 0.125	None	N/A
18NUR98	Cask Stave	Wood	37.125	2.875	0.75	N/A	N/A	0.125 0.125	None	N/A
18NUR99	Cask Stave	Wood	38.50	2.75	0.50	1.75 -	0.188 -	0.188 -	None	N/A
18NUR100	Cask Stave	Wood	41.25	3.25	0.50	2.063 2.125	0.188 0.188	0.125 0.125	None	N/A
18NUR103/224	Cask Stave	Wood	38.0	2.438	0.75	1.625 -	0.188 -	0.125 -	None	N/A
18NUR120	Cask Stave	Wood	11.25	2.50	0.625	N/A	N/A	0.125 -	None	N/A
18NUR127	Cask Stave	Wood	41.125	3.188	0.688	1.938 2.0	0.125 0.188	0.063 0.125	None	N/A
18NUR136	Cask Stave	Wood	35.50	2.625	0.75	2.625 2.938	0.125 0.125	0.125 0.125	None	N/A
18NUR139	Cask Stave	Wood	38.50	2.75	0.75	1.625 -	0.188 -	0.188 0.125	None	N/A
18NUR140	Cask Stave	Wood	38.50	2.75	0.625	1.875 -	0.25 -	0.125 -	None	N/A
18NUR157	Cask Stave	Wood	12.75	3.0	0.50	1.75 -	0.188 -	0.188 -	None	N/A
18NUR174	Cask Stave	Wood	41.188	3.063	0.625	2.125 2	0.125 0.125	0.063 0.063	None	N/A
18NUR175	Cask Stave	Wood	38.625	2.75	0.625	1.75 -	0.188 -	0.188 0.125	None	N/A
18NUR176	Cask Stave	Wood	38.50	2.75	0.438	1.625 -	0.188 -	0.125 0.125	None	N/A
18NUR194	Cask Stave	Wood	41.0	3.50	0.625	2.0 2.0	0.125 0.188	0.125 0.125	None	N/A
18NUR195	Cask Stave	Wood	41.25	4.063	0.75	2.125 1.75	0.125 0.188	0.063 0.125	None	N/A
18NUR219	Cask Stave	Wood	38.50	2.875	0.625	1.625 -	0.313 -	0.125 0.125	None	N/A
18NUR220	Cask Stave	Wood	37.0	2.50	0.625	N/A	N/A	0.125 -	None	N/A
18NUR221	Cask Stave	Wood	41.25	3.25	0.75	2.0 2.063	0.125 0.125	0.125 0.125	None	N/A
18NUR222	Cask Stave	Wood	41.0	3.125	0.75	1.813 2.0	0.125 0.188	0.125 0.125	None	N/A
18NUR225	Cask Stave	Wood	40.0	2.75	0.75	1.625 1.813	0.188 0.25	0.125 0.188	None	N/A
18NUR226	Cask Stave	Wood	41.188	3.25	0.75	1.938 2.063	0.188 0.188	0.125 0.125	None	N/A
18NUR227	Cask Stave	Wood	41.0	3.313	0.75	1.875 1.938	0.188 0.188	0.125 0.188	None	N/A
18NUR303	Cask Stave	Wood	N/A	2.375	N/A	N/A	N/A	N/A	None	N/A
18NUR360	Cask Stave	Wood	N/A	N/A	N/A	N/A	N/A	0.125	None	N/A

Henrietta Marie

Eighteen staves, four cask hoops, and three cask head pieces were recovered from *Henrietta Marie*. Although it was almost certain that these artifacts have been further documented, this information was unavailable. Unfortunately, this was all that can be said about the cask material recovered from this shipwreck (Moore 1989:181).

HMS Charon

Many cask components, including staves, heads, bungs, withy, and the corroded remnants of iron hoops, were found overlaying ballast in many areas of the *Charon* wreck. It was unclear whether they were collected or examined in situ. The exact dimensions as well as the number of casks or cask components were not reported. All casks were stowed athwartships. Due to the absence of bones or any other contents indicators and the length of the staves, the casks were believed to be water casks (Steffy 1981:120).

HMS DeBraak

The formal study of cask material recovered from *DeBraak* was not available. Shackelford at one time analyzed a portion of the material, and in 1992 published “*DeBraak, The New Cooperage*” available only at the Colonial Williamsburg Foundation, Williamsburg, VA. This publication was requested but not found by the Colonial Williamsburg Foundation, and was therefore unavailable. Shackelford (1996:N-10) mentioned this material in comparison to the material recovered from *Betsy*, as he

noted that the interior of many staves recovered from *DeBraak* were left un-shaped. Although Shackelford assessed the material, analyzed a portion, and published his work, the author had learned through communication with Delaware State Archaeologist, Chuck Fithian that all material was not analyzed and that only a minimal amount of data were produced on this assemblage.

HMS *Fowey*

According to Skowronek and Fischer (1984:33), “a partially intact cask, barrel hoops, and strap fragments litter the east end of the Legare Anchorage ship and can be found in lesser quantities both north and south in the core grid.” The majority of the hoops were constructed from iron, although three copper hoops and various fragments were also identified. The iron hoops averaged ca. 3.0 in (8 cm) in width and were up to 2.1 ft (62.0 cm) in diameter. The copper fragments averaged 1.0 in (2.5 cm) in width and ca. 16.0 in (40.0 cm) in diameter. The copper hoops had a broad arrow incised into them on their interior surface, adjacent to the rivet. All ends were overlapped and bound by a single copper rivet. Specific information pertaining to individual hoop or cask fragments recovered from HMS *Fowey* was not available. Dimensions were only provided as an average, and their locations were said to be consistent with eighteenth-century stowage practices (e.g. ship’s stores located near the mainmast and powder stores located at the stern). Several wooden cask pieces were identified (based on several test unit drawings), but the dimensions were unavailable (Skowronek and Fischer 1984:33).

HMS *Invincible*

Several different staved containers were recovered from HMS *Invincible*, including nine oak staved buckets, 12 to 15 collapsed oak “powder barrels”, four “spirit barrels”, and 21 “miniature barrels”. Each bucket measured ca. 7.92 in (20.1 cm) in height with a base diameter of 13.56 in (34.4 cm). They were bound by three nailed hazel hoops on the head and bottom, and had large broad arrows, indicative of belonging to the Royal Navy, scratched into their bases. Some still retained their original rope handles between the two handle staves (Bingeman 1982; Bingeman 1985:195; Bingeman 1998).

The collapsed “powder barrels” measured 19.8 in (50.3 cm) in height and 13.8 in (35.1 cm) in diameter at the base. According to Bingeman (1985:195) each powder barrel was bound with seven hazel hoops and two copper hoops on each end. The copper hoops appeared to have reacted with the gun powder, creating a brittle purple oxide (Bingeman 1985:195). Two different markings, “IGC” and “PGC”, with a 0.84 in (2.1 cm) broad arrow located on the opposite ends of the mark, were branded into numerous staves. Bingeman noted a total of fifty complete “powder barrels” were recovered by 1998, but measurements and provenience were not provided (1998:174).

Bound by four or five hazel hoops, the four “spirit barrels” measured 11.4 in (29.0 cm) in height. Their diameter was not available, but Bingeman (1985:197) stated that their capacity was approximately one gallon. Markings, “ID” on the side and “PD” with an “X” with dots within the angles that make up an X on the base, were identified on one barrel.

Twenty-one “miniature barrels” recovered from the orlop deck contained a black substance. Originally believed to have been gunpowder, further examination and analysis found it was a substance comprised of carbon and iron with a trace of gallic acid (Bingeman 1982: 155), or ink. Consequently, the “miniature barrels” were concluded to have been writing kits. Bingeman (1985:197; 1998:175; 1982:155) did not provide the dimensions; but a photograph in his published works indicated they were ca. 8.64 in (21.9 cm) in length and ca. 1.56 in (4.0 cm) in diameter at each end. Additionally, there appeared to be two different variants. One was bound by a single wooden hoop on each end, while the other was bound by two wooden hoops, with ca. 1.56 in (4.0 cm) between the two, on each end. The one bound by two hoops also had a slightly larger bilge diameter (Bingeman 1985:197).

HMS Sirius

Many casks were identified near the stern and bow of HMS *Sirius*. Those unearthed near the stern contained bones, the remnants of salted pork. These casks were inscribed with “J. BASSET, J. WELLER” and the letters “SP” indicated salted pork (Von Arnim 1998). Those found near the bow, were empty, but were surrounded by remnants of iron hoops. They were assumed to be the remnants of water casks. Twisted copper hoops were also found throughout the wreck: these were probably associated with gunpowder casks that exploded when the ship was set on fire. The exact dimensions, numbers, and more specifics concerning the location of casks were unavailable.

La Belle

A total of 80 individual casks were identified on the wreck of *La Belle*. Most were intact or partially intact with contents in situ: 12 casks for dry goods and trade goods; 12 casks for liquids; seven tar, resin or tallow casks; 12 powder casks; 32 shot casks; and five casks of unknown function (Bruseth and Turner 2005:83-86). The majority were constructed from white oak staves, although some were of beech and willow, and their hoops were made of split willow and chestnut branches, with the exception to iron hoops binding larger casks. Fifty-four casks were excavated from the main hold. Of the 54 casks recovered from the main hold: 10 were found to be empty (most likely having once contained liquids); 12 contained dry goods and trade goods; four contained tar, resin and tallow; and 26 contained shot. Two casks were recovered but the contents were unknown. The aft hold yielded 25 casks. One was empty (most likely having once contained liquid), three contained tar, resin and tallow, six contained shot, 13 contained powder, and two were recovered with unknown contents. A single water cask was recovered from the bow near Individual Two, one of several individuals recovered from the shipwreck (Bruseth and Turner 2005:83-86).

Meide (1197:135-141) provided further information concerning the general description of the cask components. Each cask was composed of 15 to 20 staves held together by 8 to 24 wooden hoops. The wooden hoops were split, with unmodified edges, and were divided into two groups; with one at either end of the cask (e.g. a cask with 24 hoops would have 12 hoops at the head and 12 at the bottom). The wooden hoops were not notched, but rather lashed together by a wickerlike rush binding. The

hoops averaged 1.1 in (2.7 cm) in width, narrowing to 0.6 in (1.5 cm) at the joints (Meide 1997:137).

The staves, depending on the cask size, varied in length, ranging from ca. 7.9 to 39.4 in (20.0 to 100.0 cm). Croze grooves were present at both ends of a stave, with one specimen having a double groove. The stave joints were typically beveled towards the interior. Bung holes and bungs were also recovered, identifying several casks as tight casks. Several bung shapes were identified, ranging from long, narrow plugs with tapered sides to nearly flat, tapered discs. Sample holes were also identified among the cask material, several of which were plugged with small narrow pegs. Cask heads identified among the *La Belle* wreck were comprised of one to six head pieces, held together by some unknown means, as there was no evidence of head reinforcements or dowels (Meide 1997:137).

Many different markings were also seen on the outer surfaces of both head pieces and staves. What appeared to be a number "5", the letters "DIS" on the booge of one cask, and many other circular marks were found. Circular designs located on each head (top and bottom) were identified on nearly every gunpowder cask (Meide 1997:138).

The smallest cask, a wine cask identified by purplish stains on its interior, was found in the bow, adjacent to Individual Two. This particular cask was ca. 7.5 in (19.0 cm) in length and 4.3 in (11.0 cm) in diameter at the head. The head was comprised of one piece and a disclike shaped bung was found in the bung hole.

The shot casks had lead shot ranging in size from birdshot through musket balls to swivel-gun shot. These were relatively small due to the weight of the shot. On average,

a shot cask was comprised of staves nearly 13.8 in (35.0 cm) in length and 2.4-3.9 in (6.0-10.0 cm) wide. The head diameter was ca. 7.1 in (18.0 cm), with several heads comprised of two pieces and others of a single piece. Several shot casks contained bung holes and bungs on the head, limiting the use and therefore identification of head reinforcements. Shot casks were identified not only by their contents, or the dimple impressions on the interior of the staves, but also by their unique hooping. This consisted of four sets of paired wooden hoops spread evenly across the cask. Typically shot casks were stored in rows athwartship, but some were used to fill empty spaces between larger casks, maximizing storage efficiency (Meide 1997:138-139).

Most gunpowder casks on *La Belle*, were found partially crushed and deformed, as a result of the wrecking process. Gunpowder casks varied in size, with their staves ranging from 15.7-21.7 in (40.0-55.0 cm) in length and 11.8-15.7 in (30.0-40.0 cm) wide. All were bound by two sets of eight hoops at either end of the cask, and as previously discussed, were marked with circular designs on their heads (Meide 1997:139).

The large *tonneaux* used to store trade goods and tools stood nearly 27.6 in (70 cm) tall and were nearly 19.7 in (50 cm) in diameter at the head and nearly 23.6 in (60 cm) at the bilge. The staves were bound by 20-26 wood hoops arranged in two sets. No bungs, bung holes, or bung staves were found associated with this particular cask type. These casks transported iron goods, as many of them were found to be heavily concreted on the interior (Meide 1997:139).

The *barriques* identified on *La Belle* were bound by at least four iron hoops. Typically these casks were nearly a meter in length and nearly 23.6 in (60.0 cm) in

diameter at the head and 26.0 in (66.0 cm) across the bilge. The barriques consisted of 19 staves, including one bung stave, and five head pieces at each end. These casks were all found empty, but were assumed to have contained liquids (e.g. water, or meat in a brine solution) (Meide 1997:140).

In addition to recovering cask material, a cooper's long joiner plane was also recovered from *La Belle*. This tool was used for stave construction and was found in the pump well, along with several staves and head pieces. Typically the ship's carpenter was responsible for maintaining the pump and any necessary cask repairs onboard the ship. As a result, one may infer that he had used the area as his personal storage space (Meide 1997:140).

Le Machault

Seven-hundred-seventy-nine staved container elements were found on the French privateer, *Le Machault*. From this extensive collection archaeologists found that six types of closed containers, four types of open ones, and the remnants of a cargo crate were represented. Almost all container heads and staves were white oak (*Quercus* sp.) with a few examples of beech (*Fagus* sp.). The hoops were typically fashioned from alder (*Alnus* sp.), chestnut (*Castanea* sp.) and beech (*Fagus* sp.); and were lashed together using willow (*Salix* sp.). One container was bound by iron hoops, and two containers were bound by wooden hoops nailed to the staves using iron nails (Bradley 1983:1). Several cooper's tools were recovered from *Le Machault*. These included a cooper's adze, an axe head used to trim staves and heads, a cooper's compass plane, head saw cheek fragment, and a cooper's jointer plane iron used to smooth stave and head joints (Ross 1981:69). Table 3.4 presents all information available concerning this assemblage.

Type of Container	Minimum Number of Individual Containers	Capacity	Contents	Material	Length (in inches)	Number of Staves	Number of Head Pieces	Stave and Head Thickness (in inches)	Head Diameter (in inches)	Number of Hoops	Completeness	Markings	Comments	Provenience
Small shot keg (2M99A4-39)	1	6.87 liters or 1.51 Imperial gallons	N/A	N/A	N/A	12	Two two-piece heads	N/A	N/A	▪ 24 hoop and hoop fragments	Complete	• Incised semi-circle or arc consisting of two lines extending across the two cants on one head	• Staves were split and adzed • Two trough-shaped croze grooves • Two well defined chivs • Four sets of double hoop stains • 16 small cavities present with iron staining (nail/fastener holes for hoops)	Forward port side of wreck
Small shot keg (2MA2A2-29)	1	7.10 liters or 1.56 Imperial gallons	N/A	N/A	N/A	10	Two three-piece heads (sheadper still in centerpiece bung hole)	N/A	N/A	• Two complete hoops with portions of six others	Complete	• N/A	• Shallow chivs • Four pronounced sets of two hoops marks • Six hoop fastening holes with three Nails still intact • Heads manufactured with an adze	Forward port side of wreck
Partial Small Shot Keg (2M99A2-75-1974-2M)	1	N/A	N/A	Oak	N/A	2	One cant and one cant fragment	N/A	N/A	• N/A	N/A	• N/A	• N/A	Forward port side of wreck
Partial Small Shot Keg (2M99A2/76-4817-2M))	1	N/A	N/A	N/A	N/A	7	2	N/A	N/A	• N/A	N/A	• N/A	• N/A	Forward port side of wreck
Miscellaneous Small Shot Keg Components	N/A	N/A	N/A	N/A	N/A	24 and 32 stave fragments	17 cants Nine cant fragments 10 center pieces(five with access holes) two center piece fragments	N/A	N/A	• N/A	N/A	• N/A	• N/A	N/A
Salt Pork Cask (75-3521-2M)	1	Quintal cask (capable of holding a hundred-weight of its contents) 23.86 liters or 5.25 Imperial Gallons	Fatty residue adhering to interior surfaces (pork)	Oak	N/A	12 case staves One bung stave	One four-piece head (with two cants and two middle pieces) one cant	N/A	11.0	• N/A	Mostly complete (lacking at least one cant and two middle pieces)	• An incised line on the exterior surface of the head (completes an arc that incorporates all head pieces)	• Split and adzed staves with the exterior surface shaved • Joints and chimes were planed with chivs added • Bung (made from a single piece of wood 1.2 in in diameter on outside decreasing to 1.0 in on the inside) and bung gasket in bung stave	N/A
Musket Shot Cask (2M99A5-690)	1	Baril-sized container (20.97 liters or 4.61 Imperial gallons)	N/A	Oak	N/A	Six And two case staves	One three-piece head, seven cants, and three center pieces	N/A	N/A	• 10 hoop fragments (with evidence of 14 wooden hoops oriented in two groups of seven at both ends) • Hoops were split, notched and bound with willow	N/A	• N/A	• V-shaped croze groove • Sharp chimes • Two pronounced chivs	N/A
Nail keg (76-4811-2M)	1	81.91 liters or 18.0 Imperial gallons	Nails	Oak	23.0 - 23.2	10 An additional seven staves found nearby may belong to this cask	N/A	N/A	N/A	• Five hoop fragments	N/A	• "COAN" etched down one end of a stave in a sideways orientation (makers or merchant mark?) • "8b" incised across two stave in booge area • "XX" incised across the same two staves towards one end	• One oak reinforcing bar (17.5 in in length and 3.4 in wide) • "Multiple indentations on the interior stave body consisting of straight and long, as well as circular impressions, coupled with metallic staining, sugges the kep	N/A

Type of Container	Minimum Number of Individual Containers	Capacity	Contents	Material	Length (in inches)	Number of Staves	Number of Head Pieces	Stave and Head Thickness (in inches)	Head Diameter (in inches)	Number of Hoops	Completeness	Markings	Comments	Provenience
												<p>(possible assembly marks)</p> <ul style="list-style-type: none"> • Three straight lines incised on one end of "VI" • Two incised straight line (one on each side of the booge) extending across the staves) • Associated staves have "8b" on booge area and XI on one end 	<p>contained a shipment of Nails."</p> <ul style="list-style-type: none"> • Croze groove length of 20.8 in • Light croze grooves with shallow chivs (nearly non-existent) • Hoop fastening holes indicated use as a dry cask 	
Quart Cask (75-1789-2M)	1	Quart Capacity (81.83 liters or 18.0 Impreial Gallons)	N/A	Oak	26.4 – 27.5	Nine staves one with a possible bung stave	One four-piece head (comprised of two cants and two middle pieces)	N/A	N/A	• N/A	N/A	<ul style="list-style-type: none"> • Rope burn of one end of stave • "XIX" incised on booge area in sideways orientation • Partial circle inscribed with dividers in a heart shape located on a second stave 	<ul style="list-style-type: none"> • Average croze groove length of 24.8 in • Adze marks on interior surface of staves 	N/A
Quart Cask (75-1790-2M)	1	85.31 liters or 18.77 Impreial Gallons	N/A	Oak	27.3 - 27.8	11 staves and fragments (with one bung stave)	One middle piece	N/A	N/A	• N/A	N/A	<ul style="list-style-type: none"> • "XIX" incised on booge area in sideways orientation • "IX" incised in a sideways orientation on booge of another stave • "B" incised across booge of two staves • Geometric design consisting of two interlocking circles incised in booge area across bung stave just to the side of the bung hole • "Y" incised across one end of the bung stave 	<ul style="list-style-type: none"> • 1.1 in bung hole with two circular peg holes at each end of bung stave 	N/A
Quart Cask fragments	N/A	N/A	N/A	N/A	N/A	29 staves and one bung stave fragment	12 middle pieces and 41 cants	N/A	Middle pieces range in length from 15.0 – 17.7	• N/A	N/A	<ul style="list-style-type: none"> • Three middle pieces contained incised marks • "LR" incised on two middle pieces with "BM" with the M incised over the B detected on two or possibly three middle pieces • Marks noted on only two cants • Cant 2114A1-37 contained the LR and a portion of the HI marks • Cant 78-4865-2M contained the "LR" marks • Additionally a small fragment of a middle piece, a very heavily weathered fragment of a second middle piec, and a badly burned cask component 	<ul style="list-style-type: none"> • Four middle pieces contained tap hole with cork plug still in two • Another contained a large elliptical-shaped hole and lug in the central section (unknown function) • Another contained an additional circular hole oriented towards the other end • Cant 2M16D1-1 was reworked from a large stave end and contains a large croze groove on the interior sruface 	N/A

Type of Container	Minimum Number of Individual Containers	Capacity	Contents	Material	Length (in inches)	Number of Staves	Number of Head Pieces	Stave and Head Thickness (in inches)	Head Diameter (in inches)	Number of Hoops	Completeness	Markings	Comments	Provenience
												<ul style="list-style-type: none"> fragment also contain marks of "LR" and "BM" The fractured middle piece contained incised block lettering The other middle piece contained [B] MONE[Y] and {liter}HOLMS (both which could represent the Names B. MONEY and liter. HOLMES) 		
Barrique Cask (75-1798-2M)	1	N/A	N/A	N/A	35.0 – 36.6	Eight case staves	N/A	N/A	N/A	<ul style="list-style-type: none"> Hoop marks from wooden hoops at both ends but no hoops remain 	N/A	<ul style="list-style-type: none"> Incised slash "γ" across one end of one stave An incised circle with interior center point and a set of divider marks on another in the boog area oriented towards on edge 	<ul style="list-style-type: none"> Croze grooves between 30.7 – 31.6 in Sharp chimes Well defined square croze grooves Two very pronounced chivs One stave contained three head reinforcing peg holes (two at one end and one at the other) Another stave contained one large sample hole in the booge area 	N/A
Barrique Cask (75-5918-2M)	1	Barrique (?) (236.4 liters or 52 Imperial Gallons)	N/A	Oak	25.5 -38.9 (for fragments with estimated length of 39.4 - 41.3 if complete)	18 fragmented staves with one bung stave	N/A	N/A	N/A	<ul style="list-style-type: none"> N/A 	N/A	<ul style="list-style-type: none"> Two heavily incised circles with incised dividers on one stave "R" incised on booge area of another stave in an upright orientation 	<ul style="list-style-type: none"> Staves were moderately weathered Interior of staves were split, adzed, and shaved Flat shallow chimes with a pronounced croze groove and chivs 4.5 circular cavities were noted on the intact ends (probably from head reinforcements) One circular sample peg hole in booge area of one stave 	
Bidon	2	N/A	N/A	N/A	8.9 with the spout length of 3.8	N/A	One piece lid/head	N/A	5.5	<ul style="list-style-type: none"> N/A 	N/A	N/A	<ul style="list-style-type: none"> Spout diameter of 0.6 in Lid contained a sharp bite and two distinct bevels with the interior one more pronounced Large cavity in lid measured 1.5 x 1.8 in Two smaller holes in lid (most likely for rope or strap to carry) measured 0.5 in each 	N/A
Bucket	1	N/A	N/A	Oak	6.8 – 6.9	4 and 3 fragments	One cant (6.5 in in length and 1.3 in in width)	N/A	N/A	<ul style="list-style-type: none"> N/A 	N/A	N/A	<ul style="list-style-type: none"> Croze groove measuring 5.9 to 6.0 in All staves contain a chim, a large square croze goove and no chivs 	N/A
Bucket	2	N/A	N/A	N/A	7.6 – 8.9 Handle stave was 12.0	3 staves and a handle stave	Five possible cant pieces (0.5 to 0.75 percent of the head)	N/A	N/A	<ul style="list-style-type: none"> N/A 	N/A	N/A	<ul style="list-style-type: none"> All staves contained a shallow gradual chime with exception to the handle stave No chivs present The handle stave consisted of a regular bucket stave with an 	N/A

Type of Container	Minimum Number of Individual Containers	Capacity	Contents	Material	Length (in inches)	Number of Staves	Number of Head Pieces	Stave and Head Thickness (in inches)	Head Diameter (in inches)	Number of Hoops	Completeness	Markings	Comments	Provenience
													extension that terminated at the head in a rounded shoulder with a circular cavity (1.3 in in diameter)	
Tub Stave (75-995-2M)	1	N/A	N/A	N/A	9.9	1	N/A	N/A	N/A	• N/A	N/A	N/A	• Croze groove length of 8.9 in	N/A
Tub Stave (2M99A5-561)	1	N/A	N/A	N/A	14.1	1	N/A	N/A	N/A	• N/A	N/A	N/A	• Croze groove length of 13.2 in • Shallow chime • Wide square croze groove • No chiv	N/A
Tub Stave (2M402-75-1738-2M)	1	N/A	N/A	N/A	14.0	1	N/A	N/A	N/A	• N/A	N/A	N/A	• Croze groove length of 11.5 in • Large chime • Deep narrow square croze groove • Well defined chiv • Two circular conical-shaped head reinforcing peg holes present below the croze groove	N/A
Tub Stave (77-2612-2M)	1	N/A	N/A	N/A	17.0	1	N/A	N/A	N/A	• N/A	N/A	N/A	• Croze groove length of 15.4 in • Well defined chiv • Large square croze groove • Tool marks present at croze groove (plane marks and saw marks)	N/A
Large Open-Ended Container	1	N/A	N/A	Oak	37.1 – 37.7	10	N/A	N/A	N/A	• Staining from six to seven iron bands present on exterior of staves (none present) • Two at each end • Two on one side of the booge and at least one on the other	N/A	N/A	• Croze groove length of 35.9 to 36.2 in • Large chime • Large croze groove • Pronounced chiv • One small circular sample hole on one stave oriented towards the open end • Square hole of unknown function located on another stave oriented towards open end	N/A
Miscellaneous Stave Container Components	N/A	N/A	N/A	N/A	N/A	31	21 Center pieces 14 Middle pieces 24 Middle piece fragments Six cant pieces 22 Cant fragments	N/A	N/A	• 138 hoop fragments	N/A	N/A	• Three reinforcing bars • One reinforcing bar fragment • Nine bungs • Five plugs • 144 unidentified fragments	N/A
Head Center Piece	N/A	Possible churn lid or large serving decanter	N/A	N/A	N/A	N/A	One Center piece	0.6 in thick	8.2 in in length and 7.2 in in width	• N/A	N/A	N/A	• Contained 35 square fastener holes • Moderately weathered with one side no longer intact • Large circular cavity through its surface (1.7 in in diameter)	N/A
Cant Preform (2M99A5-646)	N/A	N/A	N/A	N/A	N/A	N/A	One Cant preform	N/A	N/A	N/A	N/A	N/A	• Edge bevel on one face was marked out or shaped with an adze then planed	N/A

Type of Container	Minimum Number of Individual Containers	Capacity	Contents	Material	Length (in inches)	Number of Staves	Number of Head Pieces	Stave and Head Thickness (in inches)	Head Diameter (in inches)	Number of Hoops	Completeness	Markings	Comments	Provenience
Crate Component (2MSC2-245)	N/A	N/A	N/A	White Oak	51.4 in length and 21.1 in width	1 sawn plank	N/A	8.7 in	N/A	Ghosts of two reinforcing iron straps present	N/A	N/A	N/A	N/A

Lossen

One hundred cask head pieces and 120 casks were found on the shipwreck. The staves measured between 55.5 in (141 cm) and 86.6 in (220.0 cm) (Molaug 1998:164). Several casks were inscribed with the year, the name "LAASEN", and an inscribed cooper's name or mark. Other marks, none of which were discussed in publications, were present. At least one cask was believed to have held water, while many others were thought to hold provisions, as many faunal remains were found scattered throughout the wreck site. One complete beech wood cask contained butter. Although Molaug describes this cask as a barrel, it was most likely that it was a firkin as according to historical shipping documents, this was the typical cask used for such purposes (Molaug 1988:166). Numerous mess trays, wooden pots, and buckets were also recovered, although the number and dimensions were not available. Although a large amount of cask material was found on this shipwreck, very little information concerning the material was published or was available.

Mary Rose

Nearly 3,800 cask components, possibly representing 120 to 150 individual casks, were recovered from the *Mary Rose*. Only 33 were examined in detail, 19 of which were examined by Rodrigues as part of her MA thesis and the other 14 were examined for her chapter in the publication of *Before the Mast: Life and Death Aboard the Mary Rose* (Rodrigues 2005) (Table 3.5). Casks sampled strictly for the publication were chosen because they contained identifiable contents or were mostly complete, creating an overall sampling bias (Rodrigues 2005:409-421).

One gunpowder cask, four casks containing pitch and tar, one cask that stored tompions, one candle cask, one tallow cask, at least seven beef casks (of which four were examined in detail), one fish cask, one fruit or wine cask, one, possibly two, pork casks, and one cask believed to have contained wooden plates and bowls were recovered. Casks which contained nothing but silt were assumed to have contained liquid (e.g. water, beer, or wine) or perishable provisions such as biscuit flour. No evidence of coopering onboard *Mary Rose*, was found, as no coopering tools were found. This comes as no surprise as she was sent to sea with the sole intention of engaging in battle and returning within a few days (Rodrigues 2005:410-419).

Casks were recovered from the hold, orlop deck and the sterncastle. The forward hold contained gunpowder casks, as well as pitch and tar casks. The mid-hold area yielded a surprisingly small number of casks, ca. six small and medium sized casks, considering it was the ship's galley. The aft hold yielded a mixture of small, medium and large sized casks. Casks recovered from the hold were probably stowed bung up and

bilge free or using the vertical method of stowing, as the casks were recovered horizontally and vertically. The majority of the casks containing victuals was recovered from the Orlop deck, as well as casks containing stores, such as candles, tompions, and possibly tallow. Casks were also recovered from the Main and Upper decks, as well as the Sterncastle. Based on the location, it was believed that the cask of pork recovered from the sterncastle was being prepared for eating by steeping the pork in water rather than brine (Rodrigues 2005:420-421; Weddle 2001:148).

In general, most casks were stored admidship on each deck, probably a method of stowage to maintain the vessel's balance and stabilization. The Hold yielded casks containing ship goods and armament. The Orlop deck yielded casks for victuals, as did the Main and Upper decks. The latter were more likely to contain perishable provisions. Unlike many other shipwrecks examined in this study, the casks found on *Mary Rose* lacked overall organization and appeared to have been stored wherever there was room (Rodrigues 2005:420-421).

TABLE 3.5. Cask material recovered from <i>Mary Rose</i> (Kilby 1982 and Rodrigues 2005).								
Specimen Number	Cask Type or Size	Material	Stave and Head Thickness (in inches)	Completeness	Markings	Cask Contents	Comments	Provenience
81A1169	13.51 gallons	Wood	Stave: 0.28 – 0.47 Head: 0.28 – 0.47	<ul style="list-style-type: none"> ▪ Three-piece heads attached by dowels ▪ 12 staves ▪ Hoops around chime, quarter and bilge 	<ul style="list-style-type: none"> ▪ Brand mark on head exterior: circle and X- like mark ▪ Incised lines “/x/” on the center head piece 	Gunpowder	<ul style="list-style-type: none"> ▪ No vent holes or any holes on either head ▪ A mix of at least two casks represented ▪ Sap along 1 side of the staves (unusual) ▪ Head beveled periphery very regular 	Forward Hold
81A0361; 81A0497	35.52 gallons	Wood	Stave: 0.24 – 0.47 Head: 0.47 – 0.63	<ul style="list-style-type: none"> ▪ Three-piece heads attached by dowels ▪ 18 staves ▪ Two or three hoops around chime and bilge ▪ Two treenails inserted at edge of hoop impressions, possibly to hold the hoops in place 	<ul style="list-style-type: none"> ▪ None 	Tampions	<ul style="list-style-type: none"> ▪ Bilge hoops possibly held in place by wooden pegs ▪ Sap along 1 side of the staves (unusual) ▪ Interior of cask was very smooth while the exterior had suffered from wear and tear, especially around the bilge area 	Near the Bow of the Orlop deck
81A2106	11.39 gallons	Wood	Stave: 0.28 – 0.39 Head: 0.55 – 0.71	<ul style="list-style-type: none"> ▪ Three-piece heads attached by dowels ▪ One vent hole on one cant ▪ 12 case staves and one bung stave 	<ul style="list-style-type: none"> ▪ Three race lines on one cant exterior 	Candles	<ul style="list-style-type: none"> ▪ The Bung was near the end of the stave rather than the center ▪ Hoop impressions were clear around the chimes but nowhere else 	Aft Hold and Near the stern of the Orlop deck
81A1017	4.45 gallons	Wood	Stave: 0.31 – 0.43 Head: 0.59 – 0.71	<ul style="list-style-type: none"> ▪ Possibly a two-piece head ▪ Six to seven staves and stave fragments ▪ Two to three hoops around chime, quarter and bilge 	<ul style="list-style-type: none"> ▪ None 	Tallow?	<ul style="list-style-type: none"> ▪ Hoops were made of wood 	Near the stern of the Orlop deck
81A2610; 81A2702	30.83 gallons	Wood	Stave: 0.31 – 0.47 Head: 0.55 – 0.63	<ul style="list-style-type: none"> ▪ One four-piece head and one three-piece head attached by dowels and have a vent hole ▪ 12 staves 	<ul style="list-style-type: none"> ▪ Incised lines on middle head piece ▪ Race marks on a cant exterior ▪ Incised lines with “cccX\” on stave exterior and incised line and crosses mostly across stave edges 	Beef	<ul style="list-style-type: none"> ▪ Sap along the joints of headpieces and along the side of one stave ▪ Sampling hole on staves ▪ Chime and bilge hoop impressions were visible ▪ 81A2610/8 had a sampling hole 	Amidship in the Orlop deck

TABLE 3.5. Cask material recovered from <i>Mary Rose</i> (Kilby 1982 and Rodrigues 2005).								
Specimen Number	Cask Type or Size	Material	Stave and Head Thickness (in inches)	Completeness	Markings	Cask Contents	Comments	Provenience
81A2872; 81A2891; 81A2916	32.69 gallons	Wood	Stave:0.31 – 0.47 Head: 0.59 – 0.63	<ul style="list-style-type: none"> ▪ Three-piece heads attached by dowels ▪ 16 staves ▪ Wooden hoops some with bark and some without (which have been sized down to third of a branch). ▪ Two to three hoops around the chime and bilge 	<ul style="list-style-type: none"> ▪ Complex set of race marks ▪ “cccxl” on head exterior and 3 incised lines on a cant ▪ 2‘X’ marks incised on one stave 	Beef	<ul style="list-style-type: none"> ▪ Sap along the side of one stave 	Amidship in the Orlop deck
81A2942	33.37 gallons	Wood	Stave:0.31 – 0.47 Head: 0.39 – 0.59	<ul style="list-style-type: none"> ▪ 3-piece head attached by dowels ▪ 16 staves ▪ 2 to 3 hoops around the chime and bilge 	<ul style="list-style-type: none"> ▪ “TV” brand, scribed marks and thin, sharp assembly line on a center head piece “cccX XX ” and two other lines 	Beef	<ul style="list-style-type: none"> ▪ Staves have sampling holes with pegs still intact 	Amidship in the Orlop deck
81A5923	N/A	Wood	Stave: 0.35 – 0.43 Head:0.43	<ul style="list-style-type: none"> ▪ One cant and one middle piece attached by dowels ▪ 16 staves ▪ Two to three hoops around the chime and bilge 	<ul style="list-style-type: none"> ▪ Race marks on headpiece but unclear what they were 	Beef	<ul style="list-style-type: none"> ▪ Sap along one side of the staves ▪ Very badly infested 	Amidship in the Orlop deck
81A1651; 81A1691	49.91 gallons	Wood	Stave:0.47 – 0.71 Head:0.35 – 0.79	<ul style="list-style-type: none"> ▪ Five-piece heads attached by dowels ▪ 18 case staves and one bung stave ▪ Concical bung (0.905 in long by 0.63 in at exterior diameter and 0.472 in at the interior diameter) ▪ Chime, quarter and bilge hoops with two to three hoops at each 	<ul style="list-style-type: none"> ▪ Assembly lines on the exterior of four head pieces ▪ Missing the fifth head piece 	Fish	<ul style="list-style-type: none"> ▪ Some staves have sap along one side ▪ Some staves have sampling holes ▪ Chivs and chimes of each stave wasfashioned very smoothly 	Amidship in the Orlop deck
81A2959; 81A3099	45.92 gallons	Wood	Stave: N/A Head: N/A	<ul style="list-style-type: none"> ▪ Five-piece head not attached by dowels, rather attached by a possible brace ▪ 17 case staves and one bung stave ▪ Wooden hoops around chime and 	<ul style="list-style-type: none"> ▪ Resemblance of shipper’s marks on the exterior of staves ▪ A circle with an arch at one end to form a corner ‘eye’ 	Fruit or Wine	<ul style="list-style-type: none"> ▪ At least two staves have reinforcement peg holes at the ends ▪ Wooden hoops vary in widths from 0.98 – 1.69 in 	Near the stern of the Orlop deck

TABLE 3.5. Cask material recovered from <i>Mary Rose</i> (Kilby 1982 and Rodrigues 2005).								
Specimen Number	Cask Type or Size	Material	Stave and Head Thickness (in inches)	Completeness	Markings	Cask Contents	Comments	Provenience
				bilge				
81A3346; 81A2647; 81A2648	47.71 gallons	Wood	Stave: 0.28 – 0.59 Head: N/A	<ul style="list-style-type: none"> ▪ Possibly a five-piece head ▪ 10 case staves and one bung stave 	<ul style="list-style-type: none"> ▪ None 	Pork	<ul style="list-style-type: none"> ▪ Sap along the one side of the staves ▪ Cask was badly infested 	Sterncastle
81A0762; 81A0792; 81A1231; 81A1399; 81A0276; 81A0479; 81A0480; 81A6701	21.96 gallons	Wood	Stave: 0.98 – 1.10 Head: 1.10 – 1.18	<ul style="list-style-type: none"> ▪ One two-piece head and the other was missing ▪ 10 staves (no bung stave) (0.79 - 1.18 in thick) 	<ul style="list-style-type: none"> ▪ None 	Pitch & Tar	<ul style="list-style-type: none"> ▪ One stave had a square hole cut in its center ▪ Sap along one side of the staves ▪ Very thick and bulky cask ▪ Lumps of pitch and tar still attached but solidified 	Forward Hold
81A1001	15.34 gallons	Wood	Stave: 0.55 – 0.98 Head: 1.10 – 1.18	<ul style="list-style-type: none"> ▪ One-piece heads that were thick and heavy ▪ Wooden hoops ▪ 10 staves (0.79 - 1.18 in thick) 	<ul style="list-style-type: none"> ▪ Scribed mark: circle pattern resembling shipper's marks with two concentric circles and an 'X' touching at a corner ▪ Deep square crosses on the head exterior 	Pitch & Tar	<ul style="list-style-type: none"> ▪ A square hole was cut across two staves (possibly to function as a bung) ▪ Pitch and tar residue attached but solidified ▪ Headpiece had a sharp stick (ca. 3.14 in long) in it ▪ 2 staves have 4 long and thick wooden Nails in them leaning towards the center 	Near the Bow of the Orlop deck
81A1995	15.76 gallons	Wood	Stave: 0.28 – 0.39 Head: 0.47 – 0.94	<ul style="list-style-type: none"> ▪ 22.835 in in height ▪ 14.748 in in diameter at the head ▪ 12 staves all about 0.394 in thick with the joints poorly planed 	<ul style="list-style-type: none"> ▪ Gaming designs on the head ▪ One stave had a single incised line running diagonally ▪ Another had three curved incised lines ▪ And a third had a complex concentration of six lines all intersecting each other 	N/A	<ul style="list-style-type: none"> ▪ Nine Mans Morris game and another design next to it yet to be identified ▪ One head appeared to have been easily lifted and closed by resting on head of the cask rather than inserted in the bite ▪ Treenails observed on some staves (possibly to hold hoops in position) 	Amidship in the Hold
81A1618	33.74 gallons	Wood	Stave: N/A Head: N/A	<ul style="list-style-type: none"> ▪ Five-piece head attached by dowels ▪ Four staves 	<ul style="list-style-type: none"> ▪ Incised arrow and score marks 	N/A	<ul style="list-style-type: none"> ▪ N/A 	Amidship in the Hold
81A1732	N/A	Wood	Stave: N/A Head: N/A	<ul style="list-style-type: none"> ▪ Six-piece head with a 27.17 in diameter ▪ No staves 	<ul style="list-style-type: none"> ▪ None 	N/A	<ul style="list-style-type: none"> ▪ N/A 	Amidship in the Hold
81A1737	N/A	Wood	Stave: N/A	<ul style="list-style-type: none"> ▪ Possible 	<ul style="list-style-type: none"> ▪ Concentric circles 	N/A	<ul style="list-style-type: none"> ▪ N/A 	Amidship of

TABLE 3.5. Cask material recovered from <i>Mary Rose</i> (Kilby 1982 and Rodrigues 2005).								
Specimen Number	Cask Type or Size	Material	Stave and Head Thickness (in inches)	Completeness	Markings	Cask Contents	Comments	Provenience
			Head: N/A	five-piece head attached by dowels with a 25.08 in diameter	<ul style="list-style-type: none"> ▪ branded and "HR" brand mark ▪ Axe marks ▪ Incised "W" 			the Orlop deck
81A1516	55.33 gallons	Wood	Stave: N/A Head: N/A	<ul style="list-style-type: none"> ▪ Possible five-piece head attached by dowels ▪ One stave 	<ul style="list-style-type: none"> ▪ Two different brand marks, a 'B' and another unclear ▪ Axe marks ▪ Roman numerals 	N/A	<ul style="list-style-type: none"> ▪ N/A 	Amidship of the Orlop deck
81A1702	56.92 gallons	Wood	Stave: N/A Head: N/A	<ul style="list-style-type: none"> ▪ Five- or six-piece head attached by dowels ▪ 11 staves 	<ul style="list-style-type: none"> ▪ Assembly marks ▪ Incised straight lines ▪ Angular score marks 	N/A	<ul style="list-style-type: none"> ▪ Reinforcement peg holes present ▪ Sap along one side of the staves 	Forward Hold
81A1754	55.52 gallons	Wood	Stave: N/A Head: N/A	<ul style="list-style-type: none"> ▪ 13 case staves and one bung stave 	<ul style="list-style-type: none"> ▪ Assembly marks ▪ Brand mark ▪ Incised straight lines 	N/A	<ul style="list-style-type: none"> ▪ Head attached by dowels 	Amidship of the Orlop deck
81A0086	31.44 gallons	Wood	Stave: N/A Head: N/A	<ul style="list-style-type: none"> ▪ Four- or five- piece head attached by dowels ▪ 12 staves 	<ul style="list-style-type: none"> ▪ Assembly marks ▪ Brand mark ▪ Incised straight lines 	N/A	<ul style="list-style-type: none"> ▪ N/A 	Amidship in the Hold
81A1690	56.01 gallons	Wood	Stave: N/A Head: N/A	<ul style="list-style-type: none"> ▪ N/A 	<ul style="list-style-type: none"> ▪ Assembly marks ▪ Brand mark ▪ Incised straight lines 	N/A	<ul style="list-style-type: none"> ▪ Double croze ▪ Reinforcement peg holes present ▪ Head attached by dowels 	Amidship of the Orlop deck
81A1931	98.54 gallons	Wood	Stave: N/A Head: N/A	<ul style="list-style-type: none"> ▪ Four- or five- piece head attached by dowels ▪ Seven staves 	<ul style="list-style-type: none"> ▪ Arrow brand mark ▪ Curved incised lines ▪ Assembly marks visible on a cant piece 	N/A	<ul style="list-style-type: none"> ▪ N/A 	Amidship in the Hold
81A1751	N/A	Wood (Oak)	Stave: N/A Head: N/A	<ul style="list-style-type: none"> ▪ Possible center head piece in nine fragments ▪ No staves 	<ul style="list-style-type: none"> ▪ "B" brand mark on a head piece 	N/A	<ul style="list-style-type: none"> ▪ N/A 	Amidship of the Orlop deck
81A2275	82.40 gallons	Wood (Oak)	Stave: N/A Head: N/A	<ul style="list-style-type: none"> ▪ 11 staves 	<ul style="list-style-type: none"> ▪ A possible "R" brand mark ▪ Axe marks on the exterior ▪ Adze marks on the interior 	N/A	<ul style="list-style-type: none"> ▪ Head attached by dowels ▪ Reinforcement peg holes present ▪ Hoop impressions left on staves ▪ Sap along one side of the staves and head pieces 	Amidship in the Hold
81A1876	50.55 gallons	Wood	Stave: N/A Head: N/A	<ul style="list-style-type: none"> ▪ Two staves ▪ One middle and one head center piece 	<ul style="list-style-type: none"> ▪ Curved and Straight incised marks ▪ Unusual brand mark surrounded by straight incised cuts 	N/A	<ul style="list-style-type: none"> ▪ No sign of head attachment method 	Amidship of the Orlop deck
81A2352	N/A	Wood	Stave: N/A Head: N/A	<ul style="list-style-type: none"> ▪ N/A 	<ul style="list-style-type: none"> ▪ Angular axe marks on the exterior 	N/A	<ul style="list-style-type: none"> ▪ Reinforcement peg holes present ▪ Sap along one side of the staves ▪ Hoop impressions present 	Amidship in the Hold
81A0729	N/A	Wood	Stave: N/A Head: N/A	<ul style="list-style-type: none"> ▪ One stave (ca. 40.52 in 	<ul style="list-style-type: none"> ▪ None 	N/A	<ul style="list-style-type: none"> ▪ N/A 	Amidship of the Orlop

TABLE 3.5. Cask material recovered from <i>Mary Rose</i> (Kilby 1982 and Rodrigues 2005).								
Specimen Number	Cask Type or Size	Material	Stave and Head Thickness (in inches)	Completeness	Markings	Cask Contents	Comments	Provenience
				long)				deck
81A1657	81.06 gallons	Wood	Stave: N/A Head: N/A	<ul style="list-style-type: none"> ▪ Four-piece head attached by dowels ▪ Four case staves and one bung stave 	<ul style="list-style-type: none"> ▪ Straight and curved incised lines ▪ Brand mark ▪ Angular axe marks 	N/A	<ul style="list-style-type: none"> ▪ Interior of head was harred ▪ Vent hole with pin through center of head ▪ 1 stave had a sampling hole ▪ Sap along one side of the staves and head pieces 	Amidship in the Hold
81A1862	54.64 gallons	Wood (Oak)	Stave: N/A Head: N/A	<ul style="list-style-type: none"> ▪ One head piece (reused stave) ▪ 15 case staves and one bung stave ▪ Wooden hoop fragments 	<ul style="list-style-type: none"> ▪ Faint race marks ▪ Angular axe marks ▪ Two brand marks 	N/A	<ul style="list-style-type: none"> ▪ Sap along one side of the stave and head pieces 	Amidship in the Hold
81A0098	56.01 gallons	Wood (Oak)	Stave: N/A Head: N/A	<ul style="list-style-type: none"> ▪ Five cask staves and one bung stave 	<ul style="list-style-type: none"> ▪ Assembly marks ▪ Brand marks ▪ Straight incised lines (cross) ▪ Angular adze marks on the interior of staves 	N/A	<ul style="list-style-type: none"> ▪ Reinforcement peg holes present ▪ Hoop impressions present 	Near the Bow of the Orlop deck
81A2274	101.52 gallons	Wood (Oak)	Stave: N/A Head: N/A	<ul style="list-style-type: none"> ▪ Seven staves 	<ul style="list-style-type: none"> ▪ Curved incised lines ▪ Brand mark ▪ Angular axe marks on head pieces 	N/A	<ul style="list-style-type: none"> ▪ Head attached by dowels ▪ Reinforcement peg holes present ▪ Sap along one side of the staves and head pieces 	Near the stern of the Orlop deck
81A1753	55.49 gallons	Wood (Oak)	Stave: N/A Head: N/A	<ul style="list-style-type: none"> ▪ Five-piece head not attached by dowels rather by a brace ▪ 15 case staves and one bung stave ▪ Complete hoops and hoop fragments 	<ul style="list-style-type: none"> ▪ Multi-facets along cant beveled periphery ▪ Curved and straight incised lines ▪ Shipper's marks (intricate circles and lines) ▪ Angular axe marks on the interior of staves ▪ **These marks were believed to be "batch numbers" or indicators of content 	N/A	<ul style="list-style-type: none"> ▪ Reinforcement peg holes present 	Amidship of the Orlop deck

Millecoquins Wreck

A total of 26 casks were recovered and analyzed from the Millecoquins wreck. Twenty four were tierces while the other two were kilderkins or ankers, most likely the former. The casks represent salt or fish casks and all had markings on their heads, with none identified on staves. The markings included engraved numbers, probably representing a weight, coopers marks, and painted templates including the inspector's name and related information. The majority of casks did not retain their original contents. This was not necessarily due to spillage as many were found intact, standing straight up with dunnage still packed around them, while others were found horizontally without dunnage.

Four casks contained fish remains, and were representative of both salted and unsalted fish casks. The unsalted fish casks were identified by the lack of inspector marks, as it was not required for these to be inspected, especially if they were going directly to market (Mitchell 1996b:143; Burns 1983:15). According to Burn's "Bulk Packaging in British North America, 1758-1867: A Guide to the Identification and Reproduction of Casks." All other fish casks were supposed to be labeled with the type of fish, the town where inspected, the word "INSPECTED", the inspector's Christian surname and initials, and the year and month of the inspection. In 1840, Upper Canada required casks to be marked with No. 1 or No. 2, the species, inspector's Christian surname and initials, the district in which the inspection took place, and "UPPER CANADA" (Burns 1983:18). An unknown amount of casks surrounding these four fish casks were found laying on their sides and empty. They too may have once contained

fish. Their construction was very similar to the other fish casks, utilizing the same wood and hoop configurations. They were most likely empty at the time of wrecking, as they were found lying horizontally throughout the hold and without dunnage (Mitchell 1996b:143; Burns 1983:15).

Sixteen casks were salt casks. These were identified as such because: the casks were constructed via slack cask construction techniques, lacked remains (e.g. bone, nuts, and seeds), and appeared to be in situ, standing upright and packed with dunnage to support and stabilize them. Furthermore, local manifests included salt, sugar, and soap and after further research, the cask markings (“JM ALLEN INSPECTOR” and/or “SALINA” or “SYRACUSE” painted on the head) provided the final clue that they were indeed salt casks as J.M. Allen was the salt inspector in Syracuse between 1836 and 1839 (Mitchell 1996b:141).

Many salt casks recovered met standards for the construction of salt barrels (Garrigues 1881:29, 40). Staves constructed from soft wood were roughly half an inch thick and those from hard woods were 0.435 in (1.1 cm) thick. No staves were wider than 4.0 in (10.2 cm) and were between 30.5 in and 31.5 in (77.5 to 80.0 cm) in length. The barrels held between 280 and 320 lbs. Sample holes, ca. 0.875 in (2.2 cm) diameter were also present in several cask heads for sampling and inspection.

In general, two types of casks were identified on the Millecoquins wreck, salt and fish. These yielded an array of markings and information concerning cask construction regulations in Canada, New York, and Michigan during the mid-nineteenth century. Table 3.6 presents all all information available concerning this assemblage.

Specimen Number	Minimum Number of Individual Containers	Capacity	Contents	Material	Length (in inches)	Number of Staves	Number of Head Pieces	Stave and Head Width (in inches)	Stave and Head Thickness (in inches)	Head Diameter (in inches)	Number of Hoops	Completeness	Markings	Comments	Provenience
Cask 1 (2003 and 2090)	1	Barrel (36.28 gallons)	Salt	Head – Beech Staves – Hemlock Hoops - Ash	29.0	N/A	Two-piece head (with at least one piece missing)	4.75	0.5	17.0	<ul style="list-style-type: none"> Eight withey Four sets of two witheys each Witheys were finished bands one wide then one narrow 	Complete	<ul style="list-style-type: none"> Engravings and numbers “220” “S” “E” “6” “SU INE” “JS TIBBS” “96” 	<ul style="list-style-type: none"> One 1.0 in diameter sample hole present on head 	N 97.28 E 76.27
Cask 2 (2022 and 2089)	1	N/A	Salt	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<ul style="list-style-type: none"> N/A 	N/A	<ul style="list-style-type: none"> Numbers 	N/A	N 96.54 E 76.09
Cask 3 (2019 and 2091)	1	Barrel (34.4 gallons)	Salt	Head – White Oak Staves – Hemlock Hoops - Ash	27.5	N/A	N/A	4.5	0.4 for Staves 1.0 for Head	17.0	<ul style="list-style-type: none"> 12 withey Four sets of three witheys each Witheys were finished and unfinished 	Complete	<ul style="list-style-type: none"> Scratched overlaid X's, and Engravings 	<ul style="list-style-type: none"> One 0.5 in diameter sample hole present on head and off center Staves on these barrels were wide as were the witheys, and the heads were thick Two dowels present 	N 99.11 E 80.44
Cask 4 (2020)	1	Barrel (31.4 gallons)	Fish	Head – White Pine Staves – White Pine Hoops - Ash	27.5	N/A	Two-piece head	4.0	0.5 for Staves 1.0 for Head	16.25	<ul style="list-style-type: none"> 12 Withey Four sets of three witheys each Witheys were finished and unfinished 	Complete	<ul style="list-style-type: none"> Engravings “Pa no-33” 	<ul style="list-style-type: none"> Staves on these barrels were wide as were the witheys, and the heads were thick 	N 93.97 E 73.22
Cask 5 (2023)	1	Barrel (39.1 gallons)	Salt	Head – Beech Staves – Hemlock Hoops - Ash	29.5	N/A	N/A	3.25	0.5 for Staves 0.75 for Head	17.5	<ul style="list-style-type: none"> Eight withey Four sets of two witheys each Witheys were finished and 1.5 in wide Witheys were joined with a nail 	Complete	<ul style="list-style-type: none"> Engravings, numbers, and scratched symbol near the head 	<ul style="list-style-type: none"> One 1.0 in diameter sample hole present on head near center 	N 98.61 E 75.51
Cask 6 (2087)	1	Barrel (34 gallons)	Fish	Head – White Oak Staves – White Pine Hoops – White Oak	28.0	N/A	N/A	5.0	0.5 for Staves and Heads	16.75	<ul style="list-style-type: none"> 10 withey Four sets on head and bottom of three witheys Middle sets were two witheys each Witheys were unfinished with bark 	Complete	<ul style="list-style-type: none"> Engravings and scratched crossed swords 	<ul style="list-style-type: none"> Four dowels 	N 98.51 E 70.53
Cask 7 (2081)	1	Barrel (36.28 gallons)	Salt	Head – Beech Staves – Hemlock Hoops - Ash	29.0	N/A	Two-piece head	5.25	0.75 for Staves and Heads	17.0	<ul style="list-style-type: none"> Eight withey Four sets of two witheys each Witheys were finished and 1.5 in wide Witheys were joined with a nail 	Complete	<ul style="list-style-type: none"> Engravings “290” or “270”, numbers, template, JM Allen, JCoon, and Syracuse 	<ul style="list-style-type: none"> One 1.0 in diameter sample hole present on head near center 	N 95.68 E 65.88
Cask 8 (2035, 2079, and 2080)	1	Barrel (34.4 gallons)	Fish	Head – White Pine Staves – White Pine Hoops - Ash	27.5	N/A	N/A	3.5	0.5 for Staves 0.85 for Heads	17.0	<ul style="list-style-type: none"> 12 withey Four sets of three witheys each Witheys were finished and unfinished 	Complete	<ul style="list-style-type: none"> Scratched Side by side X's 	<ul style="list-style-type: none"> Two dowels One bung hole located on head off center Staves on these barrels were wide as were the witheys, and the heads were thick 	N 99.62 E 73.37
Cask 9 (2088)	1	Barrel (37.53 gallons)	Salt	Head – Hemlock Staves – Hemlock Hoops - Ash	30.0	N/A	Two-piece head	5.5	0.5 for Staves and Heads	17.0	<ul style="list-style-type: none"> Eight withey Four sets of two witheys each Witheys were finished and 1.5 in wide Witheys were joined with a nail 	Complete	<ul style="list-style-type: none"> Engravings “280”, numbers, template, and JM Allen 	<ul style="list-style-type: none"> One 1.0 in diameter sample hole at the head 	N 95.53 E 68.2
Cask 10 (2037)	1	Barrel (38.44)	Salt	Head – Beech	29.0	N/A	Three-piece	4.85	0.5 for Staves	17.5	<ul style="list-style-type: none"> Eight withey 	Complete	<ul style="list-style-type: none"> Engravings “0” 	<ul style="list-style-type: none"> One 1.0 in 	N 95.99

Specimen Number	Minimum Number of Individual Containers	Capacity	Contents	Material	Length (in inches)	Number of Staves	Number of Head Pieces	Stave and Head Width (in inches)	Stave and Head Thickness (in inches)	Head Diameter (in inches)	Number of Hoops	Completeness	Markings	Comments	Provenience
		gallons)		Staves – Hemlock Hoops - Ash			head		0.75 for Heads		<ul style="list-style-type: none"> ▪ Four sets of three witheys each ▪ Witheys were finished and unfinished 		numbers, template, and JM Allen	<ul style="list-style-type: none"> ▪ diameter sample hole on head ▪ Staves on these barrels were wide as were the witheys, and the heads were thick 	E 71.06
Cask 11 (2038)	1	Barrel (36.28 gallons)	Salt	Head – Hemlock Staves – Hemlock Hoops - Ash	29.0	N/A	Two-piece head	4.25	0.25 for Staves 0.75 for Heads	17.0	<ul style="list-style-type: none"> ▪ Eight withey ▪ Four sets of two witheys each ▪ Witheys were finished and 1.5 in wide ▪ Witheys were joined with a nail 	Complete	<ul style="list-style-type: none"> ▪ Engravings “320”, numbers, template, and JM Allen 	<ul style="list-style-type: none"> ▪ One 1.0 in diameter sample hole on head 	N 97.01 E 68.13
Cask 12 (2036)	1	Barrel (35.03 gallons)	Fish	Head – White Oak Staves – White Oak Hoops - Ash	28.0	N/A	One-piece head	5.0	0.5 for Staves 0.75 for Heads	17.0	<ul style="list-style-type: none"> ▪ 12 withey ▪ Four sets of three witheys each ▪ Witheys were finished and unfinished 	Complete	<ul style="list-style-type: none"> ▪ Paintings “B&D” 	<ul style="list-style-type: none"> ▪ Staves on these barrels were wide as were the witheys, and the heads were thick 	N 99.42 E 60.94
Cask 13 (5555)	1	Barrel (38.03 gallons)	Salt	Heads – Elm Staves – Hemlock Hoops - Ash	30.4	N/A	Three-piece head	5.5	0.4 for Staves and Heads	17.0	<ul style="list-style-type: none"> ▪ Eight withey ▪ Four sets of two witheys each ▪ Witheys were finished and 1.5 in wide ▪ Witheys were joined with a nail 	Complete	<ul style="list-style-type: none"> ▪ Engravings “310”, numbers, JM Allen, and Syracuse 	<ul style="list-style-type: none"> ▪ One 1.0 in diameter sample hole located at head and center 	N 98.47 E 65.72
Cask 14 (6666)	1	Barrel (39.27 gallons)	Salt	Head – Elm Staves – Hemlock Hoops – Ash	28.0	N/A	Two-piece head	5.25	0.25 for Staves 0.75 for Heads	18.0	<ul style="list-style-type: none"> ▪ Eight withey ▪ Four sets of two witheys each ▪ Witheys were finished and 1.5 in wide ▪ Witheys were joined with a nail 	Complete	<ul style="list-style-type: none"> ▪ Engravings “310”, numbers, template, and JM Allen 	<ul style="list-style-type: none"> ▪ One 1.0 in diameter sample hole on head and off center 	N 97.04 E 65.77
Cask 15 (2032)	1	Barrel (39.27 gallons)	Salt	Head – Hemlock Staves – Hemlock Hoops – Ash	28.0	N/A	Two-piece head	5.0	1.5 for Staves 0.5 for Heads	18.0	<ul style="list-style-type: none"> ▪ Eight withey ▪ Four sets of two witheys each ▪ Witheys were finished bands one wide then one narrow 	Complete	<ul style="list-style-type: none"> ▪ Engravings “273” or “270”, numbers, template, and JM Allen 	<ul style="list-style-type: none"> ▪ One 1.0 in diameter sample hold on head 	N 95.47 E 61.59
Cask 16 (7777)	1	Barrel (37.53 gallons)	Salt	Head – Hemlock Staves – Hemlock Hoops – Ash	30.0	N/A	N/A	3.5	0.5 for Staves 0.75 for Heads	17.0	<ul style="list-style-type: none"> ▪ Eight withey ▪ Four sets of two witheys each ▪ Witheys were finished bands one wide then one narrow 	Complete	<ul style="list-style-type: none"> ▪ Engravings and numbers 	<ul style="list-style-type: none"> ▪ None 	N 97.28 E 70.93
Cask 17 (2082)	1	Anker or Kilderkin(18.6 gallons)	Fish	Head – White Pine Staves – White Pine Hoops – Ash Bung - Hemlock	22.0	N/A	N/A	6.0	1.5 for Staves 1.0 for Heads	14.0	<ul style="list-style-type: none"> ▪ Eight withey ▪ Four sets of two witheys each ▪ Witheys were finished bands one wide then one narrow 	Complete	<ul style="list-style-type: none"> ▪ Engravings and two scratched side by side X's 	<ul style="list-style-type: none"> ▪ One bung hole located on head off center 	N 98.33 E 59.15
Cask 18 (2041)	1	Barrel (34.4 gallons)	Fish	Head – White Oak Staves – White	27.5	N/A	One four-piece head	4.0	0.5 for Staves and Heads	17.0	<ul style="list-style-type: none"> ▪ Eight withey ▪ Four sets of two witheys each ▪ Witheys were 	Complete	<ul style="list-style-type: none"> ▪ Engravings, paintings “A” “S”, and scratched crossed swords 	<ul style="list-style-type: none"> ▪ Two dowels 	N 98.54 E 73.84

TABLE 3.6. Cask material recovered from the Millecoquins Wreck (Coble 1994; Coble 1996; Mitchell 1996a and Mitchell 1996b).															
Specimen Number	Minimum Number of Individual Containers	Capacity	Contents	Material	Length (in inches)	Number of Staves	Number of Head Pieces	Stave and Head Width (in inches)	Stave and Head Thickness (in inches)	Head Diameter (in inches)	Number of Hoops	Completeness	Markings	Comments	Provenience
				Pine Hoops – White Oak							unfinished bark				
Cask 19 (8888)	1	Barrel (38.15 gallons)	Salt	Head – Elm Staves – Hemlock Hoops – Ash	30.5	N/A	N/A	5.0	0.5 for Staves and Heads	17.0	<ul style="list-style-type: none"> ▪ Eight withey ▪ Four sets of two witheys each ▪ Witheys were finished and one 0.5 in wide ▪ Witheys were joined with a nail 	Complete	<ul style="list-style-type: none"> ▪ Engravings, three parallel scratches, and numbers 	<ul style="list-style-type: none"> ▪ One sample hole located on head center 	N 98.53 E 68.55
Cask 20 (9999)	1	Barrel (36.52 gallons)	Salt	Head – Elm Staves – Hemlock Hoops – White Oak	28.4	N/A	N/A	4.75	0.4 for Staves 0.5 for Heads	17.25	<ul style="list-style-type: none"> ▪ Eight withey ▪ Four sets of two witheys each ▪ Witheys were finished and 1.5 in wide ▪ Witheys were joined with a nail 	Complete	<ul style="list-style-type: none"> ▪ Engravings and numbers 	<ul style="list-style-type: none"> ▪ One sample hole located on the head center 	N 99.64 E 70.88
Cask 21 (2084)	1	Barrel (30.49 gallons)	Salt	Head – Beech Staves – Hemlock Hoops – Ash	28.4	N/A	Four-piece head	5.0	0.5 for Staves 0.25 for Heads	15.75	<ul style="list-style-type: none"> ▪ Eight withey ▪ Four sets of two witheys each ▪ Witheys were finished and 1.5 in wide ▪ Witheys were joined with a nail 	Complete	<ul style="list-style-type: none"> ▪ Engravings “310”, numbers, and 2 scratched side by side X/s 	<ul style="list-style-type: none"> ▪ N/A 	N 100.38 E 70.93
Cask 22 (2085)	1	Barrel (38.9 gallons)	Salt	Head – White Oak Staves – Hemlock Hoop s- Ash	30.2	N/A	Two-piece head	5.4	0.75 for Heads	17.5	<ul style="list-style-type: none"> ▪ Eight withey ▪ Four sets of two witheys each ▪ Witheys were finished and 1.5 in wide ▪ Witheys were joined with a nail 	Complete	<ul style="list-style-type: none"> ▪ Engravings “300”, paintings, and numbers 	<ul style="list-style-type: none"> ▪ One 1.0 in diameter sample hole located on head center 	N 100.45 E 68.57
Cask 23 (2083)	1	Barrel (37.35 gallons)	Salt	Head – Beech Staves – Hemlock Hoops - Ash	29.0	N/A	Two-piece head	N/A	0.6 for Staves 0.5 for Heads	17.25	<ul style="list-style-type: none"> ▪ Eight withey ▪ Four sets of two witheys each ▪ Witheys were finished and 1.5 in wide ▪ Witheys were joined with a nail 	Complete	<ul style="list-style-type: none"> ▪ Engravings (half arrow), numbers, symbol next to bung, template, JM Allen, J Coon, and Syracuse 	<ul style="list-style-type: none"> ▪ One 1.0 in diameter sample hole located on head center 	N 100.52 E 65.87
Cask 24 (2052)	1	Barrel (37.53 gallons)	N/A	N/A	30.0	N/A	Two-piece head	5.5	0.5 for Staves 0.75 for Heads	17.0	<ul style="list-style-type: none"> ▪ Eight withey ▪ Four sets of two witheys each ▪ Witheys were finished and 1.5 in wide ▪ Witheys were joined with a Nail 	Complete	<ul style="list-style-type: none"> ▪ Engravings “300”, numbers, template, JM Allen, Richmond/ Salina 	<ul style="list-style-type: none"> ▪ One 1.25 in diameter bung hole located at head center ▪ Two dowels 	N 96.95 E 57.74
Cask 119 (119)	1	Barrel (35.03 gallons)	N/A	Head – White Oak Staves – White Oak	28.0	N/A	N/A	N/A	0.75 for Heads	17.0	<ul style="list-style-type: none"> ▪ 12 withey ▪ Four sets of three witheys each ▪ Witheys were finished and unfinished 	Complete	<ul style="list-style-type: none"> ▪ Paintings 	<ul style="list-style-type: none"> ▪ Staves on these barrels were wide as were the witheys, and the heads were thick ▪ Two dowels 	N 100.13 E 81.41
Cask 120 (120)	1	Anker or Kilderkin (18.7 gallons)	N/A	Head – White Pine Staves – White Pine	22.85	N/A	N/A	N/A	0.85 for Heads	13.75	<ul style="list-style-type: none"> ▪ 10 withey ▪ Four sets on head and bottom of three witheys ▪ Middle sets were two witheys each ▪ Witheys were unfinished with bark 	Complete	<ul style="list-style-type: none"> ▪ Scratched fish symbol, 	<ul style="list-style-type: none"> ▪ Two dowels 	N 95 E 80
Cask Head Fragment (14)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<ul style="list-style-type: none"> ▪ N/A 	<ul style="list-style-type: none"> ▪ N/A 	<ul style="list-style-type: none"> ▪ N/A 	<ul style="list-style-type: none"> ▪ N/A 	N 96.48 E 86.64
Cask Head (30)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<ul style="list-style-type: none"> ▪ N/A 	<ul style="list-style-type: none"> ▪ N/A 	<ul style="list-style-type: none"> ▪ N/A 	<ul style="list-style-type: none"> ▪ N/A 	N 100.3 E 85.71
Cask Misc. Heads (2040)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<ul style="list-style-type: none"> ▪ N/A 	<ul style="list-style-type: none"> ▪ N/A 	<ul style="list-style-type: none"> ▪ N/A 	<ul style="list-style-type: none"> ▪ N/A 	N/A

Specimen Number	Minimum Number of Individual Containers	Capacity	Contents	Material	Length (in inches)	Number of Staves	Number of Head Pieces	Stave and Head Width (in inches)	Stave and Head Thickness (in inches)	Head Diameter (in inches)	Number of Hoops	Completeness	Markings	Comments	Provenience
Iron Cask Hoop (44)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	▪ N/A	▪ N/A	▪ N/A	▪ N/A	N 99.4 E 89.58
Misc. Withys (2034)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	▪ N/A	▪ N/A	▪ N/A	▪ N/A	N 95 E 70
Cask Stave (2009)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	▪ N/A	▪ N/A	▪ N/A	▪ N/A	N 95 E 75
Cask Stave (2016)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	▪ N/A	▪ N/A	▪ N/A	▪ N/A	N 95 E 70

San Juan

Fourteen partially complete barricas, and 71 bungs from barricas; two staves from half-barricas; seven staves, 31 head pieces, and one bung from one-third barricas; and four staves and four head pieces from a bever cask were identified and recovered from *San Juan*. Barricas were the Spanish version of casks, similar to the French Barriques. Their capacity and construction differ slightly from the English and American casks produced during the eighteenth century. Table 3.7 provides the capacities and typical dimensions of the four different types of casks identified on *San Juan*. Tables 3.8, 3.9, and 3.10 present generalized descriptions of the length, width, thickness, and much more for the barrica case staves, bung staves, and head pieces recovered from *San Juan*.

TABLE 3.7. Capacity and dimensions for the four types of casks recovered from <i>San Juan</i> (after Ross 1980).					
Type of Cask	Other Names by which they were known or equivalent	Capacity of Wine (US gallons)	Number of Hoops	Head diameter (inches)	Bilge diameter (inches)
Barrica	-	52.5 – 61	18-24 willow or alder hoops	N/A 4 - 6 head pieces	27
Half-Barrica	-	26	-	N/A 4 - 5 head pieces	-
One-third Barrica	-	17.5	10 - 12	N/A 4 - 5 head pieces	-
Bever Cask	Equivalent to Spanish wine quartillo (pre-1801)	1.25	8	N/A 2 head pieces	-

TABLE 3.8. Barrica dimensions for material recovered from *San Juan* (after Ross 1980).

Barrica Staves	New Staves		Reused Staves	
	Range	Mean \pm S.D.	Range	Mean \pm S.D.
Case Staves				
Length	86.0 – 90.0 cm	87.78 \pm 0.99 cm	80.1 – 87.5 cm	85.06 \pm 1.75 cm
Distance between croze grooves	76.4 – 81.6 cm	78.98 \pm 1.20 cm	72.1 – 79.3 cm	76.34 \pm 1.34 cm
Chime angles	18 – 59 °	34.34 \pm 5.67 °	22 - 63°	40.21 \pm 9.16°
Booge width	6.6 – 18.7 cm	10.94 \pm 19.3 cm	6.0 – 14.9 cm	10.52 \pm 1.85 cm
Booge thickness	1.1 – 2.5 cm	1.73 \pm 0.28 cm	1.3 – 2.4 cm	1.82 \pm 0.25 cm
End width	5.5 – 18.5 cm	9.73 \pm 1.86 cm	4.7 – 14.0 cm	9.25 \pm 1.79 cm
End Thickness	0.7 – 2.1 cm	1.38 \pm 0.21 cm	0.6 – 2.1 cm	1.32 \pm 0.31 cm
Bung Staves				
Length	85.2 – 89.2 cm	87.88 \pm 0.57 cm	84.3 – 86.0 cm	85.15 \pm 0.85 cm
Distance between croze grooves	75.7 – 81.5 cm	78.92 \pm 1.55 cm	76.7 – 77.9 cm	77.37 \pm 0.50 cm
Chime angles	29 - 55°	38.97 \pm 7.35°	36 - 66°	49.4 \pm 9.69°
Booge width	10.0 – 14.2 cm	11.64 \pm 1.28 cm	9.4 – 15.6 cm	11.97 \pm 2.64 cm
Booge thickness	1.3 – 2.5 cm	1.80 \pm 0.25 cm	1.7 – 2.3 cm	1.97 \pm 0.25 cm
End width	8.3 – 13.8 cm	10.46 \pm 1.10 cm	8.3 – 13.7 cm	10.45 \pm 2.21 cm
End thickness	0.9 – 2.2 cm	1.35 \pm 0.29 cm	1.0 – 1.5 cm	1.20 \pm 0.17 cm
Bung hole diameter	3.8 – 5.5 cm	4.66 \pm 0.53 cm	5.3 – 6.5 cm	5.77 \pm 0.52 cm
Vent hole diameter	1.2 – 2.5 cm	2.30 \pm 0.18 cm	1.2 – 2.4 cm	1.67 \pm 0.52 cm

TABLE 3.9. Head piece dimensions for material recovered from *San Juan* (after Ross 1980).

	Cants		Middle Pieces		Center Pieces	
	Range	Mean \pm S.D.	Range	Mean \pm S.D.	Range	Mean \pm S.D.
Length	34.0 – 51.7 cm	43.94 \pm 3.96 cm	51.2 – 59.9 cm	56.57 \pm 1.83 cm	56.0 – 60.2 cm	58.57 \pm 0.88 cm
Width	5.8 – 16.4 cm	10.66 \pm 2.29 cm	8.1 – 16.8 cm	12.17 \pm 2.02 cm	9.8 – 21.3 cm	13.26 \pm 2.17 cm
Center thickness	1.0 – 2.3 cm	1.70 \pm 0.29 cm	1.4 – 2.8 cm	1.87 \pm 0.31 cm	1.5 – 2.5 cm	1.87 \pm 0.25 cm
Edge thickness	-	-	0.5 – 27.0 cm	1.34 \pm 0.27 cm	-	-
Maximum outside bevel width	0.3 – 3.5 cm	1.38 \pm 0.72 cm	0.5 – 3.5 cm	1.64 \pm 0.66 cm	0.5 – 3.0 cm	1.57 \pm 0.66 cm
Maximum inside bevel width	1.5 – 4.5 cm	2.91 \pm 0.67 cm	1.5 – 5.0 cm	2.77 \pm 0.71 cm	2.0 – 4.5 cm	2.7 \pm 0.57 cm
Outside bevel angle	-	-	95 - 119°	105.25 \pm 5.27°	-	-
Inside bevel angle	-	-	93 - 134°	112.55 \pm 6.47°	-	-
Bite width	-	-	0.1 – 0.5 cm	-	-	-
Joint angle	-	-	85 – 94°	-	-	-

TABLE 3.10. Four- and five-piece head dimensions recovered from *San Juan* (after Ross 1980).

Head Type	Length (cm)	Width (cm)	Percentage Difference
Five-piece heads	56.0	56.8	+1.4%
	57.2	54.7	-4.4%
	58.0	58.9	+1.6%
	58.2	58.7	+0.9%
	58.2	59.4	+2.1%
	58.8	60.3	+2.6%
	59.0	59.7	+1.2%
	59.3	58.8	-0.8%
	59.5	59.8	+0.5%
	59.6	60.1	+0.8%
	60.0	60.5	+0.8%
Six-piece heads	60.2	60.6	+0.7%
	59.0	59.0	0%

The barricas were bound by 18 to 24 single-piece alder, or occasionally willow, hoops joined by willow bindings. Although few were recovered, stains (or ghosts) on the barrica staves indicated that the number of hoops binding the top and bottom of the casks were typically equal. The few that were recovered indicated that the hoops were constructed from a single piece of alder or willow and had overlapping, notched ends. The overlap length ranged between 11.4 and 21.7 in (29 and 55 cm) with willow bindings covering nearly the entire length (Ross 1989:55).

Sixty-nine cork, one white oak, and one willow bungs were recovered. Generally, the bungs ranged in diameter from 3.3-6.6 cm with a mean of 4.8 ± 0.7 cm, and were ca. 0.6 to 1.7 in (1.5 to 4.4 cm) with a mean of 1.0 ± 0.2 in (2.6 ± 0.6 cm) thick. Fabric gaskets, as evidenced by fabric impressions in the cork, were often used with cork bungs to create a tighter seal (Ross 1989:135).

Two half-barrica cask staves were also recovered. These were defined by a shorter length than the typical barrica staves, but longer length than the one-third-barrica staves. Half-barricas were constructed with 16 to 17 beech staves, an unknown number

of hoops, and two, four- or five-piece beech head pieces possibly held in place by head reinforcements. Stave 6M5B73-46 was made from split and axed beech. It had planed and beveled joints and one hollow adzed, straight chime. The chime had an angle of 36° . Two hollow adzed chivs were also identified, in addition to square planed croze grooves that were 26.4 in (67.0 cm) apart, one of which was located 1.2 in (3.0 cm) below the end of the stave. The stave was incomplete, but was estimated to have a total length of 28.7 in (73 cm). The width ranged between 3.2 in (8.1 cm) at the end and 3.7 in (9.3 cm) at the booge. Its thickness was approximately 0.6 in (1.4 cm). Stave 24M12N3-4 was constructed from split and axed white oak. It had planed and beveled joints with at least one sharp top, and one hollow adzed, straight chime. The angle of the chime was 46° . One hollow adzed chiv was also identified and a single, square planed croze groove located ca. 1.2 in (3.0 cm) below the end of the stave. This stave was also not complete, as one end appeared to be severely eroded. Consequently, the only accurate width was obtained at the booge, which was 3.0 in (7.5 cm). The booge thickness was 0.6 in (1.5 cm). The overall length was not approximated and two exterior marks consisting of two divergent lines were inscribed running at an unknown angle across the stave. Overall, it was believed that these two staves may represent a single half-barrica (Ross 1989:170-173).

Specimen Number	Minimum Number of Individual Containers	Capacity	Contents	Material	Length (in inches)	Number of Staves	Number of Head Pieces	Stave and Head Width (in inches)	Stave and Head Thickness (in inches)	Head Diameter (in inches)	Number of Hoops	Completeness	Markings	Comments	Provenience
24M12N20	1	Barrica (52.5 – 61 gallons)	Most likely train oil (comprised of Baleen whale oil)	Staves – White Oak Top Head – Beech (2), White Oak (1) Bottom Head – White Oak Bung – Cork Bent hole plugs – Cork Replacement wedges for stave repairs – White Oak	N/A	21	Two five-piece heads	N/A	N/A	N/A	Staining showing what would have been 22 (11 at each end)	Mostly Complete	<ul style="list-style-type: none"> Contiguous assembly marks on all staves Bung stave marked with a circle Top head – beech center and middle pieces marked with single line assembly mark While the white oak cant had “XXXXI” inscribed on its exterior 	<ul style="list-style-type: none"> It appeared that nearly 1/3 of its components were reused 14 new staves and seven reused staves One case stave had a second croze groove at one end (repair) Two stave sample holes in boogie area Top head - held together by eight dowels Vent hole with cork plug located in head center piece Two sample/repair holes with wooden pegs located in one cant Bottom head – held together by eight dowels One vent hole with cork plug located in center piece adjacent to the bung stave Nine sample/repair hole plugged with wooden pegs, with 2 near the vent hole 	N/A
24M14M4	1	Barrica (52.5 – 61 gallons)	Most likely train oil (comprised of Baleen whale oil)	Staves – White Oak and Beech Heads – White Oak and Beech	N/A	21	One six-piece head One five-piece head	N/A	N/A	N/A	N/A	Mostly Complete	<ul style="list-style-type: none"> Unique incised lines located on two staves which may have been shipper’s marks Assembly mark located on top middle piece (matches those on the bottom head pieces) Assembly marks (lines) on two middle pieces of the bottom head 	<ul style="list-style-type: none"> Two staves had additional croze grooves indicated repair Top head constructed of six pieces with the middle piece having been reused from the bottom head 	N/A
24M14M5	1	Barrica (52.5 – 61 gallons)	Most likely train oil (comprised of Baleen whale oil)	Staves – White Oak (19) and Beech (2) Top Head – Four white oak pieces and one beech center piece Top head reinforcement – White Oak Bottom Head – Two white oak and one beech head piece Bung - Cork	N/A	21	Two five-piece heads	N/A	N/A	N/A	N/A	Mostly Complete	<ul style="list-style-type: none"> Six white oak and two beech staves had “X” cooper’s marks while one white oak stave had “Y” cooper’s marks 19 staves had contiguous assembly marks Bung stave had a circular assembly mark Circular mark observed on the interior of the top head reinforcement Top head pieces had contiguous assembly marks 	<ul style="list-style-type: none"> Two to three additional croze grooves identified on staves indicated repair 10 staves show signs of interior burning Nine staves were broken at the bottom Two sample holes present Top head constructed with five pieces held together by four dowels and a reinforcement held together with six reinforcement pegs Two sample holes identified on top head, one under the reinforcement Bottom head constructed with five pieces (only three recovered) held 	N/A

TABLE 3.11. Cask material recovered from the <i>San Juan</i> (Ross 1980).															
Specimen Number	Minimum Number of Individual Containers	Capacity	Contents	Material	Length (in inches)	Number of Staves	Number of Head Pieces	Stave and Head Width (in inches)	Stave and Head Thickness (in inches)	Head Diameter (in inches)	Number of Hoops	Completeness	Markings	Comments	Provenience
														together by two dowels and a reinforcement that was held together by six reinforcement pegs	
24M14M7	1	Barrica (52.5 – 61 gallons)	Most likely train oil (comprised of Baleen whale oil)	Staves – White Oak Top Head – White Oak (3) and Beech (2) Bottom Head – White Oak Head Reinforcements – White Oak Bung - Cork	N/A	21	One six-piece head One five-piece head	N/A	N/A	N/A	N/A	Mostly Complete	<ul style="list-style-type: none"> Original 19 staves had contiguous assembly marks Bung stave was denoted by a circular mark Partial circular mark on the exterior booge area of case stave #3 Two partial circles located on top head Bottom head pieces have contiguous assembly marks 	<ul style="list-style-type: none"> Total of 19 new staves and two repaired staves Four sample hole present in booge area between both hoped area Top head constructed with three beech and 2 white oak pieces (with one piece missing), six dowels, and a reinforcement held together with 10 reinforcement pegs (six at one end and four at the other), Two sample or repair holes plugged with wooden pegs located on top head Bottom head constructed with five pieces, three dowels, and a reinforcement held in place by seven reinforcement pegs Five sample holes and a vent hole located on bottom head 	N/A
24M14M8	1	Barrica (52.5 – 61 gallons)	Most likely train oil (comprised of Baleen whale oil)	Staves – White Oak and Beech Heads – White Oak and Beech Head Reinforcements - Beech	N/A	17	Two five-piece heads	N/A	N/A	N/A	N/A	Mostly Complete	<ul style="list-style-type: none"> Several sets of assembly marks located on staves except for the two new staves 	<ul style="list-style-type: none"> Appers to have been a reused cask 	N/A
24M14M9	1	Barrica (52.5 – 61 gallons)	Most likely train oil (comprised of Baleen whale oil)	Staves– White Oak Top Head –White Oak Bottom Head – Three Beech middle pieces and two White Oak cants Head Reinforcements – White Oak Bung - Cork	N/A	19	One five-piece head	N/A	N/A	N/A	Staining idicating 23 hoops (10 at the top and 13 at the bottom)	Mostly complete	<ul style="list-style-type: none"> All staves marked with assembly marks Case staves #17 through 19 had iunscribed shipper's mark Two small crossed marks noted on the bung stave Assembly marks inscribed include Roman Numerals Partial circle inscribed on exterior of one cant "XXXIII" inscribed on the interior of the bottom head reinforcement 	<ul style="list-style-type: none"> Bung had a fabrick gasket One stave vent hole was present with a cork plug All staves appear to be new with exception to case stave #2 which was reused (had an extra set of assembly marks in the booge area) Top head was made of five pieces secured with a reinforcement and held in place by six pegs (three on each end) Seven sample or repair holes with wooden pegs present on head Bottom head was made of five pieces secured with a reinforcement held in place by nine 	N/A

Specimen Number	Minimum Number of Individual Containers	Capacity	Contents	Material	Length (in inches)	Number of Staves	Number of Head Pieces	Stave and Head Width (in inches)	Stave and Head Thickness (in inches)	Head Diameter (in inches)	Number of Hoops	Completeness	Markings	Comments	Provenience
														<ul style="list-style-type: none"> pegs (five at one end and four at the other) Four dowels present on bottom head 14 sample holes with wooden pegs observed in boogie area between both hoped areas at the front of the barrica 	
24M14N12	1	Barrica (52.5 – 61 gallons)	Most likely train oil (comprised of Baleen whale oil)	Staves – White Oak Heads – White Oak and Beech Bung - Cork	N/A	18	Two five-piece heads	N/A	N/A	N/A	Staining indicated the cask at one time had 24 hoops (12 at each end)	Mostly Complete	<ul style="list-style-type: none"> All but one stave had contiguous assembly marks with the bung stave marked by a circle All head pieces were inscribed with double assembly marks and one cant had double circles 	<ul style="list-style-type: none"> 17 new staves with one repair stave (evidenced by the extra croze groove at the top and two assembly lines with a separate circle and dot inscribed in the boogie area) 12 sample hole present in the boogie area between the two hoped areas Top head constructed of five pieces secured by a reinforcement with nine pegs (five at one end and four at the other), and six dowels. Bottom head constructed of five pieces secured by a reinforcement held together by four pegs at one end and a stave replacement wedge at the other, and six dowels One vent hole located in middle piece of bottom head Two sample or repair holes located adjacent to the vent hole in the bottom head 	N/A
24M18M23	1	Barrica (52.5 – 61 gallons)	Most likely train oil (comprised of Baleen whale oil)	Staves – White Oak Heads – White Oak and Beech	N/A	Estimated 22	Two five-piece heads	N/A	N/A	N/A	23-24 hoops (11-12 at top and 12 at the bottom)	Partially Complete	<ul style="list-style-type: none"> Shippers' mark on two staves 	<ul style="list-style-type: none"> Bung stave was repaired with an end replacement wedge Bung hole present One vent hole present in stave 	N/A
24M18M25	1	Barrica (52.5 – 61 gallons)	Most likely train oil (comprised of Baleen whale oil)	Stave – White Oak	N/A	Estimated 17-18	Two heads (unknown number of pieces)	N/A	N/A	N/A	22 hoops (11 at each end) with hoop binding on the bung stave (hoops were not actually present, just staining)	Partially Complete	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> One vent hole in one center head piece 	N/A
24M18N19	1	Barrica (52.5 – 61 gallons)	Most likely train oil (comprised of Baleen whale oil)	Staves – White Oak and Beech Heads - Beech	N/A	Estimated 20	One five-piece head	N/A	N/A	N/A	22 hoops (11 at each end)	Partially Complete	<ul style="list-style-type: none"> N/A 	<ul style="list-style-type: none"> The five-piece head was held in place by reinforcements with one reinforcement peg present (although probably more at one time) 	N/A
24M18N28	1	Barrica (52.5 – 61 gallons)	Most likely train oil (comprised of Baleen whale oil)	Staves – White Oak Heads – White Oak	N/A	At least 18	Two five-piece heads	N/A	N/A	N/A	23 hoops (12 at the top and 11 at the bottom)	Partially Complete	<ul style="list-style-type: none"> Possibly shippers' marks on one stave and one head piece 	<ul style="list-style-type: none"> Two head vent holes present 	N/A

Specimen Number	Minimum Number of Individual Containers	Capacity	Contents	Material	Length (in inches)	Number of Staves	Number of Head Pieces	Stave and Head Width (in inches)	Stave and Head Thickness (in inches)	Head Diameter (in inches)	Number of Hoops	Completeness	Markings	Comments	Provenience
				Head Reinforcements – Beech Bung - cork											
24M18N30	1	Barrica (52.5 – 61 gallons)	Most likely train oil (comprised of Baleen whale oil)	Staves – White Oak Heads – White Oak	N/A	Estimated 19	One five-piece head	N/A	N/A	N/A	N/A	Partially Complete	• N/A	• One five-piece head with a reinforcement was recovered • Two staves still contained head reinforcement pegs	N/A
24M14N10	1	Barrica (52.5 – 61 gallons)	Most likely train oil (comprised of Baleen whale oil)	Staves – Beech Heads – White Oak	N/A	16 or more	Two heads (unknown number of pieces)	N/A	N/A	N/A	N/A	Partially Complete	• The bung stave was marked with a faint coopers’ “eye” mark • Assembly marks incised on the exterior of all staves with a circle mark on the bung stave • One cant had crosses incised on its exterior	• 20 repair holes with wooden pegs present on the cant with the crosses incised on it	N/A
24M18N10	1	Barrica (52.5 – 61 gallons)	Most likely train oil (comprised of Baleen whale oil)	Staves – At least 5 Beech	N/A	At least five staves (with an unknown total number)	N/A	N/A	N/A	N/A	Nine hoop bindings aligned with the bung stave with the hoop tip notches facing the boogie area	Partially Complete	• Coopers’ “Y” marks on three staves • Coopers’ “single-line” mark on one stave	• Both the bung and adjacent case stave had broken ends at the top (most likely from canhooks used to lift the cask aboard)N/A	N/A
24M12N14-36	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1 hoop recovered	Only a nearly complete hoop	• N/A	• Hoop measured 90.9 in in length, ca. 0.8 – 1.6 in in width, and 0.3-0.8 in in thickness	N/A
6M5B73-46	N/A	Half-Barrica (26 gallons)	N/A	Beech	28.7 in	1	N/A	3.2 – 3.7 in	0.4 – 0.6 in	N/A	N/A	Only a single cask stave	• N/A	• Constructed from split and axed beech • Planed and beveled joints • Straight chim with an angle of 36° • Hollow adzed chivs • Single planed croze grooves separated by 67.0 cm with one located 3.0 cm below the top	N/A
24M12N3-4	N/A	Half-Barrica (26 gallons)				1						Only a single cask stave	•	•	N/A

The one-third barricas were identified by the existence of seven cask staves shorter than either barricas or half-barricadas. These seven staves were believed to represent at least three individual casks based on ghost hoop stains on their exterior surface. Although only seven staves were recovered, dimensions of the one-third barricadas were generated as follows: a mean head diameter of 15.0 in (38.1 cm); a mean distance of 23.0 in (58.5 cm) between the croze grooves; and a mean capacity of ca. 66.7 liter (e.g. 15.5 gal [Imp.] or 17.5 gal [American] (Ross 1989:173). These casks were also hypothesized to have consisted of: 18 beech staves; 10 to 12 hoops; and two, four-piece or five-piece heads constructed of beech, but occasionally oak. Based on their construction, and lack of use or wear, it was believed that these represent new casks (Ross 1989:176).

Thirty-one head pieces were notably smaller than barrica head pieces and believed to belong to one-third barricadas. This collection was represented by three, four-piece heads, one, five-piece head, and a total (including parts of the previously discussed heads) of 11 cants, 16 middle pieces and four center pieces. All of these head pieces were made of split and axed wood, typically beech although several were from white oak. Their joints were planed at angles ranging between 85° and 90°. Some pieces showed signs of an outside bevel, while others lacked such an element. The head piece diameters ranged between 13.2 and 16.9 in (33.5 and 43.0 cm) with a mean of 15.0 in (38.1 cm). Their widths ranged between 2.0 and 5.0 in (5.0 and 12.8 cm) with a mean of 3.6 in (9.2 cm) and their thickness (taken at the center of each piece) ranged between 0.3 and 0.8 in (0.8 and 2.1 cm) with a mean of 0.6 in (1.5 cm) (Ross 1989:180-184).

Two head reinforcements and one cork bung were also identified as belonging to one-third barricas. The head reinforcements were constructed from white oak staves. They ranged in length from 13.9 and 14.2 in (35.3 to 36.1 cm), in width by 2.4 and 2.9 in (6.0 to 7.3 cm), and thickness of 0.5 and 0.6 in (1.2 and 1.4 cm). The bung was constructed from cork, and was a flat tapered disc. It ranged in diameter from 1.7 in (4.3 cm) on the outside portion and 1.6 in (4.1 cm) on the inner portion. It was 1.3 in (3.2 cm) thick (Ross 1989:183-184).

Fragments of one bever cask, the equivalent of today's canteen, were also recovered. These fragmented remains included one complete stave, three incomplete staves, and four cant pieces. It was hypothesized that the bever cask was composed of 16 beech staves, eight hoops with four at each end, and two two-piece white oak heads. Though no bever cask hoops were recovered, ghost stains indicated that eight hoops were used, with four at each end. The capacity was equal to 4.0 liter (1.0 gal). Three "X" marks were found incised on the shoulder of the bung spout. Staves were split and axed with their exterior surfaces planed, with the exception to the spout which was sawn rather than axed. Chimes and chivs were only present on a single stave, possibly indicated repair. The staves were approximately 10.0 in (25.5 cm) in length. They ranged in width from 1.3 to 2.0 in (3.2 to 5.0 cm) with a mean of 1.6 in (3.97 cm), and in thickness between 0.2 to 0.4 in (0.5 to 1.0 cm) with a mean of 0.3 in (0.75 cm) (Ross 1989:184-193).

Two, two-piece heads, comprised of four cants, were identified as belonging to a bever cask. Two cants appeared to have been constructed from old barrica staves,

indicative of reuse. The head pieces ranged in diameter from 6.3 to 6.6 in (16.0 to 16.7 cm) with a mean of 6.4 in (16.35 cm). Their thickness averaged 0.6 in (1.6 cm) and their width averaging 3.2 in (8.2 cm) (Ross 1989:188-193).

In addition to complete casks and cask components, several cask stowage related items were also recovered from *San Juan*. These included two billet wedges and 20 cask chocks. The billets were whittled from fir logs with their ends axed at an angle to support two barricas. Their lengths were 20.5 to 19.1 in (52.0 and 48.5 cm), with maximum diameters of 2.2 to 2.3 in (5.5 and 5.8 cm). Of the 20 cask chocks, six different types were represented. These included: one carved chock made from beech; two flat, rectangular chocks made from white oak; six whole log chocks made from fir; seven half-log chocks made from fir; two one-third log chocks made from fir; and two quarter-log chocks made from fir. The chocks were highly variable in shape and size; however, on average they ranged in length between 5.7 and 11.8 in (14.4 and 30.0 cm) with a mean of 8.7 in (22.2 cm), in width between 1.7 and 3.0 in (4.4 and 7.5 cm) with a mean of 2.4 in (6.2 cm), and in thickness between 0.7 and 2.3 in (1.7 and 5.8 cm) with a mean of 1.5 in (3.8 cm).

The barricas were recovered from the ship's hold, occupying the entire length and more than likely stowed four layers high in offset rows. The one-third barrica components were recovered from the midship hold aft of the main mast, while the beaver cask components were recovered from the bow. The chocks and billets were recovered from the hold with a concentration around the midship hold aft of the main mast.

William Salthouse

At least 1,086 casks were listed on the outgoing manifest of *William Salthouse* (Staniforth 1987). Six different sizes including; keg, half-barrel, barrel, tierce, hogshead, and puncheons were listed and contained salted and dried fish, salt pork, salt beef, flour, vinegar, paint, nails, crackers, cider and whiskey. A total of 14 complete heads, 33 partial or incomplete heads, 36 staves, and samples of hoops, dunnage and stowage materials were recovered from the *William Salthouse* (Staniforth 2000:9-10) .

The heads were typically made of oak, although 12 were pine or elm. They consisted of two or three pieces held together by two dowels per joint, and represented tierces, barrels, half-barrels, and firkins. Nearly every head, whether complete or partial, contained markings in the form of brands, stencils, letter marks, curve-line marks, straight-line marks, and circular marks. Stencils were only found on flour casks and represented makers' marks, while letter marks identified the shipper. The curve-line marks identified consisted of one double "X" and one single "X" and most likely represent inspection marks, while straight-line marks most likely represented tally marks or possibly shippers' marks. Circular marks, noted on four heads, may have functioned as position marks for where to place a bung hole, or as shippers' and coopers' marks (Staniforth 2000:9-10).

Local statutes required that staves be constructed from wood without defects; however, three staves recovered had substantial knots. Many staves were cut too thin, causing warping and splitting and disobeyed statutes that required staves to be no less

than 0.5 in (1.3 cm) thick at each edge. Thirty percent of those recovered ranged between 0.393-0.433 in (10-11 mm) (Staniforth 1987:74).

No complete casks were raised, although several did exist in the lower layers of the wreck site. The majority of the material was recovered from the upper layers, which was subject to considerable disturbance by sport divers and weather related conditions (Staniforth 2000). Information available concerning this assemblage can be found in Table 3.12.

Type of Container	Minimum Number of Individual Containers	Capacity	Contents	Material	Length (in inches)	Number of Staves	Number of Head Pieces	Stave and Head Thickness (in inches)	Head Diameter (in inches)	Number of Hoops	Completeness	Markings	Comments	Provenience
Flour cask	N/A	Barrels (31.5 gallons)	Flour	N/A	N/A	None	Nine heads (three complete, and six partial)	N/A	Ranged between 16.3 and 17.1	None	Incomplete (only head pieces)	<ul style="list-style-type: none"> All branded with "FINE W.WATSHON INS MONTREAL JUNE 1841" One head had the words "LACHINE MILLS" Painted in stencil in black paint Most of the head pieces had cooper's marks cut into the surface and other "indistinct words" painted onto the surface (one of which may be the weight of 196 lbs). 	<ul style="list-style-type: none"> All of the complete heads had a bung hole, two with the bung still in situ 	N/A
Fish Cask	N/A	The partial was a barrel (31.5 gallons)	Unknown, but not Salmon as these would have been in tierces (19.7 in in diameter)	N/A	N/A	None	Two heads (one complete, and one partial)	N/A	The partial had a diameter of 17.1	None	Incomplete (only head pieces)	<ul style="list-style-type: none"> The complete head was marked "200" "W Mac" "No 1 HERR" "St John" The partial was branded "St Johns NFLD" 	<ul style="list-style-type: none"> N/A 	N/A
Salt beef casks	N/A	Three tierces (42.0 gallon) Two barrels (31.5 gallons) One half-barrel or kilderkin (16-21 gallons) One unknown	N/A	N/A	N/A	None	Seven heads (two complete, and five partial)	N/A	Tierces were 19.5 Barrels were 16.9 Half-barrel was 13.4	None	Incomplete (only head pieces)	<ul style="list-style-type: none"> The barrels and tierces were branded with all or part of: "220 or 300 PRIME MESS BEEF W.MOORE MONTREAL liter.C. 1840 or 1841 OCT or MAY" The partial haed from a half-barrel had stenciled in black paint "100 lb RIBS Rumps & Briskets H Gilbert" 	<ul style="list-style-type: none"> The half-barrel was believed to be provisions as none were on the manifest and only one was recovered during archaeological investigations 	N/A
Salt pork casks	N/A	Barrels (31.5 gallons)	N/A	N/A	N/A	None	13 heads (eight complete, and five partial)	N/A	16.1 to 17.1	None	Incomplete	<ul style="list-style-type: none"> All were branded with all or part of "200 PRIME or 200 PRIME MESS PORK W. MOORE MONTREAL liter.C. 1840 or 1841 DEC or MARC, APRIL, JUNE" 	<ul style="list-style-type: none"> All barrels with the date June 1841 were designatted PRIME All barrels with the inspected date of Dec. 1840, March or April 1841 were deisgnated PRIME MESS 	N/A

Whydah

Two complete casks and seven wooden staves were recovered from the *Whydah* shipwreck site. All hoops recovered, including those on the two complete casks, were wood, rather than metal. Based on the limited information provided in the *Whydah* site report (Hamilton 1992), as well as contacts with project conservators (Gareth McNair, pers. comm.), it was believed that the two complete casks were barrels, although their exact dimensions were unavailable. One complete barrel contained nails and had exterior marks. One mark, based on photographs, appeared to have been created by a circular scribe, and was very similar to the types of cooper's marks seen on staves recovered from *Betsy*. None of the exterior marks visible on available photographs were a result of branding. They all appeared to have been inscribed or chiseled into the wood. This cask was bound by at least nine withy hoops, although based on ghosts seen on the staves it most likely had more at one time. It was highly possible that some hoops were destroyed during the wrecking process, as well as during the formation of the concretion around the object.

Discussion

As shown in this chapter, data available concerning cask material was rather limited and inconsistent. This created a problem when analyzing the data for possible patterns. The interchangeable use of certain terms, e.g. booge and bilge, obscured the cask component actually being analyzed. The general description of several casks as barrels with no dimensions presented was highly suspect, as the term barrel was often

applied inaccurately to describe any sized cask. Many cask sizes were not determined in previous reports, and the necessary measurements, e.g. head diameter or hoop diameter, were not present making it nearly impossible to determine the true cask size represented. The discussion of cask hoop material in certain reports allowed the determination between slack or tight cooperage, but that was all. The use of stave length alone was not enough to determine the accurate size, as the measurable volume of a cask was determined by the area located between croze grooves, and this measurement was typically missing. Comparative analyses of the wood types could not be conducted because a limited number of reports or sources determined the types of wood used. The preservation of the materials also affected the ability to conduct comparative analysis. For example, the materials recovered from the Beaufort Inlet Wreck were in a poor state of preservation leaving only epoxy resins of cask hoop fragments, a few wooden cask components, and two iron cask hoop fragments. All of these factors inhibit the ability to compare the varying array of data sets amongst one another. This chapter presented the raw data while the next next chapter presents the manipulated data, including pie charts, histograms, bar graphs, and the potential patterns revealed during analysis.

CHAPTER 4: OBSERVABLE PATTERNS AND CONCLUSIONS/DISCUSSIONS

Observable Patterns

This chapter focused on comparing the data obtained from each individual shipwreck, via pie graphs, histograms, and bar charts. Each vessel type (e.g. pirate, merchant, navy, etc...) was studied, the data tabulated, and compared to determine if a pattern in the type of cask material recovered was present. The patterns identified included the high ratio of small casks to larger ones identified amongst privateer and naval vessels. Conversely, a higher ratio of larger casks to smaller ones was identified amongst pirate and merchant vessels. Although no definitive patterns were identified, these potential patterns were and should be compared amongst other like vessels. The following was a discussion of the materials analyzed, the potential patterns, the conclusions concerning cask sizes for each individual shipwreck and their vessel type.

Pirate

Both the Beaufort Inlet Wreck and the *Whydah* were believed to be pirate ships (Wilde-Ramsing 2006 and Hamilton 2006). The former was believed to be that of Blackbeard's *Queen Anne's Revenge* and the latter belonged to Sam Bellamy. *Whydah* yielded two complete barrels and the remains of another unidentifiable cask (Figure 4.15).

The cask material recovered from the Beaufort Inlet Wreck, after 5% of the site was excavated, was much more difficult to analyze. This wreck yielded 146 hoop fragments and hoop groupings in concretions, 13 possible cask staves, four possible cask

heads, and two possible wood cask pieces. Several hoops were found in groups, possibly shooks or collapsed casks, and these groupings were identified as a single hoop group. When compared amongst the remaining cask material in the collection, these hoop groupings were treated as a single hoop or hoop fragment, n=1. Hoop diameters were an indicator of cask size (based on Table 1.1 data, Figure 4.1). Although the exact number of casks represented could not be determined, it was determined that the cask hoops represented the remains of firkins, kilderkins, barrels, tierces, hogsheads, tertians or puncheons, butts, double puncheons, and tuns (Figure 4.16). For the remaining analysis a single hoop fragment, stave fragment, and head fragment was identified as a single representative cask. Although this is misleading, since a cask is comprised of many hoops, staves, and head pieces, this was the most feasible way to determine a general assemblage. The assemblage was comprised of 60.71 % (n=51) tun sized casks; 9.52 % (n=8) tobacco hogsheads; 1.19 % (n=1) tobacco hogshead, pipe/butt or double puncheon; 2.38 % (n=2) pipe/butt or tobacco hogshead; 4.76 % (n=4) pipe/butt, tobacco hogshead, or wine hogshead/barrique; 3.57 % (n=3) wine hogshead/barrique or pipe/butt; 10.71 % (n=9) wine hogshead/barrique, pipe/butt, or tierce; 1.19 % (n=1) wine hogshead/barrique, pipe/butt, or tierce; 1.19 % (n=1) wine hogshead/barrique or tierce; 1.19 % (n=1) tierce or barrel; 2.38 % (n=2) barrel; and the remaining 1.19 % (n=1) by unknown cask sizes (Figure 4.16). These percentages do not include the cask material still in concretion that have not been analyzed, and have N/A in their diameter column in Table 3.1.

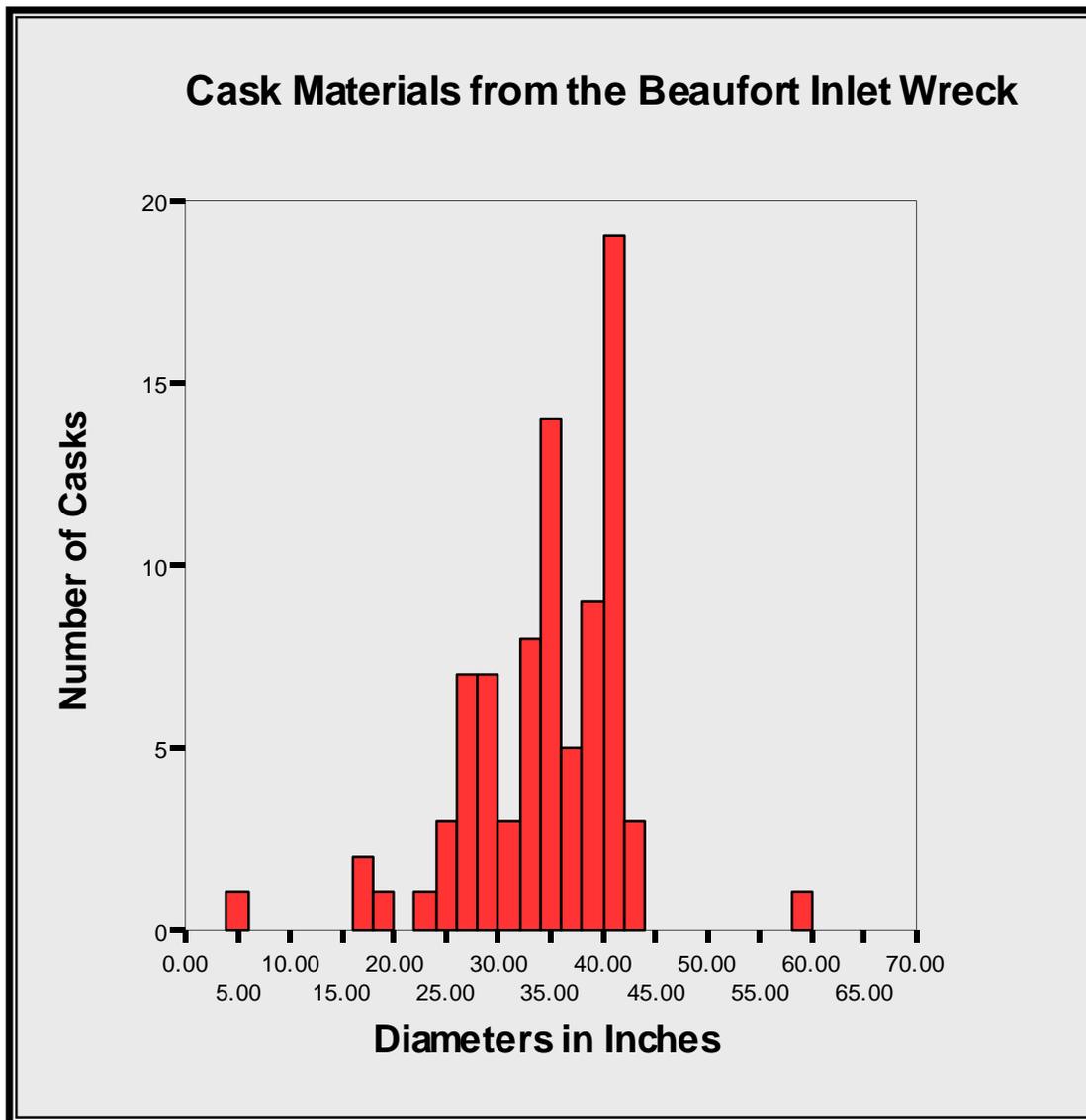


FIGURE 4.1. Histogram showing the range of cask diameters represented in the Beaufort Inlet Wreck cask assemblage. Diameters are based on head diameters found in Table 1.1 and are based on 2 inch increments.

If this vessel was the *Queen Anne's Revenge*, it was then previously *La Concorde* and the cask sizes previously discussed may have been inaccurate. If so, the casks would have been of the barrique variety, similar to those recovered from *Le Machault*. According to Watkins-Kenney's (2006:21) research,

“the record of the cargo on *La Concorde*'s 1713-1714 return voyage (Ducoin 2001:113) the casks used for sugar were mainly barriques and quarts. Wine barriques had approximately the same capacity as English wine hogsheads (Meide 2005, Ross 1983), however English hogsheads containing dry goods such as tobacco (1250 lbs) were larger (Walsh 1999). As a barrique of sugar weighed c. 500 Kg (c. 1000 lbs) (Bylden 1995; Stehle 1996) its size must have been nearer to that of a tobacco hogshead.”

Cask components were scattered across the site. It was uncertain if this was due to the wrecking process, natural/environmental factors, or if the material was in its original provenience from the time of wrecking. It was known that 12.72 % (n=21) of the materials recovered were found towards the bow, 7.27 % (n=12) near the stern, 28.48 % (n=41) near the forward area, 22.42 % (n=37) near the aft area, 29.69 % (n=49) near the midship area, and 3.03 % (n=5) were recovered on the surface and lack provenience (Figure 4.2).

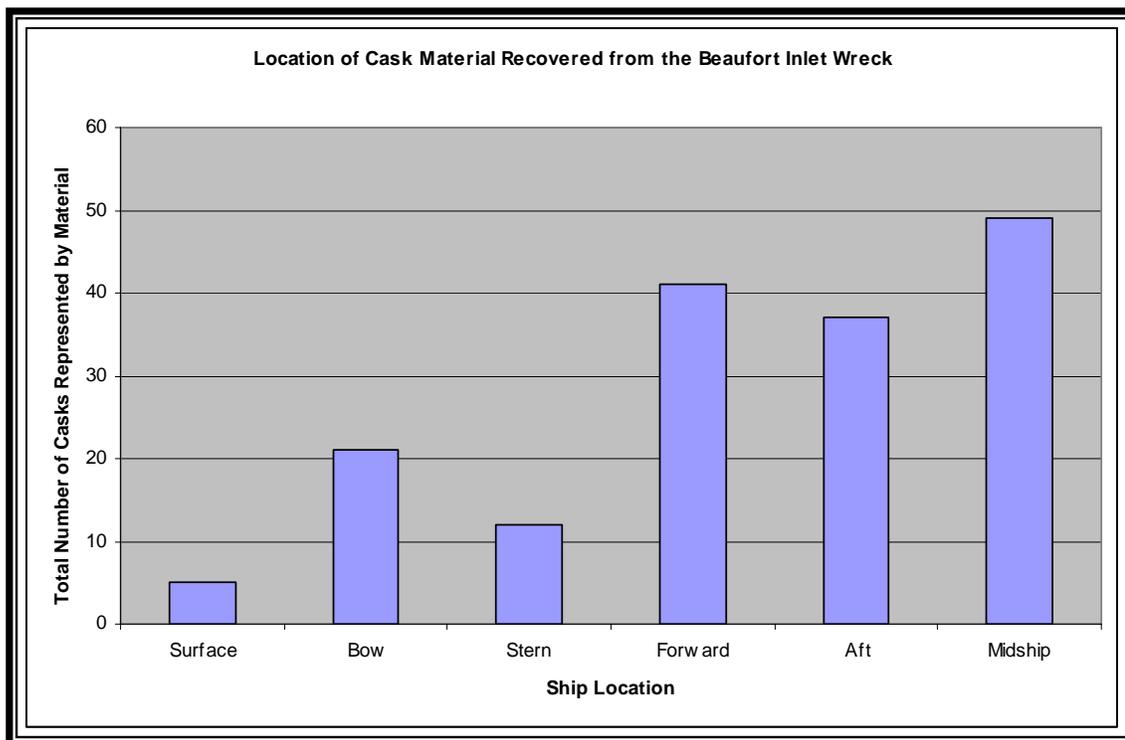


FIGURE 4.2. Bar graph showing the locations within the vessel where cask material was recovered.

Due to the lack of information concerning the cask material recovered from *Whydah*, it was uncertain whether a pattern in the type of cask material recovered from alleged pirate shipwrecks exists. There were a disproportionate number of larger casks to smaller casks. In fact, the Beaufort Inlet Wreck appeared to lack any casks with a volume less than 31.5 gallons, with exception of a single hoop recovered with a diameter of approximately 4 inches. It was unclear if this percentage of casks was due to the wrecking process or the amount of casks originally onboard the vessel. Casks may have floated away or rotted during the time the site was unknown, or the vessel may have only outfitted with large casks. It was also possible that smaller casks were removed once the

vessel ran ashore, as this vessel, if the *Queen Anne's Revenge*, may not have sunk immediately.

A total of two intact barrels were recovered from *Whydah*, but only castings of 146 hoop fragments, 13 possible cask staves, four possible cask heads, and two possible wood cask pieces were recovered from the Beaufort Inlet Wreck. A potential pattern was identified. The data suggested that it may be typical to find a higher ratio of larger casks to smaller ones, although this is not definitive. This potential pattern should be compared amongst the recovery and analysis of other eighteenth century pirate vessels.

Privateer

Defence and *Le Machault* were believed to be privateers (Switzer 1978; Switzer 1998; and Ross 1981). The exact number of casks on *Defence* was unknown. According to Switzer (1978 and 1998), many casks found in the bow, although not recovered, were barrels containing meats in brine solution and the others hardtack. Those found aft of the bow were smaller and probably represented powder kegs, while those near the galley were buckets, mess kits, and one firkin.

At least 21 casks or buckets were found on *Le Machault*. Based on the available head (Figure 4.3), the assemblage was comprised of two shot kegs (9.53 %), two partial shot kegs (9.53%), one salt pork cask (a quintal) (4.76 %), one musket shot cask (a barrel) (4.76 %), one nail keg (4.76 %), two quart casks (9.53 %), two barriques (9.53 %), three buckets (14.27 %), four tub staves (19.04 %), two bidons (9.53 %), one large open ended container (4.76 %), and several other unknown staves (Figure 4.17). The shot kegs and

shot keg components were recovered from the forward port side, but the remaining cask proveniences were unavailable.

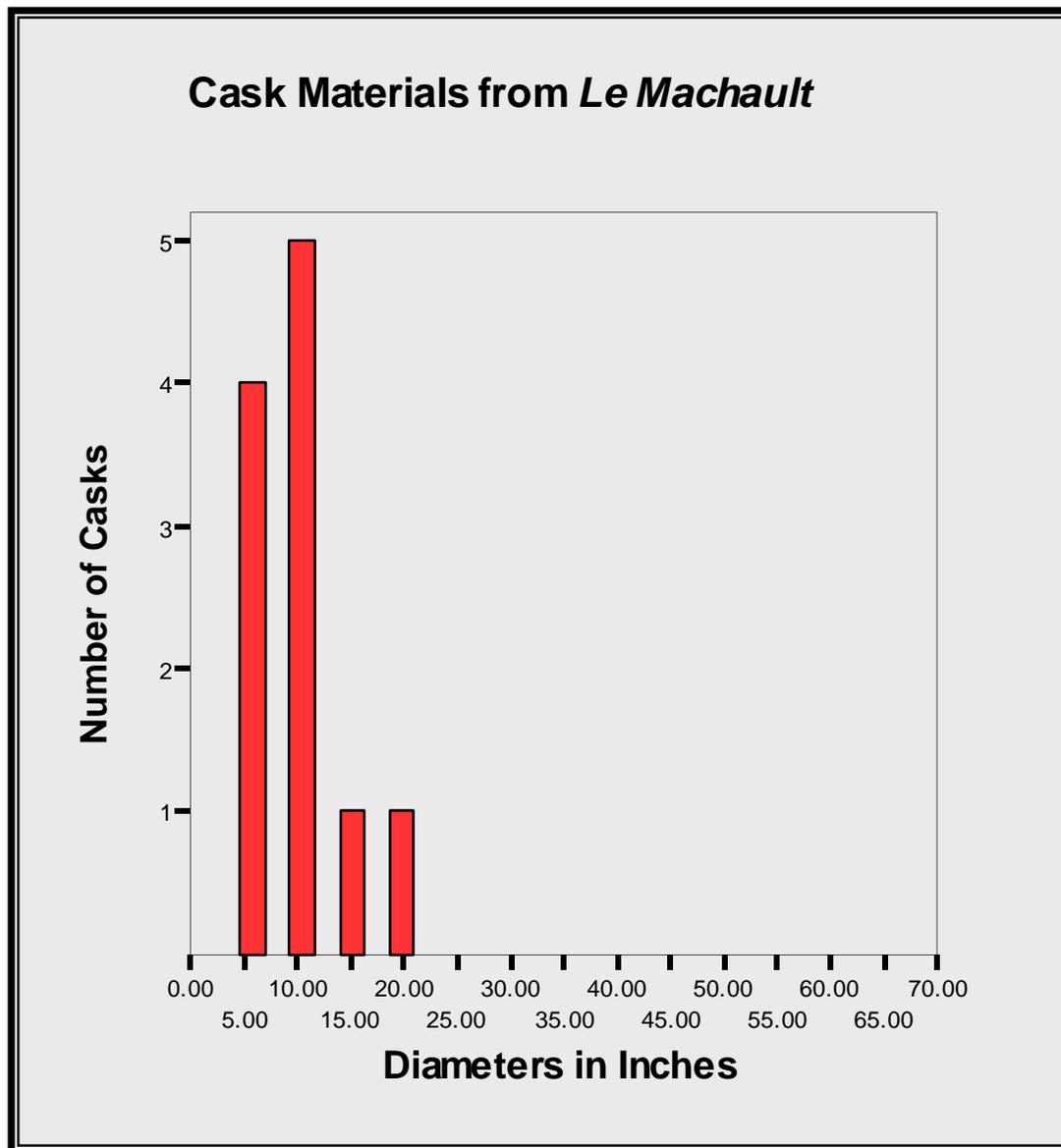


FIGURE 4.3. Histogram showing the range of cask diameters represented in the *Le Machault* cask assemblage. Diameters are abased on head diameters found in Table 1.1 and are based on 2 inch increments.

All cask material from *Defence* was not analyzed or published, leaving it uncertain whether a pattern in the type of cask material recovered from privateer

shipwrecks exists. It was demonstrated, that one can expect to find at least a few casks from this type of vessel. There was also a higher ratio of smaller casks to larger casks amongst those recovered from *Le Machault*. This was especially interesting as *Le Machault* was ordered to be set afire, and it was possible to remove materials prior to the demise of the vessel. According to the patterns identified amongst the other kinds of vessels in this study, typically smaller materials were removed leaving the larger materials behind. The value of the materials and goods in the smaller casks in comparison to the larger casks, may have had a direct affect upon why there was a higher ratio of smaller casks. It was also possible that there was a lack of large casks aboard this vessel at the time of its sinking.

A potential pattern was identified. The data suggested that it may be typical to find a higher ratio of smaller casks to larger ones, although this is not definitive. This potential pattern should be compared amongst the recovery and analysis of other eighteenth century privateer vessels.

Merchant

The *Betsy*, British Merchant Vessel from Chubs Head Cut, *Henrietta Marie*, Millecoquins, and *William Salthouse* were all believed to be merchant vessels (Broadwater 1981; Krivor 1998; Moore 1989; Cantelas 1993; and Staniforth 1987). Based on head diameters (Figure 4.4) and contents, *Betsy* yielded four barrels, one anker, one pipe, one tierce, one tun, and three kegs. Several additional casks were recovered and included: one kilderkin or quart; three hogsheads, pipe/butts, or tierces; one kilderkin

or rundlet; one pipe, butt, or hogshead; one tierce, barrel, or hogshead; one barrel or tierce; and one barrel or quart. Of the material recovered, 25.0 % (n=5) were wine hogsheads/barriques or pipes/butts; 20.0 % (n=4) were quarter barrels or barrels; 10.0 % (n=2) were firkins; 10.0 % (n=2) were unknown; 5.0 % (n=1) were tuns; 5.0 % (n=1) were wine hogsheads/barriques or tuns; 5.0 % (n=1) were wine hogsheads/barriques; 5.0 % (n=1) were wine hogsheads/barriques or barrels; 5.0 % (n=1) were barrels; 5.0 % (n=1) were kilderkins; and the remaining 5.0 % (n=1) were ankers (Figure 4.18). Additional cask material was recovered but the cask sizes represented were unknown.

Only a single representative cask was recovered from the British Merchant Vessel from Chubs Head Cut (Figure 4.19). This cask was a wine pipe/butt (Krivor 1998). Although the report stated that it was representative, it was unknown how many other casks were present and if they were identical to this particular cask.

The dimensions of the material recovered from *Henrietta Marie* were unknown. Based on the available head diameters (Figure 4.5), contents, and other cask components, the Millecoquins wreck yielded 21 barrels (84.0 %), two casks that represented either a barrel or a kilderkin (8.0 %), and two casks that represented either an anker or a kilderkin (8.0 %) (Figure 4.20). Not all casks were recovered from this site and it remained unknown how many other casks were present. The *William Salthouse* yielded no complete casks for analysis, although several were present at the wreck site in the lower layers. Based on the available head diameters (Figure 4.6), contents, and other cask components, the cask material recovered from the upper deposits comprised 12 barrels (82.75 %), three tierces (10.35 %), one kilderkin (3.45 %), and one unknown cask size

(3.45 %) (Figure 4.21). Information concerning the shipboard provenience was unavailable.

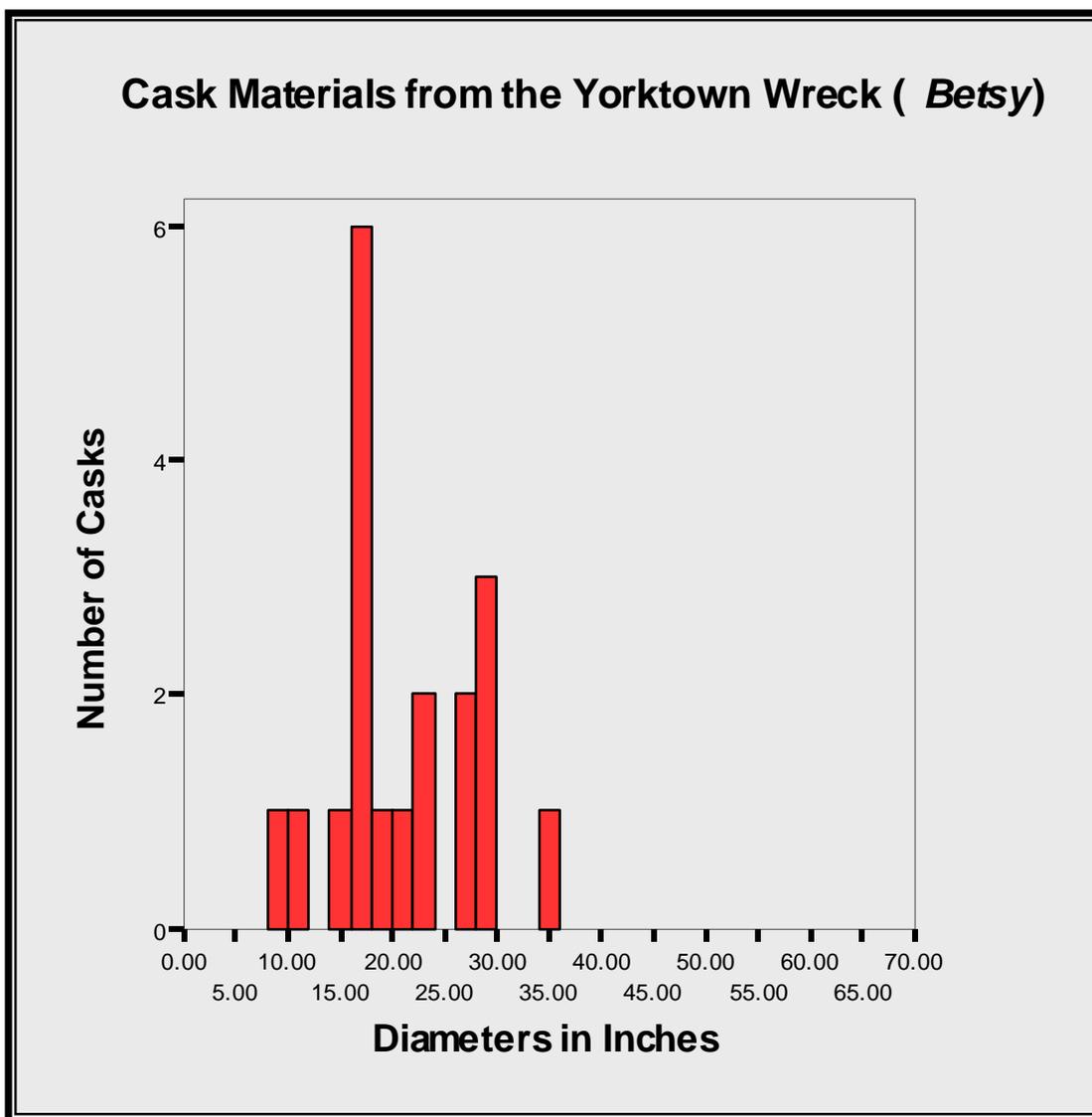


FIGURE 4.4. Histogram showing the range of cask diameters represented in the Yorktown Wreck (*Betsy*) cask assemblage. Diameters are abased on head diameters found in Table 1.1 and are based on 2 inch increments.

The cask materials from the British Merchant Vessel from Chubs Head Cut and *Henrietta Marie* were not fully analyzed or the information was not published. The published material from *Betsy*, the Millecoquins wreck, and *William Salthouse* were and provided some guidance concerning the materials one may expect to recover from a merchant vessel. First, some cask materials should be found on merchant vessel wreck sites, as each vessel in this class yielded such materials (Figure 4.8). Second, it appeared that there was a consistently higher ratio of larger casks in proportion to smaller casks. This potential pattern should be analyzed further as more merchant vessels are encountered and cask material recovered. Each merchant vessel represented in this study sank accidentally, making it impossible for any items to have been removed from the vessel at the time of sinking. Items may have floated away, become destroyed in the wrecking process, and/or decayed over the decades or centuries from the time of the wreck to its discovery. One hypothesis to test would be that lighter items floated away or rotted at a faster rate than the larger casks. They might also be more likely to sink to the sea floor and buried at a faster rate. No definitive patterns were encountered amongst merchant vessels, but it was recommended that the several potential patterns discussed previously be furthered examined amongst the recovery of other eighteenth century merchant vessels.

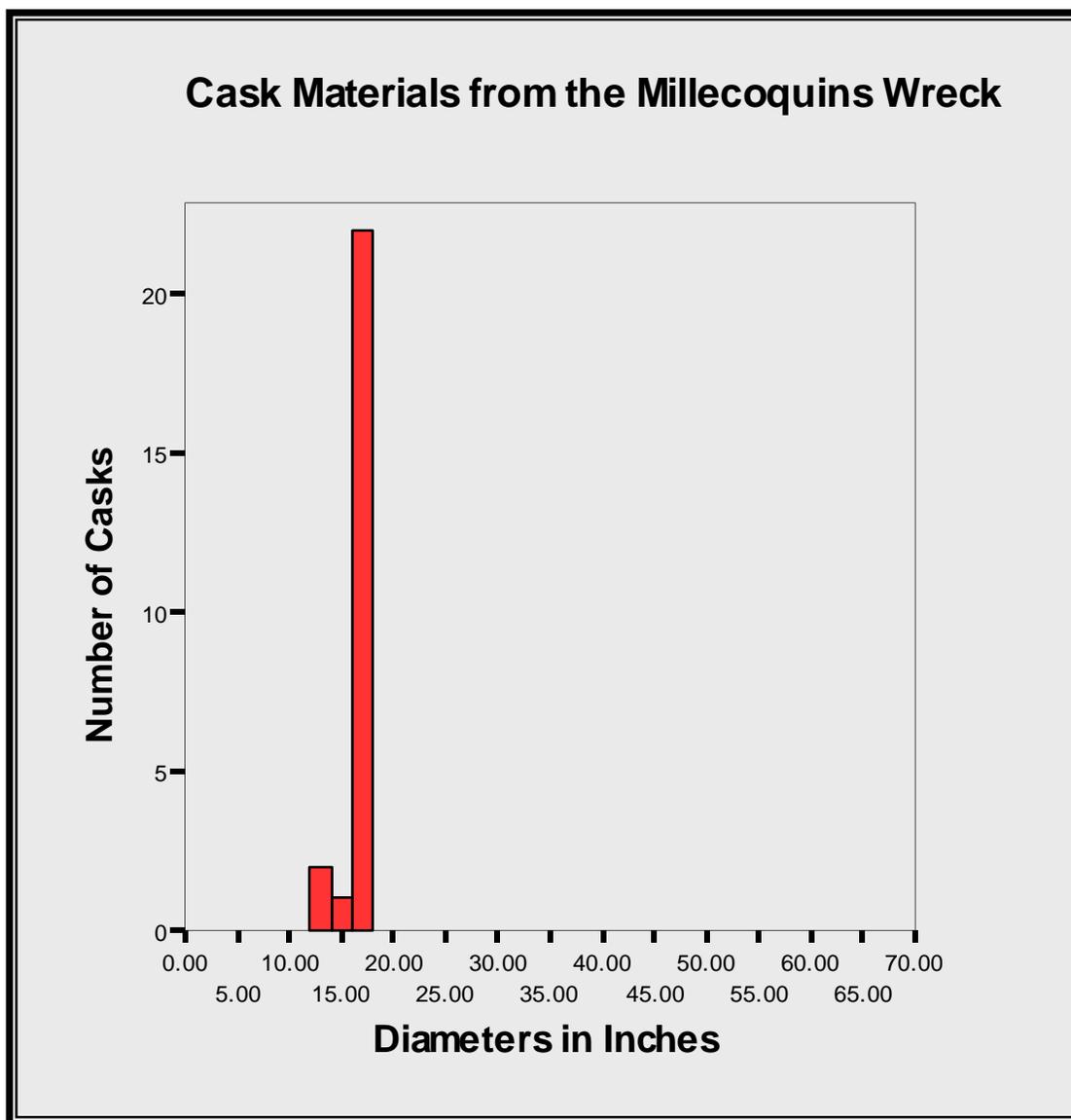


FIGURE 4.5. Histogram showing the range of cask diameters represented in the Millecoquins Wreck cask assemblage. Diameters are based on head diameters found in Table 1.1 and are based on 2 inch increments.

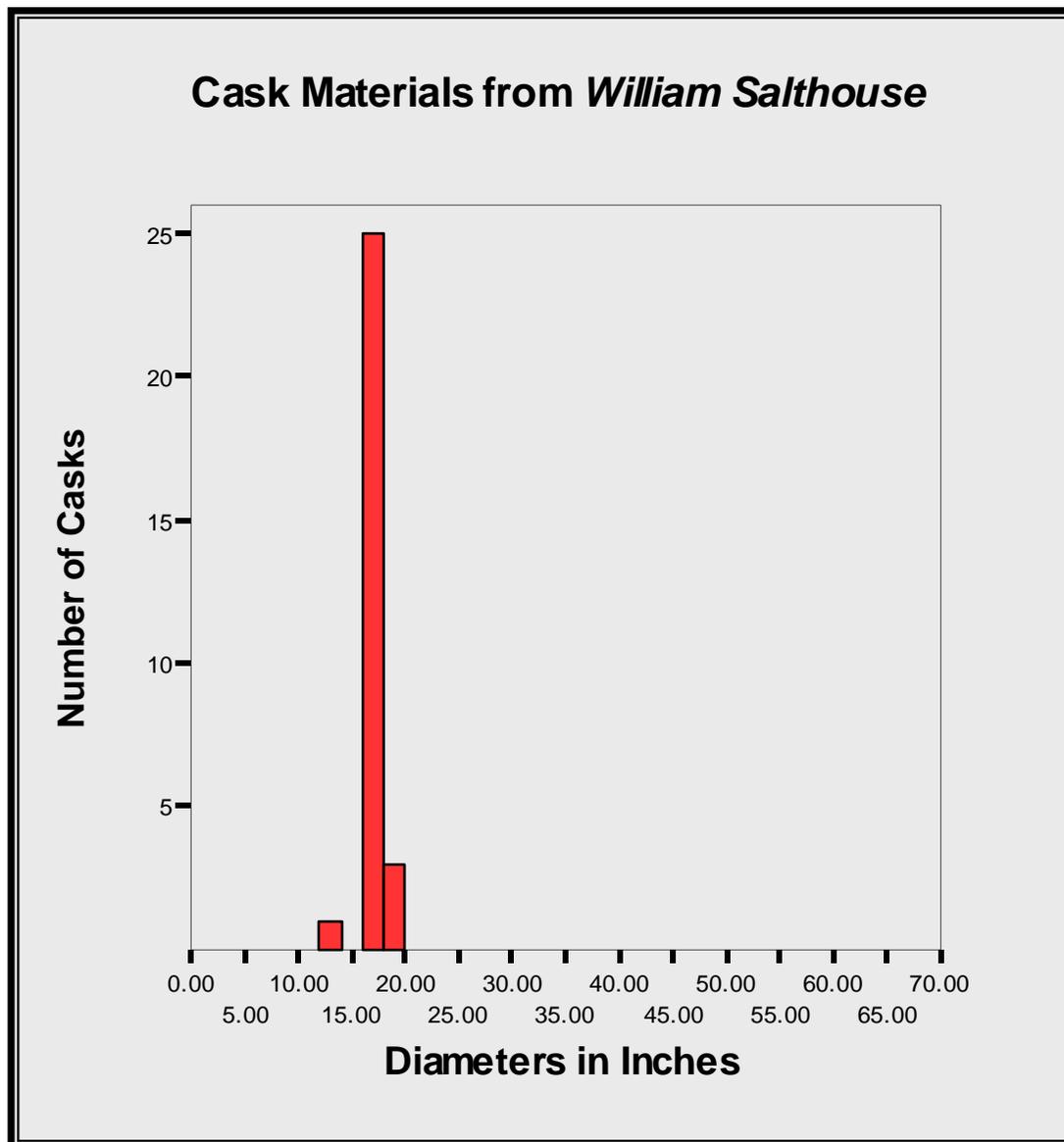


FIGURE 4.6. Histogram showing the potential casks represented in the *William Salthouse* cask assemblage. Diameters are based on head diameters found in Table 1.1 and are based on 2 inch increments.

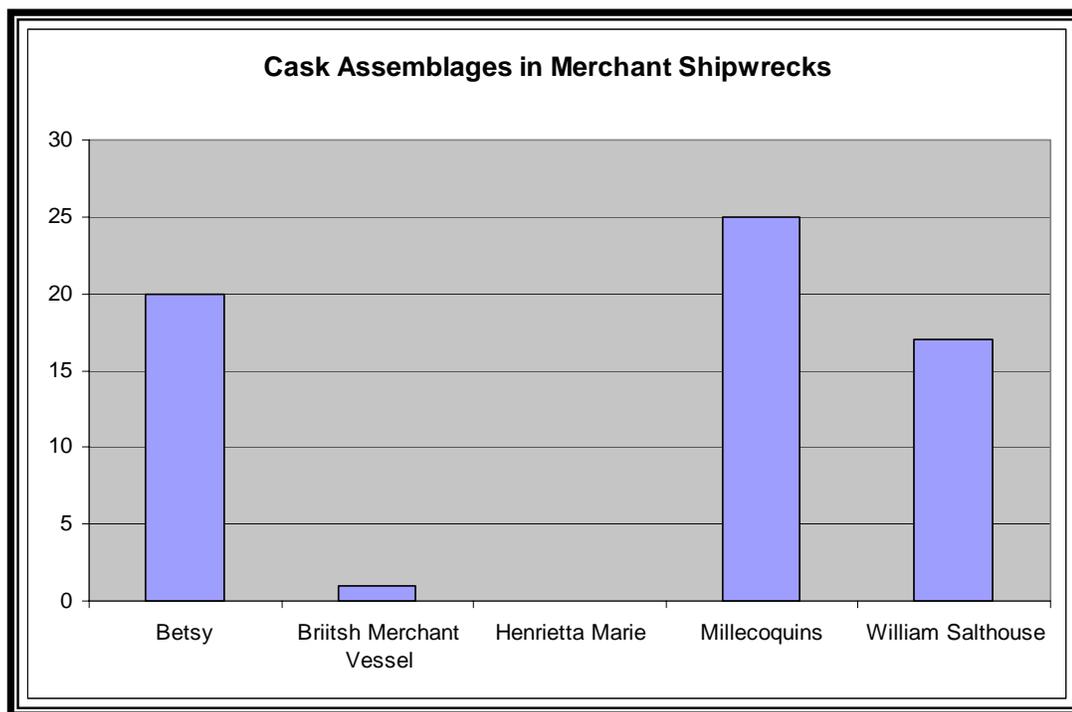


FIGURE 4.7. Bar graph showing the sum of the cask material recovered from the five merchant vessels analyzed in this study.

Naval

HMS *Charon*, HMS *DeBraak*, HMS *Fowey*, HMS *Invincible*, HMS *Sirius*, *Lossen*, and *Mary Rose* were all naval vessels (Steffy 1981; Beard 1989; Skowronek and Fischer 1984; Bingeman 1998; Von Arnim 1998; Molaug 1998; and Rule 1982). The exact dimensions as well as the number of casks or cask components recovered from or encountered on HMS *Charon*, HMS *DeBraak*, and HMS *Fowey* were unavailable. Based on the available head diameters (Figure 4.5), contents, and other cask components, a total of nine buckets (18.37 % of the assemblage), 12 to 15 powder barrels (30.61 % of the assemblage), four spirit barrels (8.16 % of the assemblage), and 21 miniature barrels or writing kits (42.86 % of the assemblage) were recovered from HMS *Invincible* (Figures

4.8 and 4.22). HMS *Sirius* yielded what appeared to be salt pork casks, empty casks, iron hoops, and several copper hoops. Unfortunately, the exact dimensions, number of casks and hoops, and more specifics concerning the exact location of the cask remains within HMS *Sirius* were unavailable.

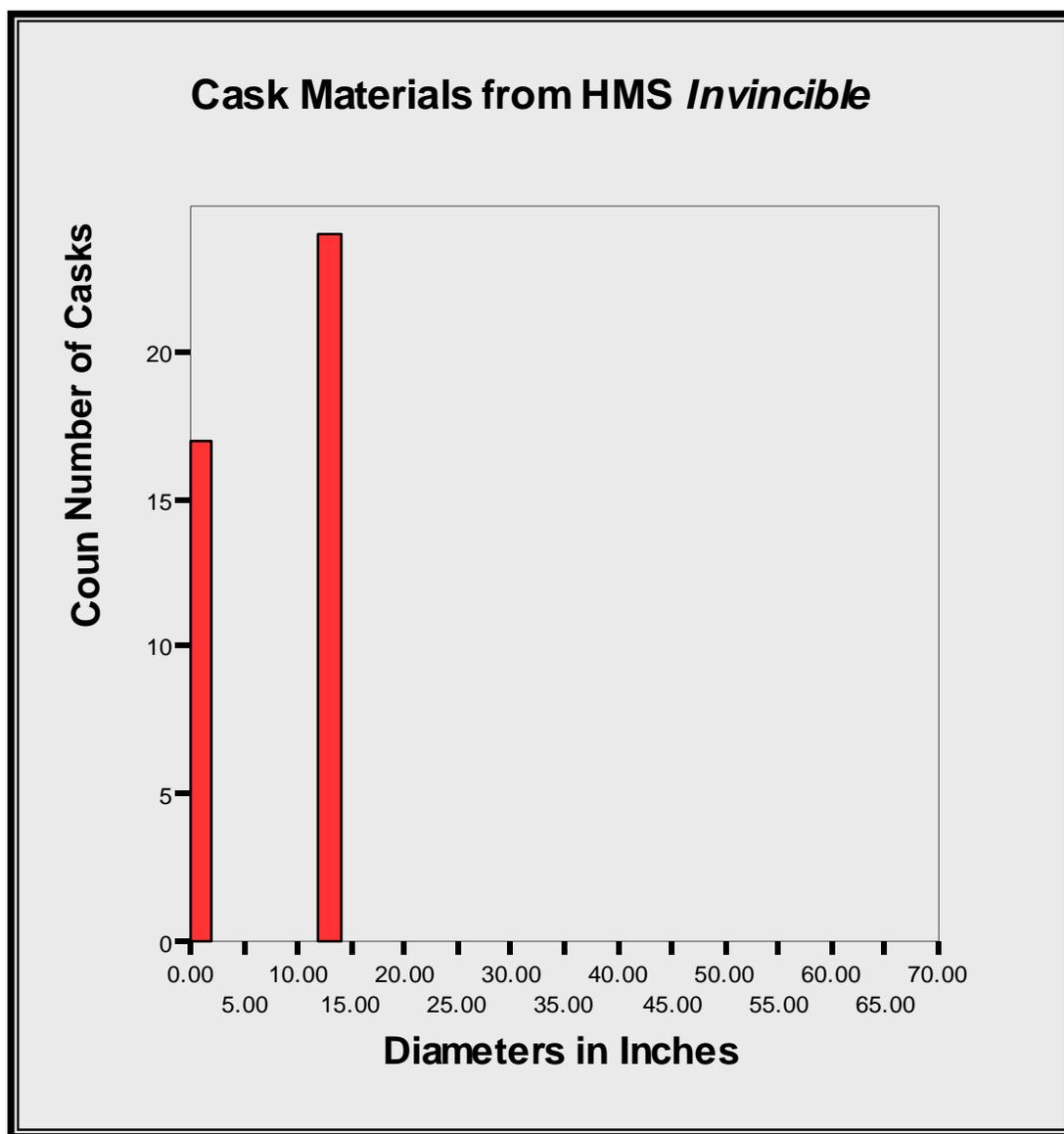


FIGURE 4.8. Histogram showing the range of cask diameters represented in the HMS *Invincible* cask assemblage. Diameters are based on head diameters found in Table 1.1 and are based on 2 inch increments.

The cask sizes identified on the *Mary Rose* were determined based on estimated capacities provided by Rodrigues (2005:420-421). These capacities were compared with those provided in Table 1.1 and were used to determine the best sizes represented, or in many cases, the several sizes that may have been present. Based on the available head diameters (Figure 4.9), contents, and other cask components, *Mary Rose* yielded six casks in which their diameters and estimated capacities were unknown (18.18 %); two casks of unknown size (6.06 %), but may represented pipes or butts; two tertians or puncheons (6.06 %), or at the very least casks similar in size; 11 tierces (33.33 %), or casks that were similar in size; six barrels (18.18 %); four kilderkins or cask of similar capacities (12.13 %); one anker or similar sized cask (3.03 %); and one bidon or similar sized cask (3.03 %) (Figure 4.23). The majority of the casks (39.40 %) were recovered admidship in the orlop deck, 27.27 % were recovered admidship in the hold, while 9.09 % were recovered from the forward hold and near the bow and stern of the orlop deck, 3.03 % from the sterncastle, and the remaining 3.03 % from the aft hold (Figure 4.10).

HMS *Charon*, HMS *DeBraak*, HMS *Fowey*, and HMS *Sirius* yielded cask materials, but the material was not fully analyzed or reported and was unknown. *Lossen* yielded 100 staves and approximately 120 casks were represented in the assemblage; however, this was all that was known.

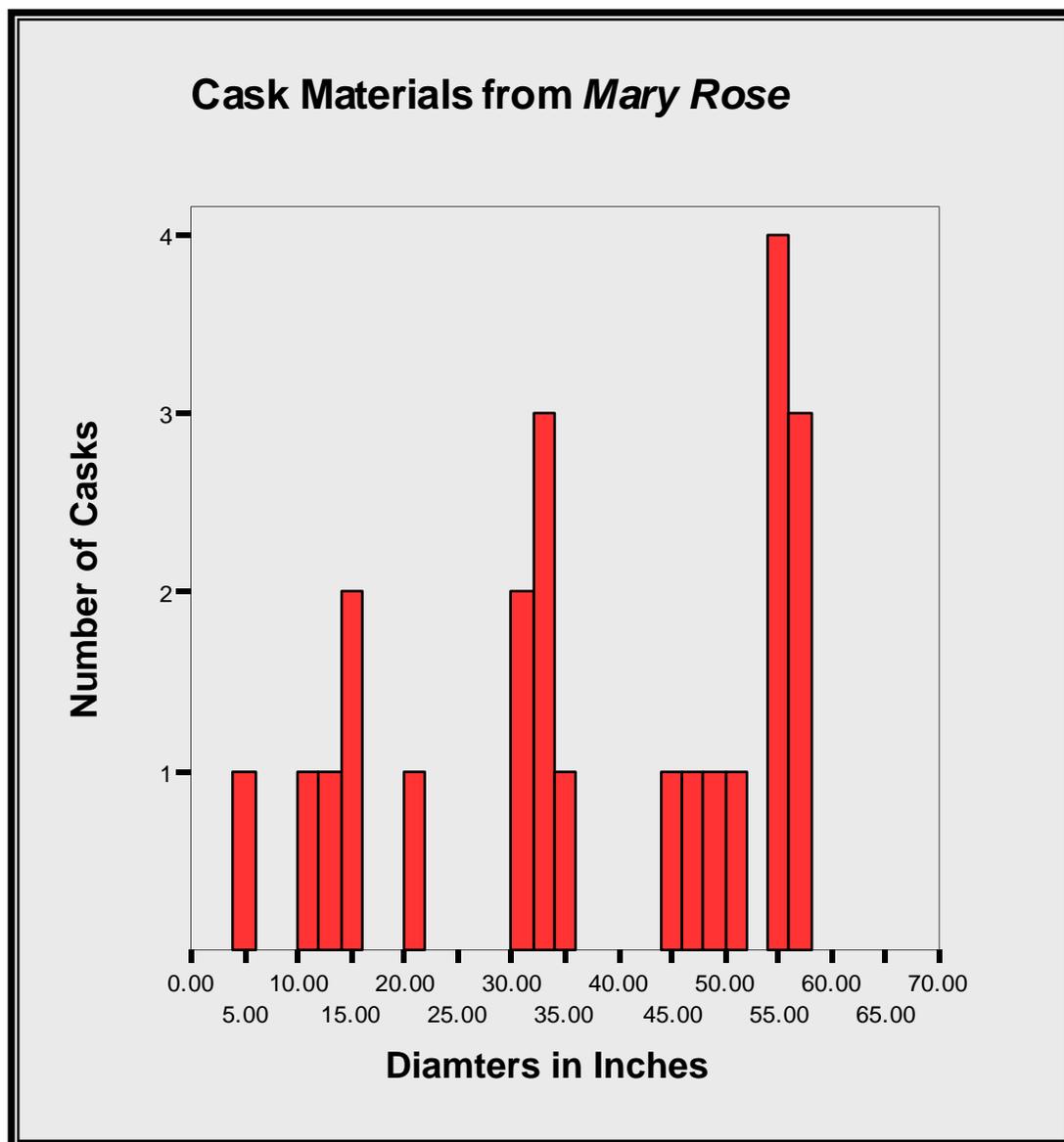


FIGURE 4.9. Histogram showing the range of cask diameters represented in the *Mary Rose* cask assemblage. Diameters are abased on head diameters found in Table 1.1 and are based on 2 inch increments.

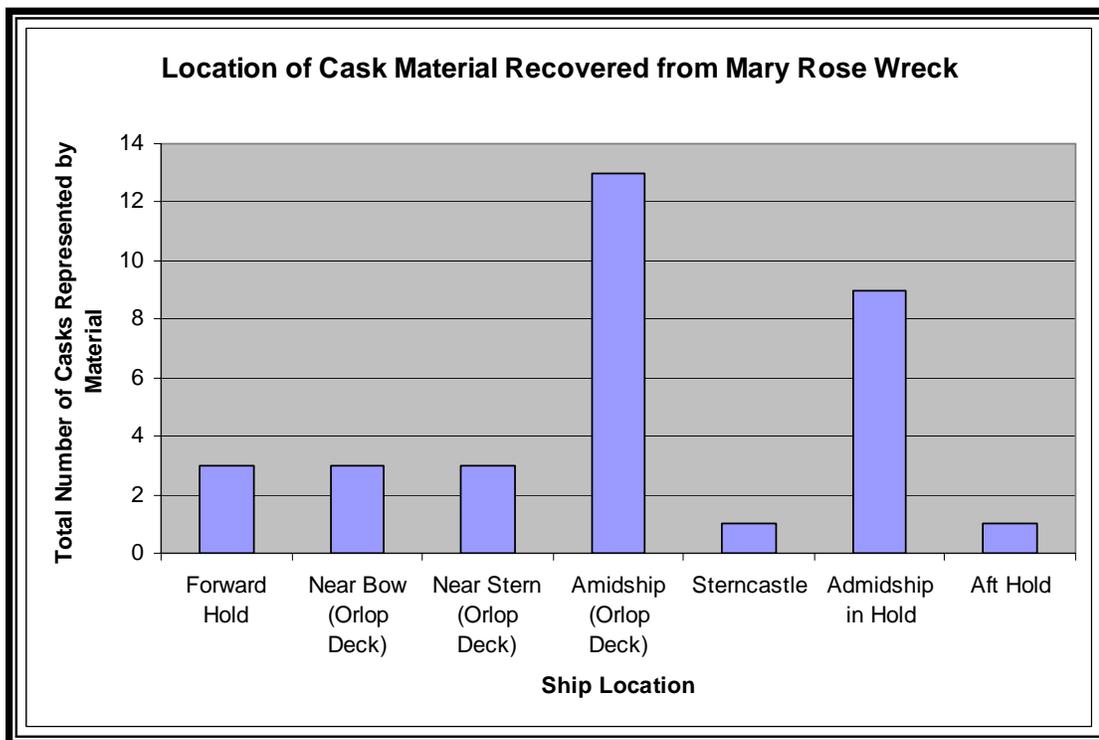


FIGURE 4.10. Bar graph showing the locations within the vessel where cask material was recovered.

The material from HMS *Invincible* and *Mary Rose* were analyzed and disseminated, and were compared to determine patterns in the materials recovered from naval vessels. Cask materials can be expected to be recovered, as each naval shipwreck in this study yielded cask components (Figure 4.11). The HMS *Invincible* yielded a greater number of casks smaller in size and capacity, approximately 20 gallons or less with a head diameter of approximately 16 inches or less. These include kilderkins, ankers, firkins, bidons, and smaller miscellaneous cask sizes. The larger casks, tierces and barrels, make up the minority (Figure 4.8). The *Mary Rose* yielded a greater number of casks larger in size and capacity, approximately 31 gallons or more with a head

diameter of 20 inches or more. The small casks make up the minority (Figure 4.9). Casks aboard the HMS *Invincible* may have been removed prior to her sinking, as it was an accidental grounding. Those aboard the *Mary Rose*, however, were not as lucky as she sank quickly. *Mary Rose* was outfitted for a short excursion, which would have limited the supplies aboard.

As a whole, no definitive patterns were identified for naval vessels,. The data provided mixed results. Dependant upon the ship's sinking or grounding, it may be typical to find a higher ratio of smaller casks to larger ones or vice versa. These patterns should be compared amongst the recovery and analysis of other eighteenth century naval vessels.

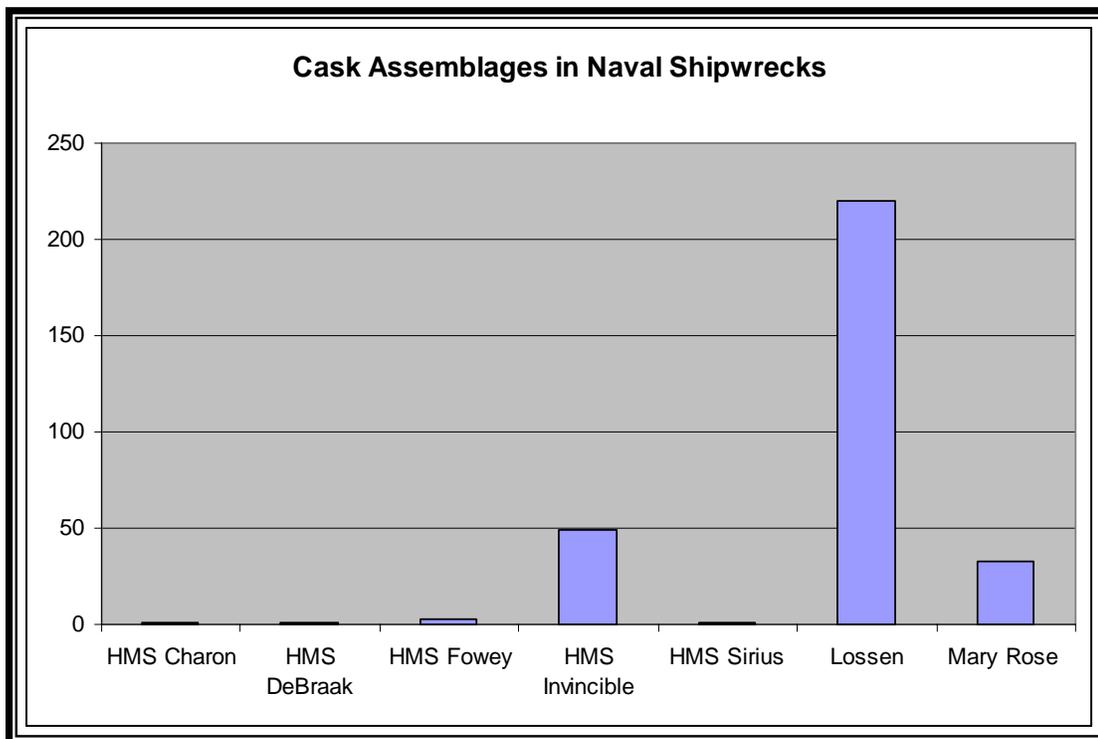


FIGURE 4.11. Bar graph showing the sum of the cask material recovered from the seven naval vessels analyzed in this study.

Exploration

La Belle was the only exploration vessel utilized in this study, due to the lack of other similar vessels having been identified and analyzed. A total of 80 casks were found on *La Belle*, most of which were intact or partially intact with their contents in situ: 12 casks for dry goods and trade goods (15.0 %); 12 casks for liquids (15.0 %); seven tar, resin or tallow casks (8.75 %); 12 powder casks (15.0 %); 32 shot casks (40.0 %); and five casks in which their function was unknown (6.25 %) (Figures 4.12 and 4.24). Figure 4.12 shows the casks in which the head diameters were available. Not all head diameters, or cask dimensions were available.

The cask sizes represented by the head diameters were provided by Meide (1997), but also match the diameters for the shot kegs and barriques located in Table 1.1. In general, the cask materials were found throughout the wreck site. Specific locations were fifty-four casks (67.5 %) were recovered from the main hold, 25 (31.25 %) from the aft hold, and one (1.25 %) from the bow (Figure 4.13).

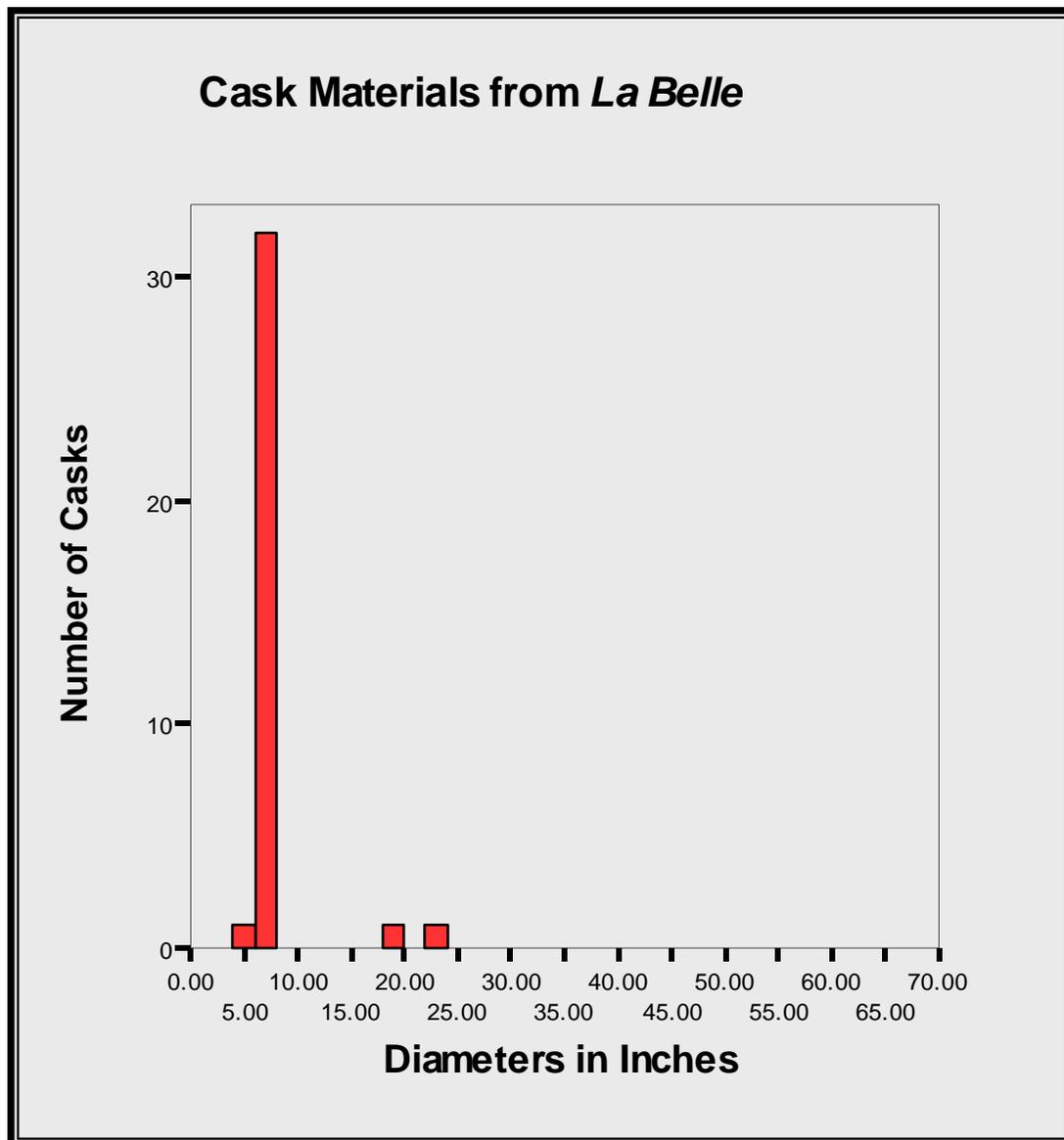


FIGURE 4.12. Histogram showing the range of cask diameters represented in the *La Belle* cask assemblage. Diameters are based on head diameters found in Table 1.1 and are based on 2 inch increments.

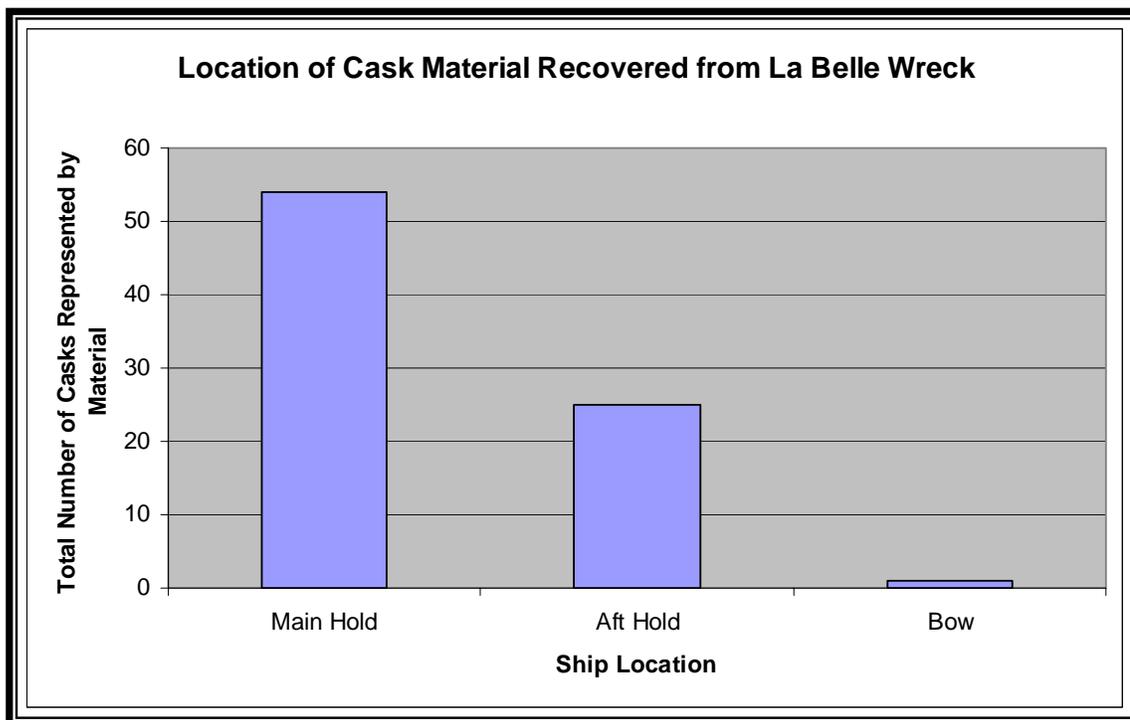


FIGURE 4.13. Bar graph showing the locations within the vessel where cask material was recovered.

Given that *La Belle* was the only exploratory vessel analyzed in this study, it was extremely difficult to determine if a pattern in the types of cask materials recovered exists amongst all such type vessels. *La Belle*'s cask materials appeared to be located away from the bow of the vessel, and mostly towards the midship, which may occur on other exploratory vessels, if any should be discovered and examined. The exact dimensions of the casks recovered were not available obscuring any patterns that may exist pertaining to cask sizes or capacities. Both cask sizes and location patterns should be examined further amongst the recovery of other eighteenth century exploratory vessels.

Whaling

San Juan was the only whaling vessel utilized in this study, due to the lack of other whalers identified and analyzed. Not all dimensions, such as the head diameter, bilge diameter or stave lengths were available; however, the overall cask sizes recovered were. At least 14 barricas, a half-barrica, a bever cask, and an unknown number of one-third barricas were most likely represented. Individual dimensions were unavailable, but generalized dimensions were. The one-third barrica heads ranged in diameter from 13.2 in to 16.9 in, and the head pieces ranged in length (possibly representing the diameter if the measurement represents the length of the head center piece) from 20.2 in to 23.6 in. The remaining diameters remained uncertain. The assemblage comprised 82.35 % (n=14) barricas, 5.88 % (n=1) half-barricas, 5.88 % (n=1) bever casks, and a minimum of 5.88 % (n=1) one-third barricas (Figure 4.25).

Given that *San Juan* casks were the only whaling vessel containers analyzed in this study, it was extremely difficult to determine if a pattern in the types of cask materials recovered exists amongst such vessels. It appeared that larger sized casks were identified. This was most likely due to the vessel's use as a whaling vessel carrying whale oil product. The larger casks were used to transport the whale oil commodities while the smaller casks were used for provisioning (Ross 1981). This potential pattern was logical, as the commodity, in this case whale oil, was expected to be in abundance as it was the purpose of the vessel to harvest and collect it. One should expect to find a higher ratio of larger cask sizes to smaller ones on this type of vessel. The exact dimensions of the casks were uncertain due to varying factors including vessel tonnage

and cultural affiliation. It should not be assumed that just because a larger cask was recovered it contained whale oil or whale products. Testing of the wood for lipids and the like to verify cask use should be done. This potential pattern should be furthered examined amongst the identification and recovery of other eighteenth century whaling vessels.

Unknown

The function of the Federal Period Vessel from Oriental, North Carolina was unknown. The cask sizes and functions represented were also unknown. No complete center head pieces were recovered making it impossible to determine precise head diameters. Stave lengths were not a useful indicator for size or capacity as was discussed in Chapter 5. Staves comprised 81.63 % (n=40) of the assemblage, while 12.24 % (n=6) were head pieces and the remaining 6.12 % (n=3) were hoops (Figure 4.26). Four components were recovered towards the bow, another four from near the waist, and the remaining 41 lacked provenience data (Figure 4.14).

The casks' exact dimensions were not available obscuring any patterns that might exist pertaining to cask sizes or capacities. The provenience was lacking, further obscuring any patterns pertaining to placement. These were necessary when determining the type of vessel which may be represented, and lacking such data has made it impossible to compare this vessel against other vessel types to determine the vessel's function. It was possible that the material represented on this vessel was shook material, especially considering North Carolina's historical role in the production and exportation

of cask materials (*The North Carolina Magazine* 1764). The material might also have represented casks that were disassembled as a result of the wrecking process or taphonomic processes. No patterns in cask material recovered from this shipwreck have been discerned.

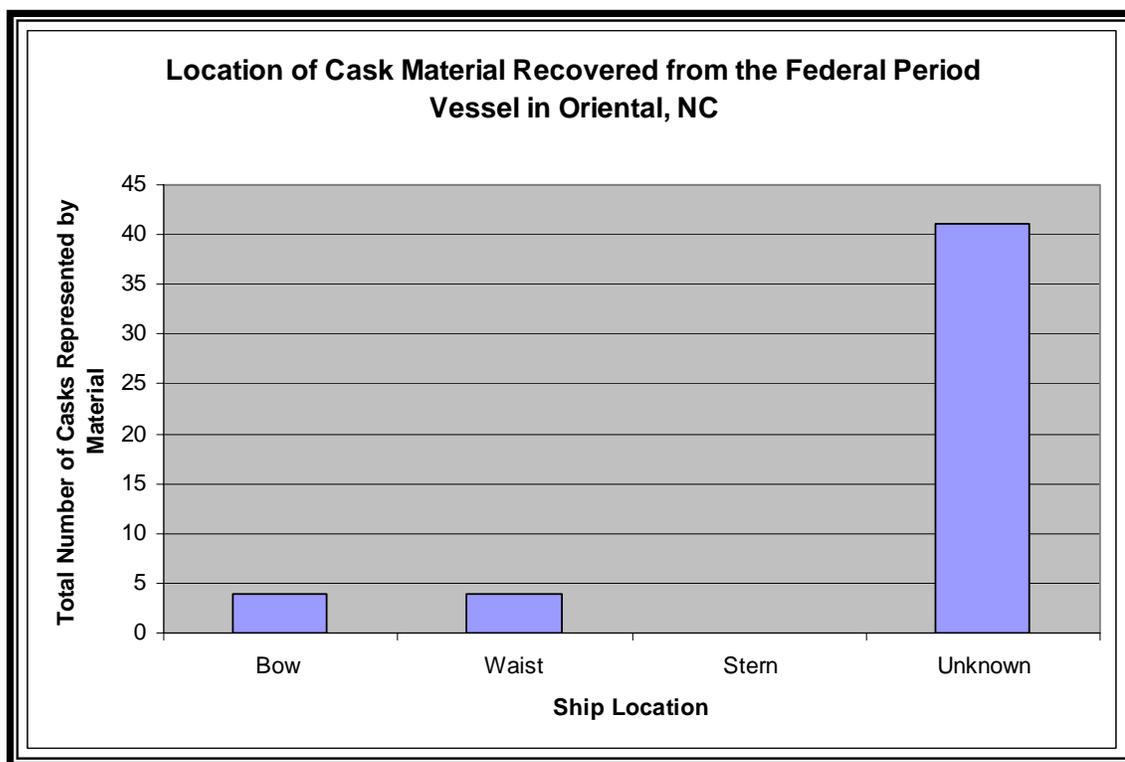


FIGURE 4.14. Bar graph showing the locations within the vessel where cask material was recovered.

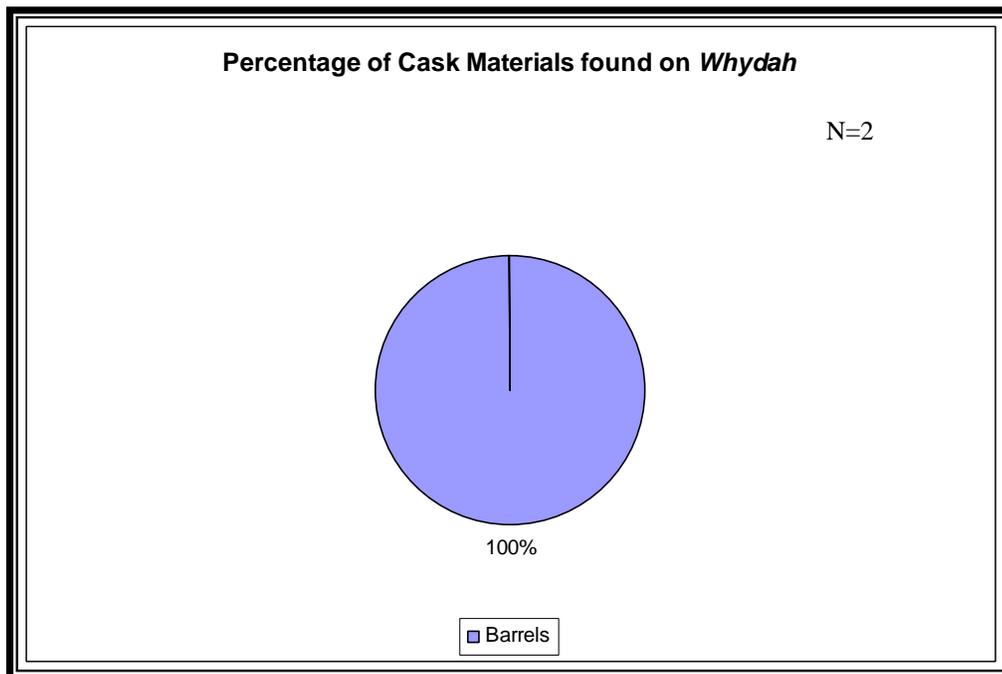


FIGURE 4.15. Pie graph showing the different types of casks probably represented on *Whydah*, and their percentage within the entire cask assemblage.

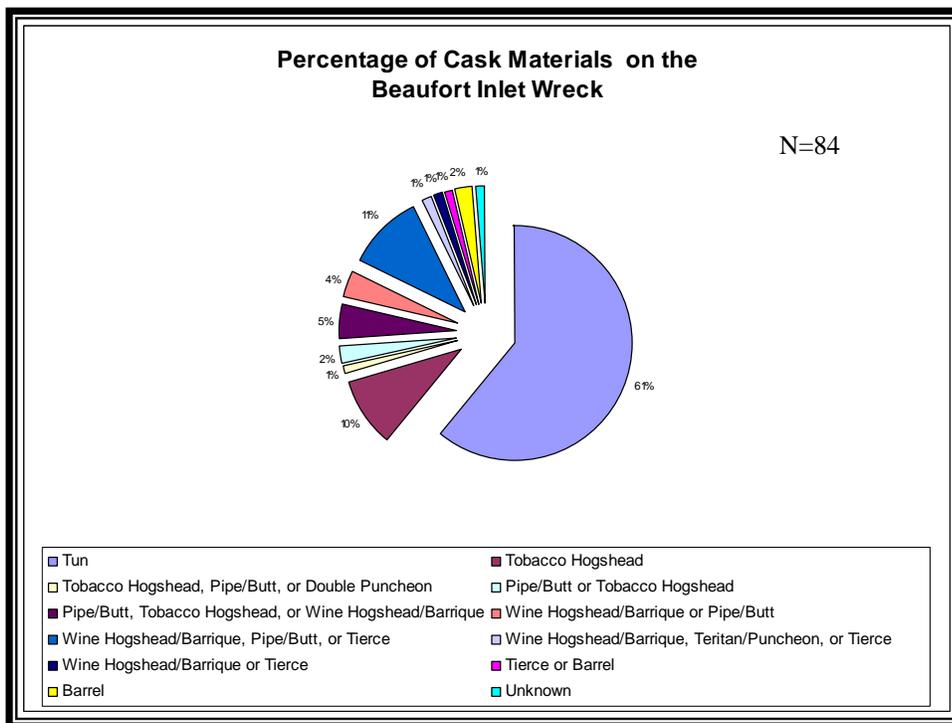


FIGURE 4.16. Pie graph showing the different types of casks probably represented in the Beaufort Inlet Wreck, and their percentage within the entire cask assemblage.

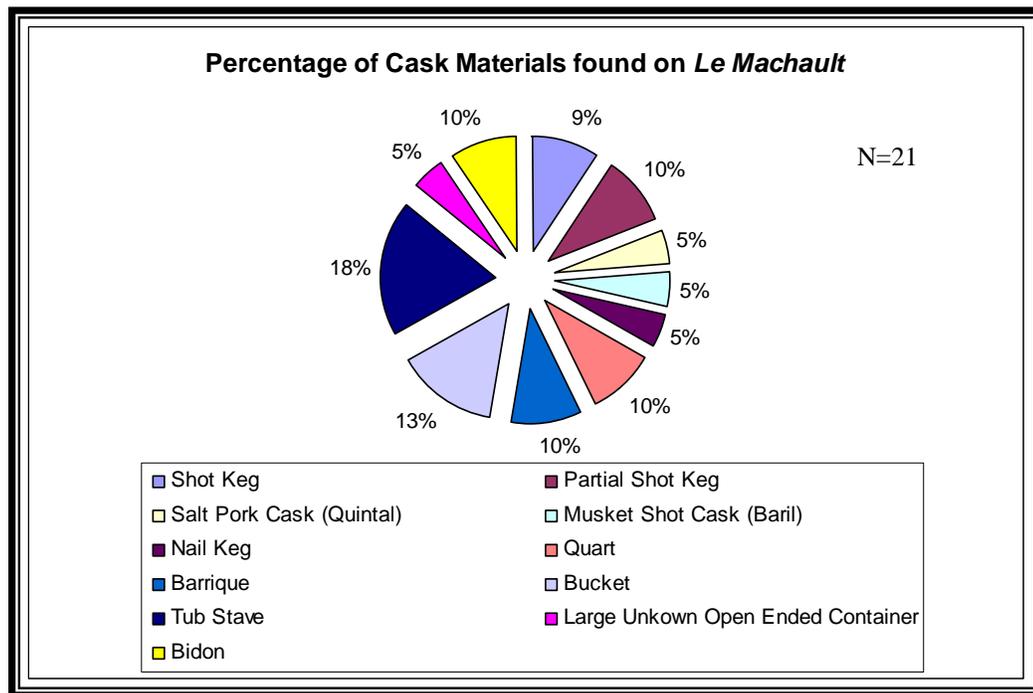


FIGURE 4.17. Pie graph showing the different types of casks probably represented on *Le Machault*, and their percentage within the entire cask assemblage.

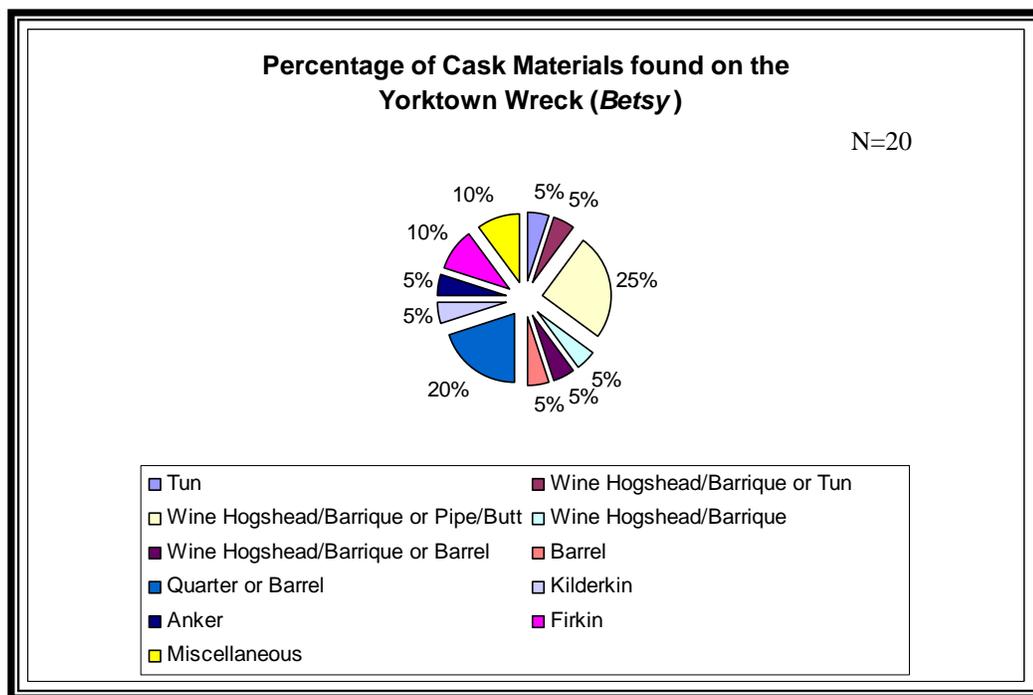


FIGURE 4.18. Pie graph showing the different types of casks probably represented on the Yorktown Wreck (*Betsy*), and their percentage within the entire cask assemblage.

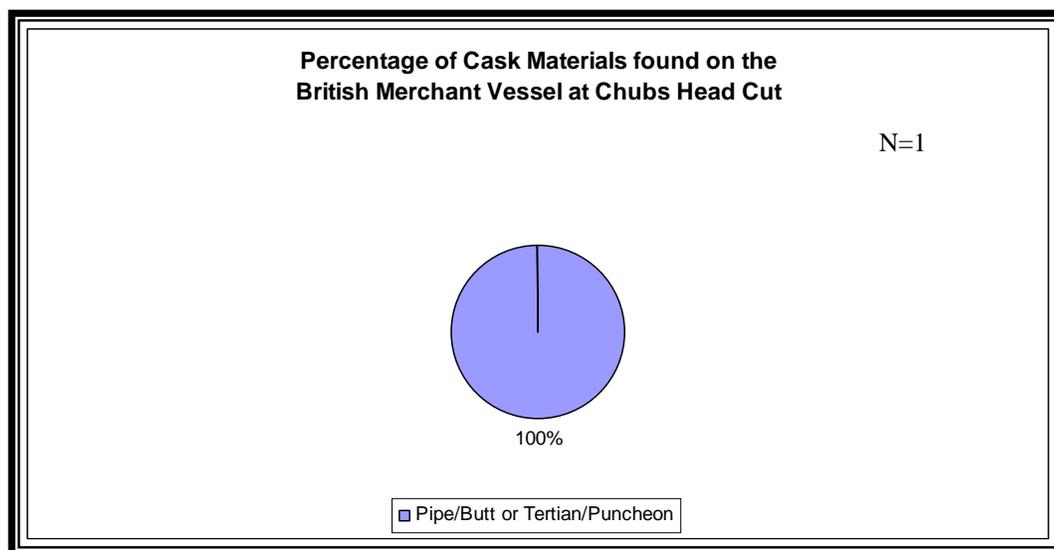


FIGURE 4.19. Pie graph showing the different types of casks probably represented on the British Merchant Vessel at Chub Head Cut, and their percentage within the entire cask assemblage.

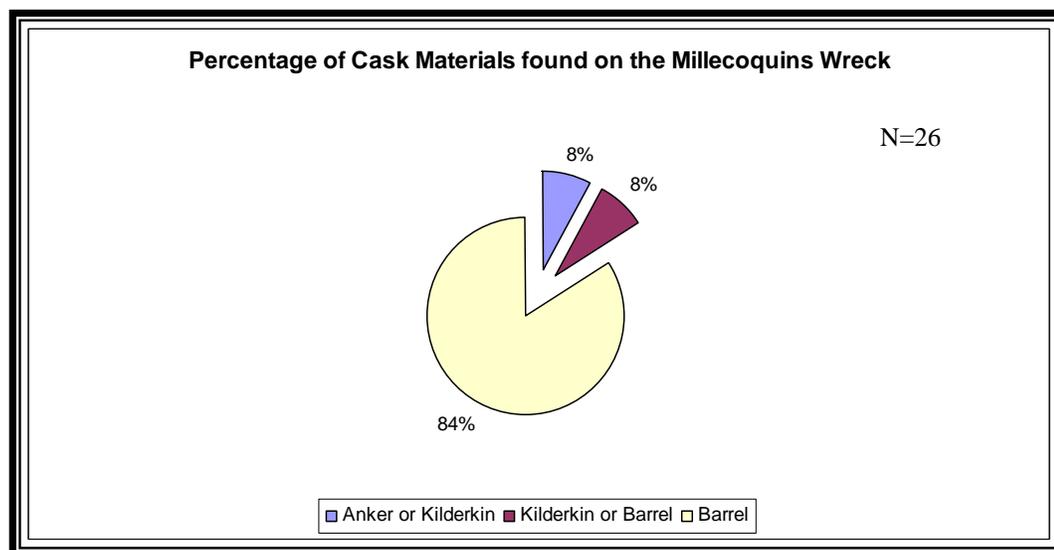


FIGURE 4.20. Pie graph showing the different types of casks probably represented on the Millecoquins Wreck, and their percentage within the entire cask assemblage.

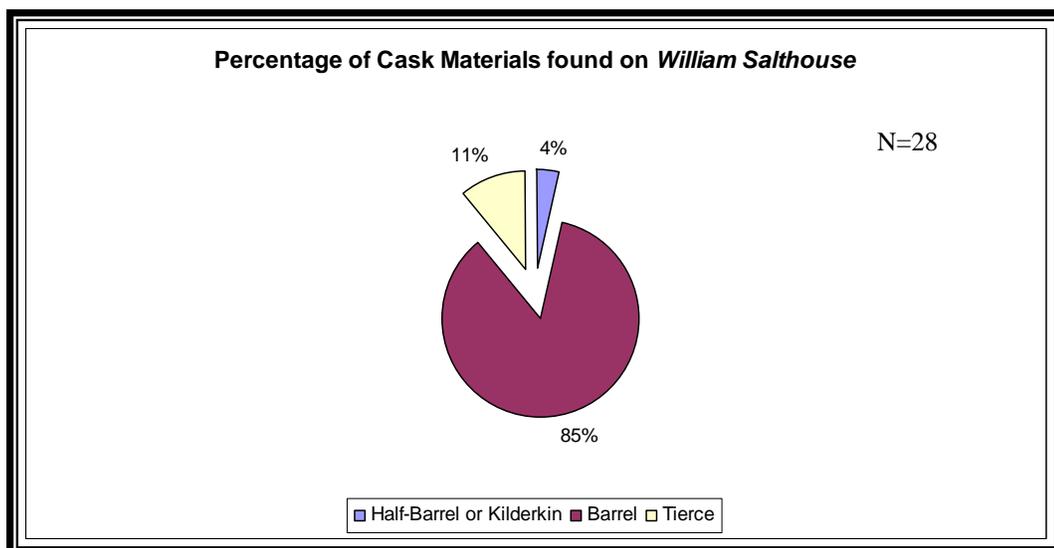


FIGURE 4.21. Pie graph showing the different types of casks probably represented on *William Salthouse*, and their percentage within the entire cask assemblage.

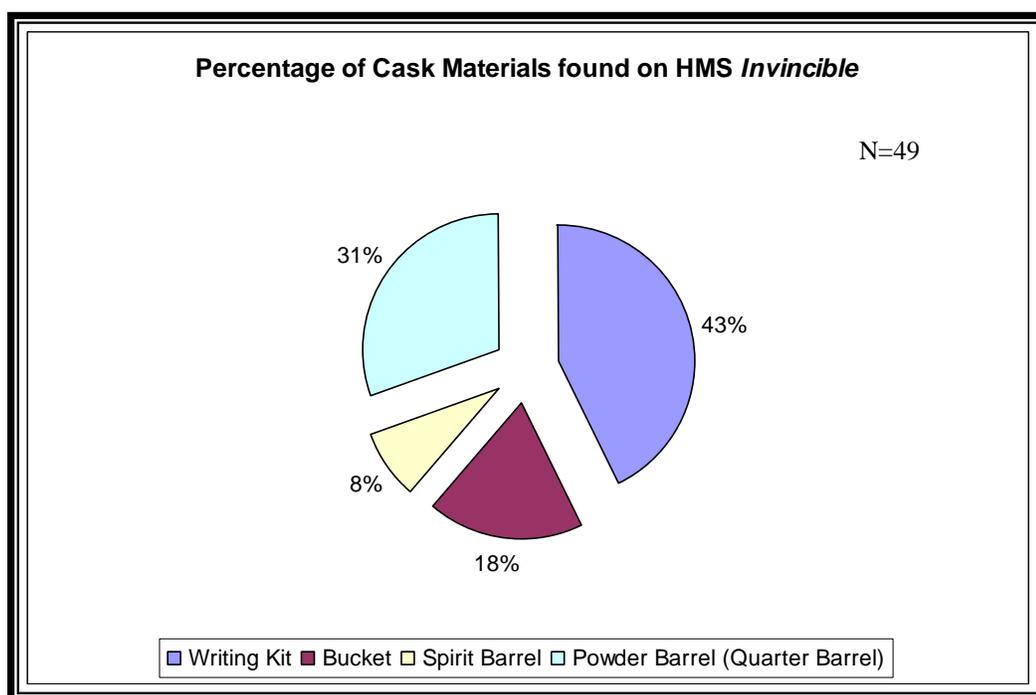


FIGURE 4.22. Pie graph showing the different types of casks probably represented on HMS *Invincible*, and their percentage within the entire cask assemblage.

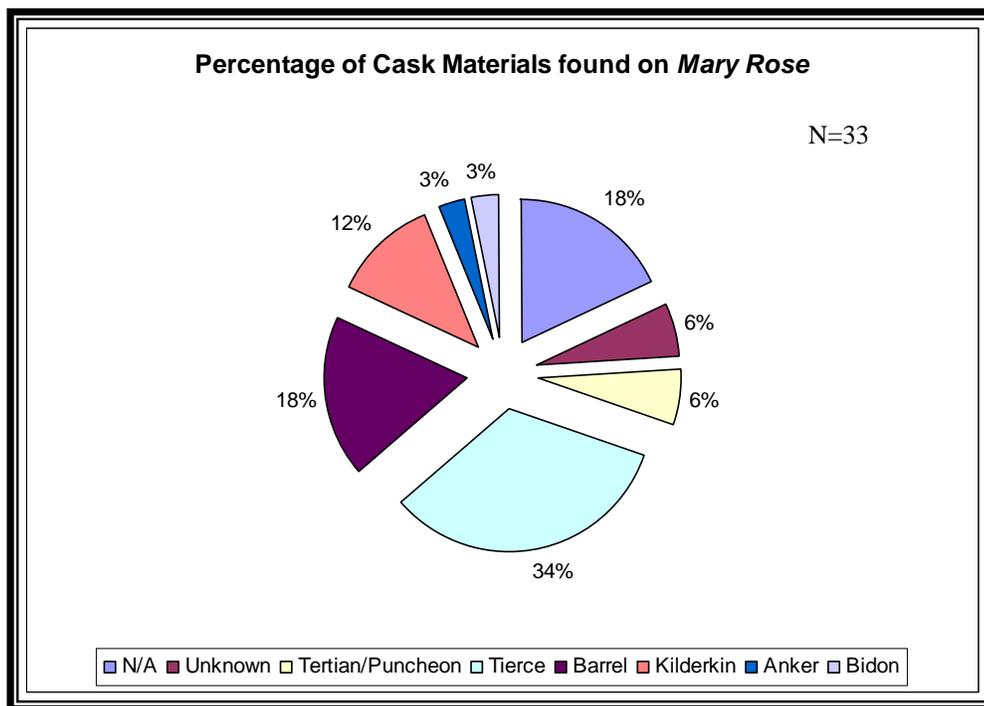


FIGURE 4.23. Pie graph showing the different types of casks probably represented on *Mary Rose*, and their percentage within the entire cask assemblage.

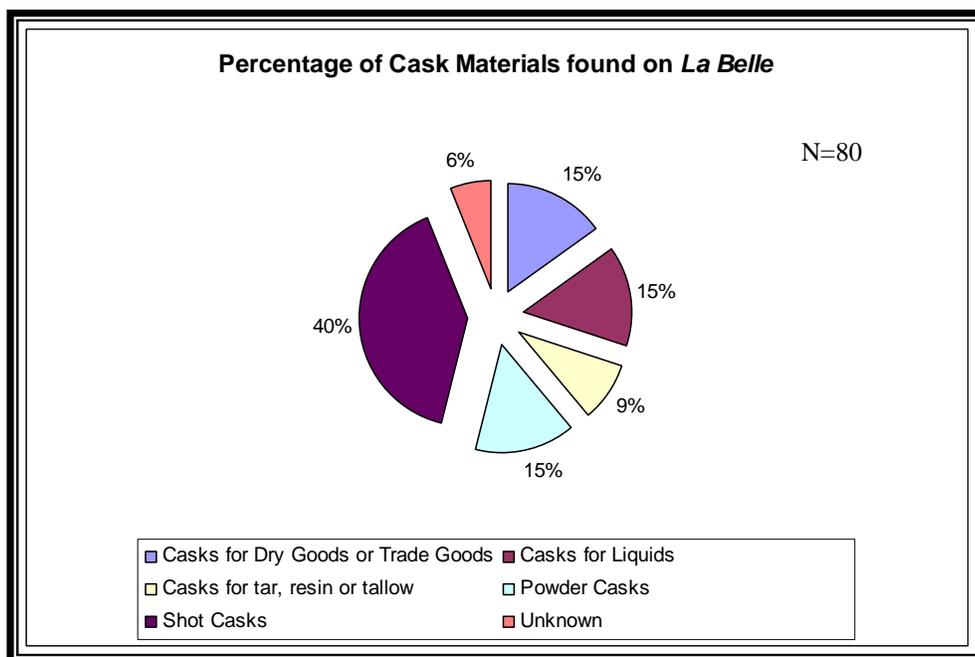


FIGURE 4.24. Pie graph showing the different types of casks probably represented on *La Belle*, and their percentage within the entire cask assemblage.

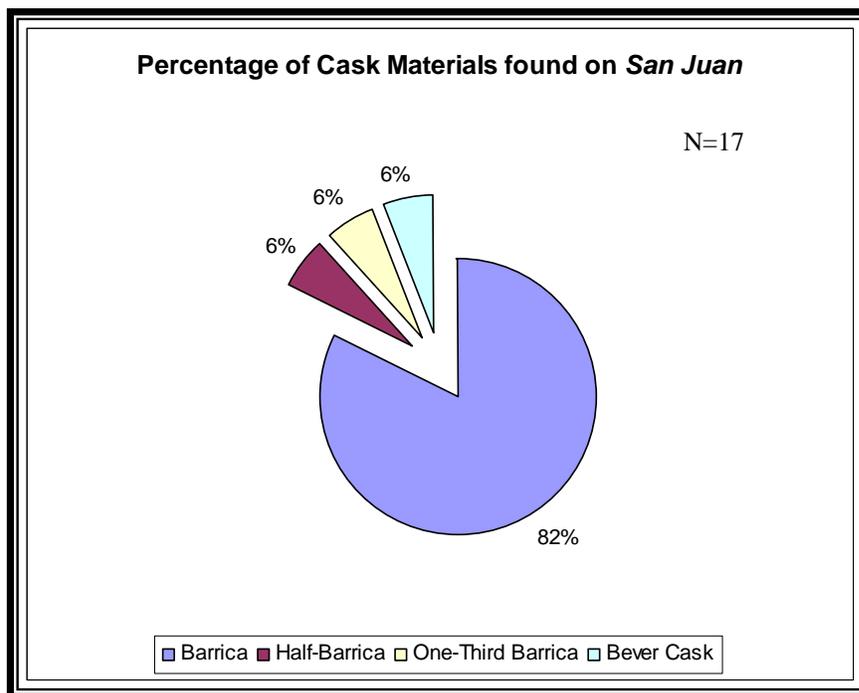


FIGURE 4.25. Pie graph showing the different types of casks probably represented on *San Juan*, and their percentage within the entire cask assemblage.

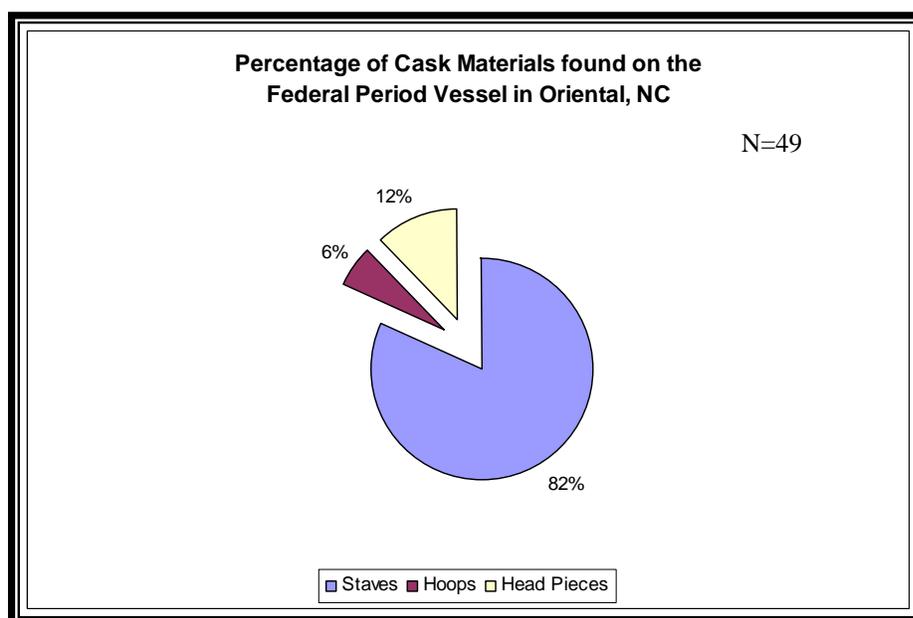


FIGURE 4.26. Pie graph showing the different types of casks probably represented on the Federal Period Vessel in Oriental, NC, and their percentage within the entire cask assemblage.

Discussion of Patterns

No distinct patterns were discerned from the data utilized in this research. Casks can be expected to be recovered from all vessel types. These may include intact casks, disassembled casks in the form of shooks, or casks that collapsed as a result of the wrecking process and the taphonomic processes that occurred over time since the sinking of the vessel. It may be hard to recognize cask materials due to toredo worm damage, the concretion process, and much more, but vessels from at least the sixteenth through eighteenth centuries always carried provisions, vessel repair items, and commodities in casks and, therefore, should have at one time been on the vessel. These items included water, flour, bread, nails, axes, meats, and much more. Environmental factors, archaeological techniques, and historical patterns may also affect the recovery of casks. Some casks may decay faster due to the environment or currents may remove artifacts from a site. These factors all inhibit the ability to identify and recover casks from archaeological contexts.

Several potential patterns were also identified and should be evaluated further upon the recovery and analysis of materials recovered from like vessels. Pirate vessels utilized in this study appeared to have a disproportionate amount of larger casks (99.31 %) to smaller casks (0.69 %). This was based almost solely on the material recovered from the Beaufort Inlet Wreck, as the *Whydah* material was not disseminated beyond the presence of two barrels as a sample of the materials on board. This potential pattern may also be indicative of slave vessels, as the *Whydah* and the Beaufort Inlet Wreck if it was the *Queen Anne's Revenge*, were also previously slave ships. This potential pattern may

be due to the original amount of casks aboard the vessels, or it may be a result of the processes incurred upon the vessels after their sinking. The *Whydah* was an accidental sinking, while if the Beaufort Inlet Wreck was truly the *Queen Anne's Revenge*, it was possibly an intentional grounding allowing the opportunity for removal or looting of goods. The question remains as to why larger casks remained aboard a vessel and not smaller ones? Was this due to the value of the contents in the smaller ones? Were there no smaller casks? Has the environment, such as the hurricanes, affected the preservation of the smaller casks, to the point that they were no longer able to be recovered? These questions should be investigated as other pirate shipwrecks are identified and their materials recovered.

Privateer vessels utilized in this study appeared to have a higher ratio of smaller casks (81.81 %) to larger ones (18.19 %), although this was based only on materials recovered from *Le Machault*, as those from *Defence* have not been disseminated. This type of vessel shows the opposite pattern from pirate vessels. *Le Machault* was set on fire, potentially providing an opportunity for the removal of items prior to burning. It was possible that the contents of the larger casks were more valuable than those in smaller casks. It is also possible that there were no larger casks or that the preservation of materials was affected by environmental factors.

Merchant vessels in this study appeared to have a higher ratio of larger casks (an average of ca. 60 %) in proportion to smaller casks (an average of ca. 40%), similar to pirate vessels. Each merchant vessel represented in this study sank accidentally with little possibility to remove items prior to the sinking. It may be expected to have a higher

ratio of larger casks to smaller ones, as a merchant vessel's sole purpose was to distribute goods, however it was not certain if this was truly the case. The question of whether or not the ratio of larger casks to smaller ones due to what was onboard in the first place or environmental factors must be asked. The preservation of smaller materials may also not have occurred due to many factors, such as toredo worms, concretions, and decay. It was also possible that the smaller materials were missed during the excavations and conservation of the materials.

Based on HMS *Invincible*, naval vessels appeared to have a higher ratio of smaller casks (56.52 %) to larger ones (43.48 %), similar to privateer vessels. It was uncertain if this ratio reflects upon the original contents of the vessel or the many other varying factors that were discussed and will be further discussed in the next chapter. It was noticed that similar sized vessels were used in both the naval, pirate, and slave trades, which may explain the similar patterns in the sizes of materials recovered. Similar sized vessels were used in both the privateer and merchant trade, possibly explaining their similarities in cask materials recovered. Based on Mary Rose, naval vessels appeared to have a higher ratio of larger casks (58 %) to smaller ones (42 %). Unfortunately, for now potential patterns in naval vessels is inconclusive.

The one exploratory vessel in this study appeared to have cask material located away from the bow, towards the midship. The cask dimensions were unavailable, limiting the potential for comparative analysis with other ships. The cask material provenience was limited on nearly every other vessel analyzed in this study, limiting their possibility of comparison.

The whaling vessel in this study appeared to have a higher ratio of larger casks to smaller casks, similar to pirate and merchant vessels. The larger sized casks were explainable by the very nature of the vessel's function to carry whale oil as a commodity. This particular whaling vessel dates to the late sixteenth century and may not be all that comparable to the vessels recovered from the eighteenth century or nineteenth century.

All patterns discussed herein should be further analyzed upon the discovery of other vessels. The potential patterns have many variables, including the varying traits identified within casks, which have not been fully discussed but will be in Chapter 5. These variables were what one may find, the reason for the difficulty in discerning patterns in the cask materials aboard different vessels and their recovery and identification.

Conclusions and Discussions

Although no definitive pattern was discerned to aid in the determination of the type of vessel and potentially its identity, at this point, a general shipboard location in which casks was expected to be found was determined. Based on cask materials in the previous chapter, it appeared that the majority of casks were recovered from the midship. This included the hold or the midship area on different decks. Casks were more likely to be found in the hold, the typical place for storing goods, near the galley, as was determined on *Defence*, and near the bow, where rations were often placed. Rarely were casks recovered from the stern. This was logical as this area of the vessel was typically reserved for cabins or quarters, with exception of the main hold.

Many variables affecting the potential to recover and identify cask materials from shipwrecks were identified. These variables often make it very difficult to recover, identify, analyze, and compare cask materials between shipwreck sites. Variables to consider include the following:

- The wrecking process
- The value of the materials used to construct the cask
- The value of the cask contents
- Bioturbation at the wreck site and other taphonomic processes
- Environmental factors
- Conservations techniques applied to the artifacts and concretions
- The tonnage of a vessel

The difference between vessels that sunk accidentally versus intentionally can greatly alter the types of cask materials recovered. If a vessel sank accidentally there was no possibility to remove items prior to sinking. What was on board the vessel at the time was what went down with it. If this vessel was sunk intentionally, such as *Le Machault*, the opportunity to remove items prior to sinking was available. Items of value could have been removed and transferred to another vessel. This obviously would alter the items recovered during excavations. If a vessel was set on fire, this would affect preservation. Casks, which were constructed from wood, would burn in the fire; potentially leaving no trace of them behind and making it appear that the vessel was bereft of casks. Only the presence of metal hoops (e.g. iron or copper alloy) would indicate the presence of casks in this case. Copper alloy hoops, however, were relatively rare, with exception of British

Naval casks, and the iron hoops were easily lost during the concretion formation and overlooked during the conservation stages..

The value of the materials used to produce the casks, in addition to the goods within the casks will also affect whether or not these casks remained on a vessel prior to sinking. If a vessel were intentionally sunk, it would be most likely that valuable items were removed if at all possible, and transferred to another vessel prior to sinking. For example, iron hoops were considered an extremely valuable commodity during the eighteenth century (see Chapter 2) and these were probably more likely to be removed than casks bound with wooden hoops. Commodities of value or importance, such as gunpowder, metal tools, and much more were more likely to have been removed from a vessel due to their cost to replace or the loss of their profit. This may explain the absence larger casks aboard the naval and privateer vessels analyzed in this study as many of these were intentionally sunk or burned.

Bioturbation of a site can also heavily affect the preservation and, hence, recovery of cask materials at a site. Torredo worms, which eat through wood, can virtually destroy staves leaving no trace of them behind. Scavenger and burrowing animals can displace materials within a site, altering the original provenience, and thus affecting analyses concerning location within a vessel. For example, although it may not concern cask materials, it was known that crabs in the Gulf of Mexico, often pick up lithics and projectile points, mistaking them for food, and place them in secondary deposits as caches of materials (Amanda Evans March 2008, pers. comm.). Similar

forms of bioturbation can occur within shipwrecks altering the artifacts' original provenience.

In addition to bioturbation, the decay rate of wooden and metal objects, in addition to the time in which concretion forms around objects, affects the preservation and recovery of cask materials within shipwrecks. Each of these varies depending on the wreck environment. Water temperatures, aerobic versus anaerobic environments, and other factors must be studied to understand the processes that may have affected the preservation of such materials prior to the analysis of the materials recovered. Understanding these environmental factors may identify reasons why materials were present and absent and will help prevent the data from being skewed.

Other environmental factors, such as the presence of hurricanes and other storms should be studied to aid in determining the effects upon cask materials from shipwrecks. Hurricanes and large storms often remove sediment from the upper layers of shipwrecks exposing them slowly over time. This will affect the preservation rates of materials, as those which were exposed will most likely be affected more than those still beneath sediment.

Conservation techniques can also alter the recovery of cask materials from shipwrecks. For example, the cask hoops recovered from the Beaufort Inlet Wreck were all recovered as epoxy resins cast from voids identified in concretions. Should a conservationist not excavate concretions carefully it is possible that this artifact group could be missed entirely. Improper conservation techniques can also distort the dimensions of the materials recovered. Improper electrolysis techniques can cause

spalling on metal objects, causing the object to be shorter, thinner, lighter, etc... than it was originally. Wooden objects that were immediately dried, rather than kept wet and subjected to PEG and Sucrose conservation techniques may disintegrate due to the lack of cellulose structures remaining in the degraded wood. Improperly conserved wooden artifacts may eliminate an artifact class from the record altogether as well.

Perhaps the most important variable when determining the amount of casks recovered from a wreck site was that of tonnage. The tonnage of a vessel, the measure of the cargo capacity of a vessel, determined the exact amount of casks which was carried on a vessel. The tonnage will have a direct affect on the number of casks recovered.

These were just a few of the many possible variables that affect the preservation and recovery of cask materials from shipwrecks. Each of these factors should be considered when analyzing the materials and determining the total sum of material that was present on the vessel in the past. It was very difficult to ascertain the exact number of cask materials on a vessel at one time, but knowledge of the processes that may have skewed or biased the data can help to infer a more accurate number. Consideration of these variables will lead to a better understanding of cask materials aboard shipwrecks and may lead to discerning a pattern in the types of cask materials recovered from the different types of vessels.

The inconsistent nature of the data recovered and disseminated in reports and research papers has affected the ability to comparatively analyze the materials. Due to the inconsistent data recovered a standard reporting method and forms were created to standardize the data recovered. This is found in the following chapter.

CHAPTER 5: RECOMMENDATIONS AND CONCLUSIONS

As discussed in the introduction, there were two main objectives to this thesis research. The first was to determine the inherent patterns in cask material recovered from shipwrecks. In particular, the focus was on determining the patterns present in the types and amount of cask material found on the different categories of vessels (e.g. pirate, merchant, naval, etc...). The second objective of this research, presented here, was to establish a standard method for reporting cask material. This second objective was inspired by the inconsistent cask data found in many site reports and cask reports; as well as the different recording and reporting guides for several artifact classes. These include books for analyzing and recording human skeletal remains (Buikstra & Ubelaker 1994), artillery (Roth 1989), and basketry (Adovasio 1977).

Adequate information obtained from cask material can enlighten archaeologists on the livelihood of coopers, sailors, and all men alike; trade; and much more. Specifically, the scientific study of cask material can aid in determining:

- 1.) the diets of sailors as well as others
- 2.) trade routes and trade goods
- 3.) the part of a ship's voyage (outward bound or return)
- 4.) the technological methods used to manufacture and assemble staved containers
- 5.) the cultural variations in construction, size, function, wear and repair the technological complexity of the coopers who produced these containers, and if

possible correlate the temporal period and cultural ascription of this coopering technology

6.) the cultural aspects of the coopers (did they or did they not follow the laws provided, and why?)

7.) the identity of the shipwreck, based on the help of the ship's manifest

The available data concerning cask material found on shipwrecks in the available literature is limited and inconsistent, making it extremely difficult to conduct comparative analyses. The recordation of consistent and coherent data will facilitate analyses for future researchers. Standard reporting formats and terminology will allow each researcher to understand the data found in reports, as they will not have to interpret the data available. For example, currently, reports name the bilge area of the cask by the terms bilge, booge, bouge, and bulge. According to the terminology presented in Appendix B, the bilge area of the cask is the bulging, curved portion of a cask equidistant from each head. The booge area refers to the center width of a stave, usually the widest portion of the stave. This poses a problem for researchers when these terms are used interchangeably as they refer to two completely different areas, obscuring the meaning in which the authors were referring to. By standardizing these terms, each researcher will understand that the bilge refers to a cask area, while the booge refers to a stave portion. Obtaining adequate cask data is also important for conducting analyses. Standard reporting forms allow researchers to collect consistent data, thus facilitating comparative analyses. The following sections are a brief discussion of the data that should be

obtained for each cask component and how to obtain it. The types of data are further expanded on the standardized forms found in Appendix C.

Provenience

One of the most important pieces of information obtained for all artifacts is its location on a site. Cask material is no different. Information pertaining to what site, where on site (e.g. aft or fore ship or hold, orlop deck, etc...), and the orientation of the cask (e.g. bilge and cantline, vertical, a-burton, etc...) is necessary to understand the cask's association with surrounding artifacts and the shipwreck.

The Material

The type of wood should be determined for each cask component recovered. A mixture in the types of wood often indicates repair or reuse of materials and is very useful in understanding the use and reuse of casks. This can be done by sending wood samples to an ethnobotanist. A magnet will provide a basic distinction between copper or copper alloy and iron cask hoops.

The material used to bind a hoop overlap should also be discussed in some detail. If they were bound by withy or fibrous material, it should be analyzed to determine the material. If bound by rivets, the appearance of the rivet's head and bottom should be noted. Typically a rivet was hammered nearly flush with the hoop, with no lip for a cooper to cut his hands on when picking up and hammering the hoop into place. If the

rivet was not flush, or was sloppily hammered, it may indicate repair, or at the very least, poor craftsmanship.

Cask Capacity

There is no precise way to determine a cask's capacity. Many reasons exist for this, but the main one is because there was no standard practice for gauging casks, especially during the eighteenth century. In addition to a lack of standard gauging, the reuse and repair of casks also hinders the ability to determine one's capacity. Repairs can compromise the specific capacity of a cask. For example, casks were often cut down creating a non-standard sized cask, such as those found on *Betsy* and *San Juan* (Shackleford 1992; Ross 1980a; and Ross 1980b).

If a cask is assembled, the best method to determine its capacity was provided by Benjamin Workman in 1788. According to Workman (1788:52) and Blunt (1825:194-197), in order to gauge the contents of a cask one must multiply the difference between the bilge and the head diameters by:

- 0.67 if it is believed to be a puncheon or a similar cask
- 0.64 if it is believed to be a pipe or a similar cask
- 0.60 if the cask has a difference less than 1/10 between the head and bilge diameter

Next, take the product and add to it the head diameter. This is the mean diameter of the cask. Now multiply the square of the mean diameter by the length. Multiply this product

by 0.0034 and the total will be the contents of the cask in wine gallons. Bear in mind that, while this equation is not 100 % accurate, it will provide a relative capacity.

If the cask is unassembled, it becomes exceptionally difficult, if not impossible, to determine the capacity. Specific stave lengths or head diameters were not mandated. Case in point, a beer barrel made in a brewery in the north of England and another made in a brewery in the south of England both hold 36 gallons of beer; however, visually and physically they appear to be different sizes. This is because the staves of one cask may be shorter but the diameter wider, while the other cask has longer staves but a smaller diameter. Another example was the use of both long and short pipes for wine casks. Both held 126 gallons, but again the stave lengths and diameters varied (Scheetz 2007, pers. comm.). Although difficult to use, the tables found in Blunt's (1825) *The Merchant and Seaman's Expeditious Measurer; Containing a Set of Tables Which Show, At One View, the Solid Contents of All Kinds of Packages and Casks According to their Several Lengths, Breadths, and Depths; Also Rules for Determining the Contents of All Sorts of Casks in Wine and Beer Measure* and Table 1.1 of this thesis provide a general idea concerning the length to head to capacity ratio, and are very useful in determining the cask capacity based on the cask components available.

Cask Contents

There are many methods to determine a cask's contents. These include:

- residue analysis
- cask markings
- cask construction, especially the stave manufacture
- hoop material

Residue analysis of casks can aid in determining their contents. Staining is often indicative of wine or other liquids. Greasy adhesions may be the remains of beef, tallow, or soap. Powdery substances may leave no visible trace, but upon microscopic analysis, may be identified within the porous wood. A close analysis of the stave material may yield a candidate for the contents of the cask.

Markings on the heads and staves also typically indicated contents. For example, the Salinas markings on the casks recovered from the Millecoquins wreck allowed archaeologists to trace them to Salinas, New York, an exporter of salt. Further analysis of the markings provided the name of Allen, the inspector of salt barrels leaving Syracuse between 1836 and 1839 (Mitchell 1996a; Mitchell 1996b; Coble 1994; Coble 1996; and Cantelas 1993).

If only stave material is present it would be best for one to look closely at the manufacture of the stave. If the stave is less than half an inch thick it most likely represents slack coopering, thus containing a dry good of some kind. If the stave is more than half an inch thick, it most likely represents tight coopering and contained some sort of liquid.

Hoop material was often indicative of cask contents. Typically iron or metal hoops were used to bind tight casks. This provided more pressure on the staves, decreasing the chance for leaks between them. Wood or withy hoops were used to bind slack casks. Dry goods did not need to be in water tight casks and consequently, cheaper and more readily available material was used to bind them.

Heads

The heads were the two ends of the cask and were comprised of one or more pieces. Much data can be obtained from the heads which can aid in identifying the type of cask and the casks contents. The most significant pieces of information to be obtained are as follows:

- The diameter of the head
- The number of head pieces that comprise a single head
- The number of head piece reinforcements
- The thickness of the head pieces (per individual piece)
- The markings on each head

Head diameter can be found by measuring the length of the center head piece, the longest head piece that spans the full diameter of the head (see Figure 5.1). Do not include the bevel portion of the cant, as this fits into the croze groove of the stave and does not increase the diameter of the head. Note that in doing so, the diameter may be skewed by several inches. If this piece is not available, a diameter measuring board to determine the curvature of the cant piece of the head and from there the circumference

can be determined. Then use the circumference equation to determine the diameter ($d=C/\pi$).

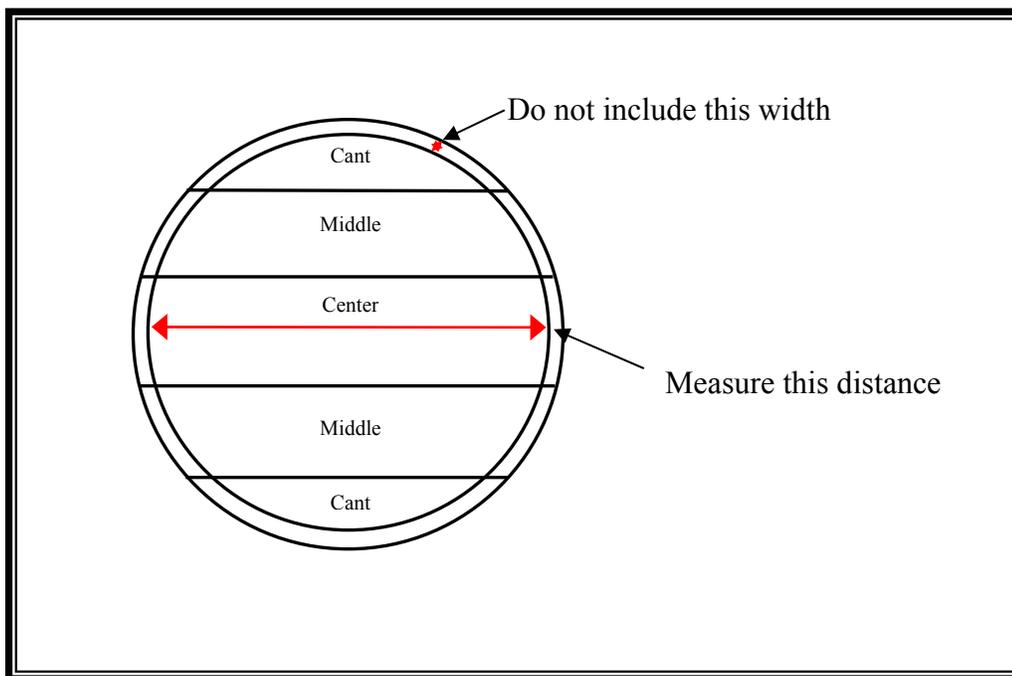


FIGURE 5.1. Drawing with the red arrow across the center head piece showing where to measure and the star in the beveled portion of the head showing what not to include in the head diameter measurement.

Head piece thickness varied from the cant bevel to the middle of the head piece, which is why several measurements should be taken. These include measurements at each end of the bevel and another measurement in the center of the head piece, with the end result of three different measurements. Difference in the overall thickness of the head pieces often indicate repair, as casks are typically constructed with staves and head pieces similar in thickness for durability.

Markings located on each head should be documented with photographs and drawings. Markings are very important as they can indicate the contents, maker,

inspector, ship, and much more. Rubbings using crayon and paper may also be used to determine if markings were present, via branding or etching, but are not visible to the eye. One must be exceptionally careful when doing this, and it is strongly suggested that the cask be dry and stabilized using freeze drying, PEG, Parylene, or some other stabilizing method before doing so.

Staves

Casks were comprised of many staves. Much data may be obtained from the staves, which can aid in identifying the type of cask and the cask's contents. For example, the length and width of the staves can aid in determining the type and size of cask, while the thickness can aid in determining the contents. The most significant pieces of information to be obtained are as follows:

- The number of staves per cask
- Stave length
- Stave width
- Stave thickness
- Is the inside of the stave concave or flat
- Type of croze groove present, if any
- The markings on each head

The exact number of staves that comprise a cask vary from one cask to another. The only way to truly know the number of staves is to either have all staves present, or to fit the staves that are present together and based on their widths, determine how many are

missing. Documenting the total number of staves per each cask, may aid future comparative analysis and help researchers determine if a particular number of staves are used in the construction of different sized casks.

The length of each staff should be provided by researchers. Particularly the length between each croze groove, as this indicates the usable volume and will aid in determining the cask's capacity. As a result, a minimum of three different measurements for each staff should be provided: the measurement between the croze grooves and the measurement between the croze groove and the end of the staves on each side (top and bottom). If several croze grooves are present, the distance between each croze groove should also be provided.

The width of each staff varied from the head to the booge. This was to accommodate the curvature of the cask and to maintain durability during the construction and filling of the cask. The varying widths create the need to take three different width measurements: a measurement of each end or head portion and a third at the booge (see Appendix B).

Staff thickness also tended to vary from the head to the booge. Staves were often hollowed out which altered their thickness, also creating the need to take three different measurements: a measurement at each end or head portion and another at the booge. If a staff was hollowed, measure the depth out of the concavity. The thickness will aid in determining the casks contents, as typically thinner staves were used for slack work. Thicker, hollowed out, staves were used for tight work.

Croze grooves should also be documented. Their shape and size can indicate the type of cask construction and thus the cask contents. The depth of the groove in addition to its shape should be drawn and measured. Close attention should be paid to indentations, holes, or marks in this area. Heads were often nailed into the croze groove. Although the nails may no longer be present, their holes may be. This is often indicative of the use of liner hoops or a secondary use of the cask. In general, deeper and well formed croze grooves were associated with tight work, while shallow or scratch croze grooves are indications of slack work.

Markings located on each stave should be documented with photographs and drawings. Markings are very important as they can indicate the contents, maker, inspector, and ship. On staves, they can indicate the number of staves during construction. Rubbings using crayon and paper may also be used to determine if markings were present, via branding or etching, but are not visible to the eye. Extreme caution should be used when doing this due to the fragile nature of the wood.

Hoops

Hoops were constructed from iron, steel, copper, and wood. Data obtained from the analysis of hoop material can provide insight concerning the time period of construction, the type of coopering, and the contents of the casks. The most significant pieces of information to be obtained are as follows:

- The number of hoops per cask
- The distance between each hoop on the cask

- Hoop diameter
- Hoop width
- Hoop thickness
- The type of hoop end
- The method in which the hoop overlaps are bound
- The number of hoop splices

The diameter of each hoop can be obtained in several ways. If the hoop is complete and still in place, it is possible to measure the hoop for a circumference. Then use the circumference equation ($d=C/\pi$) to determine the diameter. If the hoop is incomplete as was the case with those recovered from the Beaufort Inlet Wreck, a diameter chart, similar to those used for ceramics, can be used (see Figure 5.2). The edge of the hoop could be placed against the diameter board to determine the diameter, simply by moving the artifact up the curved lines until the edge matches the curve of the line exactly. Or a flexible curve can be used to obtain the curvature and then placed on the diameter board. No matter what, both minimum and maximum arc length should be recorded. Often, hoops were distorted or twisted by the wrecking process making it impossible to obtain the original hoop diameter. These hoops should be discussed in some detail as to why the diameter could not be obtained. Concretion on metal hoops can also affect the determination of the diameter. To prevent distortion, the original surface or interior of the object should be measured, not the concretion adhering to it. The same should be said for the thickness of the hoop.

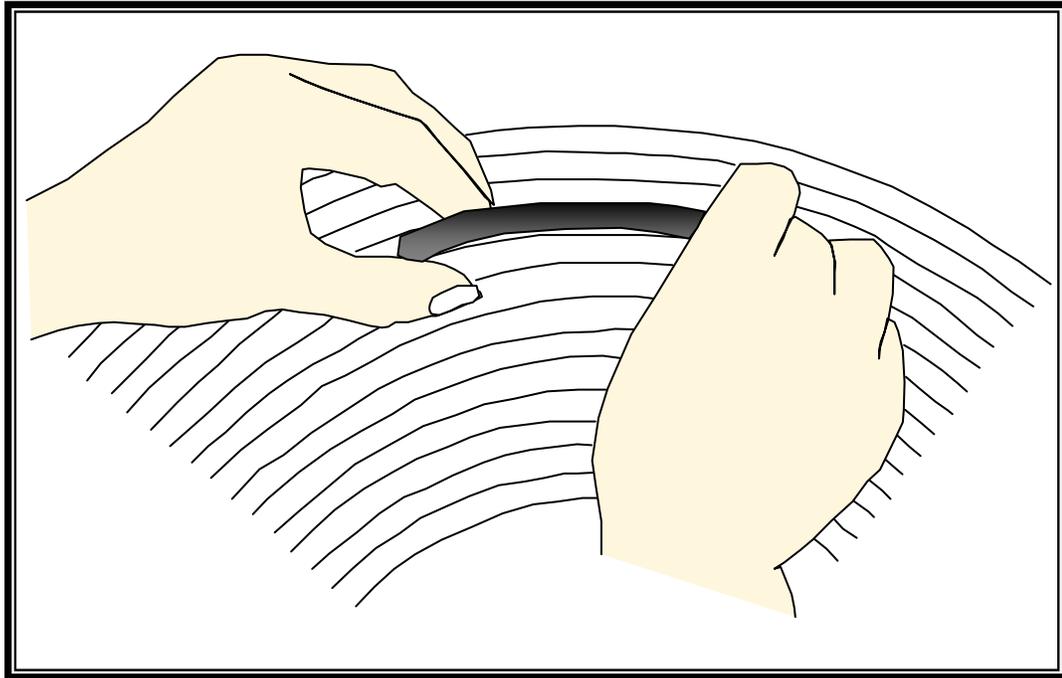


FIGURE 5.2. Drawing showing how to use a diameter chart when measuring the hoop fragment diameter.

Hoop thickness should not vary between hoop areas. Professional coopering will maintain the hoop thickness through to its overlap. Sloppy coopering may create thicker or thinner ends that are very messy and may have sharp surfaces. As a result, only one measurement is necessary and should be taken according to the artifact's original surface as discussed previously. The thickness of the hoop overlap end should also be taken, as this provides insight concerning coopering.

The type of hoop end is very important when determining if the cask was repaired. Sloppy overlaps will consist of splayed ends that are rough to the touch. Rough ends often cut the hands of those handling the cask, in particular the cooper while placing the hoop into place, and were not ideal. Hoop overlaps that were clean, maintain a

similar thickness to the rest of the hoop, and were smooth to the touch are typically the work of master coopers.

Similarly to hoop overlaps, the method of binding the hoops is indicative of the type of coopering. Metal hoops were bound by rivets. Rivets that are flattened typically indicate the work of a master cooper, while rivets that are more bulbous and jagged indicate amateur work or repair. Wooden hoops are harder to classify. Both the overlapped notch and lashing or withy was used to bind the hoop together by master coopers. The use of mixed materials or style would indicate amateur coopering and repairs, or at the very least the need for repair with no access to appropriate materials.

Hoop splices may also be indicative of reuse or repair. A splice (an area where several different pieces of wood or metal are joined together to create one hoop) would suggest that there was a lack of adequate material, creating the need to bind several fragments together to form a single hoop. The use of several splices would indicate an extreme lack of material, and most likely shipboard repair.

Materials Used to Obtain the Data

All measurements taken during the analysis of cask material should be taken using a clothing tape measure, a flexible curve, or any object that allows for the precise measurement of the curvature of the cask materials. In addition to each of the aforementioned measurements, the weight of each artifact should be obtained, both when wet, and then once conservation is completed and the object is dry to the touch. The use

of a digital scale is highly recommended; especially one that is capable of weighing objects over 15,000 grams.

Discussion of Standard Report Forms

The analysis of any given cask specimen is greatly facilitated by using standard terminology and a standardized form. A list of standardized cooperating terminology can be found in Appendix B. These terms should replace all other variants and be used consistently. Forms standardize the analytical process, ensure uniform compilations of the data, and aid in the processes of tabulation, quantification, and comparison (Adovasio 1977:20). The standard forms suggested for the analysis of cask material are located in Appendix C. Each specimen in a given assemblage has a separate form on which all pertinent data are recorded.

The first form is for cask material that is clearly associated with one another to form a single cask. The second form is for a single stave or several staves that belong to a single cask. Should several staves and hoops be associated, use the first form. The third form is for nearly complete heads or head pieces belonging to a single cask. Use this form if only head pieces or fragments are present. Should several heads or head pieces and hoops or staves be associated, use the first form. The fourth form is for hoops and hoop pieces. Should several hoops and staves or heads be associated, use the first form. The fifth, and final, form is for bungs or bung fragments that are believed to belong to a single cask. Do not use this form if it is believed the bung is associated with other staved container materials (e.g. staves, hoops, or heads). The purpose of the different

forms is to separate cask material that is believed to be a single cask, from material which is singular. This may help to differentiate shook casks from those that have collapsed or rotted after the wrecking process. Additionally, it may aid in identifying cask material scattered throughout the wreck that may belong to a single cask, and perhaps provide some insight to the wrecking process.

If the cask material will not be recovered from the wreck, data can be obtained while the object is *in situ*. This includes the:

- Location of the cask
- Orientation
- Total length of the cask (from head to head, or the length of the longest stave if the heads are not present)
- Diameter of the cask (across the bilge or the widest point of curvature in the staves, and if heads are present the diameter of each head)
- Total number of hoops and their material (please include ghosts if they are present)
- Type of hoop overlap (is the end notched, splayed, beveled, etc..)
- Markings (especially on the heads as these often indicate the contents)

This bare minimum data set should allow researchers to determine the type of cask (e.g. barrel vs. hogshead) and the type of coopering (e.g. slack vs. tight). If the coopering technology can be determined, the contents of a cask may then be speculated based on the type of coopering and the markings. The coopering technology may also provide a time period and an ethnic background to the cooper (e.g. French, Basque, English, American,

etc.) as each country used different weights and measurements. Photographs as well as planview and profile drawings of each staved container are a useful form of documentation.

The scientific analysis of cask material can lead to an increased understanding of historic lifeways. The proposed standard terminology and a minimum set of required information can further our understanding of such a diverse historical practice. To quote Adovasio (1977: preface), “This manual ... is nothing more than a guide to the analysis of cask material from the perspective of one practitioner and must be so treated. If it encourages a few individuals to describe and analyze items they would otherwise neglect or alerts them to the importance of observing and preserving remains ... that would otherwise be overlooked, I will consider my efforts amply rewarded.”

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Appendix A: Coopering Terminology and Coopering Tools

Coopering Terminology (after Ross 1980:228)

A-Burton method of stowage - term applied to the stowage of casks athwartship in line with the deck beam.

Assembly marks – marks engraved, scratched, or branded onto the cask in order to assist in the reassembly of the cask.

Bevel – there are two types of bevels, the inside and outside bevel, in which both are located on the head pieces. It creates a bite that allows the head to fit into the croze grooves of the stave to stay in place.

Backing the staves – the process of shaping the outside, or the back, of the stave using a backing knife, which ultimately beveled the outside of the cask, creating the well known rounded exterior of the stave.

Bilge – the bulging, curved portion of a cask equidistant from each head.

Bilge hoop – a hoop placed around the bilge of the cask, there are two bilge hoops on each cask, one on each end.

Bilge and Bilge method of stowage - placed the casks on top of one another so that rather than having the upper tiers rest in the cantline, they would be laid sideways so that the bilge of each cask touched.

Bilge and Cantline method of stowage - placed the casks on top of one another so that the bilge of each cask lay in the cantline, the hollow created by the four casks it is resting on.

Bite – the ends of the head pieces that come to a point at the edge of the inside and outside bevels and allows the head to fit nicely into the croze groove.

Booge – the center width of a stave, usually the widest portion of the stave.

Bung – a flat tapered stopper, typically made of cork, to plug the bung hole.

Bung stave – a stave with a bung hole (tap hole).

Bung hole – a hole centered on the bung stave, both lengthwise and according to the width, and was bored using a regular and a tapered auger to produce a tapered hole allowing the cask to be filled and drained.

Bung up and Bilge free – a cask stowage term. It is said that if casks are properly stowed, bungs are up and the casks rest on racks to keep them clear of the water in the bilge.

Case – a partially constructed cask, typically with all staves and only a few hoops and a head.

Case stave – a plain stave without a bung hole.

Cask – a type of staved container that is comprised of staves, hoops, and two heads that close each end.

Cant – the outer pieces of a head that fit into the croze groove, usually comprised of a single joint and a single continuous curved bite.

Center piece of the head – the center piece(s) of the head, usually comprised of two joints and two bites.

Chime – the beveled surface of the interior top portion of the stave.

Chime hoop - the hoop that fits around the ends of the cask, typically wider than the other hoops because the chime is the most vulnerable portion of the cask.

Chiv – the hollowed surface on the interior of a stave below the chime, where the croze groove is cut into.

Cooper's mark – a mark engraved, branded, or scratched into the cask denoting who constructed the cask, ownership, and/or quality.

Cropping – cutting down or cropping the cask to a short size in order to reuse parts of the staves that are not damaged.

Croze groove – a groove that is cut into the chiv where the edge of the head is placed.

'Cut in' - The cooper would then 'cut in', to create a pointed edge, or bite, of the head, allowing it to be placed into the croze of the staves.

Dowels – little pegs of wood that hold the head pieces together, typically there are two in each joint.

Dressing the staves - the process of shaping the staves.

Dry or Slack Coopering - also known as "slack work", produced casks capable of

holding dry goods, namely, meats, bottles, lead items, flour, gunpowder, soap, and seeds.

Ducks – a term for cracked staves.

Dunnage – the loose fibers, hay, or whatever else was available, that were packed around casks in the hold to prevent them breaking open when shifting at sea.

Flagging - a split reed harvested specifically for coopers and used for caulking, and is often found packed in leaky joints to prevent loss of contents.

Gaskets – In order to seal bungs, plugs the hole would first be filled with cloth or cork and then often covered with a lead sheet that was tacked into place, with the tacks placed nearly on top of one another in order to prevent any air from entering or escaping the cask, thus creating a gasket effect.

Ghosts – the stain of a hoop present on staved containers, although the hoop is no longer present.

Head – composite end of the cask, usually comprised of 1-6 pieces, that fit into the croze of a finished cask.

Hoops – narrow strips of wood or metal placed around the circumference of the cask in order to keep the staves tightly held together (the number of hoops per container depends on the capacity of the container).

Hoop bindings – thin wooden strips that bind the ends of a wooden hoop together to create the hoop overlap.

Hoop rivets – metal pegs or sometimes nails that are driven into the metal hoop to bind the ends together and create the hoop overlap.

Hoop overlap/ join – the area where the two ends of one hoops are overlapped and held in place by hoop bindings or hoop rivets.

Hoop splice – an area where several different pieces of wood or metal are joined together to create one hoop (different from a hoop overlap, where only the ends of one hoop are joined together).

Joints – the edges of the staves that are typically smoothed or planed and taper from the stave exterior to interior.

Kit – a type of staved container that is closed at one end and is often shorter than it is in diameter. Typically this can be held in one hand.

Liner hoop – a hoop nailed to the inside of the staves to place the head upon.

Listing the staves – the process of creating an angle and a taper on the edges of the staves.

Middle pieces of the head – the piece(s) of the head that touch both a cant and the center piece, usually comprised of two joints and two bites.

Pitch - or the belly of the cask, or the portion with largest diameter.

Pitch hoop – the hoop that fits around the pitch of the cask.

Plugging – the practice of using small tapered plugs or pegs to fill holes in the cask created by sampling, venting, or worms.

Quarter hoop – the hoop placed between the chime and the booge hoops on both ends.

Quoins – Typically beveled pieces of wood in which the bottom tier of casks would rest upon during shipment. These would provide stability preventing this tier from rolling and ultimately keeping all casks tightly stacked.

Raising the staves – the process of manufacturing the cask, involving raising the staves using wooden trusses or a raising hoop.

Recrozing – a method of repair or reuse of a cask involving cutting a new croze groove for the head.

Rebranding – a method of repair or reuse of a cask involving scratching out the old brands and replacing them with new ones indicating the cask's new contents.

Repair plugs – tapered pegs or plugs used to fill worm holes or other holes found in the cask.

Reinforcement – a wood piece that lays at a right angle to the head pieces to reinforce it, typically located on the top, or outside, or the head.

Sampling holes – drilled through staves and head pieces in order to sample the cask's contents, and were typically plugged with wood pegs or thorns.

Scratch croze - a shallow croze groove used only in casks for dry provisions.

Shook – a case or cask that has been knocked down or dismantled.

Square or hawk's bill croze – a square cut or shaped groove that accepts only a square cut cant bevel, and a deep wide groove associated with casks for liquids.

Stave – one of the basic components of staved containers. It is a piece of wood shaped to create a tight fit when placed side by side.

Staved container – typically a wooden container comprised of staves, hoops, and one or more head pieces. Types of staved containers include casks, tubs, kits, buckets, vats, tanks, funnels, jugs, coops, churns, etc.

Tap hole – a hole drilled through a head center piece, used for the insertion of a tap to draw off liquid contents from a cask, typically only drilled when the cask was tapped for use.

Tub – a wooden staved container, shorter than its diameter, closed at one end with a single permanent head, and usually requiring two hands or two people to be carried.

V-Croze – a V cut or shaped groove that only accepts a V shaped cant bevel, typically used for light casks used with semi-liquids such as salt pork.

Vent holes – holes drilled through the bung staves or the ends of the middle and center pieces, allowing air to escape from a cask during filling, plugged with tapered truncated conical vent hole plugs.

Vertical method of stowage - consisted of placing the casks upright next to one another.

Wet or Tight Coopering - also known as “tight work”, produced casks capable of holding liquids, such as, beer, wine, water, sauces, jams, syrup, vinegar, meats packed in a liquid or brine solution, and tar.

White Coopering - produced casks capable of holding water, butter, and soaps, and were built in a similar fashion as wet casks in the sense that they use staves and hoops and were meant to hold water; however, they typically only have one head instead of two.

Coopering Tools (after Ross 1980:228)

Hollowing Adze – Used to cut chimes and chives.

Tapered Auger – Required for drilling bung and vent holes.

Axe - Required for trimming the exterior, interior and edges of staves and head pieces, for cutting head piece bites and bevels, and for notching and trimming hoop tips.

Dividers – Required for measuring and marking a circular pattern on head pieces.

Curved Drawknife – Required for smoothing case exteriors.

Straight Drawknife – Required for trimming and smoothing hoop interiors.

Driver – Required to drive hoops tight on the cask.

Fore or Splitting Wedge – Required for splitting stave and head piece planks, and possibly for splitting hoops.

Gimlet – Required for drilling head reinforcement holes through stave ends.

Knife – Required for splitting and cutting hoop bindings, possibly for notching hoop ends, and for carving bugs, plugs, and pegs.

Hooping Lever - Required for stretching and forcing hoops onto cask ends.

Mallet – Required for splitting stave and head piece planks, for splitting hoops, for driving hoops tight and for driving bungs, plugs, and pegs.

Croze Groove Plane – Required for cutting the croze grooves in case ends.

Jointer Plane – Required for the cutting of stave and head piece joints.

Saw – Possibly required for the cutting of stave tops and for cutting head middle piece and center piece bites.

Scribe – Required for the inscribing of stave inspection and/or grading marks, and for the inscribing of case and head assembly marks.

Whetstone – Required for sharpening edged tools.

Rope Winch – Required to squeeze staves tight to place first hoops over the cask ends.

Appendix B: Standard Report Forms

Inventory Recording Form

For Complete or Nearly Complete Staved Containers

1. Site Name _____ 2. Site Number _____ 3. Provenience _____ 4. Observer _____ 5. Date of Find _____ 6. Date of Analysis _____ 7. Cask's Orientation _____ 8. Present Location of the Artifact _____ 9. Associated Records Photographs _____ Radiographs _____ Illustrations _____ 10. Completeness a. <input type="checkbox"/> Complete b. <input type="checkbox"/> Articulated c. <input type="checkbox"/> Distorted <input type="checkbox"/> Incomplete <input type="checkbox"/> Disarticulated <input type="checkbox"/> Non-distorted c. <input type="checkbox"/> Suspected Capacity _____ d. <input type="checkbox"/> Type of Cask or Open Container _____ e. Container Height _____ cm Bulge Diameter _____ cm Top Diameter _____ cm Bottom Diameter _____ cm Top Head Diameter _____ cm Bottom Head Diameter _____ cm 11. Known Contents _____ 12. State of Conservation a. <input type="checkbox"/> Wet b. <input type="checkbox"/> Conserved (How) _____ <input type="checkbox"/> Dry <input type="checkbox"/> Not Conserved	Enter Specimen #
--	------------------

13. **Heads**

a. Number of Heads present _____

b. Diameter (per head) (in cm) _____

c. Thickness (per head) (in cm) _____

d. Weight (per head) (in grams) _____

e. Wood Type(s) (per head) _____

f. Markings (per head) _____
(Attach photograph or illustration of markings)

Head 1 (Top)
() Branded () Chiseled () Painted

Head 2 (Bottom)
() Branded () Chiseled () Painted

g. Number of Pieces Present (per head)

Head 1
Number of Pieces in Total _____
Number of Cant Pieces _____
Number of Middle Pieces _____

Inventory Recording Form

For Complete or Nearly Complete Staved Containers

Diameter of Complete Head _____

Orientation of Head Piece Lengths to Bung Stave (in degrees) ____°

Reinforcements () Absent () Present Total____ () Unknown

Head 2

Number of Pieces in Total _____

Number of Cant Pieces _____

Number of Middle Pieces _____

Diameter of Complete Head _____

Orientation of Head Piece Lengths to Bung Stave (in degrees) ____°

Reinforcements () Absent () Present Total____ () Unknown

h. Dowels Present (per head)

Head 1

() Yes () No

If yes: Number Present _____

Wood Type _____

Head 2

() Yes () No

If yes: Number Present _____

Wood Type _____

i. Bung Hole Present

(Location) _____

() Yes () No

If Yes: Bung Hole Diameter (in cm) _____

j. Bung Present

() Yes () No

Bung Material _____

k. Sample Holes Present (Total Number) _____

() Yes () No

l. Signs of Repair _____

Description _____

14. Staves

a. Number of Staves Present _____

b. Diameter (in cm)(Please place a minimum and a maximum per stave)_____

c. Length (in cm) (Please place a minimum and a maximum per stave)_____

Inventory Recording Form

For Complete or Nearly Complete Staved Containers

d. Width (in cm) (Please place a minimum and a maximum per stave) _____

e. Thickness (in cm) (Please place a minimum and a maximum per stave) _____

f. Weight (per stave) (in grams) _____

g. Wood Type(s) _____

h. Bung Stave Present _____
() Yes () No

If Yes: Bung Hole Diameter (in cm) _____
Bung Material _____

i. Exterior Markings _____
(Attach photographs or illustration of markings)

() Branded () Chiseled/Scratched () Painted

j. Interior Markings _____
(Attach photographs or illustration of markings)

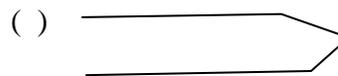
() Hollowed out () Tool marks present

k. Sample Holes Present (Total Number) _____
() Yes () No

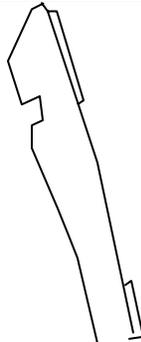
l. Signs of Repair _____

Description _____

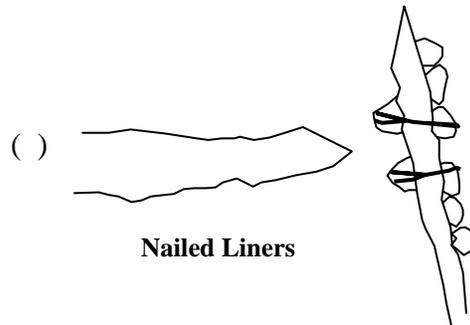
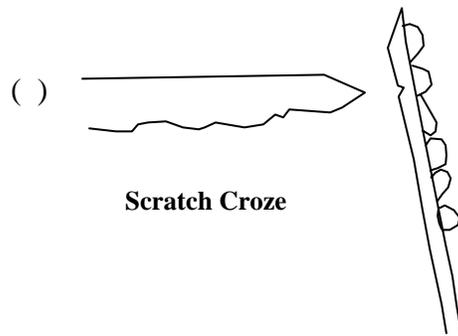
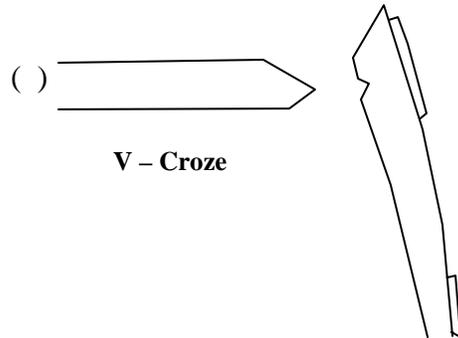
m. Types of Croze



**Square or Hawk's
bill Croze**



Inventory Recording Form For Complete or Nearly Complete Staved Containers



15. Hoops

- a. Number of Hoops Present or indicated _____
- b. Types of hoops present (Place a number in the parentheses)
 - () Chime Distance From First Hoop to Top of Cask _____ cm
 - () Quarter Distance From Bottom Hoop to Bottom of Cask _____ cm
 - () Booge
 - () Pitch
- c. Diameter (per each hoop) (in cm) _____

- d. Width (per each hoop) (in cm) _____

Inventory Recording Form

For Complete or Nearly Complete Staved Containers

e. Thickness (per each hoop) (in cm) _____

f. Weight (per each hoop) (in grams) _____

g. Material Type(s) _____

Wood Type _____

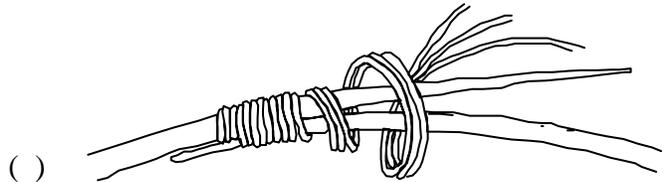
If Wood: Number of Splices Present _____

Length of Splice (in cm) _____

Shape of Splice Ends _____



Overlapped Notch



Lashed Hoop

Unknown (Draw the End Below)

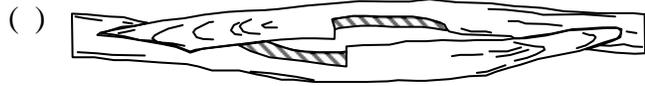
Number of Overlapped Ends _____

Length of Overlapped Ends _____

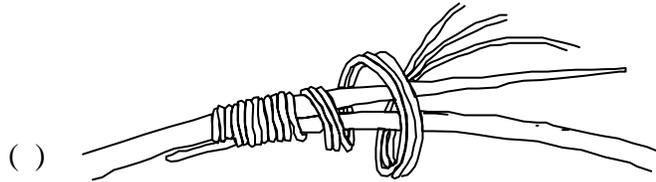
Shape of Overlapped Ends _____

Inventory Recording Form

For Complete or Nearly Complete Staved Containers



Overlapped Notch



Lashed Hoop

Unknown (Draw the End Below)

Copper Alloy/Brass

Other _____

Iron

If Iron: Number of Splices Present _____

Length of Splice (in cm) _____

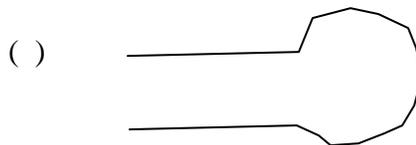
Number of rivets present per splice _____

Shape of rivets _____

Location of Hoop Joins

Bung Stave Random Unknown

Shape of Splice Ends _____



Splayed



Belt - like



Flat/Straight

Inventory Recording Form For Complete or Nearly Complete Staved Containers

() Other (Draw the End Below)

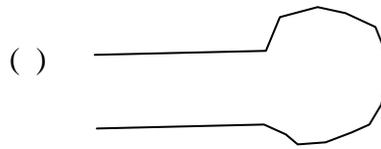
Number of Overlapped Ends _____

Length of Overlapped Ends _____

Location of Hoop Joins

() Bung Stave () Random () Unknown

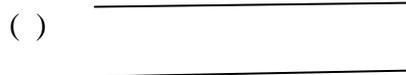
Shape of Overlapped Ends _____



Splayed



Belt - like



Flat/Straight

() Other (Draw the End Below)

h. Exterior Markings _____
(Attach photographs or illustration of markings)

i. Interior Markings _____
(Attach photographs or illustration of markings)

j. Hoop Wrapping: () Wood () Plant Fiber () Unknown

16. Flagging Present

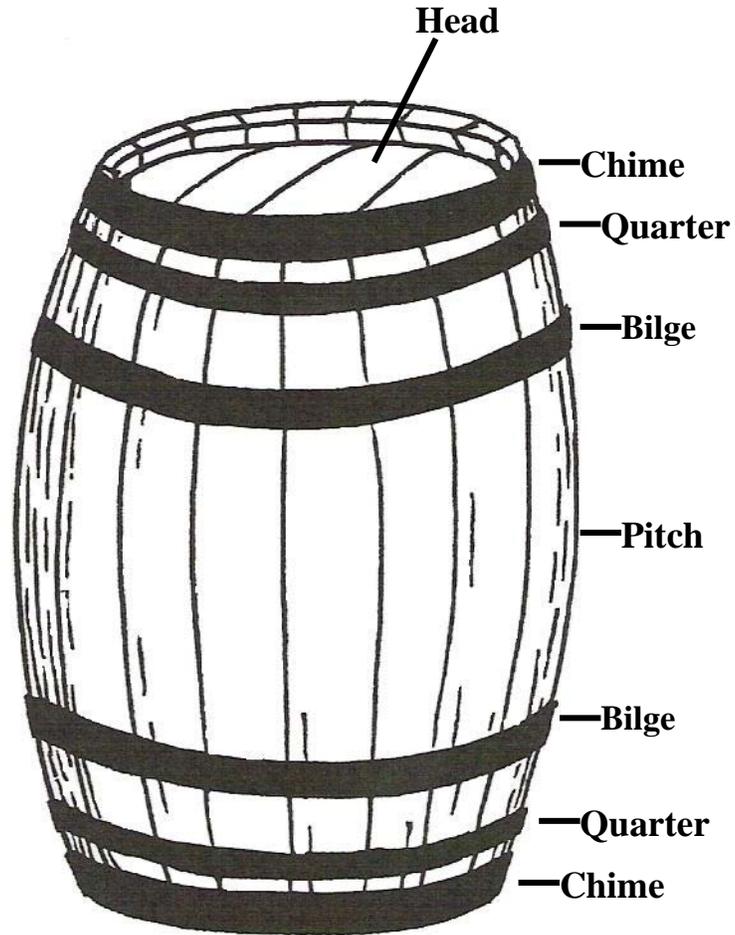
a. () Yes () No () Indicated but Absent

b. Material used _____

c. Locations _____

14. Notes _____

Inventory Recording Form
For Complete or Nearly Complete Staved Containers



Inventory Recording Form

For Individual, Fragmented, or Bundled Staves

- Outside Bulge Width _____ cm
End Widths: A _____ cm B _____ cm
- e. Thickness (in cm) (Please place a minimum and a maximum per stove) _____

- Outside Bulge Thickness _____ cm
End Thickness: A _____ cm B _____ cm
- f. Weight (per stove) (in grams) _____
- g. Wood Type(s) _____

- h. Bung Stave Present _____
() Yes () No
If Yes: Bung Hole Diameter (in cm) _____ Inner _____ Outer _____
() Tapered () Straight () Smooth Interior () Rough Interior
Bung Material _____
- i. Exterior Markings _____
(Attach photographs or illustration of markings)
() Branded () Chiseled/Scratched () Painted
- j. Interior Markings _____
(Attach photographs or illustration of markings)
() Hollowed out () Tool marks present
- k. Manufacture
Stave Exterior () Split () Axed () Shaved () Planed () Unknown
Stave Interior () Split () Axed () Shaved () Planed () Unknown
Stave Joints () L () R Planed; () L () R Unknown; () L () R
Unknown
- k. Sample Holes Present (Total Number) _____ (Diameters) _____
() Yes () No
Sample Pegs Present (Total Number) _____ (Lengths) _____
() Yes () No
() Tapered () Straight
- Cross-sections
() Round () Rectangular () Irregular
- l. Vent Holes Present (Total Number) _____
() Yes
() No
- m. Reinforcement Holes (Total Number) _____ (Diameters) _____
() Present () Absent
() Drilled () Unknown
- n. Reinforcement Pegs (Total Number) _____ (Lengths) _____
() Present () Absent

Inventory Recording Form For Individual, Fragmented, or Bundled Staves

- Drilled Unknown
 Tapered Straight

Cross-sections

- Round Rectangular Irregular

o. Signs of Repair _____
Description _____

p. Flagging Present
 Yes No Indicated but Absent

b. Material used _____

c. Locations _____

q. Joint Angles at Bulge L _____° R _____°

r. Chimes Present Absent Both Ends One End Only

Straight Hollowed

Sawn Adzed Shaved Planed Unknown

Chime Angles A _____° B _____°

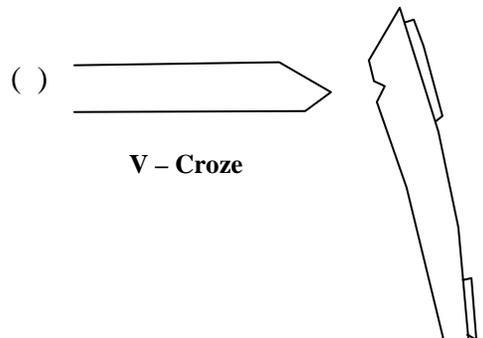
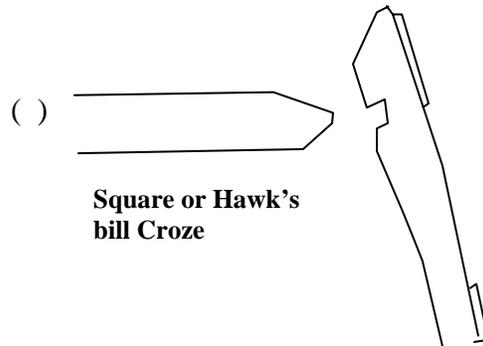
s. Chivs Present Absent Both Ends One End Only

Straight Hollowed

Sawn Adzed Shaved Planed Unknown

t. Croze Grooves Present Absent

Types of Croze



Inventory Recording Form For Head Fragments and Articulated Heads

1. Site Name _____

2. Site Number _____

3. Provenience _____

4. Observer _____

5. Date of Find _____

6. Date of Analysis _____

7. Cask's Orientation _____

8. Present Location of the Artifact _____

9. Associated Records

Photographs _____

Radiographs _____

Illustrations _____

Associated Staved Container _____

Associated Head Fragments _____

Head Piece No. ____ of ____

Associated Head Reinforcements _____

Associated Bungs _____

10. Completeness

a. Complete b. Articulated c. Distorted

Incomplete Disarticulated Non-distorted

c. Suspected Capacity _____

d. Type of Cask or Open Container _____

e. Container Height _____ cm Bulge Diameter _____ cm

Top Diameter _____ cm Bottom Diameter _____ cm

Top Head Diameter _____ cm Bottom Head Diameter _____ cm

11. Known Contents _____

12. State of Conservation

a. Wet b. Conserved (How) _____

Dry Not Conserved

13. Heads (Please Complete a Separate Form per Head Fragment or Articulated Head Recovered **)**

a. Number of Heads present _____

b. Diameter (per head) (in cm) _____

c. Length (per head) (in cm) _____

d. Thickness (per head) (in cm) _____

e. Weight (per head) (in grams) _____

f. Further Dimensions

Outside Bevel Angle _____° Inside Bevel Angle _____°

Outside Bevel Width _____cm Inside Bevel Width _____cm

Heading Joint Angles _____° Bite Width _____cm

Bite Sharp Flat Unknown

g. Wood Type(s) (per head) _____

Enter Specimen #

Inventory Recording Form For Head Fragments and Articulated Heads

h. Number of Pieces Present (per head)

Head 1

Number of Pieces in Total _____

Number of Cant Pieces _____

Number of Middle Pieces _____

Diameter of Complete Head _____

Orientation of Head Piece Lengths to Bung Stave (in degrees) ____°

Reinforcements () Absent () Present Total____ () Unknown

Head 2

Number of Pieces in Total _____

Number of Cant Pieces _____

Number of Middle Pieces _____

Diameter of Complete Head _____

Orientation of Head Piece Lengths to Bung Stave (in degrees) ____°

Reinforcements () Absent () Present Total____ () Unknown

i. Markings (per head) _____

(Attach photograph or illustration of markings)

Head 1 (Top)

() Branded () Chiseled () Painted

Head 2 (Bottom)

() Branded () Chiseled () Painted

j. Manufacture

Exterior Surface () Split () Axed () Shaved () Planed

() Unknown

Interior Surface () Split () Axed () Shaved () Planed

() Unknown

Head Joints () L () R Planed; () L () R Unknown; () L () R Unknown

Head Bites () Sawn () Axed () Shaved () Unknown

Head Outside Bevels () Axed () Shaved () Planed () Unknown

Head Inside Bevels () Axed () Shaved () Planed () Unknown

Head Reinforcement Edges () Planed () Sawn () Unknown

Head Reinforcement Bites () Sawn () Axed () Shaved

() Unknown

k. Dowels Present (per head)

Head 1

() Yes () No () Split () Carved () Unknown

If yes: Number Present _____

Diameter _____ Length _____

Wood Type _____

Dowel Cross-sections

() Round () Square () Irregular

Dowel Holes Present

() Yes () No () Drilled () Unknown

Inventory Recording Form For Head Fragments and Articulated Heads

Head 2

Yes No Split Carved Unknown

If yes: Number Present _____

Diameter _____ Length _____

Wood Type _____

Dowel Cross-sections

Round Square Irregular

Dowel Holes Present

Yes No Drilled Unknown

l. Head reinforcements present

Yes No

If Yes Plank Ribbing Inside Outside

If No Impressions Present Impressions Absent

If Present

Inside Outside

m. Bung Hole Present (Location) _____

Yes No

If Yes: Bung Hole Diameter (in cm) _____

n. Bung Present

Yes No

Bung Material _____

o. Sample Holes Present (Total Number) _____ (Diameters) _____

Yes No

Sample Pegs Present (Total Number) _____ (Lengths) _____

Yes No

Tapered Straight

Cross-sections

Round Rectangular Irregular

p. Vent Holes Present (Total Number) _____

Yes No

q. Signs of Repair _____

Description _____

r. Flagging Present

Yes No Indicated but Absent

b. Material used _____

c. Locations _____

14. Notes _____

Inventory Recording Form For Individual, Fragmented, or Bundled Hoops

1. Site Name _____

2. Site Number _____

3. Provenience _____

4. Observer _____

5. Date of Find _____

6. Date of Analysis _____

7. Cask's Orientation _____

8. Present Location of the Artifact _____

9. Associated Records

Photographs _____

Radiographs _____

Illustrations _____

Associated Staved Container _____

Associated Staves _____

Stave No. _____ of _____

Associated Bungs _____

Associated Hoops _____

10. Completeness

a. Complete b. Articulated c. Distorted

Incomplete Disarticulated Non-distorted

c. Suspected Capacity _____

d. Type of Cask or Open Container _____

e. Container Height _____ cm Bulge Diameter _____ cm

Top Diameter _____ cm Bottom Diameter _____ cm

Top Head Diameter _____ cm Bottom Head Diameter _____ cm

11. Known Contents _____

12. State of Conservation

a. Wet b. Conserved (How) _____

Dry Not Conserved

13. Hoops (Please Complete a Separate Form per Hoop Fragment or Bundle Recovered **)**

a. Number of Hoops Present or indicated _____

b. Types of hoops present (Place a number in the parentheses)

Chime Distance From First Hoop to Top of Cask _____ cm

Quarter Distance From Bottom Hoop to Bottom of Cask _____ cm

Booge

Pitch

c. Diameter (per each hoop) (in cm) _____

d. Width (per each hoop) (in cm) _____

Enter Specimen #

Inventory Recording Form For Individual, Fragmented, or Bundled Hoops

e. Thickness (per each hoop) (in cm) _____

f. Weight (per each hoop) (in grams) _____

g. Material Type(s) _____

Wood Type _____

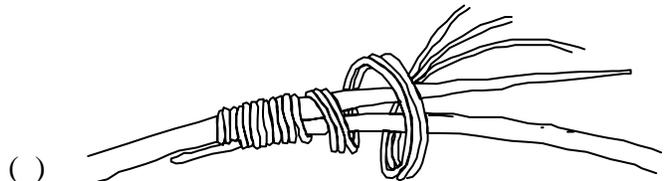
If Wood: Number of Splices Present _____

Length of Splice (in cm) _____

Shape of Splice Ends _____



Overlapped Notch



Lashed Hoop

Unknown (Draw the End Below)

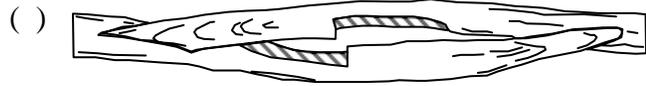
Number of Overlapped Ends _____

Length of Overlapped Ends _____

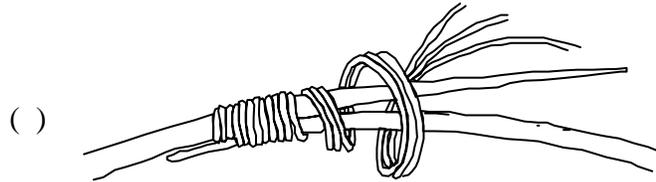
Shape of Overlapped Ends _____

Inventory Recording Form

For Individual, Fragmented, or Bundled Hoops



Overlapped Notch



Lashed Hoop

() Unknown (Draw the End Below)

() Copper Alloy/Brass

() Other _____

() Iron

If Iron: Number of Splices Present _____

Length of Splice (in cm) _____

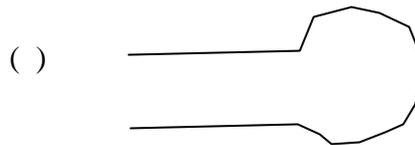
Number of rivets present per splice _____

Shape of rivets _____

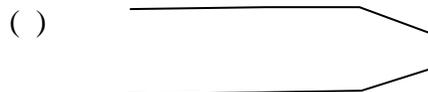
Location of Hoop Joins

() Bung Stave () Random () Unknown

Shape of Splice Ends _____



Splayed



Belt - like



Flat/Straight

Inventory Recording Form For Individual, Fragmented, or Bundled Hoops

() Other (Draw the End Below)

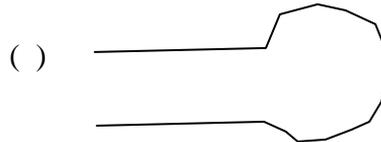
Number of Overlapped Ends _____

Length of Overlapped Ends _____

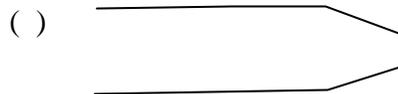
Location of Hoop Joins

() Bung Stave () Random () Unknown

Shape of Overlapped Ends _____



Splayed



Belt - like



Flat/Straight

() Other (Draw the End Below)

h. Exterior Markings _____
(Attach photographs or illustration of markings)

i. Interior Markings _____
(Attach photographs or illustration of markings)

j. Hoop Wrapping: () Wood () Plant Fiber () Unknown

16. Flagging Present

a. () Yes () No () Indicated but Absent

b. Material used _____

c. Locations _____

Inventory Recording Form For Individual Bungs

<p>1. Site Name _____</p> <p>2. Site Number _____</p> <p>3. Provenience _____</p> <p>4. Observer _____</p> <p>5. Date of Find _____</p> <p>6. Date of Analysis _____</p> <p>7. Cask's Orientation _____</p> <p>8. Present Location of the Artifact _____</p> <p>9. Associated Records</p> <p style="padding-left: 20px;">Photographs _____</p> <p style="padding-left: 20px;">Radiographs _____</p> <p style="padding-left: 20px;">Illustrations _____</p> <p style="padding-left: 20px;">Associated Staved Container _____</p> <p style="padding-left: 20px;">Associated Staves _____</p> <p style="padding-left: 40px;">Stave No. ____ of ____</p> <p style="padding-left: 20px;">Associated Bungs _____</p> <p style="padding-left: 20px;">Associated Hoops _____</p> <p>10. Completeness</p> <p style="padding-left: 20px;">a. <input type="checkbox"/> Complete b. <input type="checkbox"/> Articulated c. <input type="checkbox"/> Distorted</p> <p style="padding-left: 40px;"><input type="checkbox"/> Incomplete <input type="checkbox"/> Disarticulated <input type="checkbox"/> Non-distorted</p> <p style="padding-left: 20px;">c. <input type="checkbox"/> Suspected Capacity _____</p> <p style="padding-left: 20px;">d. <input type="checkbox"/> Type of Cask or Open Container _____</p> <p style="padding-left: 20px;">e. Container Height _____ cm Bulge Diameter _____ cm</p> <p style="padding-left: 40px;">Top Diameter _____ cm Bottom Diameter _____ cm</p> <p style="padding-left: 40px;">Top Head Diameter _____ cm Bottom Head Diameter _____ cm</p> <p>11. Known Contents _____</p> <p>12. State of Conservation</p> <p style="padding-left: 20px;">a. <input type="checkbox"/> Wet b. <input type="checkbox"/> Conserved (How) _____</p> <p style="padding-left: 40px;"><input type="checkbox"/> Dry <input type="checkbox"/> Not Conserved</p> <p>13. Bungs Staves (**Please Complete a Separate Form per Bung Recovered **)</p> <p style="padding-left: 20px;">a. Material <input type="checkbox"/> Oak <input type="checkbox"/> Wood <input type="checkbox"/> Unknown</p> <p style="padding-left: 20px;">b. Manufacture <input type="checkbox"/> Split <input type="checkbox"/> Sawn <input type="checkbox"/> Carved <input type="checkbox"/> Unknown</p> <p style="padding-left: 20px;">c. Diameter _____ cm (Inner) _____ cm (Outer)</p> <p style="padding-left: 20px;">d. Thickness _____ cm</p> <p style="padding-left: 20px;">e. Description</p> <p style="padding-left: 40px;">Shape <input type="checkbox"/> Flat Tapered Disc <input type="checkbox"/> Elongated Tapered Truncated Cone</p> <p style="padding-left: 40px;">Use-Wear _____</p> <p style="padding-left: 20px;">f. Markings _____</p> <p style="padding-left: 40px;">(Attach photograph or illustration of markings)</p> <p style="padding-left: 20px;">g. Decoration _____</p> <p style="padding-left: 40px;">(Attach photograph or illustration of markings)</p>	<div style="border: 1px solid black; width: 100%; height: 100%; margin-bottom: 5px;"> <p style="text-align: center; margin: 0;">Enter Specimen #</p> </div>
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