Abstract

The Technological and Cultural Context of the North Carolina Shad Boat

By

Jeffrey B. O'Neill

April 2016

Director: Dr. David Stewart

Department of History, Program in Maritime Studies

The North Carolina shad boat was first built on Roanoke Island at the end of the 19th century and grew in popularity over the following half century among small fishermen in eastern North Carolina. Through documentation of the four remaining shad boats constructed by George Washington Creef, the original designer, an analysis of design and construction characteristics was completed. The models for analysis were constructed in Rhinoceros software and hull statistics were calculated using Orca 3D. The resulting statistics provided an accurate description of the vessel and this data was compared with data from other vessel types in order to test the unique qualities of the design. Historical sources, namely interviews of first and second hand shad boat users and builders, were consulted in order to reconstruct resource acquisition and vessel construction.

The Technological and Cultural Context of the North Carolina Shad Boat

A Thesis

Presented to

The Faculty of the Department of History

East Carolina University

In Partial Fulfillment

Of the Requirements for the Degree

Masters of Arts in Maritime Studies

By

Jeffrey B. O'Neill

April 2016

The Technological and Cultural Context of the North Carolina Shad Boat

By

Jeffrey B. O'Neill

APPROVED BY:

DIRECTOR OF THESIS:____

[David J. Stewart, PhD]

COMMITTEE MEMBER:____

[Lynn Harris, PhD]

COMMITTEE MEMBER:____

[Nathan Richards, PhD]

COMMITTEE MEMBER:____

[Paul Fontenoy, PhD]

CHAIR OF THE DEPARTMENT OF HISTORY

____

[Christopher Oakley, PhD]

DEAN OF THE GRADUATE SCHOOL:

____

[Paul Gemperline, PhD]

Acknowledgements

I would like to thank the Program in Maritime Studies, my thesis advisor and my thesis committee for all of their efforts and utmost patience. I am especially thankful to Dave for teaching me to record small craft and Nathan for helping me do so; whether that be through securing field school funding, letting me stay a night at his house in Manteo, or on the spot total station troubleshooting.

This thesis would be entirely impossible without the work of two men in particular; Mike Alford and Earl W. Willis Jr. For their efforts in preserving the history of shad boats, all North Carolinians owe a debt of gratitude. The members of the local community, who provided oral history to Earl over thirty years ago, led directly to this work and hopefully to much more in the near future.

In addition, there have been many passionate advocates for local vessel preservation I have worked with along the way. These include Willie Phillips of Columbia, H. A. Creef Jr., Barry Wickre and the Roanoke Island Maritime Museum, Anna Davis and the Roanoke Island Festival Park, UNC Coastal Studies Institute in Manteo, Feather Phillips and the Pocosin Arts Center in Columbia, NC, and Paul Fontenoy and staff of the North Carolina Maritime Museum in Beaufort.

Personally, I have been inspired by a great cohort of scholars with diverse interests. Katie, Matt, Nat, Saxon, the never-pusillanimous Dan, Danny, Emily, Josh, John, Will and Mandy have all provided lifelong friendships and memoires and I look forward to seeing them all succeed as I know they will. Jenny Jones deserves as many Bulls games as I can take her to for her work editing this thesis.

I thank my family members who have supported me in pursuing a dream for more years than they should, my newborn twins Emma and Thomas, and my mother-in-law Anne who has helped immensely in caring for them during long hours of writing. Finally, I dedicate this work to my wife and best friend, Jen, who has always been the most ardent supporter of my many endeavors.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter 1: Introduction

North Carolina has in many ways been defined by its coast. The Outer Banks provided a sheltered harbor to early explorers while this same feature proved treacherous to shipping and gained them the nickname "Graveyard of the Atlantic." The state's ample supply of pine trees and rivers meant naval stores would be an early boost to economic development, while river-spawning fish such as herring and shad would later provide a prosperous industry for eastern North Carolina into the 20th century. Prior to the introduction of major bridges and roadways, transportation by local inhabitants always meant the use of small boats. In response to cultural and environmental demands, these vessel types have developed from Native American log canoes into the modern "Carolina-style" sportfishing boats.

The shad boat, also referred to as the Albemarle Sound boat, is an example of vessel design and technology being perfectly suited to meet the demands placed on it by its users. First designed and constructed by George Washington Creef on Roanoke Island in the early 1880s, the vessel grew quickly to dominate other small boat types in the Albemarle and northern Pamlico Sounds (Alford 2004:18-19). Creef's design proved to be perfectly adapted to working local waters, and the vessel type endured until the 1930s when overfishing and mismanagement of the rivers led to the end of a viable shad and herring industry on the sounds. So popular in the waters of North Carolina, the vessel was designated as the Official State Historic Boat by the state General Assembly in 1987, over a hundred years after its initial innovation and fifty years after the last shad boat had been built. For a vessel to have such a lasting impact on local maritime culture despite a relatively short life span, it must have been exceptional in some sense to the community. There were many designs used to catch shad and work pound nets elsewhere along the East Coast. On the Chesapeake Bay for instance, double ended and transverse planked "pound net skiffs" were used sucessfully as well as the similarly designed Choptank River shad skiff (Dodds 1992:74;78-79). Farther north, a specific shad boat existed on the Connecticut River which was lapstrake and plank keeled (Chapelle 1951:200). In Maine, larger vessels such as the Eastport Pinkies were used to fish shad as far north as the Bay of Fundy (Chapelle 1951:261). In fact, many of the Connecticut River vessels were shipped south to be used in the fisheries in a similar way that the New Haven Sharpie was introduced into the burgeoning oyster fishery around Beaufort, NC (Chapelle 1961). Situated along the major inshore trade route, the fishermen on Roanoke Island undoubtedly saw many vessel types pass through their waters, and yet it was Creef's design that continued to be built by Creef and others all along the Albemarle and north into Currituck County.

Aim & Scope

The current research focuses on establishing what was exceptional about the North Carolina shad boat by examining the remaining collection of shad boats held in museum collections, in order to identify design and construction characteristics which contributed to both its economic success and ulitmately its enduring legacy in the local community. The design and construction of the shad boat will be analyzed in order to establish why it proved superior to other potential vessel types in the sounds of eastern North Carolina at the end of the 19th century. By analyzing the design characteristics of the shad boat, the current research seeks to answer why this design may have been better suited to local conditions and demands than other vessel types. For example, integral to the conditions and demands placed on the design is the economic viability of the vessel. The availability of materials and the cost of construction play a key role in the success of a vessel design when the small scale commercial fisherman is concerned. A vessel which is not reliable or is too costly would subsequently cause fishing operations as a whole to be unprofitable.

Finally, an understanding of the importance of the vessel type to the local inhabitants must be considered if the research is to make any meaningful contribution to our understanding of local maritime culture. As the officially recognized state boat, the shad boat must be thought to convey something about the character of the state beyond simply being a combination of wood and metal. The Roanoke Island Maritime Museum uses the vessel as its logo and images of shad boats can be seen in shops and hotels all along the coast of North Carolina (Figure 1). For any vessel type to be so fondly remembered by inhabitants long after the vessel was actively in use speaks to a greater cultural significance which strikes at the heart of the unique character of maritime communities.

FIGURE 1. Front of the Roanoke Island Maritime Museum in Manteo with Shad Boat Logo (Courtesy of roanokeisland.com).

The larger aim of the current research is to integrate material culture analysis of the shad boat into an anthropological study of regional maritime culture. This creates a two-fold task. Firstly, the acquisition of dimensional and construction data on the shad boat derived from remaining vessels is completed. Secondly, this data will be integrated into our understanding of local maritime culture in the Albemarle-Pamlico region of North Carolina. This will be done by comparing the gathered data with historical information in order to more accurately understand how the environment, culture, and technology affected the object's creation and how this object codifies these variables.

Despite the extensive potential of this research, this particular research projected was limited to the initial documentation of the vessels remaining in public collections. The collected data was then analyzed to provide useful data regarding design, performance, materials, and construction. In addition, this analysis is compared with historical data and previously collected oral histories to lay the groundwork for increasing our understanding of local maritime culture in eastern North Carolina.

Interpretive Model

The core of the current research is a vessel study in its broadest definition. As J. Richard Steffy (1994:5) wrote so eloquently, vessel reconstructing is more than simply describing the structure of the vessel but rather "an all-inclusive description of the ship as a venture." In the aspect of included artifacts a small craft stripped of its context (rig, working gear, personal items etc.) does not provide as much material for broad cultural study as the wreck site of a large ocean going trade vessel. In exchange, these vessels are in a far superior state of preservation being wholly enclosed in a storage facility and largely protected from the elements. The result being that the vessel's structure itself provides an incredible amount of information while cultural information must be inferred through historic research to reconstruct the cultural context of the vessel. By attempting to create a holistic study, endless avenues of research are created and the only limit is the scope of a graduate thesis. This limit is unfortunately surprisingly restrictive and the current research is only an opening of the metaphorical door (Steffy 1994:214-216). Steffy (1994:215) listed six primary objectives for reconstruction: construction, design, technology, cargo and artifacts, economics, and people. The study vessels provide the most information regarding the first three objectives. As a result of the nature of museum acquisition, relatively little is left of cargo and artifacts. Finally, historical research intended to connect the vessels to the contemporary economy and people.

The design and construction characteristics of the vessels were used to classify the vessel as a type so that the nomenclature of "shad boat" could be given true meaning in an academic study. Building on the work of Steffy, Fred Hocker (2004:2-3) wrote of the variety and validity of such typological classification. Hocker argued that detailed recording of a vessel links us to the builders' perception of their product and ultimately how these conceptual approaches are shared cross-culturally. Once a substantial amount of data has been acquired, it is necessary to group and classify the data into typologies. These could be based on any number of characteristics from buoyancy, to function, to cultural origination (Hocker 2004:3-4). From a holistic anthropological perspective, the ultimate goal of this classification is to better understand the motivations of the people who built and used the vessels. The scope of the current thesis nevertheless prevents endeavoring far into the field of cognitive archaeology. This thesis, then, is the groundwork recorded with an ever-present eye towards that future lofty goal.

In brief summation, this research proposes that careful study of the shad boat will greatly contribute to our understanding of the culture which produced it. The ability to interpret the impact of vessel studies to our understanding of maritime cultures is integral to the success of this particular study. B.A.G Fuller addressed this very subject by developing an interpretive model which would highlight the connections between vessels and people in what he termed “a holistic contextual approach” (Fuller 1995:17). Fuller was concerned with artifact interpretation in a museum environment, though the model is equally applicable to academic study. For Fuller, a vessel is an object of material culture which alone can only provide data which is specific to the object itself (characteristics of design, performance, and construction). Only by incorporating historical studies is it possible to answer over-arching questions concerning the cultural context of the vessel. The scope of the current research limits the breadth of cultural study, though the vessel analysis was completed focusing on how it fits into the larger study. Fuller aptly summarized the issue in describing watercraft as “physical manifestations of cultural values operating within environmental and technological constraints” (Fuller 1995:21). It then follows that the goal of vessel analysis, from an anthropological perspective, is to identify the environmental and technological constraints in order to reveal the manifestations of cultural values. In addition, the greater our understanding of a particular culture's values as it relates to watercraft, the more accurate our analysis of the vessels will be. Fuller's model emphasizes the connection between the vessels and the people themselves. These people can broadly be categorized into two groups, consumers and creators (Figure 2).

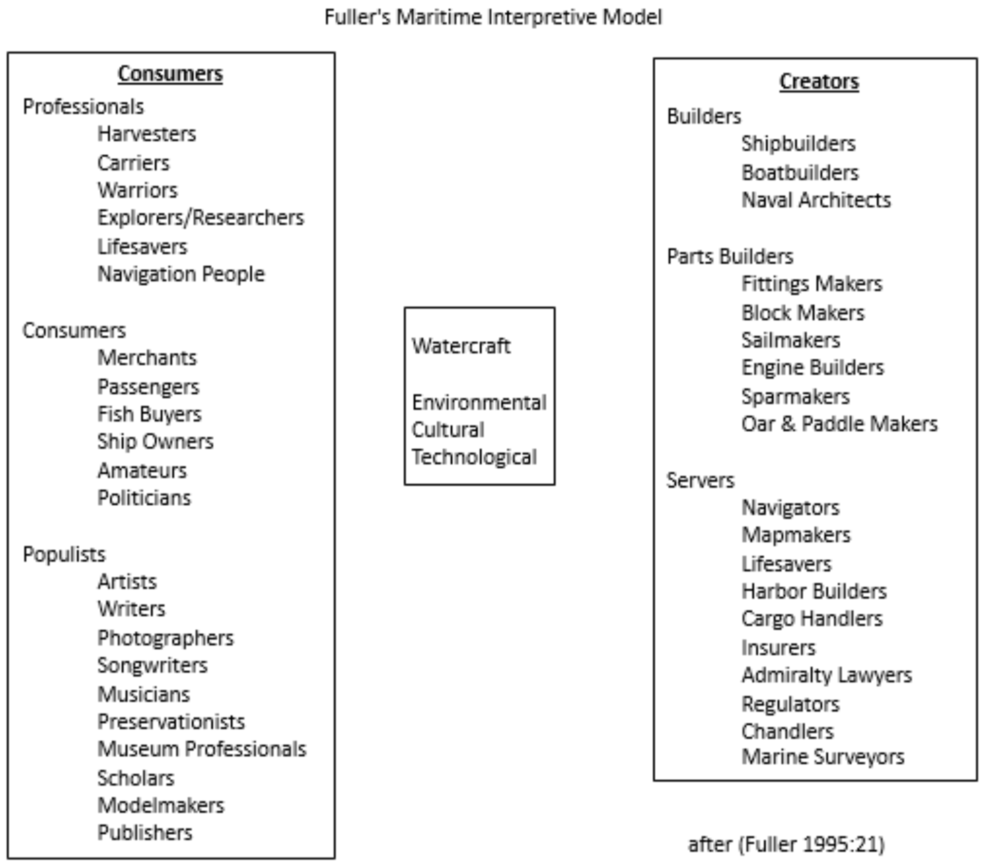


FIGURE 2. Fuller's Maritime Interpretive Model (Fuller 1995:21).

Consumers include all people who use the vessel, from fishermen to artists to scholars and museum professionals. Creators include not only those that build the vessels, but all those whose actions impact the resulting vessels. As with many small scale maritime communities, individuals can fall into a number of these categories simultaneously and at different times in the use life of the vessel. One can think of these individuals as stake-holders in the material culture of the vessel. The variables which culminate in the vessels are environmental (design characteristics), cultural (economics, traditions and aesthetics) and technological (tools, materials, and construction). Throughout the shad boat's use life, some of these actors have had a greater or lesser impact on the vessel. This research provides the basic documentation of the vessel in order to identify possible consumer influences on the material.

Research Questions

The central focus of this research is to document the shad boat as a specific vessel type and extract information to explain its significance in the history of the region. The research questions then follow directly from this focus:

Primary Question 1: What is a shad boat?

-What design and construction features define a shad boat?

-What are the origins of the shad boat's design and construction features?

-What innovations influenced its design and construction over time?

-What boat building traditions influence shad boat design and construction?

-Who were the shad boat builders and what were their backgrounds?

-How did the shad boat design evolve over time to accommodate new materials and requirements (such as the gasoline motor's introduction)?

Primary Question 2: How was the shad boat suited to its environment?

-How does the vessel's performance relate to its use?

Secondary Question: How does the study of the shad boat design affect our interpretation of its cultural significance?

-How has the shad boat influenced boatbuilding in North Carolina?

-What cultural indicators exist which identify the shad boat's significance?

While these questions are particular to this research, they bring together the preliminary information to answer these two thematic research questions:

- **What is the significance in the shad boat's design among vernacular boats, specifically in Eastern North Carolina?**
- **How does the study of the shad boat, or any vernacular craft, contribute to our understanding of local maritime culture?**

The first thematic question will be answered utilizing information recovered by recording the remaining shad boats and analyzing their design and construction features. The second question is anthropological in nature and will be answered utilizing personal interviews and historical information combined with a defined knowledge of the shad boat's place as a culturally produced object. As a result, this research is two-fold, involving data collection for design analysis and an anthropological study of local maritime culture. The current research project's intention was to complete the collection of data from the vessels and to complete design analysis to identify defining characteristics of a shad boat and existing evidence for variation in design over time and by different builders.

Literature Review

The current research framework stems from the work of countless authors of small craft studies over the past century, while introducing a focus on anthropological notions of people and place. The area of small craft studies is constantly expanding and evolving. A survey of academic literature on small craft reveals the myriad ways in which small craft types have been identified, presented, and interpreted. For example, early in the 20th century, zoologist and ethnographer James Hornell wrote on indigenous watercraft from Indonesia to Ireland (Hornell 1920, 1938). Hornell devoted his efforts to documenting “primitive” watercraft throughout the world, his most famous work being *Canoes of Oceania* co-authored in 1936 with noted British anthropologist Alfred C. Haddon. Haddon himself had been documenting canoes as early as 1898 during a Cambridge led ethnographic study of the Torres Straits. Hornell's work with small craft culminated in comparative studies such as *Water Transport: Origins & Early Evolution* (1946) and *Fishing in Many Waters* (1950). In this way, small craft studies have been closely tied to anthropological ethnographies.

Hornell focused on cross-cultural comparison as did contemporary ethnographers. His *Water Transport: Origins & Early Evolution* offers an opportunity to investigate the methodology he used in vessel analysis in order to understand how the field of vessel recording and analysis has developed over the past century. It sets the tone of comparative ethnography with the goal of recording various crafts’ construction and “geographical distribution in time and space” (Hornell 1946:vi). Under this system, craft are divided into three types based on construction: floats, skin boats, and wooden-hulled displacement craft. Analysis of these craft is limited to defining general characteristics, the craft’s use and the cultural group which used it. Very few measurements are given and those present are simply used to give scale. In the more widely studied wooden hulled vessels, Hornell (1946:189-195) does detail various construction methods from lashing, mortise-and-tenon to lap-strake planking. He describes the construction process of a modern English-built fishing vessel, and connects the vessel to its Scandinavian origins and archaeological evidence from the Bronze-Age in Denmark. Finally, Hornell (1946:195-198) postulates that technological adoption of the saw led to a transition away from cleat attachment of planking and cites environmental conditions in Northern Europe as evidence against a "raft with walls" hypothesis for vessel design evolution. This concerted effort to bring historical documentation and ethnographic information into the discussion of vessel design permeates Hornell's work.

An entirely different approach was developed in response to museum-led efforts to protect vanishing resources through documentation. In the United States, there is one name synonymous with small craft documentation: Howard Irving Chapelle. As part of Roosevelt's New Deal policies, the Historic American Merchant Marine Survey (HAMMS) was created in 1936 to record surviving examples of historic commercial vessels. This program employed a young marine designer name Howard Chapelle to record vessels in New England. In addition to the records of HAMMS, Chapelle went on to publish many books detailing American sailing craft, the most famous of which was his *American Small Sailing Craft* published in 1951. In this work, Chapelle describes various traditional small craft found along the Atlantic coast and identifies their possible influences and origins. The work is directed to the amateur boat building community and offers traditional working craft designs as alternatives to race-oriented vessel designs. Chapelle is quick to point out a craft's unique sailing characteristics and qualities. Included with these descriptions are actual plans and offset tables created from surviving examples of-vessels so that a builder could potentially recreate them. In these early books, Chapelle's focus is on the vessel as a potentially useful object and not an example of cultural traditions. Later he would use his considerable experience with small craft on the Atlantic coast to construct an argument for the migration of the New Haven sharpie during the 19th century (Chapelle 1961:135-154). Combining historical research with detailed descriptions of construction and variations in construction, Chapelle was able to provide a compelling narrative for this vessel's migration and adaptation.

The 1950s also saw the publication of a three volume study *Fishing Boats of the World* (Traung 1955). Like earlier works, this study emphasized vessel descriptions from an ethnographic context. With the growth and development of maritime archaeology, our knowledge of ancient vessel design and construction has been immeasurably increased. Sean McGrail's *Boats of South Asia* (2003) provides a unique attempt to both document contemporary craft in south Asia while relating construction techniques to iconographic and archaeological evidence of vessel construction from medieval Europe.

Recently, books such as *Traditional Boats of Ireland* (Mac Cárthaigh 2008) represent modern small craft studies focusing on local variations and historical documentation, while studies such as *Tidecraft* (Fleetwood 1995) include archaeological excavations to document vessel types which have no surviving examples. Thoroughly researched and detailed, these studies focus on documentation without applying anthropological analysis. One exception to this generalization is the study of the Achill Yawl by Chuck Meide and Kathryn Sikes (2010). Seated firmly in the background of maritime cultural landscapes, their work goes as far as asking, "What did the yawls of Achill symbolize to the people who used this type of craft" (Meide 2010:236). Although not particularly in-depth, the article does provide a number of hints at the ways one might approach maritime landscapes. Changing political and religious dynamics can be reflected in a vessel type's popularity over time and alterations in a once-foreign type may indicate acceptance into local tradition (Meide 2010:236-239). It is hoped that the future research developed from the current study will be able to focus more on identifying meaning of a vessel type within a culture at a specific time with a view towards its applicability to the field of archaeology where chronological distance can blur our vision.

The most intriguing, yet oftentimes elusive area for an anthropological approach to maritime culture comes from the field of cultural landscape studies. By focusing on the wider geographical context, the researcher is forced to avoid too specific a context. This method of approaching maritime culture allows for the integration of a seemingly endless array of material culture from gravestone morphology to folksongs.

Previous Studies

While a primary goal of this research was to produce a much more precise description of the Albemarle Sound boat or shad boat, a preliminary description could be made based upon previous research and existing descriptions. Three primary descriptions of the vessel have been published. The first was Charles Gerard Davis's description published in the 1906 work *How to Design a Yacht*. Second is Howard Chapelle's definition which is included in his 1951 classic *American Small Sailing Craft*, under the heading of the "Albemarle Sound boat." The third is by Michael B. Alford in his guide to local craft entitled *Traditional Workboats of North Carolina* (2004).

In 1906, Charles G. Davis, then design editor for *The Rudder* magazine, came across the vessels he termed "Pamlico Sound Seine Boats" being found beside a fishing shanty only 6 miles from Roanoke Island. One example he records as being 29 ft. 10 in. in length and built entirely of juniper. For Davis, the most unique features of the vessel were its frames which ended on the garboard rather than extending to the keel. Being a yachtsman, he was most concerned with performance and concludes with the following description:

> There was no means of measuring her exact speed, but I have sailed boats enough to know a good one when I see it, and that boat certainly was a thoroughbred – she fairly flew to windward, and was handled by a man who knew just what she could do, and who made her do her all (Davis 1906:38).

This statement epitomizes the spirit of this study in recognition of the man at the tiller as equally significant as the vessel's admirable characteristics.

Chapelle's book, on the other hand, was written in order to present traditional designs as low-cost alternatives to recreational yachts and as such, his emphasis is on how the vessel operates. In the case of the shad boat, he does note a great deal of construction features including a plank keel and skeg with some hollow in the garboards (Chapelle 1951:257). Interestingly, Chapelle describes the forward planking being formed to the apron with a cutwater or false stem affixed to the apron after the vessel was planked. He includes in his discussion a skipjack of similar hull profile and a v-hull type in the chapter. While not overly lauding, he writes that the vessels were "well built, in a plain workmanlike fashion" (Chapelle 1951:258-260). In addition, Chapelle looks at the peculiar rigging of the only "American spritsail-and-jib rig with a topsail" (Chapelle 1951:257).

Alford (2004:19-20) details many of these characteristics of the vessels as well as their likely origins. He attributes the shad boat's origins to an evolution of the log boat tradition to solve the problem of the lack of suitable logs for the latter's construction. This also led to the incorporation of logboat construction features into the more production-oriented plank-on-frame tradition. The shad boat's frame and keel members were constructed from Atlantic White Cedar (locally referred to as juniper) rather than the large cypress trees needed for logboat construction.

Alford also discusses the unique sail plan of a spritsail, jib, and sprit-topsail. This adaptation of the sprit-topsail, he attributes, as does Chapelle (1951:261), to the need for working close to wooded shorelines.

When the gasoline engine was adopted by small boat fleets at the beginning of the 20^{th} century, many of the sail powered shad boats were converted to gasoline power. In addition, a new type of vessel was developed which handled better under power. Known paradoxically as “round-chine” vessels, they combined the general characteristics of shad boats with a v-hull below the chine (Alford 2004:21). By the 1930s, even these vessels were becoming difficult to find materials for and their production ended prior to the Second World War.

Thesis Approach

The previous vessel descriptions have focused on the shad boat as an object outside of its native culture. Alford’s (2004) work relating the construction to older methods used in the area stands as the true exception here. Nevertheless, who the shad boat builders were and the culture within which they operated has not been linked to an understanding of the shad boat. Only through a cross-disciplinary anthropological study will it be possible to truly describe the significance of the shad boat design within the context of the maritime culture of eastern North Carolina. Through an intimate understanding of the shad boat as a cultural manifestation, we can develop an intriguing approach to the community. In this way, this study will provide avenues for future analysis and discussion between all maritime communities and the material culture they leave behind.

Reverse engineering material cultures of the past from the artifacts themselves is by no means a simple or straightforward task. One cannot predict what aspects of culture are locked in an artifact and how it manifests. For this reason, it is of primary importance to record the artifact in as much detail as possible. Without knowing exactly what a shad boat is (or is not), we cannot begin to ask meaningful questions of the shad boat. Therefore, this thesis aims to produce the baseline documentation of the shad boat in order to develop the initial vocabulary which will be used in the discussion of North Carolina's maritime culture. First, the background to the shad boat's creation was documented. This included both the geographical and ecological contexts of Roanoke Island at the end of the 19th century as well as the historical context of settlement there. Then, the shad boat itself was documented in as much detail as was practicable. By identifying and recording as many shad boats as possible, an understanding of what is and is not a shad boat can be deciphered. These vessels were then analyzed for variations in performance and design so that the range of variability amongst individual vessels could be understood and the shad boat as a design could be compared to other contemporary craft. Finally, with this vocabulary in hand, possible approaches to the maritime culture of the region were noted in order to pave the way for future research.

Vessel Selection

As with any typology development, the more data included the more accurate the analysis. The shad boats included in this study were mostly housed in museum collections for the sake of easy access. In addition, the vessels were donated and acquired on the basis of perceived historical importance which further supports their incorporation into the study. Four of these vessels are identified as having been built by the originator of the design, George Washington

Creef. As the oldest and of the truest pedigree, these vessels are identified as the primary vessel group. Subsequently, other shad boats held in the collections by later builders were consulted for changes in construction, design, etc. and constitute the secondary vessel group. The study groups are as follows:

Primary Vessel Group

Paul Jones – privately held in Manteo, NC

Ella View – located at Roanoke Island Maritime Museum

Tom Dixon – located at North Carolina Maritime Museum

Foul Play – located at Roanoke Island Festival Park

Secondary Vessel Group

Otis Dough built craft "#024" – located at North Carolina Maritime Museum

Otis Dough built deadrise – located at North Carolina Maritime Museum

Otis Dough half models – located at North Carolina Maritime Museum

"Monkey Island Boat" – located at Whalehead Club in Corolla, NC.

A.B. Wright built craft – located at Museum of the Albemarle

Round-stern "Frying Pan Landing Boat" – located at North Carolina Maritime Museum

Shad boat located in town of Hertford

Shad boat recovered from Ocracoke Island

Shad boat located in downtown Manteo

Chapter 2: Geography, Ecology, and Environment

The natural environment plays a pivotal role in determining what resources are available whether that is a local resource or providing transportation networks for outside resources. In discussing small craft prior to the fiberglass revolution following World War II, the most important natural resource is timber. Eastern North Carolina is a region dominated by softwood pine trees and only a very select group of hardwoods (Brown 1959; Richardson 1981). Traditional boatbuilding hardwoods common to the northeast were either unavailable to local builders or too expensive. The natural environment also dictates design requirements, as a vessel is an object which constantly interacts with sea and shore. Specifically, a vessel must be capable of travelling the required waters safely and reliably as well as withstanding coming to shore at dock or on the banks. For small working craft, the environment also determines what industries the craft will be involved in and what resulting requirements will be placed on the vessel. By identifying the natural resources available in the area and the conditions which the design must operate, it is possible to analyze the shad boat for its ability to meet these demands. Geographical features such as shoreline types influence how a vessel is worked close to shore and how it is stored while weather conditions influence the qualities of vessels at sea.

A fundamental argument of this research is that the shad boat is more than a static artifact. Rather, it is a dynamic reflection of a people, a place, a time, and a technology. Of these, the easiest to define is the place, or geographical location where the shad boat was built and used. As with any locally-developed craft, the available resources within its specific location play a significant role in design and construction. It is not possible to know the absolute geographical limits of the vessel type's activity, since we do not have a record of every vessel built and where it traveled throughout its use life. This is an unfortunate side effect of the temporal nature of small craft. However, the historical record can be used to identify the area where the shad boat was likely to be common.

Study Area

It is well established in the local history that the first shad boat was built by George Washington Creef on the north end of Roanoke Island during the 1880s. He later moved to Wanchese on the south side of the island, but continued to build shad boats throughout his career. Others either learned from him directly or copied vessels he had built, making Roanoke Island the true epicenter of the shad boat and it is clear that the vessel type was adopted along the waterways extending away from there. C.G. Davis called these boats "Pamlico Sound Seine Boats" in 1906 when he encountered them in a creek in the "Roanoke Marshes" six miles from Roanoke Island (Davis 1906:37).

Howard I. Chapelle, in his classic *American Small Sailing Craft* (1951), identified the vessel type as the "Albemarle Sound Boat" adding that many of the boats were from Roanoke Island and the western shore of Pamlico Sound. Chapelle also mentions their use on the Currituck, Core, and Croatan Sounds (Chapelle 1951:257). While it is likely the vessel did see use in the Currituck, it is unlikely that many vessels of the type made it as far south as the Core Sound where the sharpie type dominated. The Croatan Sound between Roanoke Island and mainland Dare County, at the intersection of the Pamlico and the Albemarle Sounds, was considered in this research within the Pamlico Sound. Through his own research, Michael B. Alford writes that the shad boat was built in various forms "from Currituck to Ocracoke, and Nags Head to Engelhard" (Alford 2004:19). Museum collections as far as Plymouth and Elizabeth City suggest that the vessel was used throughout the Albemarle Sound and the north shore of the Pamlico Sound. Combining these historical limits, Figure 3 shows the extent of the study area.

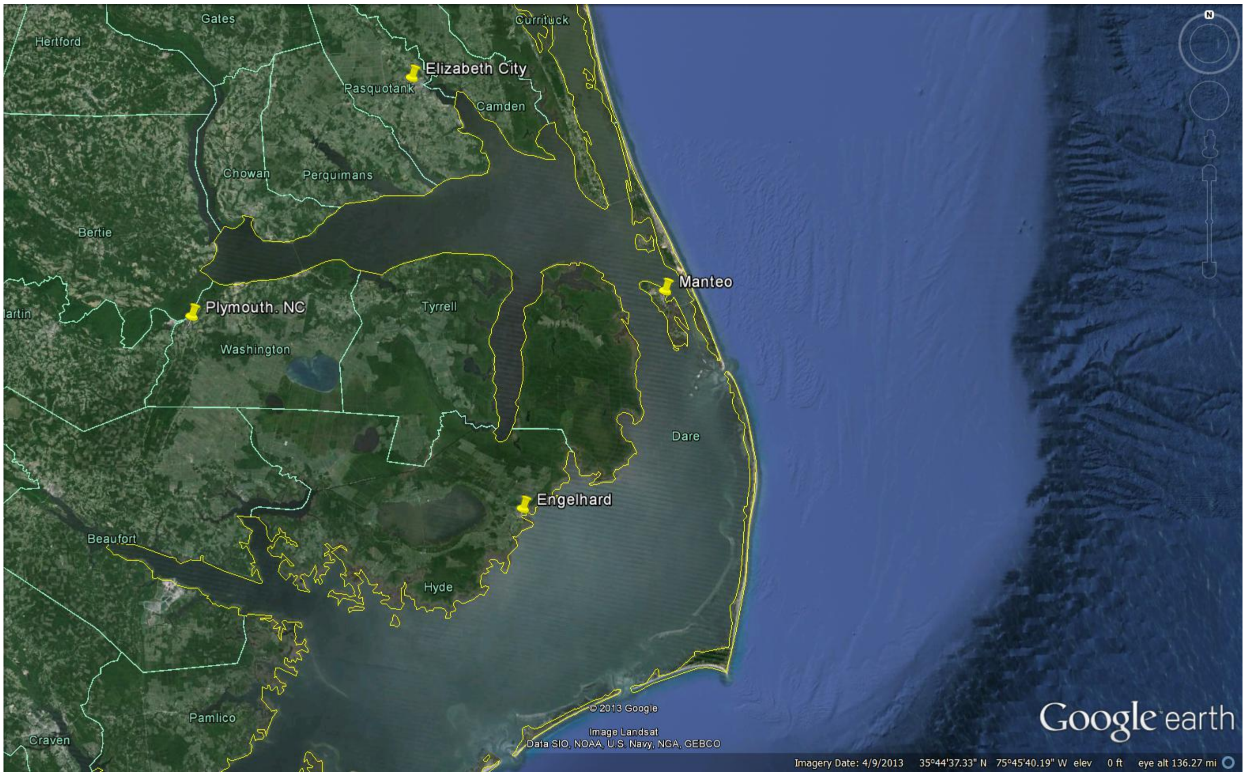


FIGURE 3. Map of study area (Image courtesy of Google Earth).

The study area encompasses the Albemarle, Croatan, Roanoke, and the northern extent of the Pamlico Sound. These bodies of water are often considered as a single geographical region, referred to as the Albemarle-Pamlico Sounds or Estuarine System, and part of the larger geographical region called the Tidewater (Gade et al. 2002:50). The Albemarle-Pamlico consists of large inland seas protected from ocean storms by the barrier islands popularly known as the Outer Banks. Many theories exist to explain the creation of the Outer Banks, but their separation from the mainland may be seen as the result of sea level rise over the past 15,000 years (Gade et al. 2002:12). Subsequently, the sounds themselves are a combination of freshwater river output and seawater passing through the inlets via tidal action.

Land and Vegetation

The land surrounding the Albemarle-Pamlico is consistent with the regional geography. Low lying Quaternary sands and clays are predominant except where organic peats have developed in swampland. Across the entirety of the Tidewater region, elevations rarely exceed 25 ft. above sea level (Lee 1955:6). While the landscape today has been heavily developed for agriculture and timber, as late as 1962 over 50% of Dare, Hyde, and Tyrrell counties consisted of freshwater marshes called pocosins, while other counties in the study area ranged from 7.9% (Currituck County) to 28.5% (Washington County) (Richardson 1981:8). Pocosin wetlands are typically covered in hearty shrubs with myrtle (*Cyrilla racemiflora*) dominating in the central and northeastern part of the state and have evolved in response to periodic fires (Richardson 1981:49). Typical trees include pond pine (*Pinus serotina*), red maple (*Acer rubrum*), sweet bay (*Magnolia virginiana*), loblolly bay (*Gordonia lasianthus*), Atlantic white cedar (*Chamaecyparis thyoides*) and bald cypress (*Taxodium distichum*) (Richardson 1981:45).

The Outer Banks too have been heavily deforested through severe storms and intense development. High winds and sand deposition dominate and progressive sand dune movement inland typifies the ocean side of the banks. There is some dispute about whether the banks were ever entirely forested, though most agree that vegetation has been largely reduced (Brown 1959:14). The seaward extents of wooded areas form a natural wind break and depositional location for sand. Over time, large dunes (some 50-70 ft. in height) are created which eventually destroy the trees behind them (Brown 1959:27). This is a continual process as evidenced by the tree stumps which often appear as the dunes move (Stick 1958:3-4, Brown 1959:15). In such a hostile environment, the only trees naturally-occurring are dwarfed varieties of wax myrtle

(*Myrica cerifers*), bayberry (*Myrica pensylvanica*), silverling (*Baccharis halimifolia*), yaupon (*Ilex vomitoria*) and live oak (*Quercus virginiana*) (Brown 1959:30). More protected areas foster woods of live oak and loblolly pine (*Pinus taeda*). The north side of Roanoke Island itself is higher in elevation than the south side and consists of many varieties of shortleaf pine, cedar, and oak, while the southern tip in the area of Wanchese represents pocosin wetlands (Brown 1959:46).

Shoreline and Rivers

The study area covers two distinct bodies of water: the Albemarle Sound and the northeastern section of the Pamlico Sound. While both are connected directly to one another and protected by the Outer Banks, the ecological differences between the two provide evidence as to why the shad boat was prolific in the Albemarle Sound while not expanding its use farther than the north bank of the Pamlico-Tar River.

The Albemarle Sound is fed primarily by the Roanoke and Chowan Rivers along with the smaller Perquimans, Pasquotank, Little, North, Yeopim, Scuppernong, and Alligator Rivers. The shoreline extends over 1,600 miles and varies considerably from east to west (Riggs 1978) (Figure 4).

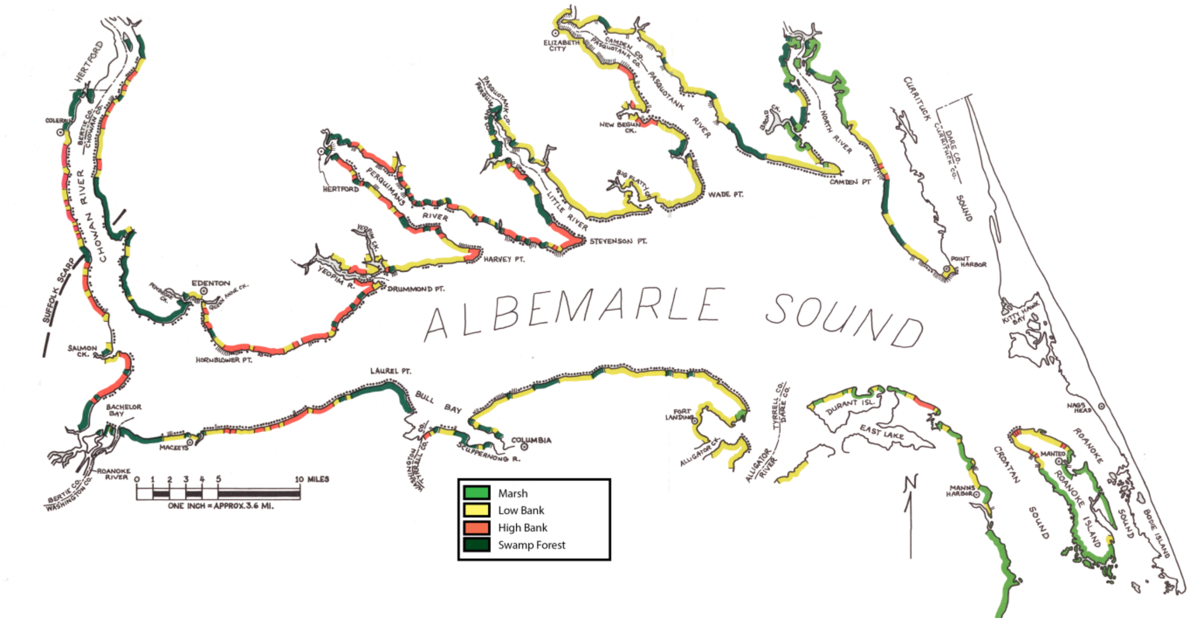


FIGURE 4. Map of Albemarle Sound shoreline types (Riggs 1978).

The most elevated shorelines in the Albemarle Sound consist of bluffs exceeding 20 ft. above the water with a maximum height of over 40 ft. along the western banks of the Chowan River. This shoreline type is, however, atypical and rarely occurs elsewhere in the Albemarle Sound (Bellis 1975:29-31). Much more common are high banks rising 5 to 20 ft. above sea level. Other than a few exceptions (including the north tip of Roanoke Island), this bank type is limited to the western end of the Albemarle Sound. Erosion, specifically undercutting of these higher banks, often results in tree-falls which create numerous snags and other navigational hazards along the shoreline (Bellis 1975:25). Also common on the western shores, making up a quarter of the total shoreline in the Albemarle, are swamps consisting primarily of cypress, gum, and maple. These swamps lie in areas often less than one foot above sea level. Only mildly tolerant of higher salinity, they are much less common east of the Scuppernong (Riggs 1978). As erosion occurs and sea levels rise, the swamp banks become inundated and the gum and maple die, leaving behind cypress trees standing in up to 5 ft. of water. Oftentimes, cypress stands can be seen out into the water some distance from shore, although the seeds will not germinate under water (Bellis 1975:34).

The most prominent type of shoreline in the Albemarle Sound in the central and eastern sections is a low bank rising between 1ft. and 5ft. above sea level. In addition to being the most common type, it is also the most conducive to commercial endeavors because of the ease of access to land from sea. All of the major towns on the Albemarle Sound are located on this type of shoreline including Colerain, Columbia, Edenton, Hertford, and Elizabeth City. South of Manteo and along the western shores of the outer banks, however, brackish grass marshes predominate. In these periodically inundated areas the primary vegetation is black rush (*Juncus roemerianus*) with few trees. This produces a largely peat soil which is easily eroded by wave action, and the edge of the marsh often drops off suddenly into 3-5 ft. of water (Bellis 1975). The grass marsh continues along the banks of the Pamlico Sound from Mann's Harbor through all of Dare County and the majority of Hyde County to Sladesville (Riggs 2001:36).

Marine Resources

For the entirety of recorded human occupation, the sounds have provided two primary resources: transportation and marine life utilized for food and raw materials. Although the history of transportation on the sounds is addressed in Chapter 3, this section will discuss the natural characteristics which may contribute to or hinder transportation. In relation to the early development of North Carolina and coastal navigation, the inlets have been pivotal. Geographically, they serve as outlets from the sounds into the Atlantic Ocean and vary considerably in size and location through time based on output from the sounds and sea level changes (Mallinson 2008:2-3). These inlets are ever changing, often appearing and disappearing with major storm events, never allowing significant depths to be carved from the Outer Banks (Mallinson 2008:2). Ocracoke Inlet is the only inlet that has remained in existence since being first recorded in 1585 (Mallinson 2008:6). Minor, temporal inlets are often opened during major storms when sound output is suddenly increased, but they close quickly afterwards (Mallinson 2008:5-7). There have been no current inlets directly into the Albemarle Sound since the closing of Roanoke Inlet in 1811, and Oregon inlet to the south of Roanoke Island is the northernmost inlet on the Outer Banks (Stick 1958:9; Mallinson 2008:6). The mouth of the Currituck Sound which flows into the northern extremity of the Albemarle, lies 24 miles from Oregon Inlet. As will be discussed in the history chapter, various human-made modifications have been performed to increase access and ease transportation on these waters.

The sounds themselves dictate the type of transportation possible within these bodies of water. Upon successfully navigating Oregon Inlet, with its shifting sands and drifting channel, a vessel would enter the northern end of the Pamlico Sound with an average depth of 20 ft. (Taylor 1951:6). Shoals occur as the marshy inner coastline rises gradually out of the water, as well as at the confluence of rivers such as at the Brant Island Shoals where depths can be reduced to 3 ft. In addition, in the northern Pamlico Sound, at the confluence of the Albemarle Sound discharge and the southern Pamlico Sound, where the Neuse and Tar/Pamlico rivers discharge, the Bluff Shoals run completely across the sound from Bluff Point in Hyde County on the mainland to Ocracoke Inlet. Depths across this shoal average approximately 10ft. Further north, Roanoke Island divides the Pamlico and Albemarle Sounds into the Roanoke Sound to the east and the Croatan Sound to the west. Both sounds run the length of Roanoke Island for 8 miles. The Roanoke Sound is narrow and shallow (1/2 - 2 miles in width and 1 – 3 ft. deep) while the Croatan is twice as wide and deeper (7 – 10 ft.) (Taylor 1951:5). Thus, the deepest entrance into the Albemarle Sound from the Atlantic Ocean is only approximately 10 ft. The Albemarle Sound itself stretches 55 miles from the mouth of the Roanoke River to the inland shore of the Banks and averages 7 miles wide with an average depth of 18 ft. (Taylor 1951:5).

Protected from the ocean by the Outer Banks, the currents in the sounds are determined to a much greater degree by internal factors rather than tidal effect through the inlets. With its broad and shallow waters, the greatest contributing factor is wind. Easterly winds can blow past Oregon Inlet and actually result in a negative net tidal discharge. Other factors affecting current include river discharge, rainfall over the sounds, and evaporation (Taylor 1951:9-10).

Sea conditions undoubtedly influence vessel design in many ways and affect how a vessel is utilized in the transportation of people and goods. Shad boats were both transportation vessels as well as tools used in fisheries. As gear used for harvesting different marine species vary significantly, the species which are exploited consequently affect the vessel design.

While the scarcity of inlets and shallow waters have hindered large scale transportation on the Albemarle and Pamlico Sounds, these very characteristics have contributed to the overall abundance of commercial marine species, specifically anadromous fish. These are species which live in salt water but migrate into fresh water to spawn, salmon running upstream are perhaps the most widely known example. The salinity of the sounds varies dramatically based on the same factors which contribute to current, the most important being freshwater discharge from tributaries and proximity to inlets. As the Albemarle Sound has no direct connection to an inlet and remarkably higher river discharge, it is considered freshwater. The Pamlico is brackish with high salinity given its proximity to Ocracoke Inlet and distance from the approaches to the Pamlico and Neuse Rivers (Taylor 1951:38,41).

The variable salinity greatly affects the marine species available in particular parts of the sounds. As of the 1950s, the menhaden or fatback (*Brevoortia tyrannus* primarily) fishery was the most important to North Carolina both in value and tonnage. While not popular as a food staple, it was used for its oil in the production of industrial products such as soap, paint, and linoleum and has been used for bait and fertilizer as well (Taylor 1951:85-76). Their high tolerance to salinity and dependence on water temperatures above 10 C° (50º F) results in a spring run (May through August) with the migration north and a winter run (October through December) with the migration south. Most of these fish are caught in the Pamlico and Core Sounds (Taylor 1951:93-96).

It is in the arena of edible finfish that Albemarle, Croatan, Roanoke, and northern Pamlico Sounds stand out. In North Carolina, alewives, goggle-eyes (*Pomolobus pseudoharengis*) and school herring (*P. aestivalis*), are almost entirely harvested from the Albemarle Sound. While declining significantly in the 20th century, from 1890-1900 the alewife fishery in North Carolina made up a third of the national catch with annual yield between 15 and 20 million pounds. As an anadromous fish, the alewives spend the majority of their lives off-shore but spawn in freshwater. The goggle-eyes run in the Albemarle beginning in late March and the school herring follow three to four weeks later with the season ending in early May (Taylor 1951:109-110).

The shad (*Alosa sapidissima*) come into the Albemarle Sound at the same time as the school herring, dependent upon water temperatures reaching 10-13°C (50-55º F). Prior to 1935, this was the most valuable fishery in North Carolina. In the past, North Carolina's geographical position meant its shad harvest hit the market earlier in the season than northern fisheries, resulting in a higher price at market (Taylor 1951:111-112). The last major anadromous species spawning in the Albemarle is the rockfish or striped bass (*Roccus saxatilis*) which is predominantly caught in the Croatan Sound and the eastern end of the Roanoke Sound (Taylor 1951:124). The white perch (*Morone americana*) is also primarily caught in these waters and north into the Currituck Sound.

The Pamlico Sound, which benefits from brackish waters, harvests gray trout (*Cynoscion regalis*) and spotted or speckled trout (*C. nebulosis*) all year. Further south past Ocracoke Inlet, the shallow waters provide for a croaker (*Micropogon undulatus*) fishery in summer and a spot (*Leiostomus xanthurus*) fishery in the fall (Taylor 1951:125-131). Lesser commercial species include sea mullet (*Menticirrhus americanus and M. saxatilis*), pigfish or hogfish (*Orthopristis chrysopterus*), harvestfish (*Peprilus alepidotus*), butterfish (*Poronotus tricanthus*), sea bass or blackfish (*Centropristes striatus*), flounder (*Paralichthys dentatus*), and carp (*Cyprinus caprio*) (Taylor 1951:131-134).

The blue crab (*Callinectes sapidus*), today the most successful fishery in North Carolina, has not always been intensively exploited despite its availability throughout the state's estuarine waters. In 2012, over 26.6 million pounds of blue crabs were harvested. Yet prior to 1945, the harvest was less than 100,000 pounds and in 1901 less than 30,000 pounds (Taylor 1951:206; NCDMF 2013). Oysters (*Ostrea virginica*), scallops (*Pecten irradians*), and clams (*Venus mercenaria*) are exploited in the southern Pamlico Sound but lie largely outside the study area. While shrimp (*Penaeus sp.*) is also an important commercial fishery in North Carolina, it is not harvested north of Cape Hatteras given the northern extent of its habitat (Taylor 1951:193-196). Consequently this limited the need for the low, wide-beamed vessels used in these fisheries on the Albemarle Sound.

Climate and Weather

Contributing to both maritime transportation and marine resources, climate and sea conditions have a dramatic effect on vessel requirements and resulting design. In addition to the impact on available flora and fauna discussed above, climate affects day to day operations of fishermen, determining the fishing season and daily conditions. While analysis of weather and climate data as it relates to vessel design is beyond the scope of this research, it is an important area to be researched in the future of historic vessel studies and may provide endless avenues of research. For comparative analysis to be feasible, data would need to be collected at the operating regions of several historic vessel design types. For the current study, it is sufficient to recognize the potential influence conditions might have, especially on rigging.

Chapter 3: History

Once the physical landscape, weather conditions, and natural resources have been established, it then follows to establish the human-made landscape, cultural demands, and resource exploitation affecting vessel design. To a great extent, the environmental aspects dictate the conditions a vessel type must operate within, but the societal needs within this landscape drive innovation. Natural resources are important, but without an industry of resource exploitation these materials cannot be utilized. Essentially, a tree is not useful as timber until it is able to be cut down, transported to the location it is needed, and worked. Fortunately, the historical record aids in the understanding of both of these factors. Consequently, the combined historical and material record allows for the description of two further factors, innovation and development. These records provide a basis for the technological context of the shad boat's invention. The application of available resources to the needs of the community within an environment leads to this innovation. Changes in needs and resources through the vessel type's use life result in further innovation and development which can be seen in historical photographs, personal interviews, and existing artifacts.

Need – Why make a shad boat?

As with any vehicle, a boat's primary function is transportation and in historical eastern North Carolina transportation has relied heavily on watercraft. Small, shallow drafted vessels have a very long history in the southeast. The indigenous solution was the shaping and hollowing of vessels from a single log resulting in the craft variously referred to as the dugout, log boat, or canoe. Historically, canoes have been documented beginning with Christopher Columbus' first voyage in 1492 when he describes many canoes including one over 65 ft. in length (Fleetwood

1995:1-2). The types of vessels common in the region have changed with its inhabitants and their technological abilities and industrial needs. The earliest canoes found in the southeast have been from Florida where vessels radiocarbon dated to 5000 years B.P. have been discovered (Fleetwood 1995:1). Significantly, 25 canoes have been excavated from Lake Phelps in Washington County with radiocarbon dates ranging from 4300 - 500 years B.P. (Pierce 2010:47).

The first Europeans to see the North Carolina coast, members of Giovanni da Verrazano's 1524 expedition, did so by boats which sailed from Cape Fear north to Kitty Hawk and on to New England (Ready 2005:17). Having seen the Pamlico Sound, Verrazano believed it to be the Pacific Ocean, which accounts for the inaccuracy of the da Verrazano map of 1529 which identifies the Sea of Verrazano splitting North America in two (Powell 1989:30) (Figure 5).

FIGURE 5. Reprint of Verrazano's Map of 1529 (Photo Courtesy of David Rumsay Map Collection, *Atlas of the Historical Geography of the United States* by Charles O. Paullin).

In 1526, a Spanish colonization effort led by Lucas Vásques de Ayllón landed at the Rio Jordan, likely the Cape Fear River. It was here that the first Carolina-built, European-designed watercraft were constructed in order to explore the shallow waters (Powell 1989:31). Called *La Gavarra*, it was likely a flat-bottomed, oared craft with a single square sail built of native oak and pine (Fleetwood 1995:11-12). After many failed attempts at colonization in the area, Spain's efforts in Carolina ended with Angel de Villafañe being driven by distress to Cape Hatteras when he decided to sail home to Hispaniola and a vain attempt at establishing a mission on the Chesapeake (Lewis and Loomie 1953; Powell 1989:32; Ready 2005:18). The French, under Jean Ribaut, later attempted to establish a colony at the Rio Jordan, but errors in navigation landed them at Parris Island, SC in 1562 (Powell 1989:33). An effort fraught with tragedy, the garrison left by Ribault constructed a small "*pinness*" caulked with Spanish moss and sailed for France only to resort to cannibalism and rescue by the English (Fleetwood 1995:13-14).

The most intensive early explorations of the Albemarle and Pamlico Sounds were the Roanoke voyages instituted by Sir Walter Raleigh and undertaken first by Philip Amadas and Arthur Barlowe in April 1584 (Powell 1989:38). According to Barlowe's report, the first sighting of the natives by the English was that of a dugout boat rowing across the sound carrying three men. After receiving gifts from the English, the natives returned the favor by fishing and dividing the catch between the two barks designated by Barlowe as "the ship" and "the pinnace" (Old South Association 1889:3-4). It may indeed be the case that the first meal the English had once arriving near Roanoke was shad. Barlowe tells of the method for dugout construction involving burning out the center of a log either "pine or of pitch trees, a wood not commonly known to our people nor found growing in England." After burning, the coals were scraped out using shells. He also mentions a new industry for colonial North Carolina, namely salvage.

Barlowe writes that they have only a few edge tools to aid in hollowing the logs which they collected some twenty-six years prior "of a wreck which happened upon their coast of some Christian ship" (Old South Association 1889:6). Survivors from the wreck were heard of living among the natives at Secotan on the shores of the Pamlico Sound. Having been stranded on a then unsettled Ocracoke, he notes these people attempted to sail away, tying two dugouts together as a catamaran and rigging it with their shirts for sails, though these efforts failed (Old South Association 1889:9). Had colonization ended then, it would have been interesting to see where this technological integration might have led.

In addition to Barlowe's report, there are many surviving watercolors done by John White, an artist who sailed with them. These paintings provide some of the only images of pre-contact life in southeastern North America. White's work would most famously be used for Theodore De Bry's engravings which accompanied Thomas Harriot's "Brief and True Report of the New Found Land of Virginia" in 1590. John White also drew detailed maps of the sounds which show many native villages along the shores and upriver, emphasizing the importance of watercraft to the native transportation network (Figure 6).

FIGURE 6. Theodore De Bry engraving of 1590 based on John White's map (Image courtesy of Roane County Tennessee Family History Project).

White's map indicates many locations where native villages are in approximately the same locations as later colonial settlements such as Roanoac (Manteo), Dasamonquepeu (Mann's Harbor), Pomeiock (Englehard), Mequopen (Columbia), Waratan (Edenton), and Pasquenoke (Elizabeth City).

Two of White's watercolors are of particular relevance. The first details the native method of felling trees and boat building (Figure 7).

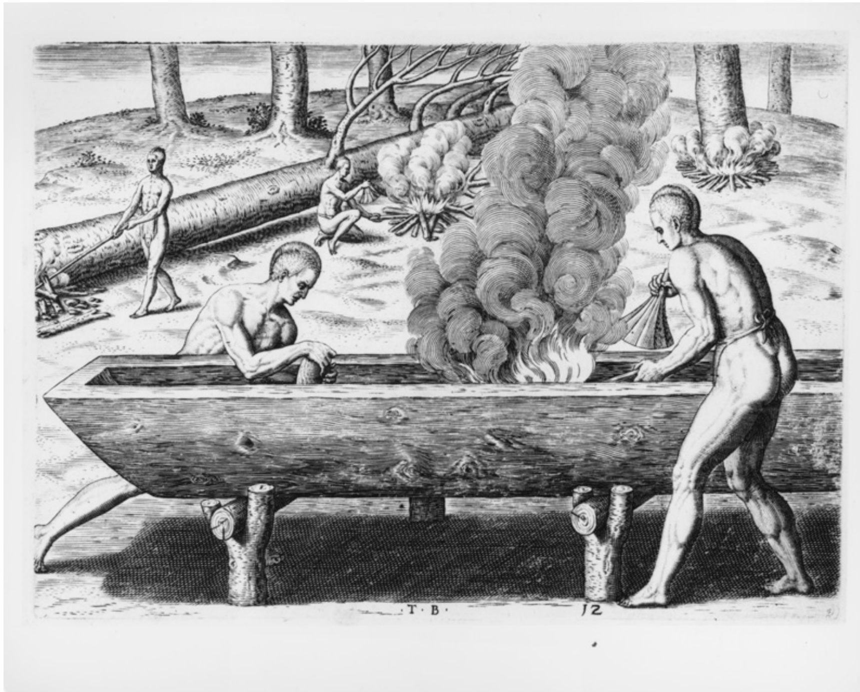


FIGURE 7. Theodore De Bry 1590 engraving of boat building in Virginia (Photo courtesy of Roane County Tennessee Family History Project).

Thomas Harriot (1590:XII) describes the process:

> The manner of making their boats in Virginia is very wonderful. For whereas they want instruments of iron, or other like unto ours, yet they know how to make them as handsomely, to sail with where they list in their rivers, and to fish with all, as ours. First they choose some long, and thick tree, according to the bigness of the boat which they would frame, and make a fire on the ground about the root therof(sp), kindling the same by little, and little with dry moss of trees, and chips of wood that the flame should not mount up so high, and burn too much of the length of the tree. When it is almost burnt through, and ready to fall they make a new fire, which they suffer to burn until the tree falls of its own accord. Then burning off the top, and boughs of the tree in such wise that the body of the same may retain his just length, they raise it upon poles laid over cross wise upon forked posts, at such a reasonable height as they may handsomely work upon it. Then take they off the bark with certain shells: they reserve the innermost part of the length, for the nethermost part of the boat. On the other side they make a fire according to the length of the body of the tree, saving at both the ends. That which they think is sufficiently burned they quench and scrape away with shells, and making a new fire they burn it again, and so they continue sometimes burning and sometimes scraping, until the boat have sufficient bottoms.

Following the success of Amadas and Barlowe's exploratory voyage, Raleigh quickly arranged a colonization effort lead by Ralph Lane which sailed in April of 1585 (Ready 2005:21). Lane was a military man and after setting up Fort Raleigh on Roanoke Island, abandoned it sailing back to England with Sir Francis Drake before the supply ship arrived. By this time it was agreed that the shallow inlets of the Carolina coast were far inferior for colonization by sea than the Chesapeake area to the north. As fate, and the pilot Simon Fernandez would have it, the second attempt at colonization landed back at Fort Raleigh. Lacking food and with hostility from the natives growing, White made the decision to return to England to request supplies only a month after arriving. England's war with Spain saw to it that no supply ship would return for three years and by that time, the colonists had disappeared. (Ready 2005:24-30) It would be seventeen years before another English colony would be founded in North America and only through expansion of these settlers away from the Chesapeake would the Albemarle region be settled by Europeans.

In the beginning of the seventeenth century, very little is spoken of the Albemarle region or indeed most of what was to become Carolina. King Charles granted the charter for Carolina to Sir Robert Heath in 1629 but neither Heath, nor Henry Frederick Howard who was given proprietorship in 1638, were able to recruit colonists (Powell 1989:50-52). Activity on the Albemarle during this time from colonists most likely consisted of Virginia trappers and others trading with the natives. Marmaduke Rayner was sent by the Virginia colony to explore the region in 1620 while others explored the land to the north and west (Dunbar 1958:16). The first permanent colonial dwelling appears on the Comberford Map of 1657 with Nathanial Batts' home situated between the Roanoke and Chowan Rivers (Figure 8). In 1654, Francis Yeardley wrote of a fur trader whose sloop somehow accidentally left him in the Albemarle Sound. The trapper and another of his party took a boat northwards to ask Yeardley's help in reaching his boat. He granted this assistance and tells of them reaching the island, interacting with the native village, and bringing back some token from the "ruins of Sir Walter Raleigh's fort" (Salley

1911:25-26). Very slowly, Virginia planters were making their way to the north bank of the Albemarle Sound and by 1663 there were over fivehundred residents (Powell 1989:52). Later, James Lancaster’s map of 1679 shows twenty-three houses (in most cases undoubtedly plantations) on the shores of the Albemarle including one on Colleton (Collington) Island (Figure 9).

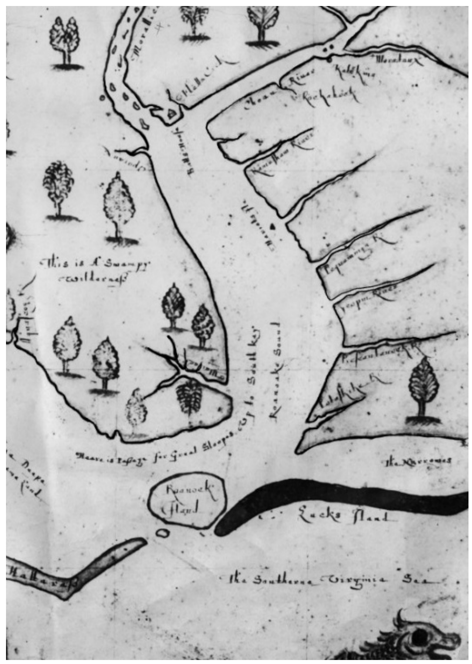


FIGURE 8. Albemarle Sound section of the Comberford Map of 1657 with “Batts House” at far western end of sound (Photo Courtesy of North Carolina Maps).

FIGURE 9. Albemarle Sound section of James Lancaster map of 1679 with settlements noted (Photo courtesy of North Carolina Maps).

The year 1663 also marks the year Carolina became a proprietary colony. Charles II, having recently gained the throne with the restoration of the monarchy in 1660, looked upon Carolina as a blank slate so far unable to prosper. Combining idealistic views of government creation with political favoritism, Charles appointed eight supporters including George Monck, the first Duke of Albemarle, to administer the province of Carolina. With the success of the colony at Charleston and briefly on the Cape Fear, it became clear that along with the original settlement on the Albemarle Sound~~,~~ the colony would not be able to be run from a single center (Ready 2005:39-41). Charleston, with its ever expanding port facilities and cultural ties to Bermuda and transatlantic trade, differed greatly from the Albemarle region settled by expanding agriculturalists with strong ties to Virginia and New England. After four rebellions and the Tuscarora War, North and South Carolina were divided in 1712.

Transportation in the Albemarle colony during the seventeenth century was an arduous task which contributed to its self-sufficient and politically isolated nature. Separated from the Virginia colony in the north by the Dismal Swamp and the Albemarle Sound to the south, the colony was notorious for both overland travel and dangerous passage through the inlets. Scattered swamp land and numerous rivers and creeks called for roads and bridges which were difficult to maintain by the scattered population. Instead, rather than settle adjacent to roads, plantations developed along the banks of the rivers and sounds. Shallow-drafted trading vessels which passed through Roanoke and Currituck Inlets, exchanged goods directly at plantation landings (Butler 1989:44). Transportation across rivers and sounds was accomplished with the ubiquitous cypress-built dugout and the colonially-developed periauger (Brown et al. 2010).

Trade with the Albemarle was predominately between the New England ports in Massachusetts and Rhode Island, and between Barbados and the West Indies (Butler 1989:41). Having been first settled by Virginia planters, tobacco was the primary trade good coming out of the area in the early seventeenth century, though overproduction drastically reduced the value of this crop by the 1630s, forcing Albemarle plantations to diversify. Major export products included corn, beef, pork, and whale oil harvested on the Outer Banks, and to a lesser extent horses, sheep, chickens, flax, hemp, and peas. Having no demand for Carolina tobacco in Virginia, most went to New England where it would travel directly to Holland in defiance of the 1660 Navigation Acts. In exchange, New England traders brought manufactured goods to the Albemarle, textiles being chief among them as little wool was produced locally. Barbados and the West Indies demanded beef and pork in exchange for sugar, molasses, and rum (Butler 1989:45-46). With little enforcement of regulations in such a backwater colony, most plantation owners were involved in smuggling and this would later prove to encourage piracy in the region (Butler 1989:39-42). At this time it appears that fishing was of little concern to the area and the only maritime export was a relatively small quantity of whale oil (Butler 1989:47).

As observed in Charleston during the late seventeenth century, the primary coastal trading vessel was likely the two-masted, square-rigged ketch being replaced by the single-masted, fore-and-aft rigged shallop or sloop by the end of the century, the entrance to the Albemarle Sound naturally limiting vessels to those with less than approximately 9 ft. draft (Fleetwood 1995:25-30). Vessels bound for the Albemarle ranged in size from 12 to 50 tons with crews from four to six men. Completely lacking the facilities and personnel though, Albemarle was not able to produce these larger vessels and most ships trading in the area were English built and owned by New Englanders (Moody 1943:43-53).

For inland travel, the locally produced cypress dugout or canoe was a mainstay of Albemarle life. The sparsely populated area could not have supported full time boat builders and the emphasis on agriculture over marine resources meant the simplest, most cost-effective solution to local transportation was sought. They varied greatly in size from small, one or two man "paddling canoes" to vessels capable of carrying two or three horses (Watson 1966:71). Canoes built from readily available cypress trees did not require bronze or iron fasteners, which would have needed to be imported, and only basic tools and little specialized knowledge to produce. Cypress is a very rot-resistant wood and canoes could either be sunk or painted in order to protect against shrinkage and checking of the timber. So common was the dugout that every visitor to the area seems to have traveled by a canoe at some point during their trek (Lawson 1709:6; Bricknell 1737:260). Unnerving to some, the narrow beam of the dugout canoe resulted in instability when weight was high in the vessel though through practice, the native Carolina Algonquians were quite capable of paddling or poling canoes from a standing position. More established plantations also had larger boats, yet there is little documentation to indicate the type. These boats allowed for much easier travel and larger carrying capacity (up to forty or fifty barrels), though the greater draft hindered maneuverability on the rivers (Watson 1966:71; Butler 1989:41). If these boats were locally produced, it is likely that they would have been of the *periagua* or periauger type as documented both in North and South Carolina (Crittenden 1931; Fleetwood 1995) (Figure 10). These vessels expanded upon the simple dugout by using multiple logs to raise the sheer height or increase beam and create more complex hull shapes. Often, the log would be split and timbers would be inserted along the centerline for this purpose. Additionally, thwarts, washboards, transoms, and even cabins could be added. In general, the hull shape is best described as being an enlarged version of the canoe. On coastal waters, periaugers were rigged for sail, though in their primary duties of upriver cargo transport this would have been unwieldy (Fleetwood 1995:37-41). Unfortunately, there is only historical evidence for the larger periauger types and only a few remaining multi-log dugout vessels.

FIGURE 10. Replica periauger on display in Hertford, NC (Photo courtesy of www.visitperquimans.com).

The eighteenth century brought with it rapid growth and development in the Albemarle region. Native populations dwindled on the coast as these tribes consolidated with others further inland. This aided in colonial expansion southward, first across the Albemarle Sound and along the banks of the Pamlico Sound and ending with settlement of the Cape Fear River. North Carolina's 1729 European and African population is estimated to be 36,000 with 40% of those residing in Chowan County (Ready 2005:50). Although not being incorporated until 1722, Edenton had long served as the cultural and political center of North Carolina. The first Chowan County courthouse was built in Edenton in 1712, and the town served as the unofficial provincial capital from 1722-1743. Difficulties in navigating the inlets into the Albemarle meant towns being settled to the south became more advantageous to trade and consequently economic and political power shifted southward. New Bern was settled in 1710 by Swiss and German immigrants under Baron von Graffenried. It suffered greatly in the Tuscarora War and was abandoned until 1720. Furthermore, the creation of the Granville District in 1744 granting the area from the Virginia border 60 miles south to Sir John Carteret, Earl of Granville, pushed royal administration out of the region. In 1746, New Bern rather than Edenton was designated the royal capital. Brunswick and Wilmington on the Cape Fear also began to vie for power as the Cape Fear River became the dominant port in the colony by the time of the American Revolution (Powell 1989:144-146). It was from Wilmington that North Carolina shipped the majority of America's naval stores and the town grew to be larger than New Bern by 1830 (Powell 1989:135).

In Albemarle, trade goods included the agricultural products typical of the earlier period in addition to a growing naval stores, barrel staves and shingles, market. An unidentified French traveler passed through the region in 1765 and gave a detailed account of his journey through the area around Edenton (American Historical Association (AHA) 1921:736-738). Traveling from Bath, he first crossed the Roanoke River at Dayly's Ferry and noted the many warehouses which lined the river. The majority of goods including tobacco, wheat, and corn, were sent to the James River in Virginia "where they get a better price for them than here or in any port in the province" (AHA 1921:736-738). On the Neuse, these goods were shipped down in flats and periaugers and this was likely the same for the Roanoke and Chowan (AHA 1921:736). The Frenchman cites Edenton's distance from the "bar" at Ocracoke Inlet as the cause for trade being poorer than at New Bern or the Cape Fear. At Edenton harbor, he noted "a dozen vessels, brigs, sloops, and schooners here taking in pork, pitch, tar, turpentine, wheat, and corn" (AHA 1921:738). The white cedar and cypress, common to the region, made for excellent staves and shingles as well as small craft production. The West Indies desperately needed barrels for sugar, rum, and salt, and prior to the revolution, North Carolina was exporting 5.5 – 7.5 million shingles each year (Powell 1989:137). From 1771-1776, 827 ships left Edenton carrying 10 million barrel staves, 16 million shingles, 320,000 bushels of corn, 100,000 barrels of tar and 6,000 hogsheads of tobacco. During this period, John Hewes from New Jersey established a shipyard in Edenton Bay (Parramore 1967:26-27). Elsewhere on the sound, shipping records from Edenton also indicate that merchants were operating on Roanoke Island by 1767 (McCall 1988:7).

The John Collet map of 1770 provides the best evidence for the extent of transportation routes at this time (Figure 11). From this map, it can be seen that the northern bank of the Albemarle Sound was heavily settled with great tracts of swampland having been drained.

FIGURE 11. Albemarle Section of Collet Map 1770 (Photo Courtesy of North Carolina Maps).

However, in 1770 the southern banks of the sound, Roanoke Island, and the Outer Banks were seemingly undeveloped and disconnected from the overland road network. In addition to roads and ferries, the Collet map indicates a number of mills including Richard Brownriggs' saw mill on the Chowan. Undoubtedly, as saw mills increased in numbers so too did plank built flats and small trading craft. In larger planked craft, it is likely that frames were of live oak and the vessels planked in oak, juniper, yellow pine, or some combination (Fleetwood 1995:52-57).

Adding to the difficulties of travel on the Albemarle, the ephemeral inlets eventually left the sound without direct access to the Atlantic. Roanoke Inlet, which was always shallow, became tenuous by 1780 and was completely closed by 1810. South of Bodie Island, Gunt Inlet closed in the 1770s and to the north, New Currituck inlet closed in 1828. It was not until 1846 that present day Oregon and Hatteras inlets opened (Stick 1958:9). Politically and geographically isolated, trade with the Albemarle had little hope of enduring.

The long established trade between the Albemarle Sounds and Virginia directed internal improvement efforts at maintaining this network. Water transport had always been preferred to the overland route crossing the Great Dismal Swamp. In the early 18th century, there was a growing movement to drain the swamp for its use in timber and to connect the Albemarle to Virginia by canal. George Washington endeavored to do just this with the charter granted him in 1764 by the Virginia Assembly (Brown 1971:23-27). The state of Virginia passed an act for creating a navigable canal in 1787, and North Carolina passed complementary legislation in 1790 (Brown 1971:31-32). By the end of 1801, however, it had not been completed and was only 11ft. wide and 2 ft. deep, and the flanking road was not suitable for carriages for another two years (Brown 1971:38-39). The canal was completed in 1805, and in 1807 tolls were being collected for shingles and staves cut from the swamps. The vessels in use on the canals were shallow drafted flats up to 40 ft. long, 6 ft. in beam, and drafting no more than 2 ft. which could carry up to 8,000 juniper shingles (Brown 1971:46). Goods would be transferred to more seaworthy vessels at either end of the canal for transport on the Albemarle or Chesapeake Bay. After the War of 1812 efforts were made to improve the canal (which managed a depth of 6.5 ft. by 1827), and in 1823 a 65 ft. schooner from Halifax went up the canal to Norfolk carrying cotton, flour, tobacco, and hogs (Brown 1971:54). Canal boats built in 1828 were schooner rigged and averaged 67.5 ft. length, 15.3 ft. beam, and 6.6 ft. depth of hold (Brown 1971:66). In 1829, 770 hogsheads of tobacco, 1,964 bales of cotton, 2,937 barrels of flour, 2,507 barrels of fish, 30,000 bushels of corn, 2,307 barrels of turpentine, over a million staves and well over 14 million shingles traveled north along the canal (Hinshaw 1948:26).

A need for an offloading terminus at the southern end of the canal led to the incorporation of Elizabeth City on the Pasquotank River in 1793. This town would prosper via the canal trade, becoming the Albemarle's largest city (Griffin 1970:1). Elizabeth City grew in parallel to development and improvements of the Dismal Swamp Canal. The first steamboat *Norfolk* saw service to Elizabeth City in 1818 while increased draft to the canal to 3.5 ft. in 1828 brought further growth to the town, including a shipyard able to build two 300 ton brigs (Griffin 1970:71-74). Prior to this, shipbuilding was not as profitable as agriculture in Carolina and it could be expected that traders from New England and abroad would provide the ships (Fleetwood 1995:47, 61). Elizabeth City's dominance of regional trade finally waned with the completion of the Albemarle-Chesapeake Canal which allowed commercial traffic to bypass Albemarle Sound entirely. Still, by 1891 five saw mills, five planing mills, two marine railways, and a cotton net factory served the town (Fearing and Bearing 1983:2).

As the railroad spread throughout the region, steamships became connectors between lines as with the Norfolk Southern Railroad which began operating the Old Dominion Steamship line in 1882. In North Carolina, the line's primary intent was to connect Elizabeth City to Norfolk, VA, but routes went as far south as New Bern. On Roanoke Island, the line stopped at Skyco wharf on the Croatan Sound side (Prince 1972:213).

The shad boat spent most of its year transporting people and goods, yet a second primary function of the shad boat is that which it is most known for, fishing. The eponymous shad (*alosa sp.*) has been harvested in North Carolina waters since long before European arrival, though its commercial importance only became significant at the end of the 19th century (Taylor 1990:i). While North Carolinians had long used watercraft for transportation, this new demand on small craft was undoubtedly one of the primary factors leading to the development of the shad boat.

From the first European contact with Native Americans in North Carolina, there is historical evidence for subsistence-level fishing in the sounds (Figure 12). During the Roanoke expeditions, Thomas Harriot (1590:20) noted the fishing techniques as follows.

> The inhabitants use to take them two manner of ways, the one is by a kind of weir made of reeds which in that country are very strong. The other way which is more strange, is with poles made sharp at one end, by shooting them into the fish after the manner as Irishmen cast darts; either as they are rowing in their boats or else as they are wading in the shallows for the purpose.

FIGURE 12. John White's Watercolor of Native Fishing Methods (Photo courtesy of Virtual Jamestown, http://www.virtualjamestown.org).

Fishing with a weir to direct fish into a trap was well known to Europeans at the time and would not have been thought of as unusual. Weirs can be used either to exploit fish migration during tidal shifts or migration of anadromous fish. The native methods were also adopted by later colonists and John Lawson reported in 1701 that natives were employed in weir construction. By 1712, he noted that a small quantity had been salted and shipped abroad. The commercial exploitation of fish at this time was limited to plantations around Edenton with the exception of whaling on the Outer Banks. John Bricknell (1737) wrote that herring had been exploited in large quantity for export to the West Indies, but efforts were limited by available salt. An anonymous French traveler to the area in 1765 observed herring fisheries near New Bern and at Alexander Brownrigg's plantation near Edenton (AHR 1921:738). Brownrigg established his fishery, the first large fishery in North Carolina, in 1762 on the Chowan and by 1772 it was identified as a haul seine operation with a seine in excess of 1,000 ft. Other planters quickly joined Brownrigg and by the time of the revolution, the herring and shad fishery on the Albemarle had become a sizeable industry. From 1771-1776, over 24,000 barrels of salted fish left Edenton, mostly for the West Indies (Taylor 1990:9-10).

In the antebellum period, transportation networks increased salt availability while booming slave populations created a need for inexpensive food sources. In these conditions, the salted fish industry continued to develop and expand. Between 1835 and 1874, one fishery averaged annual hauls between one and three million herring and thirty thousand shad (Taylor 1990:22-23). Joseph Skinner established the first large haul seine fishery on the Albemarle Sound in 1807 and by 1846 there were fifteen (Taylor 1990:15). By this period, the nets had increased in size to over a mile in length. The haul seine fisheries required intense labor for only a short part of the year and almost exclusively employed slave and freedman labor from nearby plantations and towns (Taylor 1990:21). Capital requirements were also high, estimated at twelve to fifteen thousand dollars in the 1850s (Taylor 1990:26). Canoes rowed by ten men hauled the nets from shore by towing them on flats (Figures 13-14).

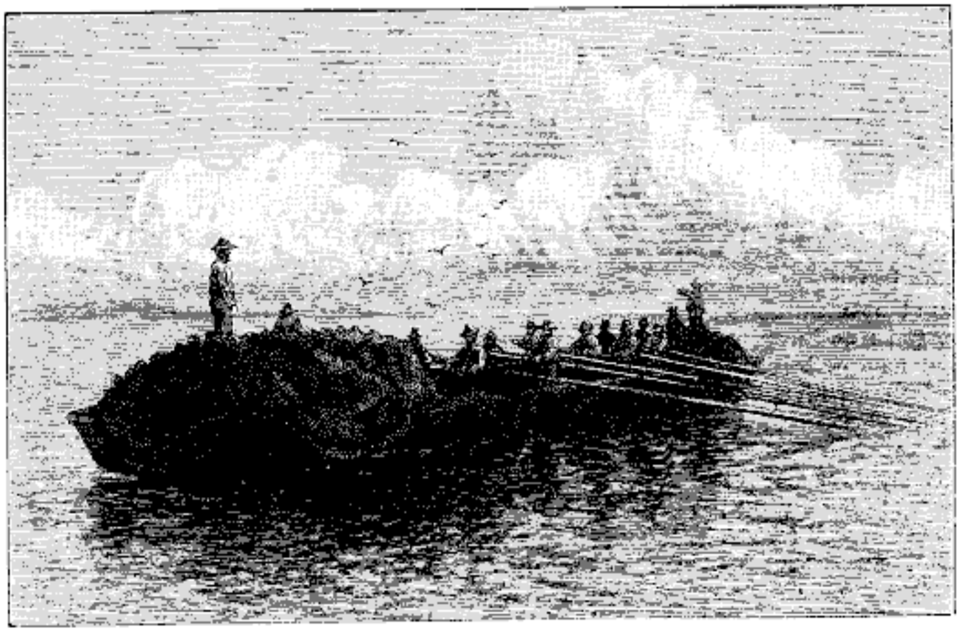


FIGURE 13. Sketch of seine with rowboat, circa 1880 (Miner 1880).

FIGURE 14. Haul seine operation on the Albemarle Sound (Photo Courtesy of NCMM).

Once the nets were shot from shore, the hauling ropes would be brought in with horse driven windlasses. Already, there was growing tension between these large scale commercial operations and independent fisherman who claimed the seines were depleting resources upriver on the

Roanoke and Cashie (Taylor 1990:15). Disputes of this sort would follow over the next century, as smaller operations expanded into new fisheries on the sound.

The Civil War led to a temporary halt of operations as the Union held the Outer Banks for most of the war and much of the slave workforce escaped. Following the war, railroads, steamships, and the availability of ice shipped from the north allowed for long distance trade in fresh fish. The year 1869 saw the introduction of the pound net to the Albemarle Sound when the Hetterick brothers from Ohio settled in Edenton. Pound nets, short for impoundment, operate on the same principle as a weir, though are more compact and less permanent (Goode 1887:609). The major advantages of the pound net are the low cost of the equipment and the ability to be hauled by only two people. In addition, the shore facilities required by haul seines are not needed to accommodate the pound nets. Whereas in 1860 only a thousand people were employed in commercial fisheries entirely within the Albemarle Sound, by 1880 there were five thousand engaged in fisheries all along the North Carolina coast, that number doubling to over ten thousand in 1896 (Taylor 1990:30). The haul seine fisheries countered by increasing capacity with steam launches to shoot nets and steam winches to replace horses. By 1880, they were averaging 1,750,000 herring a season (Taylor 1990:38). The ability of the average fisherman to operate a pound net eventually decreased the numbers of haul seines. Less than thirty years after their introduction, there were well over a thousand pound nets on the Albemarle Sound. Pound nets on the Croatan Sound to catch shad entering spawning grounds so diminished populations in the Albemarle that legislation was passed in 1905 requiring an open channel for fish (Taylor 1990:42).

The latest fisheries to be developed in North Carolina were those for shellfish. Prior to improvements in shipping, fresh oysters, clams, crabs and shrimp could not be sent any great distance because of their high perishability (the first ice plant was not built in NC until 1879). The Chesapeake Bay provided nearly all of the oysters entering northern markets (Taylor 1990:48). It was not until 1874 that George Ives established an oyster industry in Carteret County. He was from Connecticut and brought with him the New Haven sharpie. These flat-bottomed, round-stern vessels with a centerboard proved well adapted to tonging for oysters in the shallow waters of the Core Sound. As catch numbers declined on the Chesapeake, oystermen traveled south into the Pamlico Sound to access the previously unexploited oyster beds of North Carolina. In 1891, 64% of oysters harvested were done so by non-residents utilizing dredges which were new innovations in North Carolina (Taylor 1990:52). The oyster industry was not prominent on the Albemarle, yet these northern vessels passing Roanoke Island undoubtedly contributed to the design of the contemporary shad boat. On the Core Sound, New Haven sharpies were enlarged, decked, and schooner rigged to create the North Carolina sharpie or "Core Sounder" (Figure 15). This vessel type remained popular locally until the 1930s (Chapelle 1961:151).

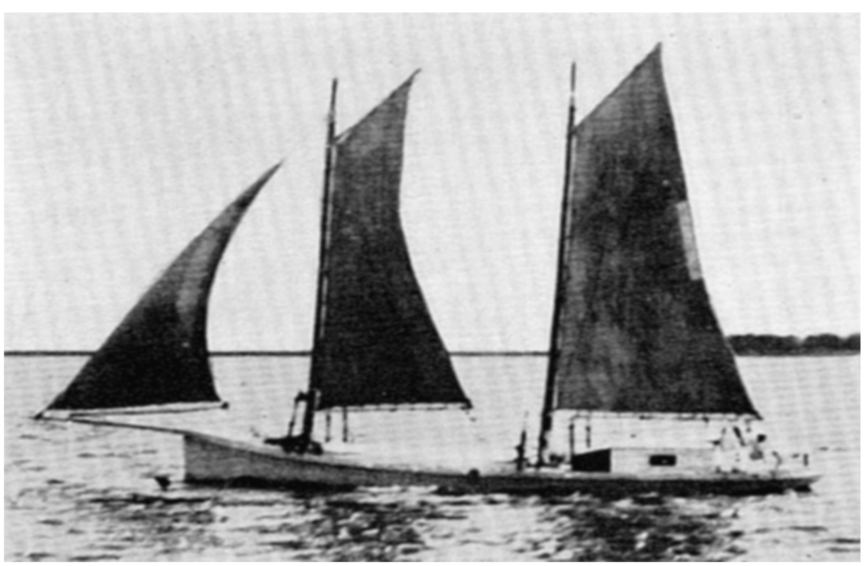


FIGURE 15. North Carolina sharpie (Chapelle 1961).

While fishing was seasonal for most of the Albemarle, fishermen on Roanoke Island and the Outer Banks worked year round as there was little agriculture to compete for labor (Taylor 1990:31). Fresh shad, white perch, mullet, and striped bass were now caught by fishermen operating from small craft with dragnets and shipped north through the Albemarle and Chesapeake Canal which opened in 1869 (Taylor 1990:31-32). For Roanoke Island in particular, the striped bass, called "rock" locally, fishery along with the shad fishery was of primary importance. In 1886, there were 215 fishermen employed and 380,000 pounds of rock landed (Taylor 1990:33). It is in this environment that George Washington Creef designed and built his first shad boat.

In order to best understand the cultural and economic factors contributing to the innovation in design surrounding the shad boat, it is necessary to analyze the cultural and economic environment in which George Washington Creef and other shad boat builders operated. It will then be possible to see the manner in which the available resources and the socio-cultural atmosphere effloresced into a vessel type.

George Washington Creef was born on 10 January 1829 to English immigrant Joseph and his wife Mary Amanda Holmes. George is found in the 1860 census under the name Crief with his wife Margaret Howard and three children, the youngest George Jr. being four years old. Without a great deal of local history having been recorded at this time, the census data itself may be the best method of constructing the economic and cultural environment in which Creef spent his early years. In 1850, the census began listing all free persons within a household by name and in addition the occupation of all males over fifteen. The occupations list, while unfortunately including only free persons (excluding 25-50% of the population in Tyrrell County), creates a picture of what daily life in the area might have looked like and the technological influences which Creef encountered. Dare County was not established until 1870 and the only division in Tyrrell County made by the 1860 census takers was the town of Columbia. Creef's occupation is oddly not listed in the 1860 census, though he would have likely been identified as a farmer.

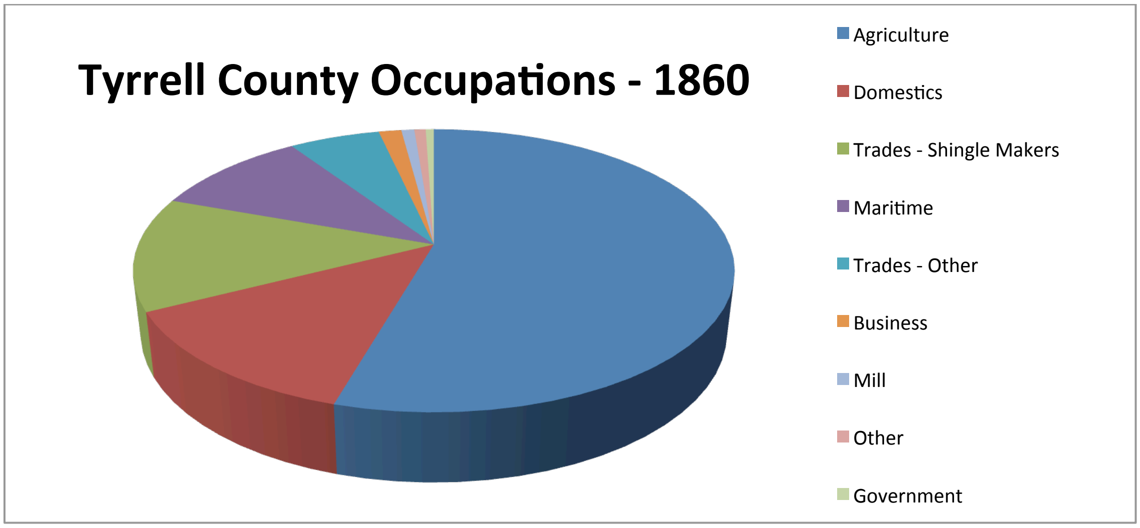


TABLE 1. Tyrrell County Occupations – 1860 (Data from U.S. Census Bureau, 1860 Tyrell County, NC; Copy No. M-635, Roll No. 915).

The 1860 census takers visited 638 properties including 603 families in Tyrrell County (Table 1). As expected, agriculture dominates the list of 960 people with identified occupations. Most noteworthy are the sizeable numbers of those occupations related to the lumber industry, specifically shingle-making. When milling professions are combined with logging and shingle-making, they represent 15% of those with listed occupations in the County, 17% east of Columbia. Of the 15 domiciles visited before and after Creef, there were 14 shingle makers, 24 farmers (including Creef's two brothers), four domestics, four mariners, a fisherman, and a carriage maker. In 1860, the Tyrrell County manufacturing census indicated 5 shingle operations which produced 3.8 million cypress and juniper shingles, and three steam saw mills produced approximately 1.2 million board feet of pine lumber. Shingles being made from cypress and juniper, Creef would have been well familiar with both the industry and the quality of the timber coming out of the swamps in East Lake. For 1869, 81 of the 97 mariners were listed as mariner (ten as master mariner) rather than fisherman. This indicates that most mariners were involved in the transportation of goods to larger ports on the Albemarle, while only a small number of fishermen were providing fish to local markets, unable to compete commercially with the large seine operations on the Sound.

In 1870, Dare County was formed from parts of Hyde, Tyrrell, and Currituck Counties, with a centralized courthouse located on Roanoke Island at a site that would become Manteo, NC. George Washington Creef lived in the area known as East Lake Township east of the Alligator River which was part of the Dare County annexation. The creation of this division allows for a more geographically confined area from which Creef came before he settled on Roanoke Island in 1879. The 1870 census of East Lake identifies 57 dwellings with 68 individuals with occupational titles, with the exception of those women keeping house or children at home (which were not indicated in the 1860 census). Farmers and farm laborers represent 50% of the population, while the numbers of those identified as swampers increased to 26% of the population. No longer indicating those specifically involved in timber gathering or shingle making, these professions were all categorized as swampers. Still, the numbers indicate a strong presence of shingle making in East Lake Township and only two sailors and a single fisherman. Creef himself is identified as a carpenter along with two others in the township. Creef owned $400 in real estate and $250 dollars in personal estate and his eldest son was identified as a farm laborer so undoubtedly, Creef was working as a carpenter while maintaining his farm. East Lake Township (Creef's location) is, unfortunately, absent from the Dare County manufacturing records though Nags Head (including Roanoke Island) and Croatan Townships (between East Lake and Roanoke Island) do not list any timber products. The 1870 manufacturing census for Tyrrell County lists 3 steam saw mills outputting 623,000 board feet of yellow pine, and 5 shingle making operations outputting 2.1 million cypress and juniper shingles. In Tyrrell County that year, there were 5 hand seine operations producing 800 shad or rock, 3,238 shad, and 414,000 herring. In Dare County, 2 gill net fishing operations produced 220,000 shad, and 3 hand seines hauled 2 million herring and 11,000 shad. The shad were iced and shipped fresh while the herring continued to be salted. The absence of fisherman from the East Lake population census, combined with the absence of timber production in Dare County east of East Lake, creates a picture of the area where those along the Alligator River concentrated on inland farming and shingle making while those living on the shores of the Croatan Sound devoted their efforts to fishing for herring and shad.

With the establishment of Dare County and the building of the courthouse on Roanoke Island at Shallowbag Bay, local water transportation increased between the mainland, Roanoke Island, and Nags Head. The post office was built in Manteo in 1873 (though all of Dare County is listed as Manteo post office in the 1870 census), and the island population grew in accordance with its rise in importance as the seat of county government (Khoury 1999:21-22).

The 1880 census designates Roanoke Island separately from Nags Head Township and allows for interpretation of the environment where George Washington Creef relocated (Table 2). As a self-identified carpenter, it would have been extremely advantageous for Creef to do so. The 1880 economic census for all of Dare County is unfortunately lost, as it would have been incredibly useful in identifying the scale of economic activity on Roanoke Island.

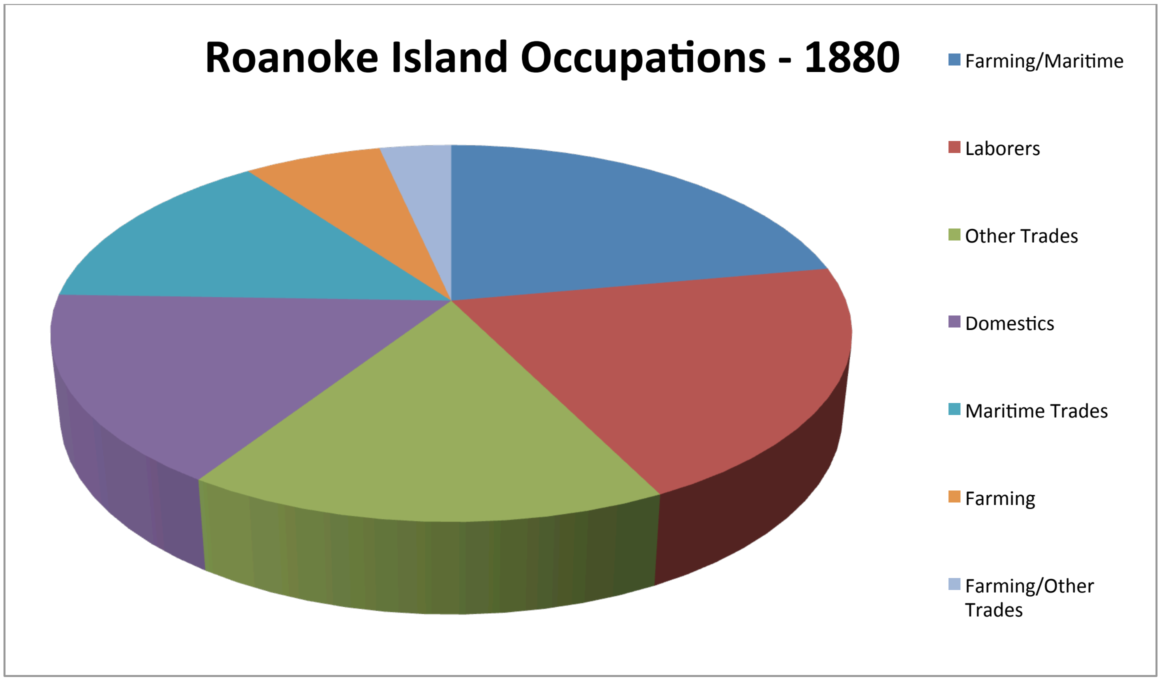


TABLE 2. Roanoke Island Occupations – 1880 (Data from U.S. Census Bureau 1880, Dare County, NC Copy No. T-9; Roll No. 961).

Roanoke Island at this time was quite a different cultural and economic environment from East Lake Township in 1870. By 1880 there were 157 families living on Roanoke Island. Of the total population of 774, there were 292 persons of color, representing 38% of the population. Following the Union's capture of Roanoke Island in February of 1862 and expansion into eastern North Carolina, escaping slaves made their way into Union held territory. Roanoke Island became one such place and by the end of the war there were over 3,000 newly freed slaves on the island (Click 2001:11). Many descendants of the freedmen's colony remained on Roanoke Island in 1880. Economically, maritime activity was the dominant feature of a growingly diverse town. Timber, however, was of little concern. There were no mills, and only one part-time swamper was listed. Full time farmers made up only 5.5%, while those involved in full-time maritime trades (excluding the 23 seamstresses who likely spent a great deal of time mending sails) accounted for 14.4%. Of persons listed with occupations, 65 of the 380 were employed in both fishing and farming, while a number of others farmed and worked various other trades. The term "laborers" is ambiguous and may indicate that they too were involved in both fishing and farming. Another term, "mechanics," was used to identify 6 people, and 4 were involved in both farming and work as a mechanic. George Washington Creef Jr. belonged to the former and Creef himself to the latter. The "Instructions to Enumerators" for the 1880 census stated specifically that enumerators not use the designation of mechanic "if it is possible to describe him more accurately" (Department of the Interior 1880). Again, this may indicate that Creef's work was so varied as to make a specific title impossible. He was known to have built *Ella View* in 1883 and was likely working in carpentry and boat building and repair at this time. Creef Jr. was also a boat builder beginning by the 1880s. He most famously constructed the 55 ft. *Hattie Creef* in 1888 which carried the Wright Brothers and their flyer to the Outer Banks in 1911.

Available Resources - What makes a shad boat?

Each of the four surviving George Washington Creef shad boats were built entirely of Atlantic white cedar fastened with rivets at the bottom piece and with planks nailed to frames. Historical evidence suggests that, at least prior to the Civil War (and likely into the 1870s), the most common small craft in the region were cypress canoes and split log boats built largely without any metal fasteners. This transition to Creef's design represents a complete change in the materials utilized for small craft construction and warrants investigation.

The first survey of eastern North Carolina's timber and its industry was not published until 1894, and it reveals the state of the industry nearly thirty years after the end of the Civil War. Discussing the Pamlico Peninsula, lying south of the Albemarle Sound and encompassing Dare, Tyrrell, Hyde, and Washington counties, the survey notes 40,000 acres of juniper and that "the cypress acreage is not near so large as formerly, but there is still a large amount standing"

(Ashe 1894:29) (Figure 16). In regards the counties north of the sound (which includes the Dismal Swamp), the report finds that both cypress and juniper had been largely removed for use as shingles and concludes that “the timber lands of these counties have, as a rule, been more thoroughly lumbered than any others in the State” (Ashe 1894:30). In short, while significant timbering had occurred between 1860 and 1891, nearly depleting the northern shore of the Albemarle Sound, there were still large stands of both cypress and Atlantic white cedar in the swamps of Dare, Hyde, and Tyrrell counties. It was the benefit of utilizing juniper which fostered change rather than the unavailability of cypress and indeed cypress canoes were built in very small numbers and in isolated areas well into the 20th century (Alford 1992:193).

FIGURE 16. Map of counties comprising the Pamlico Peninsula (Image courtesy of North Carolina Maps).

Innovation – What is a shad boat?

George Washington Creef was a farmer turned carpenter and boat builder who grew up and lived his life among the cypress and juniper trees commercially exploited for their resistance to deterioration. The increase in small scale fishing operations in competition with the steam driven haul seines of the Albemarle Sound meant an ever growing need for a small craft which could be utilized both for transportation of fish and other cargo on shallow, open sounds, as well as work the pound nets used by local fishermen. Northern investors sought out the untouched oyster beds in the Pamlico and Core Sounds and with them, vessels designed to travel on the Chesapeake Bay and other sheltered waters further north. Traveling the Albemarle and Chesapeake Canal or the Dismal Swamp Canal, they would all have passed Roanoke Island where locals undoubtedly debated the design and sailing qualities of these "foreign" vessels. Creef was the first to combine all of these influences into a vessel type which would succeed for over fifty years, evolving from a simple work vessel to an adaptable recreation vessel, leading it to remain close to the hearts of eastern North Carolinians.

The descriptions of shad boats by Davis (1906), Chapelle (1951), and Alford (2004) were used to select which vessels the current study would focus upon. Maritime museums and locals of eastern North Carolina have a very broad definition of the shad boat which has developed for over a century. This variable use of the term is worthy of future study of course, but for the current research it had to be refined. The earliest description by C.G. Davis (1906:37) is as follows:

> She was 29ft. 10 in. long; built entirely of juniper. The sides were planked with it and the frames cut from the roots, so as to get natural crooks. In model they somewhat resemble the Jersey Beach surf boats, only these boats are smooth planked. They have similar broad raking transoms, very high bows, and quite a bit of flare to the sides. They have a good sized centerboards, numerous thwarts, a wide flat board like a planksheer, forming a partial deck. But the most peculiar feature I noticed was that none of the frames came to the keel but ended in about the middle of the garboard.

Davis undoubtedly observed the frames ending on the bottom piece and did not realize that the frame and the garboard were a single timber. His accompanying drawing indicates a section at the centerboard trunk which would also be the section most likely to disguise this construction feature (Figure 17).

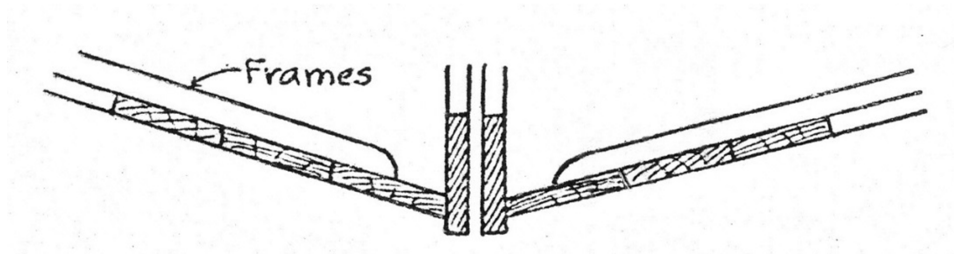


FIGURE 17. C.G. Davis' centerboard drawing suggesting separate timbers (Davis 1906:37).

Chapelle (1951) recorded a "hulk" on Roanoke Island in 1951 for inclusion in *American Small Sailing Craft*. He includes a lines plan, sail plan, and table of offsets for this 23' 10.25" vessel. Chapelle identifies the frame construction as single futtocks, 12" on center ending on a "plank keel" and skeg with floors independently placed between futtocks. There is no mention of a one piece bottom, and he describes a plank keel with bevel for garboards. At that time, Chapelle noted that the shad boat (the original round bottom craft which ranged 18-30ft.) was no longer built and had been replaced by V-bottom power craft referred to as dead-rise skiffs or "skipjacks" and sharpie skiffs used under sail (Chapelle 1951:258).

Based on his work recording many shad boats throughout his career, Michael Alford published the most recent description of the shad boat in 1990. His publication was intended as a general guide to watercraft local to North Carolina and is more descriptive than technical. He does include an argument for the vessel's creation via the logboat tradition and follows the design through the development of the "round-chine" hull developed after the 1920s (Alford 2004:18-21).

These three publications allowed for an initial generalized identification of the shad boat. The following statements are descriptive of the shad boat in its original development:

- 18-30ft. in length.
- Built in Eastern North Carolina with Roanoke Island as the center of production and use.
- A high bow, round bilge, and with prominent flare to the sides.
- A raking, straight stem and flat, wine-glass shaped transom.
- Built entirely (or almost so) of Juniper (Atlantic White Cedar).
- A framing pattern consisting of floors alternating with futtocks, which could also be called half frames.
- A spritsail and jib and a fore-and-aft, independent triangular topsail.

The current study then sets as its goal the confirmation of these generalizations and the expansion of our understanding of these characteristics and how they influence the life-cycle of the design. The shad boat proved immensely popular for its reliability and handling capability, and many area boat builders took to the task of shad boat construction and each did so with his own eye. Each individual shad boat gained a reputation based on its own merits. In addition to subtle variations seeking to make a boat with a higher load capacity or weatherliness, the design lent itself well to a conversion in propulsion. The large, one piece bottom piece allowed easy boring for the propeller shaft and the open deck contributed to a straightforward engine installation. Only a single survivor (*Tom Dixon*) has its original bottom piece, as evidenced by the plugged centerboard hole.

The history of the region and the myriad changes which occurred in North Carolina during the 19th century contributed to the technological leap wrought by George Washington Creef over 130 years ago. This research is admittedly not the first regarding the shad boat, but instead endeavors to systematize all of the available information regarding the vessel type and its historical/geographical context in order for that information to provide meaningful contributions to the study of maritime culture in eastern North Carolina.

Chapter 4: Methodology

As mentioned in Chapter 1, the environmental and historical background set the shad boat within the context of eastern North Carolina at the end of the 19th century, though a clear definition of the shad boat has not yet been established. The key feature of this study involves the direct documentation of the shad boat as an artifact. The research goals introduced earlier - focusing on design and construction elements — have helped develop the methodology in order to answer research questions, specifically those directly related to understanding the vessel as a cultural object. Both traditional and digital methods were used to record the hull's lines in order to analyze design and performance characteristics. In addition to lines, construction details were recorded in the form of timber dimensions and locations. The raw recording data was imported into a three-dimensional modeling program, Rhinoceros. Finally, the hull analysis tool Orca 3D was used to define and compare features found in the primary vessel group. As this group represents the best existing examples of the shad boat in its original form, it provides definitive characteristics which allow for understanding the vessel type itself.

Before any vessels were recorded, a substantial amount of information about the shad boat was gathered from interviews with the builders themselves. Perhaps the most reliable information on shad boats was collected by Earl Willis Jr. during personal interviews conducted in the 1980s. Although George Washington Creef (d. 1917) and his son G.W. Creef Jr. (d. 1928), as well as builders such as Nal Midyette (d. 1932) and Otis Dough (d. 1957), who were among the last to build these craft, had passed away, Willis was able to interview those that knew these men. In some instances, the interviewees had built or seen boats built alongside them. These valuable interviews recorded first-hand information about those that built and used shad boats, while also providing details about how they were constructed. Information concerning builders, techniques, terminology, use, and vessel history was collected. This information was then used to confirm information recorded about the vessels in the study and provided accurate terminology for discussion of vessel features.

The selection of vessels was made based upon two primary factors: historical evidence suggesting a vessel's pedigree in the shad boat tradition and ease of recording. The four boats built by George Washington Creef have the best pedigree, as he was the first builder of shad boats. And his craft was known to have admirable qualities among contemporaries (Pugh 1962; Willis 1981a, 2000). Otis Dough, a later builder, was the subject of many of the personal interviews and this combined with photographic evidence would have contributed to the inclusion of his vessels. The limitations of the current research however necessitated the full recording of only the Creef built craft, though the Otis Dough boats would be used for comparative analysis as part of the secondary study group.

Ease of recording also had a significant impact on the decision to include or exclude vessels. There are-many exemplary shad boats still in use and excellent examples from noted builders stored on private property; however, identifying these vessels and recording them in various working conditions would have been impossible for the present study. Therefore, local maritime museum collections with shad boats were consulted as the case studies for this research.

Vessel Recording

The shad boats housed in museum collections are in various states of deterioration, restoration, or preservation, and included in various types of display or storage. These factors, combined with the general size of these vessels, prevented their movement for the purpose of easily recording them. As a result, no single methodology was easily applicable to recording the entire study group. When possible, digital recording was the preferred methodology given its speed and accuracy, but when using this method presented conflicts, various hand-recording methods were utilized instead. Often, hand measurements were also used to record timber dimensions in addition to the use of total station for documenting hull shape and timber positions. This traditional method of recording timbers allowed for a more personal understanding of construction and design features as well as interpretation.

When hand recording was used, the method for taking hull shape was a radial method depending on what best suited the vessel as it sat. The radial method of recording was published in *Fishing Boats of the World* as related to the documentation of West Pakistan fishing craft (Traung 1975: 41). The benefits of this method are the ability for a single person to accomplish the task and less reliance on keeping the recording setup level. First, stations are assigned near locations of rapid changes in vessel shape, typically at the bow and stern. Stem and stern posts and sheer height are recorded with a vertical post and line level, noting station points on the sheer. The backbone structure is also recorded, noting the locations of the stations on the keel. Hull shape is then taken at the stations using two boards each with an origin point (Figure 18).

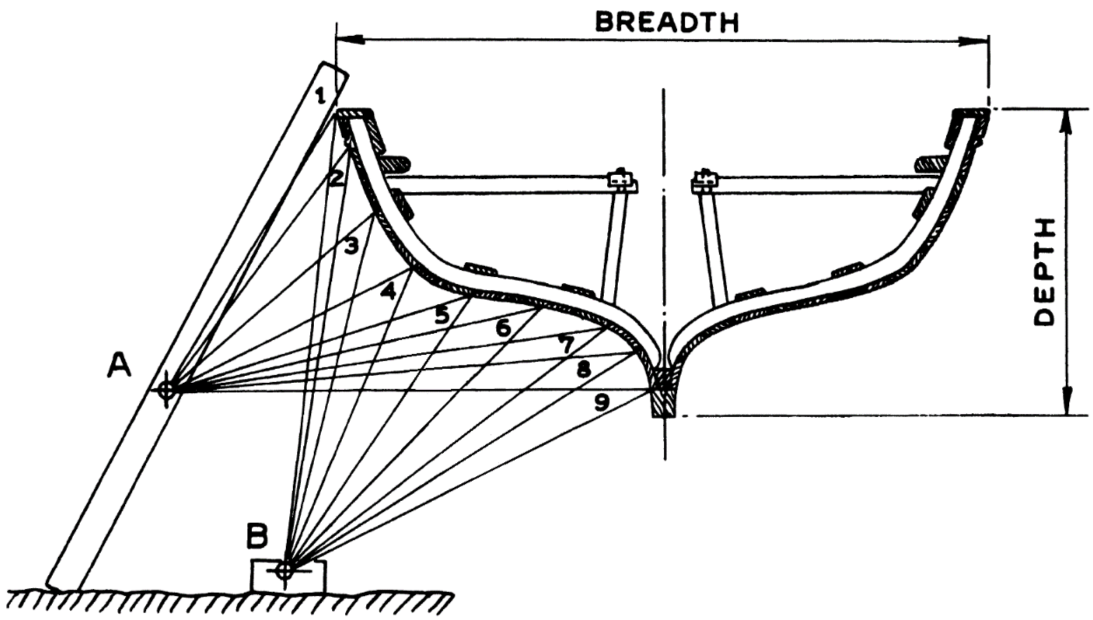


FIGURE 18. Radial method of recording (Traung 1975: 48).

As point 1 and point 9 have previously been identified, they can be used to triangulate recording origins A and B. These origins can then be used to triangulate points 2 through 8 and the shape faired. As long as A and B are within the same section plane, no other leveling is required and recording is extremely fast. This was the method utilized by Mike Alford in the field and he assisted in the recording of *Tom Dixon*'s hull in this fashion. He has been recording and designing watercraft in North Carolina for over thirty years and his consultation proved invaluable.

For digital recording of the vessels, the reflectorless TOPCON GPT-3000 series total station was used to record the hull shape and timber locations. A total station is a surveyor's theodolite combined with an electronic distance meter. The device was originally designed for use in terrestrial survey and is capable of measuring points in three dimensions at a great distance. The angles are recorded from the device itself, while the time it takes for an emitted laser to return is used for distance measurement. Older models required a prism to reflect the

Electronic Distance Meter laser back to the total station, but newer models offer a reflectorless option. This forgoes the need for an additional person to station the reflector and allows a single person to record points. Because of the total station's accuracy and speed of point acquisition, the overall hull shape could be acquired in only a few hours. The accuracy of the total station is listed at 10 mm (Topcon 2004:171). First, several points (including a datum) on fixed surfaces around the vessel were marked in order to allow relocation of the total station. This provides a line of sight on all points on the hull, which is impossible from a single location. Back-sighting to these fixed points around the vessel was used to relate each total station position to the recording datum. Because of the need for the total station to record an appreciable amount of time that the EDM laser is in transit, there is a minimum distance from the total station to point of approximately two feet.

In order to get a fair representation across the hull's surface, artificial station lines were created along the outside of the hull in lines, generally perpendicular to the centerline of the vessel. By taking points where this artificial station met plank seams on the hull, both shape and plank width could be recorded in a single collection of points. Stations would be combined with points taken for the bow and stern profile in order to create a point cloud of the hull. Only one side of the hull was recorded in this manner, and the data was simply mirrored over the centerline for the other side of the hull. Although not completely accurate for representing the other side of the vessel due to typical inconsistencies in hull shape (i.e. builder characteristics, wood type, etc.), this method provides a sufficient representation of the vessel for basic calculations and analysis.

Following the acquisition of hull shape, the methodology turned to recording construction. The backbone profile was recorded by taking points at corners where various timbers intersected, such as the cutwater to plank heads, the keel to garboard, and the transom to keel and any filler pieces along the way. At the bow and stern, points were taken at either side of the centerline to confirm distances away from centerline and thus, total dimensions of timbers athwartships. By setting a total station high above the sheer and shooting into the vessel, points were taken at apron, frames, floors, centerboard, thwarts, and other structural timbers, enabling these features to be located in the point cloud.

After total station recording was completed, hand measurements of timber dimensions were taken to supplement construction data acquired with the total station. The total station excels at quickly locating timbers though accurate measurements of timber thickness is accurately and easily done by hand with a measuring tape. Notes were taken of various fastenings in order to understand construction procedures and variations in construction by different boat builders. Photographs were taken throughout in order to assist in point cloud interpretation.

Data Importation (Rhinoceros)

The point cloud, divided into many layers representing the type of point being recorded, was imported into Rhinoceros software. Rhinoceros has numerous uses in many industries from video game graphics to CNC machining to architecture and marine fabrication (Robert McNeel & Associates 2016). This software allows the importation of points from the total station and virtual manipulation of the cloud in three dimensions. As Rhinoceros did not easily support point names, the layer identifications combined with notes from the total station recording were used to identify individual points in the cloud. These were first connected with straight lines forming a skeletal system for reference to points meaning. With points taken along the same plank seam being theoretically fair, they were connected with extrapolated curves to give the basic framework of the hull's shape. Finally, a surface was applied to this framework giving a computer-based interpretation of the hull surface. This process of identification, framing and surface creation was continued throughout the entire vessel in as much detail as the record allowed.

At its core, the research questions involve analysis of design and construction as key aspects in understanding what was important to the builder. The vessels were built by eye with no more to define the hull shape than the stem, transom, and three mould stations. In this way every vessel was unique, being a combination of these defined shapes with the natural bends and characteristics of the timbers used. The final hull shape represented by the lines plan (and the resulting Rhinoceros model) offers insight into the qualities that the vessel had, these qualities in large part intentional. Comparisons between vessels identified as shad boats answered research questions relating to vessel type characteristics, while historical research was used to establish a chronology to determine changes in vessel design in response to outside influences.

The preparation for vessel recording revealed a fundamental difficulty created by the research questions. In essence, the current research attempts to identify valuable information that surviving examples of shad boats provide, in order to better understand this vessel design within a cultural context. The exact nature of this information cannot be identified prior to recording; this is an inherent part of the field of anthropological research. The need to record many details that may ultimately prove trivial has been identified before (Hocker 2004:4). Recording of these vessels must therefore attempt to look at as many observable aspects as possible in order to prevent a biased analysis toward one particular facet of the vessel. Modern science provides numerous avenues of research such as tree ring analysis or decomposition on a chemical level that would produce potentially useful analyses; however, these methods are beyond the scope of this research, and a number of vessel characteristics have been identified and utilized to provide the best possible analysis for the given study.

Data Analysis

The qualities of a vessel shape are indicative of the performance of the vessel under various conditions. A vessel is designed to effectively operate in particular conditions and perform particular tasks. In the case of the shad boat, the conditions are defined as those of the waters and shores of the Albemarle and Pamlico sounds. The tasks required to perform involve transporting fishermen to and from fishing grounds, operating pound nets, and general transportation between the towns and villages on the sounds. Sean McGrail's (1987) *Ancient Boats in Northwest Europe* provides the most proficient attempt to connect design analysis with maritime archaeology. Small boat design analysis for vessels built prior to modern manufacturing materials and construction is a field in its infancy though, fundamentally, the theoretical aspects are the same. In his study, McGrail (1987:12) divided design analysis into three parts: stability and seaworthiness, speed and cargo capacity, and propulsion and steering. As this research shares the goal of holistic interpretation, a similar analysis structure was applied to this study.

The most fundamental design element in engineering is stability. Shad boats and other small fishing vessels act first as reliable transportation to and from fishing grounds, requiring hydrodynamic stability, and secondly as a working platform, requiring hydrostatic stability. As sailing vessels, shad boats had significantly different stability properties because of the weight distribution of ballast and the high reaching masts. The surviving evidence on the hulls and historic documentation must be used to reconstruct this now absent rigging. Once reconstructed, it will be possible to identify strengths and weaknesses in design and how some weaknesses were addressed throughout the vessel's use life.

Every vessel is designed with some desire for speed as it represents time efficiency. Fishermen have historically been concerned with speed because of the perishable nature of their catch. The race shoreward led many fishing vessels to carry as much sail as possible. A vessel's speed alone could earn it respect even if it was lacking in other qualities. Shad boats were inshore craft and likely not as outwardly competitive, but the fishermen culture must have been present to some degree and is evident in the oral interviews with locals who emphasize a vessel's reputation for speed and racing activities (Guthrie 1981; Gaskill 1982:2).

Carrying capacity directly relates to the scale of the task assigned. The size of shad boats (approximately 18-30 ft.) dictated that they were not used to move large or extremely heavy cargo. This is a logical assumption, yet it does very little to illustrate how various designs within this general size range compare. A more precise calculation of cargo capacity will allow for accurate comparisons between vessels and vessel types. It is in this that computer modelling programs offer their best advantages. For example, Orca 3D has the capability to calculate areas and various stations, potential displacement, and coefficients for an extremely precise determination. These calculations can also be used to adjust interpretations of design features found amongst the surviving shad boats.

Shad boats were propelled through the water in many ways, all of which would result in different performance qualities. Originally a sailing vessel, photographic and historical evidence suggest the most common rig was a single mast with jib, a sprit mainsail and a mast extension flying a completely separate, triangular topsail (Figure 19).

FIGURE 19. A historic photograph of a fully rigged shad boat (Image courtesy of the Smithsonian).

After the introduction of the inboard gasoline engine, the sailing rig was quickly abandoned as a primary propulsion system (Gaskill 1982b). The centerboards and trunks were removed and the engines installed on bed timbers running over frames. All of the shad boats in the current study were converted to gasoline engines. At all times, paddles or oars were used to maneuver vessels in close quarters or as backup propulsion. In addition to analysis from recorded data, there is a recently constructed shad boat copy in use at the Roanoke Island Maritime Museum that is rigged for sail which could be used for experimental performance analysis as part of future research.

In addition to the design, the construction provides insight into how the builder approached the design. It is through their own personal and cultural background that the shad boat builders took a theoretical design and made it a reality. In this way, every element of construction helps to describe the cultural lens through which the builders viewed the design. For example, a builder from the Scandinavian tradition might approach the same design and apply techniques from his own culture to produce a shell-first, lapstrake craft. A builder from western Ireland might utilize a stronger dual-gunwale construction used in his native *curach adhmaid*. By accurately describing what techniques were used historically in these and other local craft, we can begin to understand the boatbuilding tradition of the shad boat builders and ultimately the maritime culture of eastern North Carolina. Combining historical descriptions and photographs with the data collected from the surviving examples, a detailed theoretical construction sequence is best used to organize this information for study.

Hand recording combined with computer modeling allows for an accurate record of scantling dimensions. This information was used to create interpretations regarding timber milling and construction sequence. Fastener types and patterns also contribute to our knowledge of available materials and limitations in addition to adherence or alteration to traditional American boatbuilding practices. Finally, hand notes regarding signs of repair, modification, and rigging illustrate the conditions of the vessel after it left the boat builder's shop.

Example of Vessel Documentation – *Ella View*

The vessel documentation and data processing is both simple in its execution yet complicated with the numerous steps required, so it is perhaps best understood by focusing on the recording of a single vessel as an example of the methods used for all vessels. *Ella View* is located in a boatshed at the Roanoke Island Maritime Museum in Manteo, NC (Figure 20). The vessel was recorded twice, each recording taking two full days of work. At first, lacking access to a total station, the radial method was utilized.

FIGURE 20. Boat shed at the RIMM housing *Ella View* (Image by Author).

Unfortunately, the vessel's cradle caused difficulties in this method, and a second recording was done using the total station. The cradle prevented recording hull points from a low position, as in point B, in figure 18. To begin total station recording, several resectioning points were created on the interior walls and the rafters of the boat shed so that from any possible total station location there would be at least three or four of these points to locate the total station in space (Figure 21). The starboard side of the vessel was chosen to record as it offered the clearest area for total station setup.

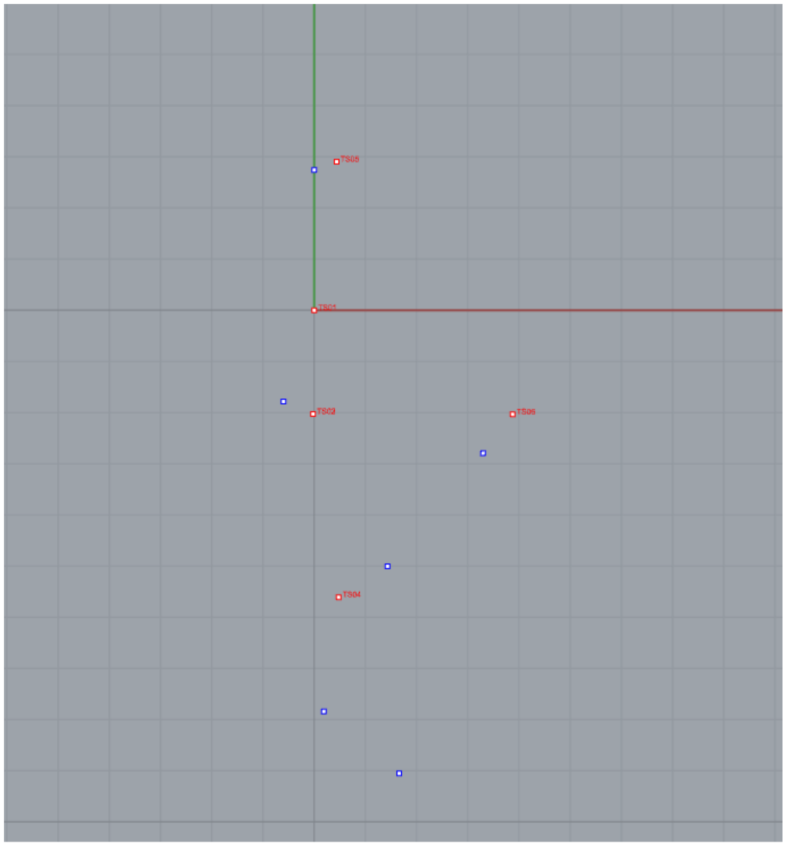


FIGURE 21. *Ella View* prism (blue) and total station (red) locations (Image by Author).

In processing, the starboard side was mirrored to create the shape of the port side. Any structural differences between the sides were noted, but for the sake of performance analysis, mirroring hull shape proved sufficient. Eleven stations were selected with the majority being closer to bow or stern. The choice of station position is an attempt to aid in accurately fairing the hull later and as a result, more points are needed where the curves change the most. For *Ella View*, these areas were the rapid transition of planking to a slender entry at the stem and cutwater and the strong tuck of the bilge into the skeg and heart-shaped transom. At each station, 14 points were taken at the rabbet, each plank seam, the gunnel, rubrail, and the sheer. Vertical stations are desirable but not required when lofting the surfaces on the computer. The point locations provide a dual function of both describing hull shape as well as plank dimensions and taper. In addition to hull shapes, bow and stern shape were defined. For the stern, the transom shape was captured along the aft face edge and the sternpost. At the bow, forward ends of planks were taken along the seams and the cutwater recorded both in profile and in the body plan to establish distance from the centerline.

After hull shape had been established, the total station was set up on a permanent deck that was installed next to the vessel (Figure 22).

FIGURE 22. Total station setup for recording timber locations in hull. Location is the far right point in Figure 21 (Image by Author).

From this position, points were shot along the deck and structural timbers in order to accurately place them within the hull. Timber dimensions can be recorded with the total station though for the sake of time, most points were used to locate an edge of the timber and dimensions were taken by hand. *Ella View* had been converted to an inboard motor earlier yet more recently, was restored to a sailing configuration by the Mariner's Museum (Willis 1981b). The centerboard trunk and ceiling planks were re-creations, but the centerboard trunk was recorded under the assumption that supporting evidence for the original was used in the reconstruction.

The points were imported as a point cloud into Rhinoceros. The various types of points were then separated into layers arranged by type of structure. The sheer and keel points were used to create curves at the top and bottom of the hull shape. With bow and transom points used to define the limits of the hull surface, the surface was then lofted over the station points (Figures 23-25). The wash rail and rub rail were given separate surfaces in order that their point locations not interfere with the lofting of the actual hull. The transom was also created using the points to complete the half-hull form. This outer hull shape was then mirrored across the centerline to represent the unrecorded port side.

Construction points were also combined with hand measurements to define various structures such as the wash-boards, stem and sternpost, thwarts, frames, and centerboard trunk. Surfaces were then lofted over the defined edges of structures, completing the model.

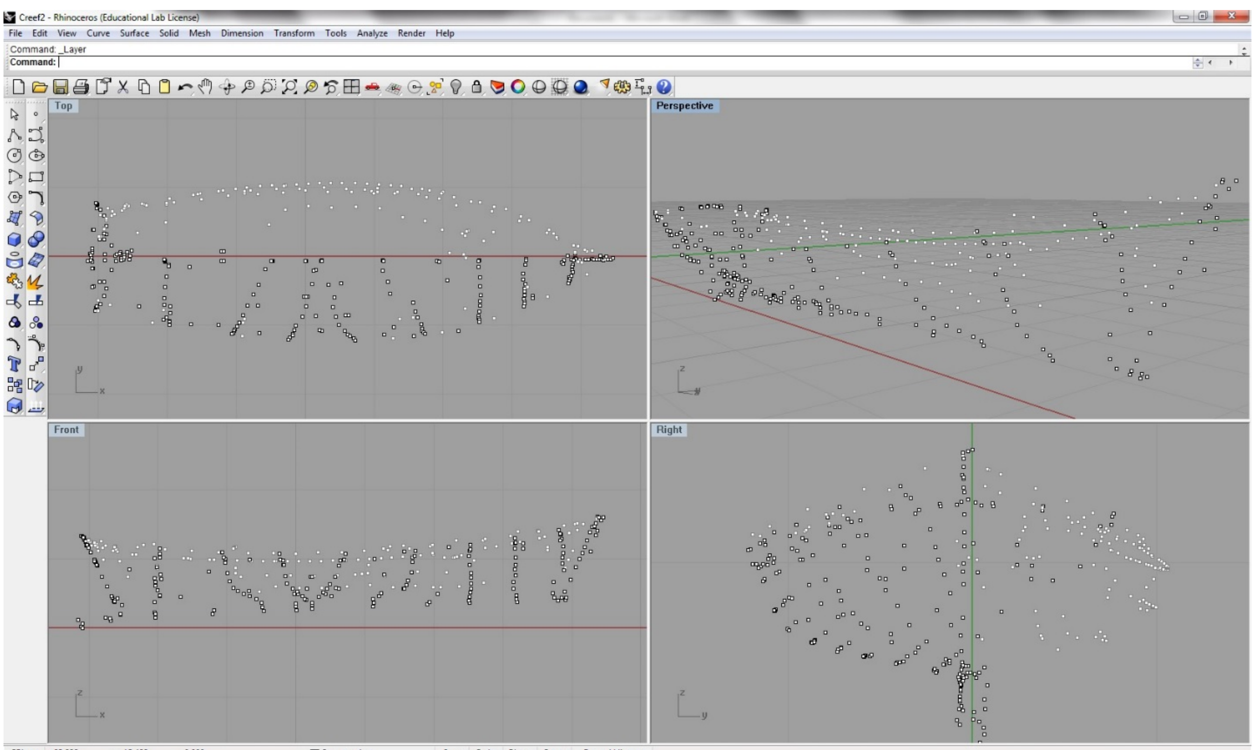


FIGURE 23. Point cloud of total station data imported into Rhino 3D (Image by Author).

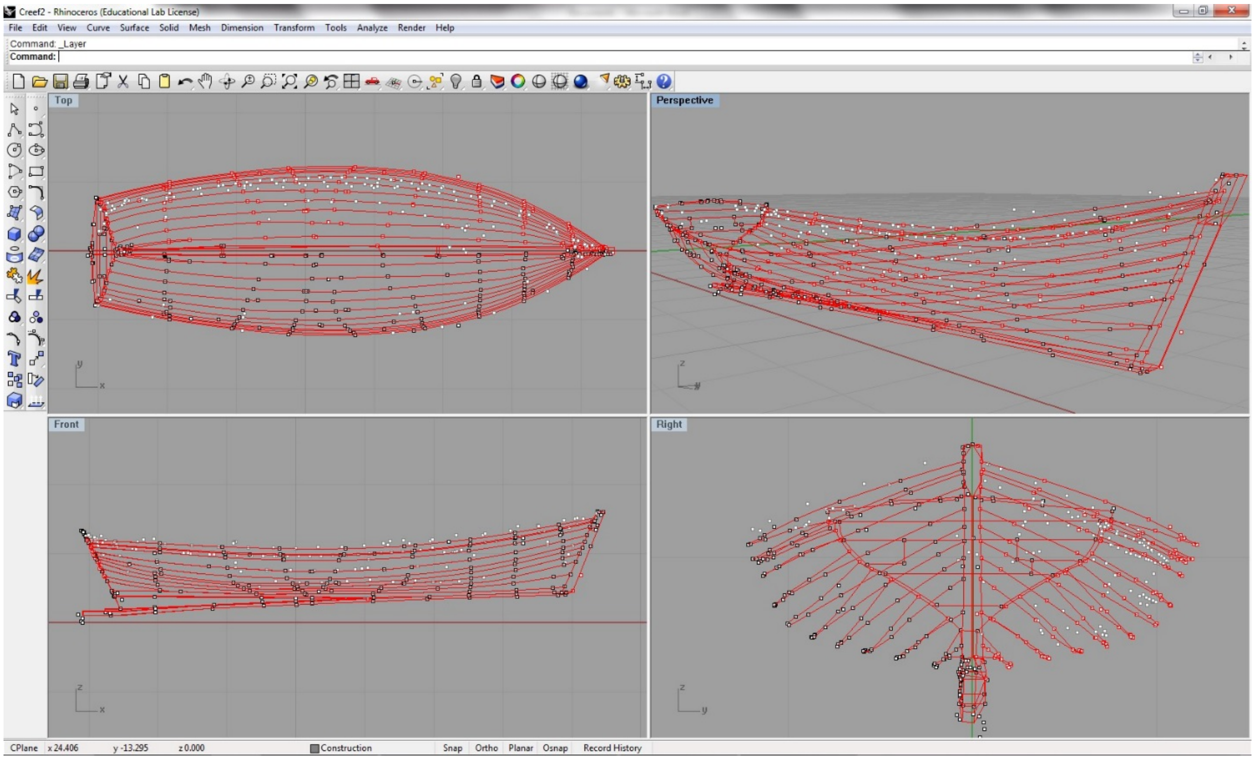


FIGURE 24. Vessel lines created through points in Rhinoceros (Image by Author).

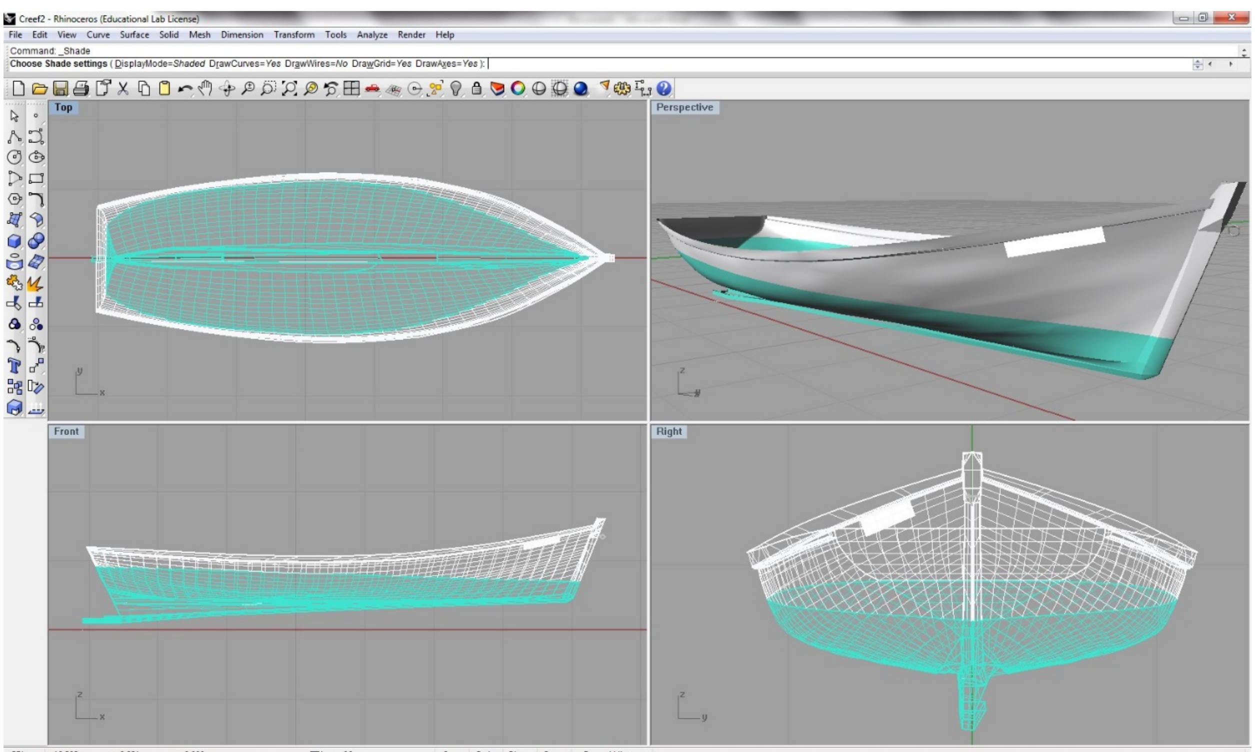


FIGURE 25. Hull surfaces created in Rhino 3D (Image by Author).

Conclusion

As objects of material culture, there are countless ways that culture has been codified within the study vessels, and there are just as many interpretations of those codes. This study attempts to provide and analyze vessel data in order to create an accurate lens for analyzing maritime culture. As artifacts housed in museum collections, these vessels provide various layers of information that require dynamic data acquisition methods to allow for the most useful and comprehensive analysis. For this reason, the recording methods were not identical for every vessel, though enough data for comparative analysis was acquired with standardized hull shape and scantling data collection. Recreating the vessels as models on paper and in a software program allowed for rapid calculations of performance characteristics that would be impossible with these now static museum pieces. With these calculations in hand, useful analysis of the various dimensions were made to compare the vessels within the study group and with other similar data sets.

Chapter 5. Vessel Study

The primary study group consists of the four surviving shad boats built by George Washington Creef. Before discussing the vessels individually, it is best to establish what is known about Creef, or as he was later known "Uncle Wash," as a boatbuilder, member of the community, and his legacy.

Creef arrived on Roanoke Island between 1870 and 1880. Although there is no definitive evidence that he had previously built boats, there is an oral history establishing that he was building log canoes prior to building the first shad boat, named *Dolphin*, around 1880 on the north end of the island (Willis 1982; Davis 1984). He was born in 1829, and as a carpenter, it is likely he built many dugout canoes in East Lake prior to relocating. Some go as far as to recall that Creef developed the shad boat specifically in response to the difficulty he had finding appropriate trees for dugouts (Willis 1982). As he passed away in 1917, we can estimate his shad boat production occurring between 1880 and sometime shortly before the turn of the century. None of the interviewees knew Creef while he was an active builder and remember him only as a jovial man in his retirement. Uncle Wash was a tall, bearded man remembered fondly by all who were interviewed (Figure 26). He was known for spending much of his later years visiting among family and friends (Tillet 1981, 1982). One story recounts his ability to effortlessly drop in when a preacher was visiting in order to partake in the traditional fried chicken dinner (Tillet 1981).

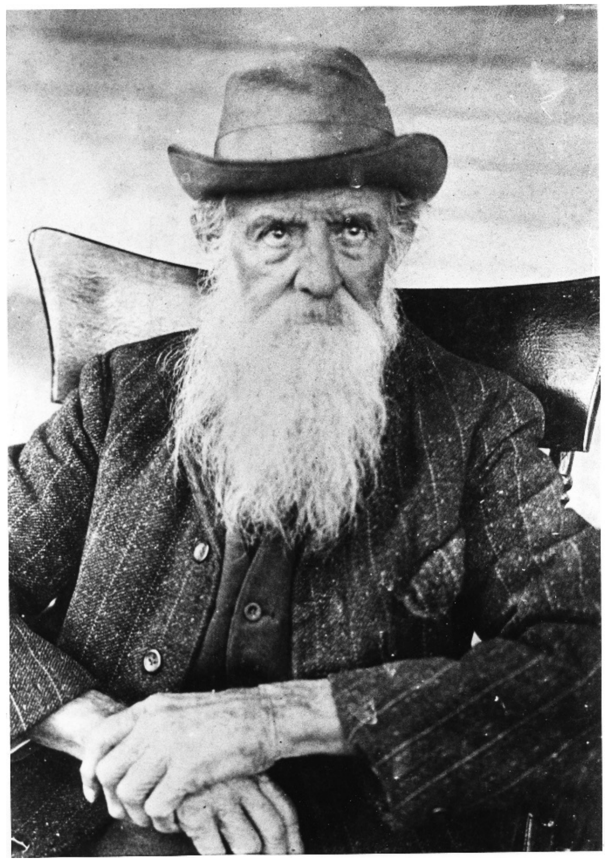


FIGURE 26. George Washington Creef in his later years (Photo Courtesy of Earl Willis Jr.).

Creef would live to see his design continue with other island builders. This included his son George Washington Creef Jr., who went on to operate a larger shipyard constructing coastal shipping craft. Creef Jr. built the famous *Hattie Creef,* which carried Orville and Wilbur Wright to Kitty Hawk. Creef Sr. may also have directly instructed Otis Dough, a Roanoke Islander who built many surviving craft along with his sons Worden, Horace, and Lee (Basnight 1982). The shad boat design itself continued to be copied by other builders in the region, each adding their own distinctive character. These builders included A.B. Wright near Elizabeth City, Nal Midyette in Engelhard, and William O'Neal in Currituck County. There are currently only four remaining vessels known to have been built by Creef. As the product of the vessel type's originator, the surviving George Washington Creef vessels provide both the truest design and the central starting point to understand the later descendants.

Paul Jones

Paul Jones is documented as having been built in 1882 (Figure 27). Originally 25’, it has been shortened six inches (Willis 1983a). This minor shortening is often the result of removing rotten ends of planking at the stem. The vessel was named for a tug that pushed timber barges to Buffalo City, which was located in East Lake (Spencer 1983). Once owned by Ira Spencer from Mann’s Harbor, it was later acquired by H.A. Creef Jr., the great-grandson of its builder. The vessel is in good condition and stored privately in a shed in Manteo. The total station data was recorded in the fall of 2011 as part of a regional study focusing on the Scuppernong River (Richards et al. 2012).

FIGURE 27. *Paul Jones*, circa 1980 (Image courtesy of Michael Alford).

Ella View

Ella View was reportedly built in 1883 and was owned for many years by the Berry family of Manteo. It was given an extensive restoration by Maystic Seaport returning it to a sailing configuration with a reconstructed centerboard trunk based on Chapelle's drawings, eventually traded to the Mariner's Museum in 1974 and loaned to the Roanoke Island Maritime Museum in 1998 (Fuller 1981; Fontenoy 2016, elec. comm.). The vessel is currently in a well maintained, restored condition, on display in a non-climate controlled shed outside of the Roanoke Island Maritime Museum in Manteo (Figure 28). *Ella View* was recorded in the fall of 2013.

FIGURE 28. *Ella View* in the spring of 2016 (Image by Author).

Tom Dixon

Tom Dixon was built in 1891 and is named for the controversial figure Thomas Dixon Jr., the author of anti-reconstruction novels which inspired D.W. Griffith's film, *The Birth of a Nation,* in 1915 (Midgette 1986). It is the only vessel in the primary group to have its original bottom piece. This is evidenced by the hole for the centerboard, now filled, though the trunk was removed when *Tom Dixon* was converted to inboard power-- a two-cycle German engine of reportedly too much power (Gaskill 1981) . Originally owned by Will Baum, the vessel was purchased by Earl Willis Jr. with the intention to restore it. However, it was not in sailing condition during his ownership (Figure 29). Willis later donated the vessel to the North Carolina Maritime Museum in Beaufort, where it is currently housed in a climate controlled storage facility. At present, *Tom Dixon* is in a state of disrepair with heavy damage to the starboard bow and washboards, though the planking is still riveted to frames and hull shape is intact. Will Baum's son Wayland (1981) commented that *Tom Dixon* was the finest working boat he "ever set foot in- much finer than *Ella View*." Some people have commented on *Tom Dixon*'s bottom piece being unusually small though originally the centerboard would have provided additional strength. As one story goes, Will Baum approached Creef complaining that the vessel was too limber. Creef responded that he could strengthen it if Baum insisted, but that a sailing vessel should be limber (Meekins 1985). *Tom Dixon* was recorded in the fall of 2013.

FIGURE 29. *Tom Dixon*, circa 1980 (Image courtesy of Michael Alford).

Foul Play

Foul Play was built in 1891 and spent many years in the Pugh family fishing near Oregon Inlet and Hog Island on the south end of Roanoke Island. The vessel was converted to power between 1905 and 1910 (Willis 1982). The current keel was installed by noted builder Otis Dough (Willis 1983b). Charles Pugh (1962) said that the vessel was notably able to sail very close to windward and the tuck of the stern caused the vessel to squat, assisting the stem in riding over waves. His father called it the safest shad-fishing boat that operated out of Oregon Inlet. It served as Pugh's "flagship" before he acquired *Tom Dixon*. Joseph Meekins later purchased the vessel, which was eventually acquired by H.A. Creef Jr. and subsequently donated to the Roanoke Island Maritime Museum. It was sent to the NCMM, restored and converted to a sailing configuration, and is now on display in the Roanoke Adventure Museum at Roanoke Island Festival Park in Manteo (Figure 30). The vessel was recorded in the spring of 2016.

FIGURE 30. *Foul Play* in the spring of 2016 (Image by Author).

George Washington Creef’s background was not significantly different from the later builders of shad boats. However, as the first to build, the credit for the design is his. It is impossible to determine that the four surviving craft are representative of Creef’s entire body of work, yet as analysis will show, these vessels contain a degree of standardization that suggests the non-surviving craft followed similar, though not identical, design and construction.

Chapter 6. Vessel Analysis

As a starting point for initial evaluations comparing the shad boat as a vessel type with other fishing vessels which either came before, competed with the shad boat, or would come later, the shad boat must be given a refined definition. The four George Washington Creef vessels represent the truest definition of the type as the result of being the progenitor of the tradition. By combining information collected from those that have firsthand experience with the vessels and an analysis of the qualities of the remaining vessels, it is hoped that a picture of the shad boat as a material object becomes clear. The nomenclature associated with the vessels provide a wealth of knowledge about its daily operation. Computer analysis of the recorded hulls provides hull statistics for later comparison with other vessels. Finally, an investigation into the later introduction of technological or economic influences to the shad boat provide a path for future investigation into changes that may be seen in vessels constructed after these developments occurred.

Nomenclature

Prior to discussing the analysis of the four George Washington Creef vessels, the historical record provides the necessary nomenclature for discussion. To the untrained eye, many local vessel types might appear similar to shad boats; however, oral interviews suggest that the local population had a clear understanding of what was and was not a shad boat (Williams 1981; Baum 1982; Dough 1983). In addition to terminology used for identifying shad boats, an understanding of the names used for timbers allows for comparisons to other boatbuilding traditions. Shad boats were divided into spaces by thwarts and this nomenclature can be used in vessel analysis for quick reference. Finally, some names for rigging parts are documented and serve both for reference and for possible rig reconstruction as part of future research.

The shad boat is notably distinguished from the later variations which have alterations largely below the waterline. As stated previously, prior to the shad boat's introduction, the most common small boat type was the dugout canoe, called a *kunner* in the local dialect (Dough 1983). These vessels generally ranged in length from 20-30 feet. Generally larger than the *kunner*, the *periauger* was constructed of multiple logs in order to create a wider beam than was possible with a single log (Alford 2004:31). The increased beam was needed to carry a greater load. As the shad boat replaced the *kunner*, the stake boat replaced vessels of the size of the *periauger* which over time became referred to as *kunners* as well. There seems to be little difference noted in the design or construction of the two, and only length separated one from the other (Baum 1981). Shad boats varied in size between 22 and 28 ft. The use of shad boats to fish pound nets limited the size of the vessel, which had to work within the stakes set in place to hold the net in position. The larger stake boat, over 27 ft., was used to haul the stakes to the site and as a working platform to position and remove them (Meekins 1982b). Shad boats would later be replaced by the deadrise, named for the sharp angle from the keel to a hard chine. Though these vessels would be engaged in the same activities, they were not referred to as shad boats because of the name's strong connection with the vessel design by that time (Baum 1982). The deadrise has continued to evolve in form, but the derivatives are still used in local fishing operations today.

Timber Names

The most significant timber to the shad boat as a vessel type is the "bottom piece." It is a term used to distinguish the timber from the standard keel used in traditional boat construction, including the later deadrise boats (Spencer 1983). Most other timber terminology of the shad boat would be familiar to any boatbuilder in the western tradition. Some builders referred to the frames simply as timbers, but frame is commonly used (Dough 1982d). Prior to being shaped, the root knees which were to become frames were called spurs (Dough 1982d). This term is also used to refer to the knees of the Atlantic white cedar and cypress trees, though there is no record of the actual knees being used in construction.

Layout

As a standardized work vessel, most shad boats had a standard layout with divisions called rooms, created by thwart positions (Figure 31).

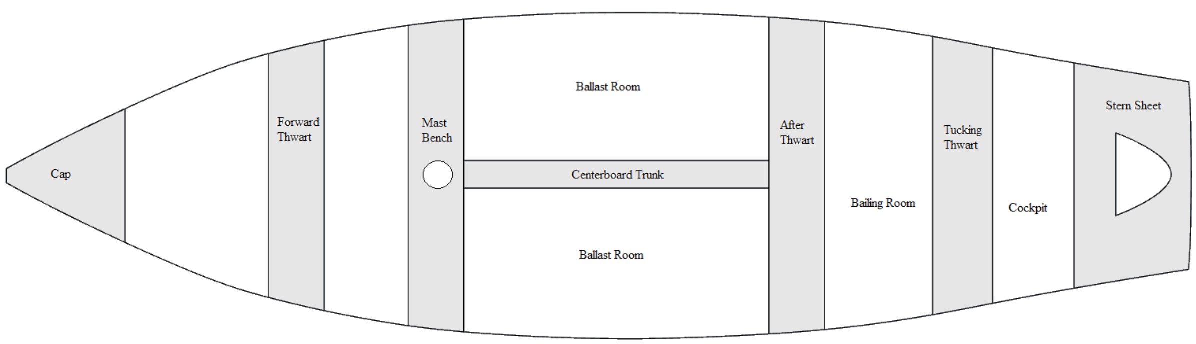


FIGURE 31. Standard layout of a sailing shad boat (Image by Author).

At the stern was the stern sheet, consisting of the last thwart and fore and aft decks aft of the thwart. Between the stern sheet and the next forward thwart was the cockpit. This area was given flat floor boards for standing, as it was from here that the skipper operated the rudder. The thwart forward of the cockpit was called the tucking thwart, likely because of its location where the hull began to tuck towards the stern. Forward of the cockpit was the bailing room. This was the space between the after thwart of the centerboard trunk and the tucking thwart. Hal Ward (1985) recalled there not being ceiling planking in the bailing room to assist in bailing. Vernon Gaskill (1983) remembered it being planked, and in at least one case, the planking had to be replaced because of the wear caused during bailing. The ballast room was to either side of the centerboard trunk, and it is here that sandbags of 45-50 pounds used for ballast were stacked, often on a wood grating set underneath to prevent the bags from rotting (Ward 1985). Fish were also loaded here and temporary bulkheads at the forward and aft ends kept the fish out of the bailing room and the forward area. When loaded, the ballast bags would be moved to the forward area, making room for fish (Gaskill 1982d). At the forward area of the centerboard trunk was the mast bench which held the mast. In the bow, a short deck under the washboards, the cap, provided dry storage. In larger shad boats and stake boats, there were removable thwarts in the ballast rooms and the forward area (Gaskill 1982b).

Rigging

As most shad boats were converted to power by the time of interviews in the early 1980s, interviewee knowledge of rigging details was not as detailed, and only a few facts could be extracted from the interview transcripts. The standard sailing rig for shad boats consisted of a sprit mainsail, a triangular topsail called a goose wing, and two jib sails (Gaskill 1981). These jib sails were simply called the big jib and the small jib (Gaskill 1982b). Normally the two jibs were not flown at the same time; however, there was a single oral history and several photographic references to a temporary bowsprit used when racing or travelling long distances in which both could have been flown together (Ward 1985). Sails were made with #7 canvas, with 75-85 yards needed for the mainsail (Herbert 1982).

The nomenclature that distinguishes the shad boat from its contemporaries assists in pinpointing the vessel type as defined by its users. This, combined with an understanding of the shad boat terminology related to its usage, presents a more precise definition than had previously been recorded. Design and construction analysis can now be used to apply particular hull characteristics to the shad boat vessel type.

Design Analysis

Historical contributions to design analysis and the surviving vessels themselves are the two sources available in order to analyze the shad boat's design. As with many local traditions, the historical record of design development primarily consists of oral history and, in the case of the shad boat, two surviving half models. Design software allows for characteristics to be analyzed from computer models created from the four shad boats recorded in the field.

Historical Contributions

The historical record provides no definitive answer regarding design influences which contributed to George Washington Creef's innovations. Many agree Creef's previous experience as a builder of dugout log boats influenced his designs, and a few cite vague influences from Bermuda where Creef sailed as a schooner captain (Dough 1983). His education is not documented, although as a carpenter he would have known how to read and write and mastered many geometric principles. Creef may have utilized half models, carved models of the hull shape, prior to construction and later builders certainly did (Dough 1982f). It is unfortunate that beyond this, the historical record leaves only speculation.

Model Analysis

As described in the methodology, the vessel hulls were modeled in Rhinoceros and then run through a hydrostatics package through Orca 3D. In order to create meaningful results, the waterline had to be determined. Having no evidence for a designed waterline, the painted waterline was used. It must be noted that this waterline may not be indicative of the line at which the vessel ordinarily sat when loaded or unloaded and in addition, is most likely not indicative of the original waterline for the vessel in a sailing configuration. Only through further investigation into the vessel's weight and center of gravity would it be possible to calculate an accurate load waterline. In all cases, it was beyond this study's capabilities to weigh the vessels or lift them in any way. The waterlines do, however, likely represent how the vessel sat in trim during its most recent seaworthy configuration. The basic computer-calculated dimensions can be used for an initial design comparison between the four vessels (Figure 32) (Tables 3 and 4).

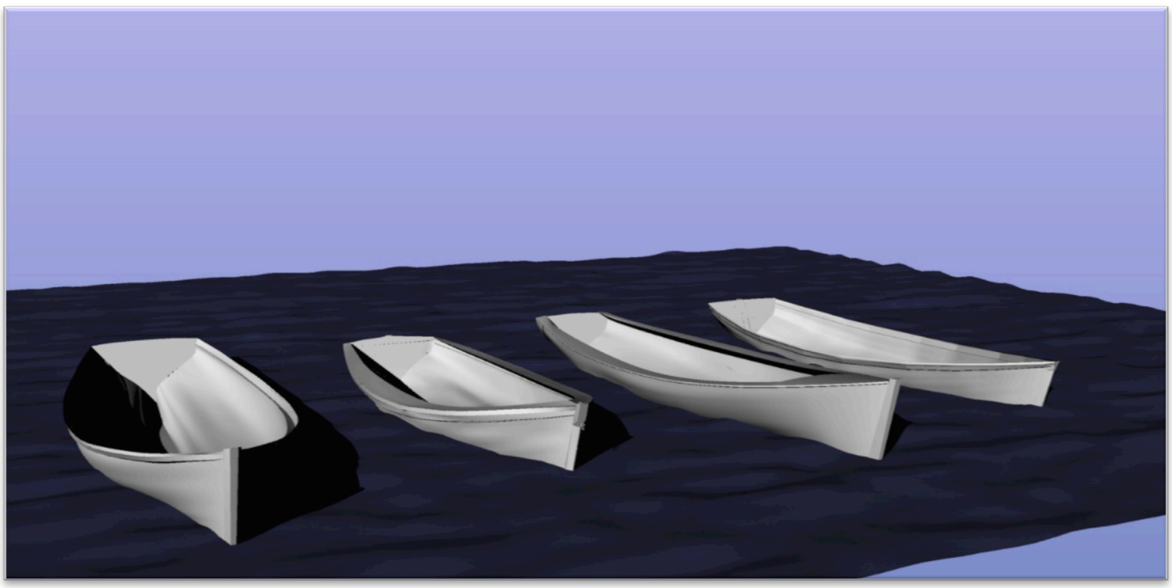


FIGURE 32. Vessel models in Rhinoceros. Left to Right- *Ella View, Paul Jones, Tom Dixon, Foul Play* (Image by Author).

Vessel	**Displacement (kgf)**	**LOA (m)**	**Max Beam (m)**	**Depth (m)**	**Lwl (m)**	**Bwl (m)**	**Dwl (m)**
Ella View (1883)	1781.69	8.38	2.50	1.54	7.76	2.09	0.43
Foul Play (1891)	2517.45	7.63	2.39	1.45	7.15	2.08	0.63
Paul Jones (1882)	3318.04	7.54	2.46	1.74	7.01	2.22	0.81
Tom Dixon (1891)	4161.47	8.64	2.38	1.62	8.26	2.15	0.72

TABLE 3. Basic vessel dimensions of study group (Table by Author).

Vessel	Length: Beam Ratio	BOA/ Depth	Lwl/ Bwl	Bwl/ Dwl	Depth/ Dwl
Ella View (1883)	3.35	1.62	3.71	4.85	3.57
Foul Play (1891)	3.20	1.65	3.44	3.28	2.28
Paul Jones (1882)	3.07	1.41	3.15	2.73	2.14
Tom Dixon (1891)	3.63	1.47	3.84	3.00	2.26
Average	**3.31**	**1.53**	**3.53**	**3.47**	**2.56**

TABLE 4. Vessel dimension ratios (Table by Author).

These dimensions present some interesting comparisons. *Tom Dixon* is the largest vessel in both length and displacement, though not the widest in beam. *Paul Jones* is surprisingly the widest vessel at its painted waterline, a close second in overall beam, and yet the shortest in length. The large displacement for *Paul Jones* relative to its length may be the result of an incorrect painted waterline. Converting the measurements to a set of ratios allows for more accurate comparisons (Table 4). As deduced, *Tom Dixon*'s great length produces a slender length to beam ratio of 3.63, while the beamier *Paul Jones* has a ratio of 3.07. The interesting ratios here are related to *Ella View*. At its waterline, *Ella View* has the greatest beam to depth ratio, much higher than the others. The depth of hull to depth at waterline ratio is equally high, representing a high free board relative to depth.

In addition to these simple measurements, Orca3D provides standard hull design coefficients which give a more in depth description of the hull characteristics (Table 5).

Vessel	Cb	Cp	Cwp	Cx	Cws	Cvp
Ella View (1883)	0.25	0.53	0.62	0.46	3.19	0.40
Foul Play (1891)	0.26	0.61	0.66	0.42	3.23	0.39
Paul Jones (1882)	0.26	0.63	0.73	0.41	3.17	0.35
Tom Dixon (1891)	0.32	0.56	0.73	0.57	2.96	0.43
Average	0.27	0.58	0.69	0.47	3.14	0.39

TABLE 5. Hull Analysis Coefficients (Table by Author).

These calculated coefficients suggest an underlying standardization of model features. The block coefficient (Cb) is calculated as the ratio of the displacement volume to the volume Lwl*Bwl*Dwl(Draft) producing an interpretation of the fullness of the displacement. For instance, the block coefficient of an empty fish tank would be nearly 1.00, as its displacement would be almost its entire potential volume of Lwl*Bwl*Dwl. For all four vessels the Cb is within 0.07 of one another. The prismatic coefficient (Cp) is a representation of displacement consistency along the LOA. As an example, a horizontal cylinder would have a 1.00 Cp because its displacement would be equal to the area of the midships station for its entire length. Again, the four Creef vessels produce ratios in a range of only 0.10. The vertical prismatic Cvp, as the name implies, is the consistency of displacement along the Dwl. If the cylinder were turned vertically, it would have a 1.00 ratio because the displacement would be equal along its entire depth. For this coefficient, the study vessels remain close to one another, ranging only 0.08. Finally, the waterplane coefficient (Cwp) and the midships section coefficient (Cx) relate to the fullness of the hull at waterline and midships section respectively. While not as consistent, these still never deviate more than 0.10 from the average of the four vessels.

These hull coefficients show a consistency between the four vessels that would likely be distinctive when compared with vessels of other vessel types, and perhaps even of shad boats built by other builders. These studies, while beyond the scope of the current research, are necessary to determine the practical advantages or disadvantages of the shad boat in local sailing conditions. Nevertheless, a basic comparison with other vessel types based on lines drawings alone. Chapelle (1951) provided detailed lines of nearly every boat he included in *American Small Sailing Craft.* To gain the most from a comparative study, three distinctly different vessel designs from three distinct operating conditions were chosen.

The bank dory originated in the 18th century though came to prominence in the Gloucester fisheries of the mid to late 19th century. The vessel differs greatly from the shad boat in many aspects. Carried on ships, the dory had to be light and easily constructed. The dory is a nearly double ended, flat bottom boat with sawn oak frames relying on cast iron frame clips to support paired frames and floors at the chine. The type was much smaller than the shad boat ranging in size from 16-20ft. Chapelle's lines are of a 14 ft. model which had a LOA of just over 18 ft. (Chapelle 1951:85-89). No loaded waterline is indicated in the plans and as a result, an arbitrary waterline was set at 35cm over the base line resulting in a theoretical vessel loaded to 986.33kg (Table 6).

Vessel	**Displacement (kgf)**	**LOA (m)**	**Max Beam (m)**	**Depth (m)**	**Lwl (m)**	**Bwl (m)**	**Dwl (m)**
Dory	986.33	5.47	1.49	0.97	4.67	1.22	0.35
Sharpie Skiff	750.25	5.83	1.78	1.19	5.51	1.53	0.41
Mackinaw Boat	1506.19	8.11	2.36	1.87	7.68	1.95	0.54

TABLE 6. Basic vessel dimensions of comparison group (Table by Author).

The second vessel chosen was a 19 ft. sharpie skiff built on the Chesapeake in 1906 and a near contemporary of the last Creef boats built. The sharpie is a transom sterned, v-bottom craft which was often transverse planked below the chine. A waterline is indicated on this plan and was used for calculations indicating a very light (750.25 kg) hull. This particular model is not as wide as the larger Chesapeake sharpie skiffs used for tonging (Chapelle 1951:318-322).

The third vessel was the Mackinaw boat type from the Great Lakes. A two-masted, round-bottomed, double-ender, its larger size puts it closer in displacement and length to the average shad boat (Chapelle 1951:180-183).

Being generally smaller craft, the basic dimensions of the three comparative craft are distinctive from the shad boat though overall size is more indicative of the general operating conditions of the vessels. The dory was carried aboard larger vessels, launched, fished, and retrieved (Chapelle 1951:85-86). This meant it had to be manageable in size and light when unloaded, reportedly under 200 pounds for a 14 ft. model. The sharpie skiff proved to be an interesting vessel because of its relatively light weight. Despite having a greater length, beam, and depth, at the Chapelle indicated waterline it displaced over 200 kg less than the Dory. The largest of the three predictably displaced significantly more; twice that of the sharpie.

The dimensional ratios of the three test vessels provide a better understanding of the vessel proportions disregarding their size differences (Table 7). The sharpie skiff has a greater beam to depth ratio than the dory at designated waterlines which may explain the displacement discrepancies.

Vessel	**Length:Beam Ratio**	**BOA/Depth**	**Lwl/Bwl**	**Bwl/Dwl**	**Depth/Dwl**
Dory	3.67	1.54	3.83	3.48	2.76
Sharpie Skiff	3.27	1.50	3.61	3.70	2.87
Mackinaw Boat	3.43	1.27	3.95	3.60	3.45

TABLE 7. Vessel dimension ratios (Table by Author).

Finally, the hull coefficients provide the best measure of actual performance characteristics in order to actually compare these vessels with the shad boat (Table 8). The three comparative vessels have very different designs which resulted in a great deal of coefficient variation and were best compared only to the shad boat type.

Vessel	**Cb**	**Cp**	**Cwp**	**Cx**	**Cws**	**Cvp**
Dory	0.48	0.59	0.66	0.82	2.56	0.72
Sharpie Skiff	0.21	0.47	0.63	0.45	3.70	0.33
Mackinaw Boat	0.18	0.50	0.55	0.36	3.61	0.38

TABLE 8. Hull Analysis Coefficients for comparison group (Table by Author).

The three test vessels differ from the shad boat greatly in actual dimensions but by distilling the hull characteristics into coefficients, comparative analysis is possible. As indicated in Table X3, none of the vessels produced ratios which fell into the established shad boat range in all cases. The sharpie skiff's coefficients fell into shad boat ranges most often and this was only in three of the six. The results of comparison with vessels of different types suggests that the entirety of vessel calculations for the recorded shad boats does produce a reliable profile which other vessels can be tested against for their relationship to the shad boat design.

These comparisons did however highlight the precision needed to correctly evaluate the hull analysis. As an example, Table 9 shows the hull coefficients for the Mackinaw boat if it was loaded to displace 2440 kg and consequently sinking 10 cm along with the shad boat averages from Table 5.

Vessel	Cb	Cp	Cwp	Cx	Cws	Cvp
Mackinaw -10 cm	0.23	0.53	0.61	0.43	3.41	0.38
Shad Boat Avg.	0.27	0.58	0.69	0.47	3.14	0.39

TABLE 9. Hull Analysis Coefficients comparing modified Mackinaw boat and shad boat averages (Table by Author).

While still not identical to shad boat numbers, the increase in similarity at this new waterline calls into question the reliability of any particular waterline for comparison. An accurate waterline is therefore pivotal to understanding design analysis and performance characteristics. As stated earlier this will require both an accurate weight of the hull, through measurement or estimation, and an estimated gear and cargo weight.

As a description of vessel types, these hull calculations may still be inappropriate to the task when differences are largely above the waterline. The analysis software is only capable of calculating coefficients at a given waterline. One possible workaround would be to sink the vessel entirely underneath a waterline so that calculations include the hulls entire shape though this may introduce errors based on software parameters regarding included surfaces. Future research is needed to test the appropriateness of calculation methods.

Construction Analysis

As with design analysis, both the historical record and the recorded vessels provide information for analyzing shad boat construction features. Fortunately, several period photographs exist and a great deal of first-hand information is available in the historic record which allows for a reconstruction of the construction sequence. The recorded vessels allow for a confirmation of these reconstructed techniques. Once later vessels have been recorded in the same manner, they can be used along with the historical record to determine changes in construction over time.

Construction Sequence

The oral interviews provide a detailed picture of the entire construction process from shop location through launching the vessel. There is no doubt that every boat builder did certain processes according to his own training and innovation, but a general process was likely true in most cases. George Washington Creef had stopped building boats by 1900 and consequently no one available in the 1980s had first-hand experience of Creef's exact process; however, the sequence used by the later Roanoke Island builders, students of Creef, is analogous.

Shad boat builders operated in their home towns and seemingly everywhere they happened to be across the study area. George Washington Creef's first boat shop was on the North end of Roanoke Island until he later relocated to Wanchese. Figure 33 shows Creef's shop and is likely representative of the structures used by other boat builders, although a structure was not a necessity for the process. For example, John Hill, who built shad boats with his brother Charlie, simply operated underneath an oak tree behind the school on Collington Island with power supplied by gas generators for any large equipment (Ralph Meekins 1983). A.B. Wright operated as far away as the Arnuse Creek near Elizabeth City, and Wallace O'Neal of Aydlett was the only builder in Currituck County who built shad boats (Wright 1982; Tate 1985). Boats were built all over the Pamlico Peninsula, from Columbia to Manns Harbor, where Mann H. Basnight built. Captain Raynaldo "Nal" Midyette built in Englehard, as did Ken Mann and Bill Howett of Mashoes and Calvin Payne of Stumpy Point. On Roanoke Island, Otis, Horace, Lee, and Worden Dough built shad boats in what is now the parking lot of Festival Park (Dough 1981).

FIGURE 33. George Washington Creef standing by his shop (Image courtesy of the Smithsonian).

Few boatbuilders did so year round, and performed additional occupations. Creef and Nal Midyette were both carpenters. Capt. Nal also farmed, fished, and ran a store in Englehard for which he carried supplies by his own schooner to and from Baltimore (Carrowan 1982). Otis Dough fished in the spring and built boats in the summer (Dough 1981). Certain times of the year were also reserved for gathering the materials for boatbuilding. John Hill made his way into the swamps of Mill Tail Creek near Buffalo City in winter to avoid snakes (Ralph Meekins 1981). Wayland Baum remembered gathering stumps from Callihan's Woods south of Manns Harbor (Baum 1981). James Thomas "Pink" Gard of Manns Harbor had John Sanders Creef of East Lake harvest 750 ft. of juniper for him for $35.00 in 1926 (Gard 1985). The Doughs also got their timber from Mill Tail Creek at Dare Lumber Co., or when they had to go themselves they went in spring so the water was warmer as they dug up the stumps in waist deep water (Wynne Dough 1982). Digging the stumps was no easy task, and one would be fortunate to get two knees out of a single stump (Dough 1982b). Once harvested, the stumps and logs had to be hauled to a mill to turn them into spurs and planking (Wynne Dough 1982). In crossing back to Roanoke Island, the Doughs would load all the timber into their boat and tow the log for the bottom piece behind it, getting it all across in a single trip (Dough 1982f).

Shad boats were built without plans, though often half models were used (Dough 1982f; Carrowan 1983). The construction began with carving the bottom piece using broad ax and adze (Meekins 1982c). In the Creef boatshop photo, Creef can be seen standing over a newly carved bottom piece (Figure 34).

FIGURE 34. Detail of upside down bottom piece in Creef boatshop photo (Photo Courtesy of the Smithsonian).

The half models or experience would be used to create the three or more molds or stretchers and the stem, sternpost, and transom (Meekins 1982a). The transom was built up from horizontal planks jointed and held together with staggered drift pins (Dough 1982e). Battens were then sprung from stem to transom to form the hull shape (Meekins 1982b). This method can be seen in a later photograph of construction by the Doughs (Figure 35). To take the curve from the battens, a lead bar or some other form of flexible curve was often used (Dough 1982e; Meekins 1982a:2, 1982b). After framing, the vessel was planked starting with the sheer in order to assist in holding the frames in place during the rest of the operation (Dough 1982c). Strakes were riveted to frames and ribbands were removed as planking reached them. The holes were predrilled to avoid splitting the frames, and burrs installed on the inboard end (Meekins 1982c). It is said that when copper burr prices rose to over a penny, a penny might be used instead

(Basnight 1982). The shutter strake installation marked the end of planking (Meekins 1982d).With two assistants, John and Charlie Hill could frame and plank a boat in seven working days (Ralph Meekins 1981). Often, the sheer strake and the outer sheer strake were beaded as can be seen in the creef boatshop image and in the surviving vessels (Figure 35).

FIGURE 35. Vessel set up for construction with battens and stretchers (Image courtesy of Earl Willis Jr.).

This is the state of the vessel behind Creef in Figure 33. The frames still extend beyond the sheer, though all planking is installed. As shown, Creef is building two boats at the same time. It has been said that Creef built everything in pairs, including his wife's coffin, storing his own above the shop (Creef 1983). This may have been the result of the use of a single log to provide two bottom pieces (Fontenoy 2016, elec. comm.).The vessel in the foreground has washboards and rubrail installed and the planking smoothed. Deck knees were installed under the washboards at every frame. A deck clamp ran the entire length of the hull underneath the knees and another ran nearly to the stem to support the thwarts. Both of these clamps were riveted through to the outer planking. The centerboard and mast step were installed as well as thwarts and the stern sheet. The centerboard itself consisted of two 2”x12” boards doweled together and rounded on the edges for streamlining (Gaskill 1982). It would be logical to install ceiling planking prior to securing permanent thwarts with clamps above. Removable bulkheads, ballast room grating, oar locks, spars, and other rigging elements would have completed the hull. Vessels were painted in many colors, though they were typically white on the topsides with gray interiors. The most distinctive paint feature seems to be the stripes at the sheer (Tate 1985). They were of a two color combination and seemingly done to the tastes of the owner. Not all boats had bottom paint applied if they were to be pulled after the fishing season (Gaskill 1981). Sometimes gasoline was added to the paint, which helped when scraping the paint the next year (Tate 1985). The Doughs could completely build a shad boat in two weeks (Dough 1982c).

The construction sequence, as extracted from historical and photographic observations, provides a set of expectations for analyzing construction features in surviving vessels. In all four of the study vessels, observed construction features agree with this sequence, and when a feature does not agree, there is other strong evidence to suggest the discrepancy is a repair, such as nailed rather than riveted planking or clamps.

Design and Construction Developments

The shad boat was less than 30 years old when the first technological revolution affecting its design came. The Lathrop Engine Company was founded by James W. Lathrop of Mystic, Connecticut in 1897 to produce inboard marine engines. Within the next ten years his engines as well as others began showing up in shad boats (Figure 36).

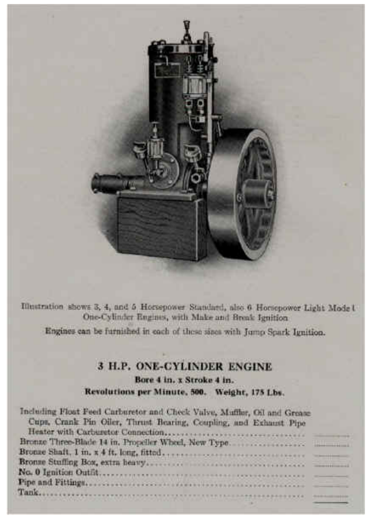


FIGURE 36. Catalogue listing for 3 HP Lanthrop engine (Image courtesy of www.oldmarineengine.com).

The first to use the new technology may have been Bob Wescott, who installed a motor for a man from Powell's Point in Currituck County around 1904 (Ward 1985). Marshall Tillet's father Thilman built a new shad boat rather than convert his old one in 1907 (Tillett 1982). Vernon Gaskill (1982c) remembers conversions starting around 1908 with 3 HP Lathrops and that most vessels had been converted by 1912. *Tom Dixon* first had a 6 HP Lathrop which was later replaced by a 9 HP Bridgeport. E.R. Daniels, who financed many of the fishermen, was a Mianus engine representative and consequently many of these engines were installed (Meekins 1982a). Conversion only required the installation of a wider stern- post to accommodate the propeller cutout and the drilling of the shaft hole through the bottom piece (Meekins 1982e). For the small horsepower (less than eight) engines, a one inch shaft was used and for larger engines a 1 1/8 inch shaft. Engines came with a 10-12 gallon fuel tank which was mounted in the bow under the cap (Meekins 1982b:1-2). Early engines were called "make and break" engines for their ignition system (Tillett 1982). To improve performance under power, the Doughs reduced the stern tuck (Dough 1982a). Later modifications included adding squat boards to increase the vessel's planing ability (Figure 37).

FIGURE 37. A Calvin Payne built boat with squat boards added (Photo courtesy of Michael Alford).

Soon after most vessels adopted small inboard gasoline engines, another vessel introduction began to compete with the shad boat design. Around 1910, Bill Howett of Mashoes reportedly built the first “roundchine deadrise” hull (Dough 1983; Spencer 1983). A seeming contradiction of terms, this alteration of the shad boat design featured a much reduced tuck in the stern resulting in a hard turn of the bilge that was not, however, a true chine (Figure 38).

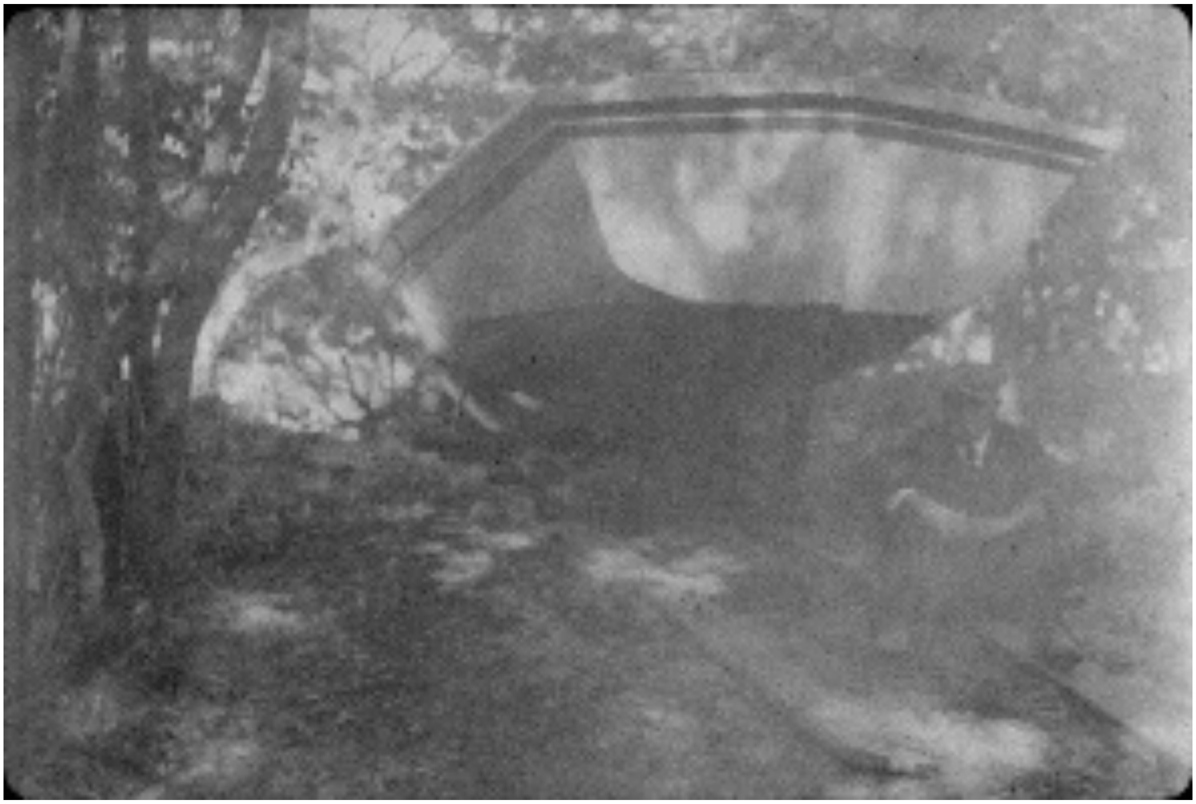


FIGURE 38. Roundchine deadrise hull (Image courtesy of Earl Willis Jr.).

The greatest advantage this modification had was in material acquisition (Meekins 1981). Rather than utilizing natural bends available only from stumps, the framing system of the roundchine deadrise required only relatively straight timbers which could come from the main trunk. Builders no longer had to wade into the swamps and dig up stumps in waist deep water in order to extract perhaps a single frame. Furthermore, the bottom piece was abandoned, and instead a keel with beveled edges meeting the garboard was incorporated into the construction (Spencer 1983). This keel type construction can be seen in the Dough construction photograph (Figure 30). A combination of shad boat and roundchine deadrise was built by Calvin Payne and others in the area of Stumpy Point, and was consequently known as the “Stumpy Point Deadrise” (Baum 1982). In this model the shad boat bottom piece was combined with the roundchine deadrise framing and was “a better looking model” than others (Baum 1982).

Shad boats continued to be built in small numbers into the 1930s. The last shad boats the Doughs built were for the Back Bay Hunt Club in Currituck County during this decade (Wynne Dough 1982). These two vessels are now owned by the Whalehead Club in Corolla, NC. Over time the true deadrise hull with chine timbers and a strong deadrise from the keel came to dominate the working fleets, followed by fiberglass construction.

By combining construction and design analysis, a more accurate appraisal of the vessel qualities can be made. In addition, it becomes possible to identify the builder's ability to convert his design into reality and ultimately to understand the philosophy of boatbuilding in the local tradition.

Chapter 7. Conclusions

The efforts of the current research were directed at the need for a holistic approach to the study of local maritime culture, and it is fitting that the research itself draws a similar conclusion. Our understanding of the shad boat and its place within the maritime cultural landscape of eastern North Carolina in the last two centuries has been greatly enhanced through the consolidation of historical information and technical understanding of the shad boat. Yet, the results produce many more questions and avenues to approach future research than answers. While the initial goals of this research were to answer questions about the shad boat and its relationship to the culture, the findings revealed the multifaceted nature of anthropological study. Only through an exploration of the findings can its relevance be understood.

Historical research into the economic and social conditions which influenced settlement in the region revealed changes in resource availability. The exploitation of swamps and coastal woodlands in eastern North Carolina paved the way for development which had originally been starved by a lack of easily navigable waters. As populations in Virginia grew and settlers started to seek out available territory southward, the Albemarle Sound became the center of economic expansion in North Carolina. From pine trees for naval stores to cypress and cedar shingles, the trees of Eastern North Carolina provided the impetus for development. After the Civil War and the increased ability to get fresh fish to northern markets, fishing became a large well-funded industry. The spread of steam powered mills provided the final piece needed for technological innovation in local boatbuilding traditions. The man to do it first, George Washington Creef, was a product of these developments. He was a carpenter and kunner builder who came from the center of regional timbering activities and relocated to Roanoke Island just as the expansion of pound net fishing reached its zenith. Careful documentation of the innovation Creef created has laid the foundations for further exploring both boatbuilding technology and the economic systems at work in eastern North Carolina at the turn of the 20th century. The collected oral history of the shad boat's place in the lives of the locals also provides an otherwise undocumented source for new paths to investigate the maritime cultural landscape.

Despite producing many new questions, this research has provided answers to many of the research questions it was designed to shed light on. The shad boat as a vessel type has been given a distinctive set of features and a vocabulary to understand those features. The nuances between a shad boat, stake boat, roundchine deadrise, and deadrise have been established and supported with documentation. The vessel's origins and construction features have been identified, at least in relation to its earliest form by its original designer. Every possible influence on Creef's design will undoubtedly never be known, but the historical record has been utilized to present a logical sequence that certainly contributed to the vessel's origins and features. Only through further research into the various shad boat builders who followed Creef and their craft, can a deeper understanding of the design's evolution take place. The analysis of the four Creef vessels also provides a baseline study as a prerequisite for that research.

In light of the current research, the second primary research question becomes a daunting task. To adequately answer how a vessel responded to the environmental pressures, a great deal of environmental data will need to be collected. The hull coefficients calculated in computer analysis are only useful when combined with comparative data from other craft engaged in the same activities, as well as detailed knowledge of the sea conditions under which these vessels performed. As of yet, these studies have not been completed.

The most intriguing result of the current research has been the identification of avenues for future research. The historical research focused around the two most directly influencing technologies, namely timbering and fisheries. The possibilities of finding further influences on the maritime activities of Roanoke Islanders are endless. A focus on the development of county government, ferry systems, and the need for small scale transportation would have produced equally descriptive results and is certainly worthy of future study. One intriguing direction for future research is the investigation of the dynamic between larger middlemen like E.R. Daniels and the Roanoke Island Fishery and the individual fishermen, and how that relationship affected the lives of themselves and their families in regards to cultural and socioeconomic standing.

The detailed documentation of vessels built by the Doughs, Capt. Nal Midyette, and others must be undertaken if an understanding of the vessel type and its variations is to be complete. The vessels of the secondary study group would provide an excellent start to this task. By completing similar studies for other vessel types in the region, a greater appreciation for local boatbuilding technology is possible. Small boats, and especially small boats of the southeast, have received little mention in the historical and archaeological literature of the region, and the opportunities for collecting oral histories of the time before mass produced, fiberglass boats are vanishing daily. Fiberglass fishing vessels also have a strong history in eastern North Carolina, going back nearly a century, and it is perhaps the best time to direct study toward the birth and transition that has so changed the maritime landscape in the region.

This research has from the outset been designed to open the door to future research and it is in this that it has best succeeded. A meaningful allegory may exist in this lesser known photograph of Creef at his boatshop (Figure 39). In this new view, Creef and the shad boat are now set within a slightly larger backdrop. Through this research, we have expanded our vision, and though we are provided only a minute increase in view, we have drastically enhanced our appreciation of the cultural landscape.

FIGURE 39. A wider view of George Washington Creef at his boatshop on Roanoke Island (Image courtesy of Earl Willis Jr.).

References

Albertson, Catherine

1914 *In Ancient Albemarle*. North Carolina Society Daughters of the Revolution, Raleigh, NC.

Alford, Michael B.

1981 Shad boats and Sharpies. *Tarheel Magazine* 9(6): 42-46.

1989 Small Craft Typology: A Tool for Archaeological Research, *Underwater Archaeology Proceedings from the Society for Historical Archaeology Conference* 1989: 64-70. Baltimore, MD.

1992 Origins of Carolina split-dugout canoes. *International Journal of Nautical Archaeology* 21.3 (1992):191-203.

2004 *Traditional Workboats of North Carolina*. North Carolina Maritime Museum. Beaufort, NC.

Alford, M. B. and C. R. McNeill

1976 Sailing the North Carolina Sharpie. *Woodenboat* 13: 68-74.

American Historical Association

1921 Journal of a French Traveller in the Colonies, 1765. *The American Historical Review* 26(4):726-747. The Macmillan Company. New York.

Andersen, Raoul, ed.

1979 *North Atlantic Maritime Cultures: Anthropological Essays on Changing Adaptations.* Mouton Publishers. The Hague.

Anderson, Richard K.

2004 *Guidelines for Recording Historic Ships, Third Edition*. National Park Service, U.S. Department of the Interior, Historic American Engineering Record. Washington, D.C.

Bailey, Josiah W., Jr.

1962 The Carolina Spritsail Skiff. *Yachting*. January: 452-456.

Baker, W. A.

1966 *Sloops and Shallops*, Barre, MA.

Basnight, Moses

1982 Interview by Earl W. Willis Jr. 3 August. North Carolina Maritime Museum. Beaufort, NC.

Baum, Wayland

1981 Interview by Earl W. Willis Jr. 7 November. North Carolina Maritime Museum. Beaufort, NC.

1982 Interview by Earl W. Willis Jr. 28 December. North Carolina Maritime Museum. Beaufort, NC.

Beck, Horace P.
1973 *Folklore and the Sea*. Mystic Seaport Marine Historical Association American Maritime Library, vol. 6. Wesleyan University Press. Middletown, CT.

Bellis, Vincent and Michael P. O'Connor and Stanley R. Riggs
1975 *Estuarine Shoreline Erosion in the Albemarle-Pamlico Region of North Carolina*. UNC Sea Grant Publication UNC-SG-75-29. Sea Grant Program. Raleigh, NC.

Brewington, Marion. V.
1963 *Chesapeake Bay Log Canoes and Bugeyes*. Cornell Maritime Press, Inc. Cambridge, MD.

Brown, Daniel, Cooper Katherine and Harris Lynn
2010 The Plantation boat *Accomodation*: An Icon of the South. *Nautical Research Journal, 56 (2)*, 93-114. Beaufort, NC.

Butler, Lindley S.
1989 *North Carolina Genesis: Seventeenth-Century Albemarle County*. Perquimans County Restoration Association. Hertford, NC.

Carrowan, Ethel Midyette
1982 Interview by Earl W. Willis Jr. 26 October. North Carolina Maritime Museum. Beaufort, NC.
1983 Interview by Earl W. Willis Jr. 6 February. North Carolina Maritime Museum. Beaufort, NC.

Chapelle, Howard
1941 *Boatbuilding: A Complete Handbook of Wooden Boat Construction*. W.W. Norton. New York, NY.
1951 *American Small Sailing Craft: Their Design Development and Construction.* W.W. Norton. New York, NY.
1961 The Migration of an American Boat Type, *USMM Bulletin,* 228(25): 141-154, Washington, DC.
1976 *The National Watercraft Collection*. 2d ed. Smithsonian Institution Press; Camden, Me. International Marine Publishing Co. Washington, D.C.

Click, Patricia C.,
2001 *Time Full of Trial: The Roanoke Island Freedmen's Colony 1862-1867*. University of North Carolina Press. Chapel Hill, NC.

Comeaux, Malcolm L.
1978 Origin and Evolution of Mississippi River Fishing Craft, *Pioneer America* 10 (1978): 73-97.

Creef, H. A. Jr.
1983 Interview by Earl W. Willis Jr. 23 April. North Carolina Maritime Museum. Beaufort, NC.

Crittenden, Charles Christopher
1931 Inland Navigation in North Carolina in *North Carolina Historical Review* 13(2) (April 1931). North Carolina Historical Commission

Crumlin-Pedersen, Ole
2000 To be or not to be a cog: the Bremen Cog in perspective. *The International Journal of Nautical Archaeology* 29.2 (2000): 230-246.

Davis, C. G.
1906 Pamlico Sound Seine Boat, *How to Design a Yacht,* pp. 37, 38. Rudder, NY.

Davis, Vernon
1984 Interview by Earl W. Willis Jr. 23 September. North Carolina Maritime Museum. Beaufort, NC.

Deetz, James
1996 *In Small Things Forgotten: An Archaeology of Early American Life. Expanded and Revised.* Anchor Books. New York, NY

Delgado, James P.
1987a *Preliminary Inventory of Historic Large Vessels Preserved in the United States*. Washington: U.S. Department of the Interior, National Park Service, The National Maritime Initiative, 1987.
1987b *Preliminary Inventory of Historic Small Craft Collections*. Washington: U.S. Department of the Interior, National Park Service, The National Maritime Initiative, 1987.
1989 Grim Realities, High Hopes, Moderate Gains: The State of Historic Ship Preservation, *Cultural Resources Management Bulletin* 12, no. 4 (1989): 1, 3-4.

Delgado, James P., and a National Park Service Maritime Task Force.
1992 Nominating Historic Vessels and Shipwrecks to the National Register of Historic Places, *National Register Bulletin* 20. Washington: U.S. Department of the Interior, National Park Service, Interagency Resources Division.

Dodds, Richard J.S. and Pete Lesher (Editors)
1992 A Heritage in Wood: The Chesapeake Bay Maritime Museum's Small Craft Collection. Chesapeake Bay Maritime Museum. St. Michaels, MD.

Dough, Worden
1981 Interview by Earl W. Willis Jr. 9 June. North Carolina Maritime Museum. Beaufort, NC.

1982a Interview by Earl W. Willis Jr. 11 August. North Carolina Maritime Museum. Beaufort, NC.
1982b Interview by Earl W. Willis Jr. 22 May. North Carolina Maritime Museum. Beaufort, NC.
1982c Interview by Earl W. Willis Jr. 4 August. North Carolina Maritime Museum. Beaufort, NC.
1982d Interview by Earl W. Willis Jr. 11 August. North Carolina Maritime Museum. Beaufort, NC.
1982e Interview by Earl W. Willis Jr. 4 September. North Carolina Maritime Museum. Beaufort, NC.
1982f Interview by Earl W. Willis Jr. 28 October. North Carolina Maritime Museum. Beaufort, NC.
1983 Interview by Earl W. Willis Jr. 25 February. North Carolina Maritime Museum. Beaufort, NC.

Dough, Wynne
1982 Interview by Earl W. Willis Jr. 10 August. North Carolina Maritime Museum. Beaufort, NC.

Dunbar, Gary S.
1958 *Historical Geography of the North Carolina Outer Banks*. Louisiana State University Press. Baton Rouge, LA.

Fearing, Edward and Gloria J. Berry (Editors)
1983 *A Pictorial History of Elizabeth City, NC*. Carolina Printing Company. Elizabeth City, NC.

Fleetwood, Rusty and William C. Fleetwood Jr.
1995 *Tidecraft: The boats of South Carolina, Georgia, and Northeastern Florida 1550-1950*. WGB Marine Press. Tybee Island, GA.

Frye, John.
1978 *The Men All Singing: The Story of Menhaden Fishing*. Norfolk, Va.: Dunning.

Fuller, B.A.G.
1981 Letter to Earl Willis Jr. 15 December. Mystic, CT.
1995 Towards a Maritime Interpretive Model, *Museum Small Craft Association TRANSACTIONS* Vol. 1 (1993-1994), pg. 17-25. Museum Small Craft Association. Toronto, Canada.

Gade, Ole and Arthur B. Rex and James E. Young with L. Baker Perry
2002 *North Carolina: People and Environments*, *Second Edition*. Parkway Publishers Inc. Boone, NC.

Gard, Floyd M.
1985 Interview by Earl W. Willis Jr. 15 April. North Carolina Maritime Museum. Beaufort, NC.

Gardner, John.
1986 Taking Off Lines Allows Duplication of Existing Boats, *National Fisherman* 66, no. 12 (April 1986): 44-5.
1986a Taking Lines Off Bigger Boats, *National Fisherman* 67, no.1 (May 1986): 58.
1986b Triangulation Method is Well Suited to Lifting Lines, *National Fisherman* 67, no. 4 (August 1986): 65-67.

Gaskill, Vernon L.
1981 Interview by Earl W. Willis Jr. 17 April. North Carolina Maritime Museum. Beaufort, NC.
1982 Interview by Earl W. Willis Jr. 11 April. North Carolina Maritime Museum. Beaufort, NC.
1982b Interview by Earl. W. Willis Jr. 12 July. North Carolina Maritime Museum. Beaufort, NC
1982c Interview by Earl. W. Willis Jr. 13 July. North Carolina Maritime Museum. Beaufort, NC.
1982d Interview by Earl W. Willis Jr. 27 October. North Carolina Maritime Museum. Beaufort, NC.
1983 Interview by Earl W. Willis Jr. 17 December. North Carolina Maritime Museum. Beaufort, NC.

Gillmer, Thomas C.
1978 *Working Watercraft: A Survey of Surviving Local Boats of America and Europe*. Camden, Me.: International Marine Publishing Co.

Glassie, Henry
1968 *Pattern in the Material Folk Culture of the Eastern United States.* University of Pennsylvania Press. Philadelphia, PA.
1999 *Material Culture.* Indiana University Press. Bloomington, IN.

Goode, George Brown, (Editor)
1887 *The Fisheries and Fishery Industries of the United States*. 7 vols. Washington: Government Printing Office, 1884-87.

Greenhill, Basil.
1976 *Archaeology of the Boat: A New Introductory Study*. Middletown, Ct.: Wesleyan University Press.

Griffin, William A.
1970 *Ante-Bellum Elizabeth City: The History of a Canal Town*. Roanoke Press. Elizabeth City, NC.

Gunda, Bela, (Editor)
1984 *The Fishing Culture of the World: Studies in Ethnology, Cultural Ecology and Folklore*. 2 vols. Budapest: Akademiai Kiado.

Guthorn, Peter J.
1971 *The Seabright Skiff and Other Jersey Shore Boats*. Brunswick, N.J.: Rutgers University Press.

Guthrie, Max
1981 Interview by Earl. W. Willis Jr. 13 August. North Carolina Maritime Museum. Beaufort, NC

Hallock, Charles
1894 The Albemarle Shad Fisheries, *Forest and Stream.* XLII, no. 14 (April 7th, 1894)

Harriot, Thomas
1588 *A Brief and True Report of the New Found Land of Virginia*. Electronic Texts in American Studies. Paper 20. University of Nebraska-Lincoln, Lincoln, NE. <http://digitalcommons.unl.edu/etas/20/>. Accessed November 5th, 2011.

Hasslöf, Olof, Henning Henningsen, and Arne Emil Christensen, Jr., (Editors)
1972 *Ships and Shipyard, Sailors and Fishermen: Introduction to Maritime Ethnology.* Copenhagen: Rosenkilde and Bagger.

Heath, Jr. Charles L.
1997 A Cultural History of River Herring and Shad Fisheries in Eastern North Carolina: The Prehistoric Period through the 20th Century. Master's thesis, Department of Anthropology, East Carolina University, Greenville, NC.

Herbert, John
1982 Interview by Earl W. Willis Jr. 18 December. North Carolina Maritime Museum. Beaufort, NC.

Hinshaw, Clifford Reginald Jr.
1948 North Carolina Canals Before 1860 in *North Carolina Historical Review* Vol. XXV No. 1 (January 1948). State Department of Archives and History. Raleigh, NC.

Hocker, Frederick M. and Cheryl Ward
2004 *The Philosophy of Shipbuilding: Conceptual Approaches to the Study of Wooden Ships.* College Station, TX: Texas A&M University Press.

Hornell, James
1920 *The Outrigger Canoes of Indonesia*. Madras Fisheries Bulletin, Report no. 2, vol. XII. Government Press. Madras.
1938 *English Coracles and Irish Curraghs*. Society for Nautical Research. London, England.

1946 *Water Transport: Origins & Early Evolution*. Cambridge University Press. Cambridge, England.

1950 *Fishing in Many Waters*. Cambridge University Press. Cambridge, England.

Johnson, Paula J., and David A. Taylor.

1988 *Working the Water: The Commercial Fisheries of Maryland's Patuxent River.* University Press of Virginia. Charlottesville, VA.

1993 Beyond the Boat: Documenting the Cultural Context*, Boats: A Field Manual for the Documentation of Small Craft*, ed. Paul Lipke. American Association for State and Local History. Nashville, TN.

Khoury, Angel Ellis

1991 *Manteo, a Roanoke Island Town.* The Donning Company. Virginia Beach, VA.

Kingery, W. David (Editor)

1996 *Learning from Things: Methods and Theory of Material Culture Studies.* Smithsonian Institution Press. Washington, DC.

Knipmeyer, William P.

1976 *"Folk Boats of Eastern French Louisiana."* Edited by Henry Glassie. In American Folklife, ed. Don Yoder, 105-49. University of Texas Press. Austin, TX.

Lee, William D.

1955 *The Soils of North Carolina: Their Formation, Identification, and Use*. Technical Bulletin No. 115. North Carolina Agricultural Experiment Station. Raleigh, NC.

Lewis, Cliford M. and Albert J. Loomie

1953 *The Spanish Jesuit Mission in Virginia 1570-1572*. The Virginia Historical Society. University of North Carolina Press. Chapel Hill, NC.

Leuchtmann, Amy C.

2011 The Central Places of Albemarle Sound: Examining Transitional Maritime Economies through Archaeological Site Distribution. MA Thesis. East Carolina University.

Lipke, Paul, (Editor)

1993 *Boats: A Field Manual for the Documentation of Small Craft.* American Association for State and Local History. Nashville, TN.

1981 *Plank on Frame: The Who, What and Where of 150 Boatbuilders* International Marine Publishing Co. Camden, ME.

Lonergan, Edwin

1988 *A Waterman's Story*. Sea and Land: Cultural and Biological Adaptations in the Southern Coastal Plain: 92-105. The University of Georgia Press, Athens, GA.

Lubar, Steven and W. David Kingery (Editors)
1993 *History from Things: Essays on Material Culture.* The Smithsonian Institute. Washington, DC.

Lunt, C. Richard K.
1976 *"Lobsterboat Building on the Eastern Coast of Maine: A Comparative Study."* Ph.D. diss., Indiana University.
1973 The St. Lawrence Skiff and the Folklore of Boats, *New York Folklore Quarterly* 29 (1973): 154-268.

Maarleveld, Thiks J.
1995 Type or technique. Some thoughts on boat and ship finds as indicative of cultural traditions. *The International Journal of Nautical Archaeology* 24.1 (1995):3-7.

Mallinson, David J. and Stephen J. Culver, and Stanley R. Rigs, and J.P. Walsh and Dorthea Ames, and Curtis W. Smith.
2008 *Past, Present, and Future Inlets of the Outer Banks Barrier Islands, North Carolina*. White Paper. North Carolina Coastal Geology Cooperative Research Program. East Carolina University. Greenville, NC.

McCall, Marguerite Butler
1988 *Business as Usual: Edenton Merchant Ledgers 1759-1819*. Chowan County. Printed by The Chowan Herald. Edenton, NC.

McKee, Eric.
1972 *Clenched Lap or Clinker: An Appreciation of Boatbuilding Technique*. National Maritime Museum. London, England.
1983 *Working Boats of Britain: Their Shape and Purpose*. Conway Maritime Press. Greenwich, England.

Meekins, Joe
1981 Interview by Earl W. Willis Jr. 6 November. North Carolina Maritime Museum. Beaufort, NC.
1982a Interview by Earl W. Willis Jr. 12 April. North Carolina Maritime Museum. Beaufort, NC.
1982b Interview by Earl W. Willis Jr. 23 April. North Carolina Maritime Museum. Beaufort, NC.
1982c Interview by Earl W. Willis Jr. 21 May. North Carolina Maritime Museum. Beaufort, NC.
1982d Interview by Earl W. Willis Jr. 29 July. North Carolina Maritime Museum. Beaufort, NC.
1982e Interview by Earl W. Willis Jr. 12 August. North Carolina Maritime Museum. Beaufort, NC.
1985 Interview by Earl W. Willis Jr. 16 August. North Carolina Maritime Museum. Beaufort, NC.

Meekins, Ralph
1981 Interview by Earl W. Willis Jr. 15 June. North Carolina Maritime Museum. Beaufort, NC.
1983 Interview by Earl W. Willis Jr. 5 April. North Carolina Maritime Museum. Beaufort, NC.

Meide, Chuck and Kathryn Sikes
2011 The Achill Yawl: Vernacular Boats in Historic Context on Achill Island, Ireland. *The International Journal of Nautical Archaeology* 40.2 (2011):235-255.

Midgett, P. D.
1986 Interview by Earl W. Willis Jr. 15 April. North Carolina Maritime Museum. Beaufort, NC.

Miner, James W.
1880 The Alewife and the Shad in *Harper's New Monthly Magazine*. Vol. LX. Harper & Brothers. New York, NY.

Moody, Robert E.
1943 Massachusetts Trade with Carolina 1686-1709 in *North Carolina Historical Review*. Vol. XX No.1 (Jan. 1943). North Carolina Historical Commission. Raleigh, NC.

North Carolina Division of Marine Fisheries
2013 Annual Fisheries Bulletin: 2012 Commercial & Recreational Statistics. Issued by NCDMF, Department of Environment and Natural Resources.

Old South Association
1889 The First Voyage to Roanoke. *Old South Leaflets* 92. Reprint by Burt Franklin. New York, NY.

Parramore, Thomas C.
1967 *Cradle of the Colony: The History of Chowan County and Edenton, North Carolina*. Edenton Chamber of Commerce. Edenton, NC.

Pearson, John C., (Editor)
1972 *The Fish and Fisheries of Colonial North America: A Documentary History of the Fishery Resources of the United States and Canada*. 9 vols. National Marine Fisheries Service. Rockville, MD.

Phillips-Birt, Douglas.
1957 *The Naval Architecture of Small Craft*. Hutchinson and Co. London.

Pierce, Greg

2010 *A Synthesis of the Prehistoric Archaeological Investigations of Lake Phelps, Washington County, North Carolina*. Master's thesis, Department of Anthropology, East Carolina University, Greenville, NC.

Powell, William S.

1989 *North Carolina through Four Centuries*. University of North Carolina Press. Chapel Hill, NC.

Prince, Richard E.

1972 *Norfolk Southern Railroad, Old Dominion Line, and Connections.* R.E. Prince. Millard, NE.

Pugh, Carl S.

1962 Letter to Joseph G. Meekins, 4 June. Smithfield, NC.

Ready, Milton

2005 *The Tar Heel State: A History of North Carolina*. University of South Carolina Press. Columbia, SC.

Richards, Nathan, Daniel Bera, Saxon Bisbee, John Bright, Dan Brown, David Buttaro, Jeff O'Neill and William Schilling

2012 *The Scuppernong River Project: Volume 1, Explorations of Tyrrell County Maritime History*. The PAST Foundation. Greenville, NC.

Richardson, Curtis J. (Editor)

1981 *Proceedings of Pocosins: A Conference on Alternative Uses of the Coastal Plain Freshwater Wetlands of North Carolina.* Hutchinson Ross Publishing Co. Stroudsburg, PA.

Riggs, Stanley R.

2001 *Shoreline Erosion in North Carolina Estuaries*. The Soundfront Series. North Carolina Sea Grant. Raleigh, NC.

Riggs, Stanley R. and M.P. O'Connor and V.J. Bellis

1978 (Poster) Estuarine Shoreline Erosion in North Carolina: Cause and Effect. University of North Carolina Sea Grant College Publication. Raleigh, NC.

Robert McNeel & Associates

2016 Rhinoceros Feature Overview. Rhinoceros. <www.rhino3d.com>. Accessed 12 February, 2016.

Salaman, R. A.

1967 Tools of the Shipwright, 1650-1925*, Folk-Life* 5 (1967): 19-51.

Salley, Alexander S. Jr.

1911 Francis Yeardley's Narrative of Excursions into Carolina, 1654 in *Narratives of Early Carolina 1650-1708*. Charles Scribner's Sons. New York, NY.

Simmons, Walter J.

1991 *Lines, Lofting, and Half Models*. Ducktrap Woodworking. Lincolnville, ME.

Spencer, Ira

1983 Interview by Earl W. Willis Jr. 29 January. North Carolina Maritime Museum. Beaufort, NC.

Steffy, J. Richard

1982 Reconstructing the Hull. *Yassi Ada: Volume I*. George F. Bass and Frederick H. van Doornick, editors. Texas A&M University Press. College Station, TX.

1985 The Kyrenia Ship: An Interim Report on Its Hull Construction. *American Journal of Archaeology* 89.1 (1985): 71-101.

1989 The Role of Three-Dimensional Research in the Kyrenia Ship Reconstruction. *TROPIS I (Proceedings of the 1st International Symposium on Ship Construction in Antiquity)*, H. Tzalas, ed. Athens.

1994 *Wooden Shipbuilding and the Interpretation of Shipwrecks.* College Station, TX. Texas A&M University Press.

Stick, David,

1958 *The Outer Banks of North Carolina 1584-1958*. University of North Carolina Press. Chapel Hill, NC.

Tate, Elijah

1985 Interview by Earl W. Willis Jr. 1 March. North Carolina Maritime Museum. Beaufort, NC.

Taylor, David A.

1982 *Boat Building in Winterton, Trinity Bay, Newfoundland*. Canadian Centre for Folk Culture Studies, Paper no. 41. Ottawa: National Museum of Man.

1977 Taking the Lines, *Woodenboat* 19 (Nov.-Dec. 1977): 42-45.

Taylor, Harden F.

1951 *Survey of Marine Fisheries of North Carolina*. University of North Carolina Press. Chapel Hill, NC.

Taylor, Mark Thomas

1990 *North Carolina Fisheries in the Old and New South*. Master's thesis, Department of History, North Carolina State University, Raleigh, NC.

Tillett, Marshall

1982 Interview by Earl W. Willis Jr. 2 August. North Carolina Maritime Museum. Beaufort, NC.

Tillett, Sallye Baum
1981 Interview by Earl W. Willis Jr. 23 May. North Carolina Maritime Museum. Beaufort, NC.
1982 Interview by Earl W. Willis Jr. 15 June. North Carolina Maritime Museum. Beaufort, NC.

Topcon
2004 *Instruction Manual: Pulse Total Station, GPT-3000 Series*. Tokyo, Japan.

Traung, Jan-Olof (Editor)
1955 *Fishing Boats of the World*. Fishing News (Books). Surrey, England.

U.S. Department of the Interior, Census Office
1880 *Instructions to Enumerators*. May 1st, 1880. Accessed 4/29/2014 from Integrated Public Use Microdata Series. (https://usa.ipums.org/usa/voliii/inst1880.shtml).

Ward, Hal
1985 Interview by Earl W. Willis Jr. 23 February. North Carolina Maritime Museum. Beaufort, NC.

Watson, Alan
1966 Overland Transportation in Colonial Eastern North Carolina. MA Thesis. Department of History, East Carolina University. Greenville, NC.

Weski, Timm
1999 The Ijsselmeer Type: Some Thoughts on Hanseatic Cogs. *The International Journal of Nautical Archaeology* 28.4 (1999):360-379.

Wilde-Ramsing, Mark and Michael B. Alford
1990 *North Carolina Small Craft, Historical Context: An Underwater Archaeology Unit Management Plan*. NC Department of Cultural Resources.

Williams, Florence Tillett
1981 Interview by Earl W. Willis Jr. 28 July. North Carolina Maritime Museum. Beaufort, NC.

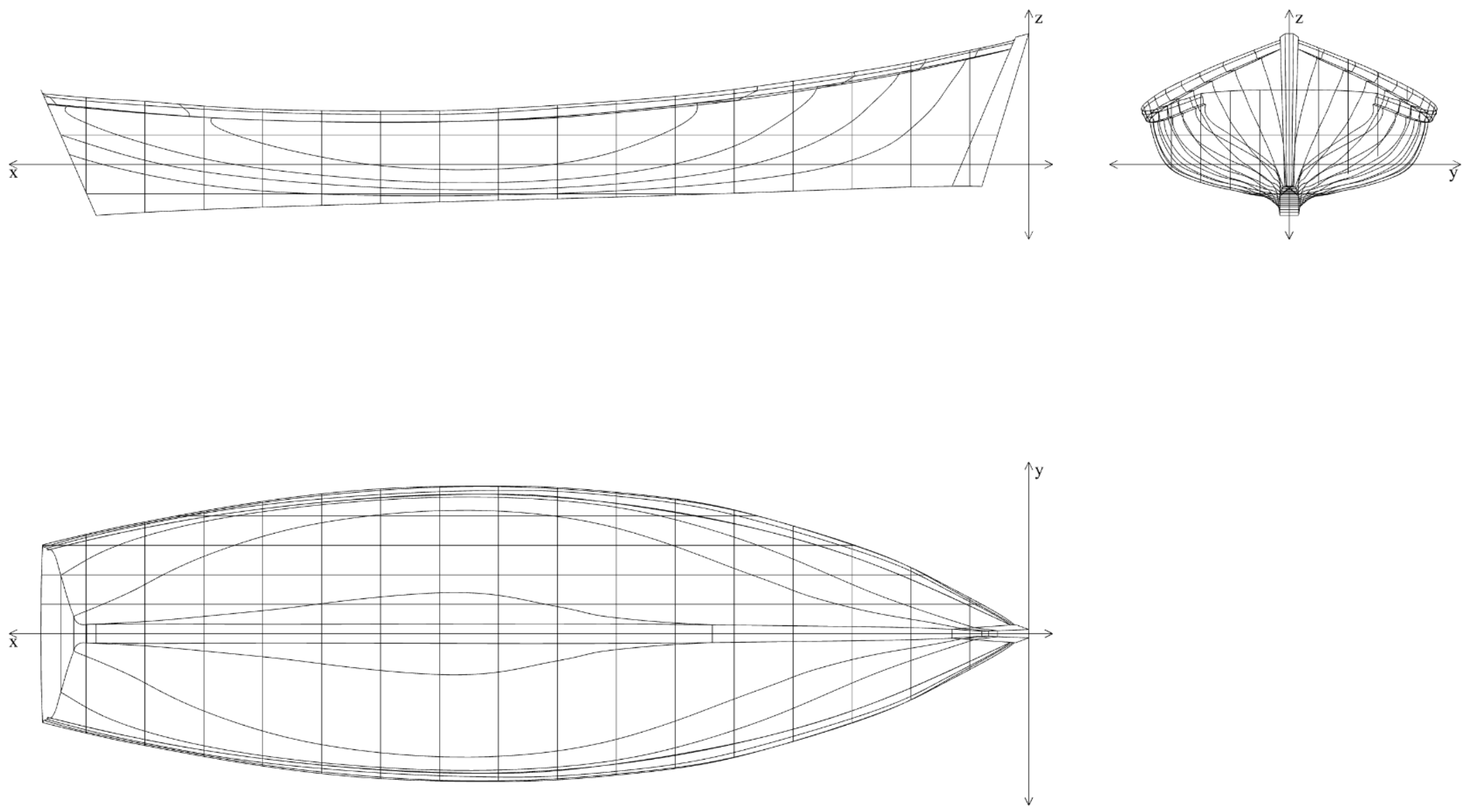
Willis, Earl W. Jr.
1981a Letter to Michael Alford, 15 April. Hertford, NC.
1981b Letter to Melvin R. Daniels, 11 March. Hertford, NC.
1982 Letter to Michael Alford, 13 February. Hertford, NC
1983a Letter to Michael Alford, 1 February. Hertford, NC
1983b Letter to Michael Alford, 9 May. Hertford, NC
2000 Letter to John Wilson, 2 March. Hertford, NC.

Wright, Edmond
1982 Interview by Earl W. Willis Jr. 17 March. North Carolina Maritime Museum. Beaufort, NC.

Appendices

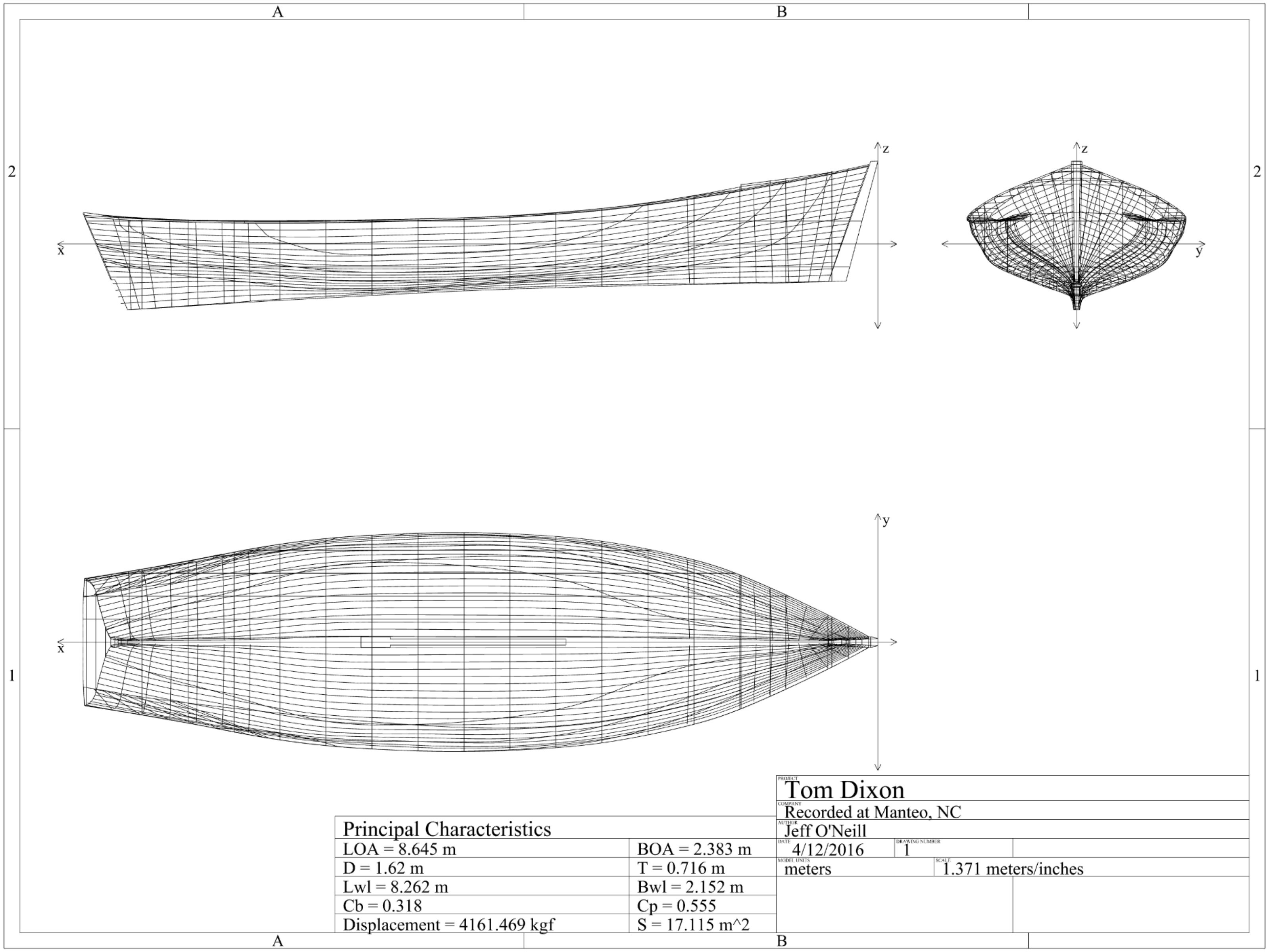
Appendix 1. Occupations Listed in 1860 Census - Tyrrell County.

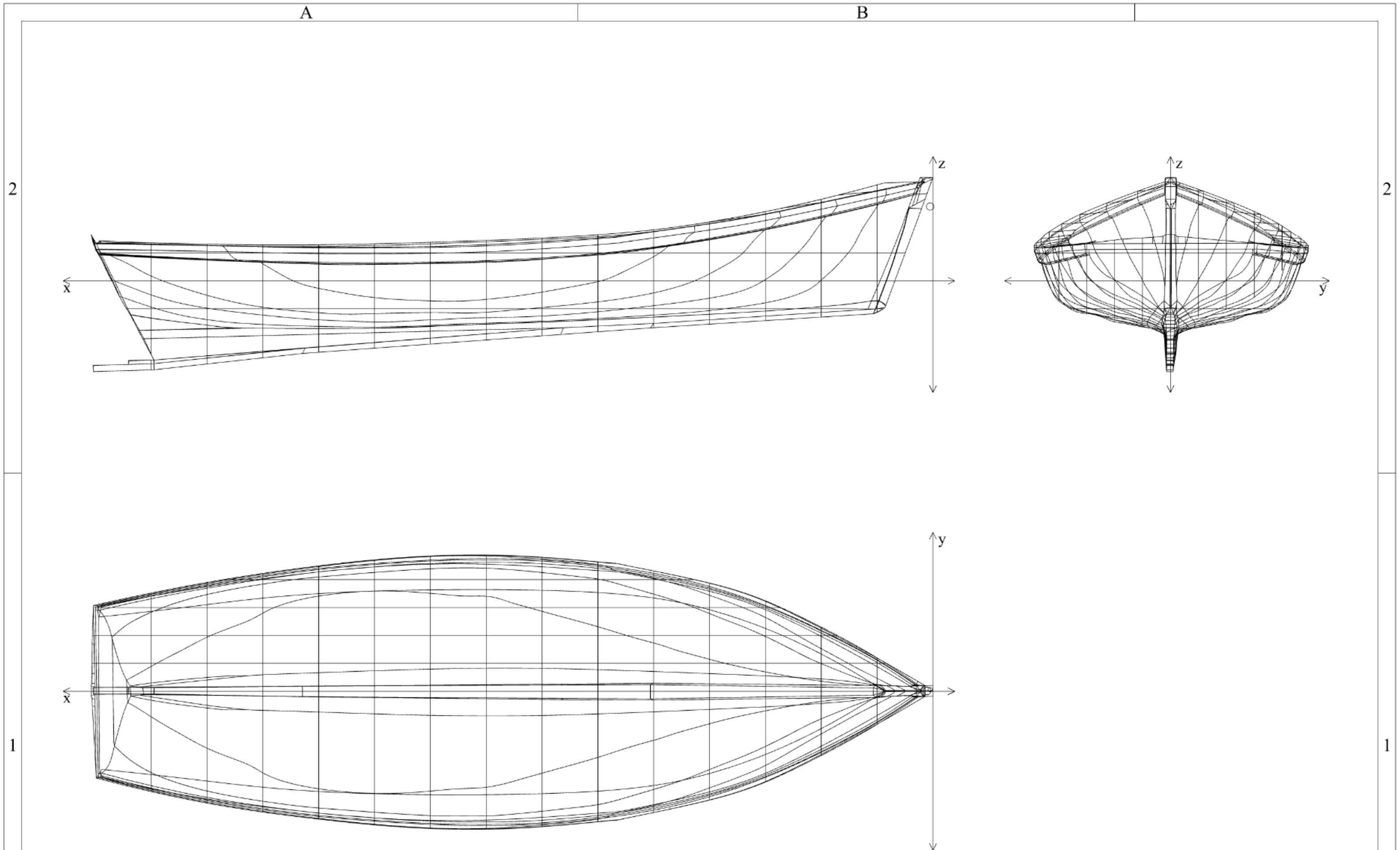
Profession	**East**	**Town**	**West**	**Notes**
Agriculture - Farm Laborer	129		72	
Agriculture - Farmer	202		120	
Business - Clerk		3		
Business - Hotel Keeper		2		
Business - Merchant	3	3		
Business - Merchant / Farmer		1		
Business - Peddler	1			
Business - Trader	1			
Clergy	2			
Domestic	69	1	55	
Government - Collector	1	1		
Government - Constable	1			
Government - Keeper of county poor house	1			
Government - Sherriff		1		
Laborer		1		
Maritime - Fisherman	1		15	
Maritime - Mariner	53		28	
Medicine - Midwife	1			
Medicine - Nurse		1		
Medicine - Physician	1	1		
Mill - Laborer in mill		3		
Mill - Laborer in steam mill	1			
Mill - Miller		2		
Mill - Overseer of shingle mill		1		
Mill - Saw mill	1			
Trades - Blacksmith	1	2	1	
Trades - Cabinet Maker	1		2	
Trades - Carpenter	9	1	9	
Trades - Carriage Maker	1			
Trades - Cooper	1			
Trades - Machinist		1		
Trades - Mason		2		
Trades - Seamstress	3		2	
Trades - Shingle Maker	95		30	
Trades - Shoemaker	1			
Trades - Swamper	3		2	
Trades - Teacher	8	1	2	
Trades - Timber getter	3			
Totals -	594	28	338	960



PROJECT	Ella View
COMPANY	Recorded in Manteo, NC
AUTHOR	Jeff O'Neill
DATE	4/12/2016
DRAWING NUMBER	1
MODEL UNITS	meters
SCALE	1.354 meters/inches

Principal Characteristics	
LOA = 8.381 m	BOA = 2.499 m
D = 1.542 m	T = 0.432 m
Lwl = 7.763 m	Bwl = 2.095 m
Cb = 0.247	Cp = 0.533
Displacement = 1781.688 kgf	S = 11.707 m^2


A
B
2
1
x
z
y
Tom Dixon
Recorded at Manteo, NC
Jeff O'Neill
4/12/2016
1
meters
1.371 meters/inches
Principal Characteristics
LOA = 8.645 m
BOA = 2.383 m
D = 1.62 m
T = 0.716 m
Lwl = 8.262 m
Bwl = 2.152 m
Cb = 0.318
Cp = 0.555
Displacement = 4161.469 kgf
S = 17.115 m^2



Paul Jones

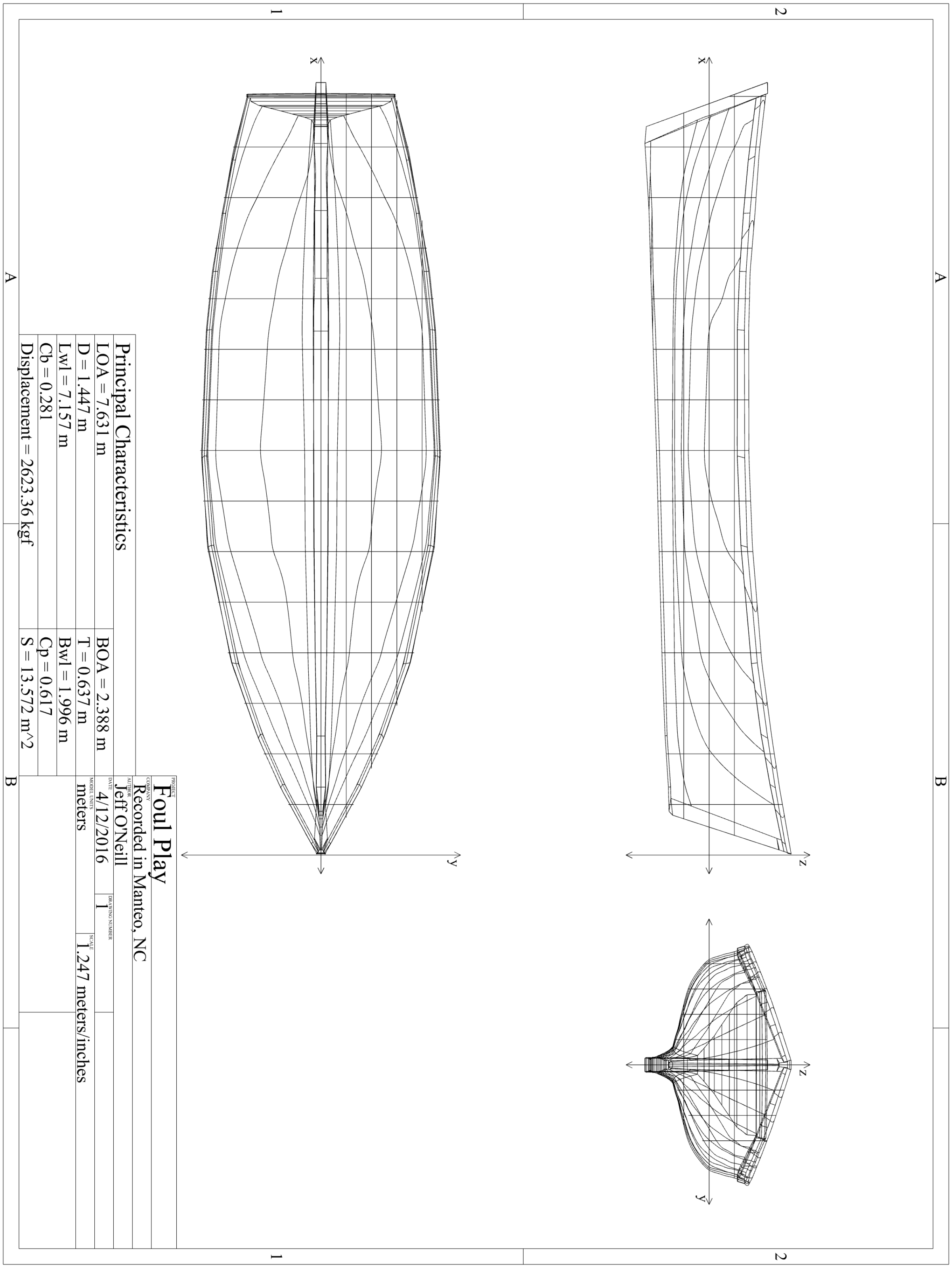
Recorded at Manteo, NC

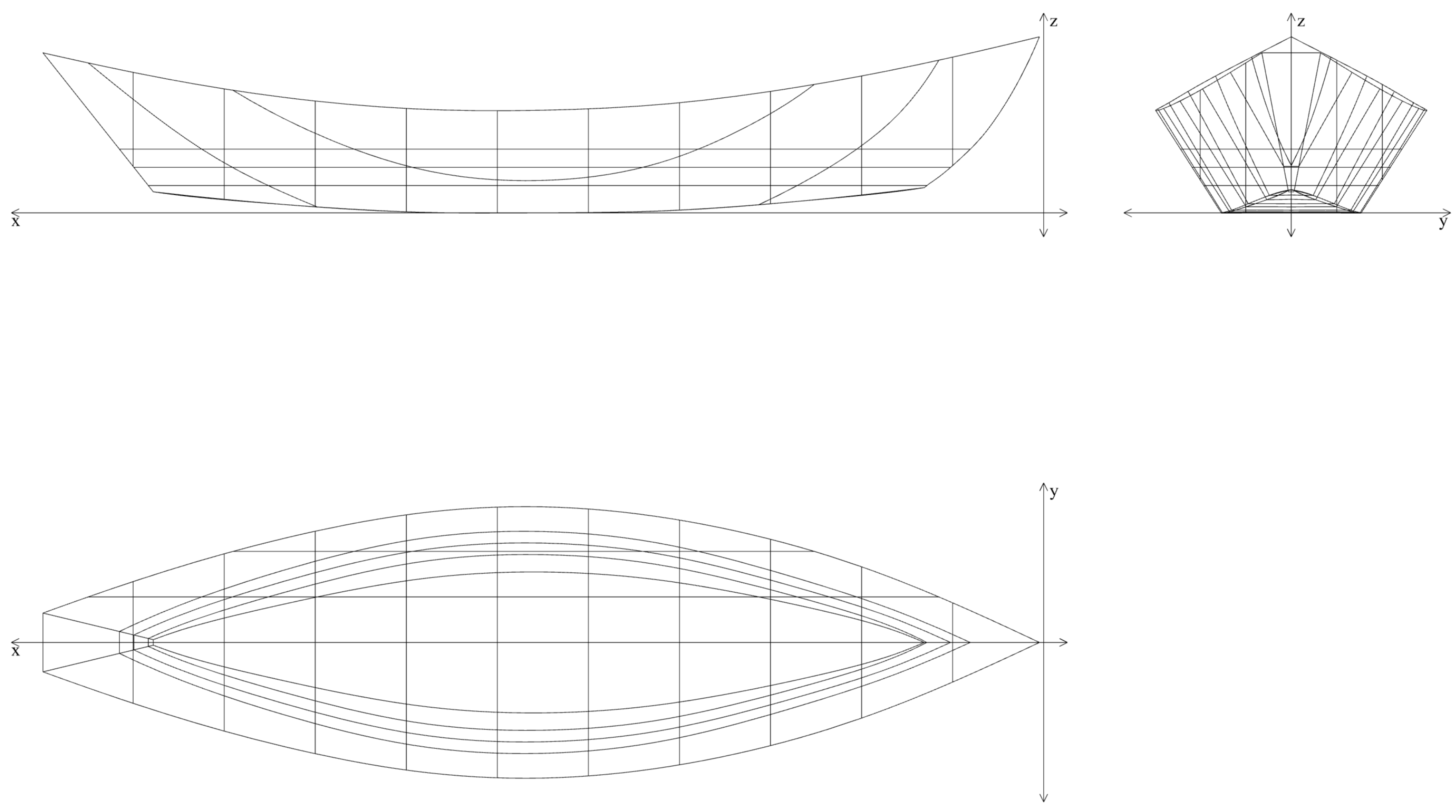
AUTHOR: Jeff O'Neill

DATE: 4/12/2016 | DRAWING NUMBER: 1

MODEL UNITS: meters | SCALE: 1.246 meters/inches

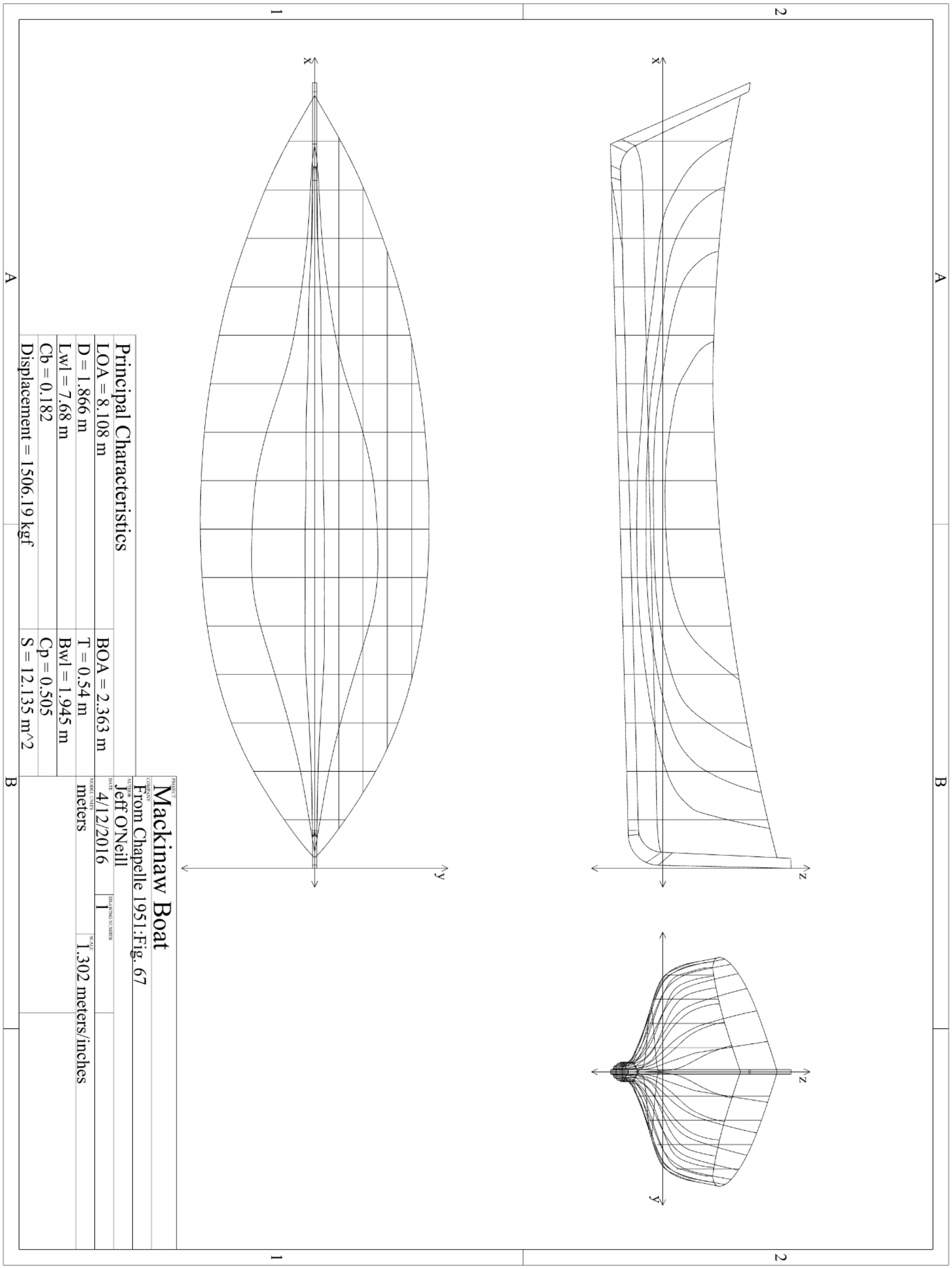
Principal Characteristics	
LOA = 7.5 m	BOA = 2.459 m
D = 0.595 m	T = 0 m
Lwl = 0 m	Bwl = 0 m
Cb = 0	Cp = 0
Displacement = 0 kgf	S = 0 m^2

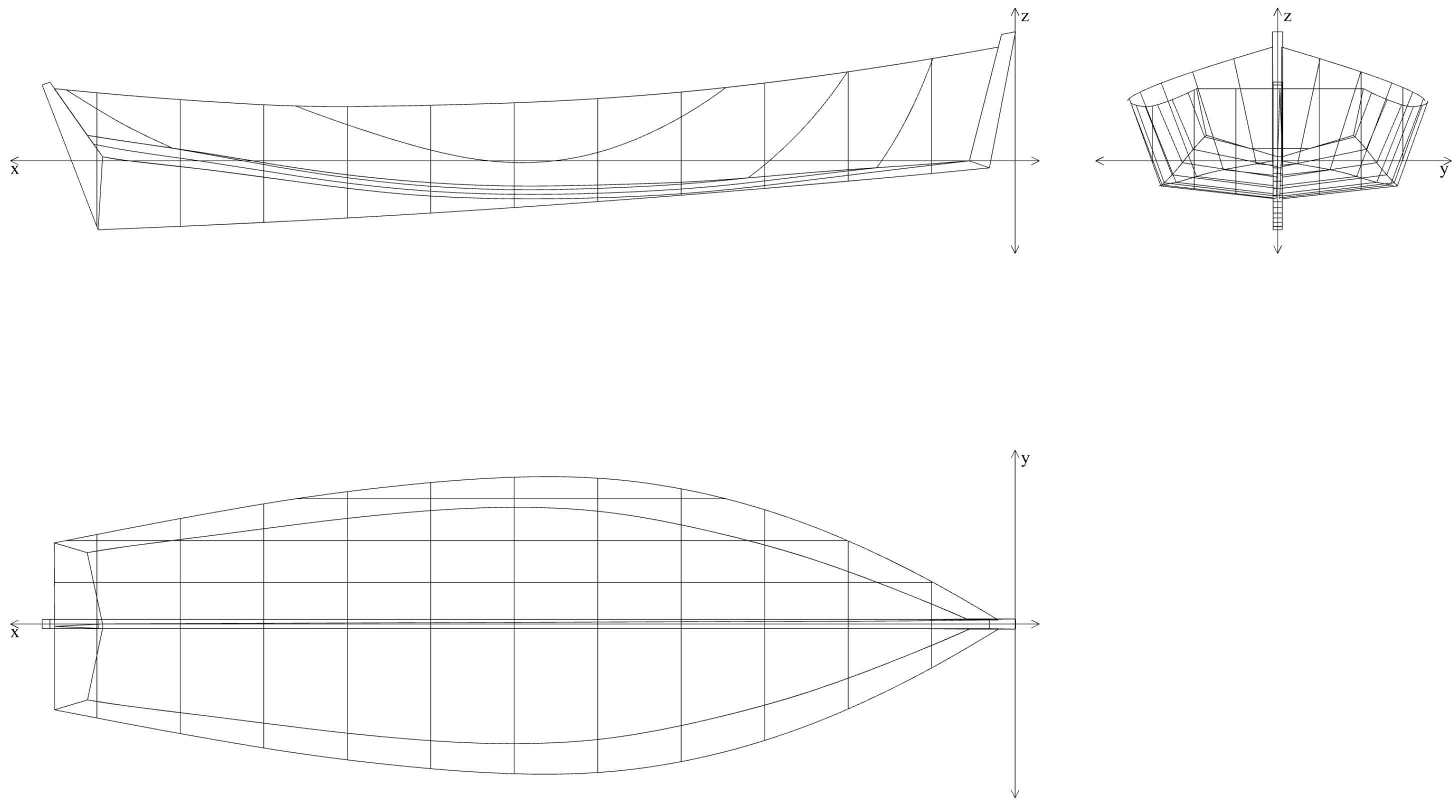

Principal Characteristics
LOA = 7.631 m
BOA = 2.388 m
D = 1.447 m
T = 0.637 m
Lwl = 7.157 m
Bwl = 1.996 m
Cb = 0.281
Cp = 0.617
Displacement = 2623.36 kgf
S = 13.572 m^2
Foul Play
Recorded in Manteo, NC
Jeff O'Neill
4/12/2016
1
meters
1.247 meters/inches
x
y
z
A
B
1
2



14' Banks Dory	
From Chapelle 1951:Fig. 29	
AUTHOR Jeff O'Neill	
DATE 4/12/2016	DRAWING NUMBER
MODEL UNITS meters	SCALE 0.869 meters/inches

Principal Characteristics	
LOA = 5.472 m	BOA = 1.491 m
D = 0.968 m	T = 0.351 m
Lwl = 4.672 m	Bwl = 1.221 m
Cb = 0.48	Cp = 0.587
Displacement = 986.325 kgf	S = 5.434 m^2


Principal Characteristics
LOA = 8.108 m
BOA = 2.363 m
D = 1.866 m
T = 0.54 m
Lwl = 7.68 m
Bwl = 1.945 m
Cb = 0.182
Cp = 0.505
Displacement = 1506.19 kgf
S = 12.135 m^2
Mackinaw Boat
From Chapelle 1951:Fig. 67
Jeff O'Neill
4/12/2016
1
meters
1.302 meters/inches



Modified Sharpie Skiff

From Chapelle: Fig. 115

AUTHOR	Jeff O'Neill
DATE	4/12/2016
DRAWING NUMBER	1
MODEL UNITS	meters
SCALE	0.949 meters/inches

Principal Characteristics	
LOA = 5.831 m	BOA = 1.782 m
D = 1.186 m	T = 0.413 m
Lwl = 5.506 m	Bwl = 1.525 m
Cb = 0.211	Cp = 0.467
Displacement = 750.249 kgf	S = 7.426 m^2