Abstract

WAVES OF CARNAGE:

A HISTORICAL, ARCHAEOLOGICAL, AND GEOGRAPHICAL

STUDY OF THE BATTLE OF THE ATLANTIC IN NORTH CAROLINA WATERS

by

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April 2010

Director: Dr. Nathan Richards

DEPARTMENT OF HISTORY

By the end of World War II, the waters of North Carolina were littered with the hulks of merchant vessels and German U-boats as well as the bodies of sailors from many different nationalities. This wreckage and loss of life attest to the carnage wrought by the German submarines in the waters of North Carolina, which were the deadliest waters along the American East Coast during the war. Although much previous study into the Battle of the Atlantic has focused on the vessels lost along the American Coast, the battle was not devoid of other phenomenal accounts of survival, defensive operations, and additional war-related tragedies. It is the compilation of all of these events that provide a broader understanding of the U-boat war off the coast of North Carolina.

This thesis uses statistical and geospatial analysis of the events occurring offshore to provide a more complete view of the battle and to determine the boundaries of this maritime battlefield. Through the use of tangible evidence of the war such as shipwreck locations in conjunction with the intangible evidence of the battle including routing orders, attack reports,

and survivor rescues, this thesis examines the historical events and behavioral trends that shaped the geographical extents of the engagement.

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STUDY OF THE BATTLE OF THE ATLANTIC IN NORTH CAROLINA WATERS

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DEDICATION

This thesis is dedicated to my wife Leigh

and to my parents Don and June

for their unconditional support and inspiration

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GLOSSARY OF ACRONYMS

B.d.U.	Befhelshaber der Unterseeboote (U-boat Commander in Chief)
CCSF	Commander Caribbean Sea Frontier
CESF	Commander Eastern Sea Frontier
CGSF	Commander Gulf Sea Frontier
CG	Coast Guard
CINCLANT	Commander-in-Chief, Atlantic Fleet
CNANCF	Commander North Atlantic Naval Coastal Frontier
CNO	Chief of Naval Operations
ComFive	Commandant Fifth Naval District
COMINCH	Commander in Chief, United States Fleet
ESF	Eastern Sea Frontier
EWT	Eastern War Time
KTB	Kriegstagebücher (German War Diary)
NANCF	North Atlantic Naval Coastal Frontier
OCNO	Office of the Chief of Naval Operations
USCG	United States Coast Guard

CHAPTER ONE: INTRODUCTION

Introduction

After the Japanese attack on Pearl Harbor on December 7, 1941, the United States had no choice but to enter into World War II. In the wake of this epic tragedy and devastating attack on American soil, a longer lasting and more widespread conflict is often overlooked. This conflict was one waged along the entire eastern seaboard of North America, ranging from Nova Scotia all the way to the Gulf of Mexico. This battle, however, was not between aircraft carriers and battleships, or even between America and Japan. The conflict instead was waged between Hitler's Gray Wolves and the merchant and naval vessels of any nation unfortunate enough to find themselves in the field of view of the German U-boat periscopes. By the end of August 1942 alone, German submarines had attacked 285 vessels in North American waters while losing only seven of their own (Hickam Jr. 1989:329-338). At the center of this conflict lay the waters of North Carolina, a zone that teemed with U-boat activity. Allied losses off Cape Hatteras were so numerous that the aptly named "Graveyard of the Atlantic, was being called a new name by the freighter and tanker crews: 'Torpedo Junction'" (Hickam Jr. 1989:22).

It is in these waters off North Carolina, once covered with oil and strewn with wreckage, that the archaeological remains of many once-proud vessels and the bodies of their unfortunate crewmembers rest. While the battle is long since over, the vessels' remains as well as the locations of their attacks and other war related events can provide a detailed and previously unknown view of what the Battle of the Atlantic looked like geographically and can shed light on how much of North Carolina's seascape truly was commandeered by this German naval offensive. Even though the Battle of the Atlantic's U-boat attacks off the North Carolina coast are by no means lacking previous research and writings, an attempt to use GIS software to reveal the boundaries of the battleground had not been attempted before this study. Similarly, while

many site maps and sketches of World War II shipwrecks off the coast have been created by sport divers and archaeologists alike, no study had formerly addressed each vessel and the events it contributed to the battle as individual archaeological features that, when added to a GIS, can compose an entire site plan or battleground for the waters of North Carolina.

Previous Research

Research on vessels lost along the North Carolina seaboard has been quite extensive as the state has some of the best shipwreck diving in the world. Diving enthusiasts have produced popular books with research on many vessels in the waters off North Carolina. These secondary sources include books such as Gary Gentile's *Track of the Gray Wolf: U-boat Warfare on the U.S. Eastern Seaboard 1942-1945* (1989), *Shipwrecks of North Carolina from Hatteras Inlet South* (1992), *Shipwrecks of North Carolina from the Diamond Shoals North* (1993), and *The Fuhrer's U-boats in American Waters* (2006). Additional publications relating to shipwrecks off North Carolina, Allied losses, and the Battle of the Atlantic include Edwin Hoyt's *U-Boats Offshore: When Hitler Struck America* (1978), Roderick Farb's *Shipwrecks: Diving the Graveyard of the Atlantic* (1985), Homer Hickam Jr.'s *Torpedo Junction: U-boat War off America's East Coast, 1942* (1989), and David Stick's *Graveyard of the Atlantic: Shipwrecks of the North Carolina Coast* (1989). While many of these sources rely on the same primary source documents, each author presents information in a new light and often highlights parts of the conflict that might otherwise be overlooked.

Additional recent research into the Battle of the Atlantic off the North Carolina seaboard has included the National Oceanic and Atmospheric Administration's (NOAA) "Battle of the Atlantic Expeditions" that surveyed and documented the remains of *U-85, U-352, and U-701* in July 2008 and the remains of HMT *Bedfordshire* in August 2009 (NOAA 2008,2009). This

expedition provided historical information about these German submarines and this British armed trawler and generated site plans, photographs, and video of each vessel to establish benchmark conditions with which to monitor site formation processes. Following the 2008 expedition, East Carolina University Professor, Dr. Nathan Richards, began creating a database of ferrous World War II shipwrecks.

This database was expanded during the Fall 2008 Semester when Dr. Richard's History 6850 course produced reports on ferrous vessels in North Carolina waters, ten of which were sunk offshore during World War II (Campbell 2008; Hayman 2008; MacKenzie 2008; Morra 2008; Ray 2008; Smith 2008; Steinmetz 2008; Thompson 2008; Wagner 2008; Wyllie 2008). These combined reports and popular books provide valuable information about vessels sunk within North Carolina waters; however, they focus on individual ships and the information that can be obtained from site specific archaeological surveys of those vessels and not the battlefield in its entirety. This is largely because the extent of the battlefield or even the extent of the territorial waters of North Carolina during the war have never been studied on a regional and geographic level to determine which events actually transpired within North Carolina waters. The objectives of this study focus on delineating these particular boundaries.

Objectives

This study compiles many primary and secondary sources pertaining to events occurring off the North Carolina coast during the Battle of the Atlantic and attempts to use the events and characteristics of the battle that have known or speculated geographical locations to delineate the battle's extents. This thesis further focuses on what types of events occurred within the waters of North Carolina, what types of vessels are represented in the battlefield, what nations contributed to events occurring within the battleground, and how many U-boats made successful sorties into

the state's waters. By revealing these battle elements and revealing the number of events, the number of vessels involved, and the nationalities of those vessels, it is possible to obtain a broader understanding of the battle. This understanding can help expose overall trends on a regional level as the battle transpired and can serve as the basis for comparative studies in the waters of other American states, or other international regions. In order to provide information about the events occurring within North Carolina waters and to determine the battlefield boundaries, one specific primary research question and multiple secondary research questions were used to guide the research of this thesis.

Research Questions

In a study as broad as the one detailed in this thesis, it was important to formulate a careful research plan to keep research focused on the major characteristics of the battle pertinent to revealing a broader understanding and ultimately delineating the boundaries of the battlefield. While there are many fascinating accounts of survivor rescues, U-boat attacks on vessels, and allied attacks on U-boats that can lead a researcher down a number of different paths, detailed research questions helped keep the study focused on historic events and the geographic extent of those events. The research questions upon which this study revolved are:

Primary-

- Can the boundaries of North Carolina's Battle of the Atlantic be determined based upon the archaeological remains of the vessels sunk throughout World War II whether by U-boat attacks, collisions, mines, or wartime patrols, as well as the coordinates of U-boat attacks on Allied vessels not resulting in a wartime casualty?

Secondary-

- Did the North Carolina seascape dictate where attacks took place?
- Were there differing trends in U-boat attack locations as the war progressed?
- Is it possible to reconstruct the geographic battle area of a naval confrontation that lasted throughout World War II?
- If the entire battle cannot be represented, is there a representative sample of vessels that clearly portray the confrontation?

- Do any of these wartime events or archaeological sites fully embody or represent the behavioral, strategic, technological, and economic contexts underlying the Battle of the Atlantic?
- What are the main causes of vessel losses off North Carolina during World War II?
    - How many vessels were lost to U-boat attacks?
    - How many were lost to Allied accidents?
    - How many were simply lost due to troubles during wartime patrols?
    - How many vessels lost were enemy vessels?
- Can a geographic model be constructed that can ultimately be expanded to all sectors of the Battle of the Atlantic including the U-boat war as a whole?
- Can the accuracy of coordinates relayed in distress calls and German sinking reports be verified or disputed through shipwreck sites and extrapolated to test the accuracy of the possible whereabouts of vessels still not located?
- Can these boundaries be utilized for future management plans to protect the material culture of World War II.

By concentrating on these research questions and allowing them to guide the study, it was possible to keep focused on answering the primary research question and to keep the study centered on the waters of North Carolina. One important issue that should also be addressed, however, is why the waters of North Carolina were chosen for study when the Battle of the Atlantic was waged all along America's eastern seaboard.

Importance

The waters of North Carolina were chosen since more merchant vessels were destroyed here than in the waters of any other state during World War II, and many rest in depths that render them accessible to most intermediate or advanced level divers. Similarly, there are three known U-boats in diveable depths and potentially a fourth that is within the diving range of many technical divers. Some of these are the same divers who think "nothing of whipping out a sledgehammer and beating a porthole from the side of a ship" simply because "[u]nderwater, rules of possession ben[d] with the light; some divers cut prizes from the mesh goody bags of other divers, following the motto 'He who floats it owns it'" (Kurson 2005:6). With so many shipwrecks accessible to divers with malicious intent and those looking to take home souvenirs

simply because "if someone had been to this ship's wheelhouse before me, he would not have left this telegraph behind" (Kurson 2005:7), the need to protect our nation's cultural heritage is readily apparent. The ability to do so is another thing, however.

Although many terrestrial battlefields have been protected and carry significant federal punishments for those found looting the sites, the idea of defining and protecting a maritime battlefield has previously seemed quite abstract. This thesis, however, attempts to provide a model for defining maritime battlefields based upon the locations of vessels sunk in the naval engagement as well as events occurring within the seascape that do not leave evidence in the archaeological record but are reported in the historic records of an engagement. By creating a battlefield around the tangible cultural heritage of ships lost in naval engagements and the locations of events including survivor rescues, shipping routes, and attack locations that can best be described as intangible heritage, it is possible to ensure that the majority of events transpiring during the battle fall within the battlefield boundaries. By presenting a model for defining a maritime battlefield in the waters of the state with the most U-boat attacks, this study may help additional regional studies to be undertaken in the waters of states that witnessed less U-boat activity. By demonstrating the feasibility of defining the extent of a maritime battlefield in the broadest sense, it is the author's hope that additional similar models will be applied to the battle in other regions and that the feasibility of protecting our nation's WWII cultural heritage for future generations will be addressed.

Although there are potentially other ways to define a maritime battlefield, this thesis draws upon the theories of multiple sub disciplines of archaeology as well as some GIS theories to present a model for defining the Battle of the Atlantic in the waters of North Carolina.

Generalist Archaeology Theory

The theoretical framework underlying this study attempts to transition away from the site-specific approaches of many shipwreck archaeology surveys to provide a generalized comparative analysis of the Battle of the Atlantic off North Carolina. While undoubtedly many questions about seafaring and the wrecking events of vessels covered in this study can be revealed through the site and artifact specific studies common to maritime *historical particularism* (Richards 2008:38), this theoretical avenue does not allow for general and regional observations. For this reason, this study moves away from the *historical particularism* that "justifies much of the current work in shipwreck archaeology" (Gould 1983:4), and attempts to study the battle as an entire entity of historical events and activities that can "inform and enlarge our general view of man's relationship to his maritime environment, especially with respect to voyaging and matters of commerce, warfare, and other relevant factors" (Gould 1983:5).

Although there is nothing wrong with evaluating a particular site in order to glean as much information as possible, the long history of maritime archaeologists viewing shipwreck sites as isolated "time capsules" has meant that few convincing generalist studies have been published. This is in stark contrast to the often well-documented and thoroughly published site and event specific studies of many maritime archaeologists. The lack of convincing generalist studies has unfortunately contributed to the belief that "generalists have yet to prove themselves by designing projects, carrying them out, and publishing them in detail so the results can be evaluated and used by interested experts and scholars of all kinds" (Watson 1983:36). Since few generalist studies have been conducted and seen through to completion, the field of maritime archaeology has been dominated by particularistic event-based studies. This is also because the "principal limitation of the contribution of shipwrecks to the body of data on human social

processes has been the approach of investigators. Most shipwreck archaeology has been intensely particularistic and without a problem orientation" (Murphy 1983:70). Simply put, this means that "[s]hipwreck archaeologists need to develop and implement broadly conceived research designs asking significant questions of a general nature about human social behavior, or the contribution of shipwrecks to knowledge will only be the generation of historical detail" (Murphy 1989:70).

As previously stated, there is nothing intrinsically wrong with the historical particularistic study of shipwrecks. It is just that examining shipwrecks as event specific and occurring within a vacuum devoid of social, economic, and behavioral factors has its pitfalls, or as Gould (2000:2) puts it, the "historical-particularistic perspective, though legitimate, is inadequate to the task of interpreting archaeological results". It is instead increasingly by "deemphasizing the importance of events, and by thinking about process" that "archaeologists have come to see ships as more than just the paraphernalia of human activity…[and] have come to see watercraft from a range of creative perspectives" (Richards 2008:44). Since an event-specific approach to maritime archaeology necessitates an in-depth study of one particular event or site, this archaeological method is simply not fitting for the study of a maritime battle.

For this reason, this study is based on comparative and generalist theories. By making broad observations about the battle and the events occurring during it, the underlying social and behavioral factors of the battle can be analyzed, providing far more information about the engagement in North Carolina waters than a site-specific survey of one wartime casualty ever could. Furthermore, since "a comparative study undertakes the task of synthesizing particularist studies into the larger framework of anthropology and history," this "broad approach is applicable to lost watercraft because their archaeological value is greater than what can be

learned from a particularistic study alone" (Price 2006:10). Although this study follows a generalist approach towards understanding the Battle of the Atlantic in North Carolina waters, it differs from previous generalist studies. Previous studies including Murphy (1983), Price (2006), and Richards (2008) have focused on the idea of the ship as a single artifact that can be compared in numerous ways to other ships viewed as artifacts.

This study, however, focuses on historic battle events and features ranging from attack locations to survivor rescues, to shipping routes, to minefield locations as artifacts, or pieces of *intangible* heritage, of human and social interaction. By treating the intangible characteristics of the vessels involved in each event as attributes of that historical artifact, this study makes broad observations and generalizations about the battle. Similarly, treating the events as part of an interrelated social network helps one to better understand the battle. This closely follows Murphy's view that

> [w]hen considering ships as part of a cultural system, it may be profitable to view them as similar to hunting-gathering or trading parties. These groups are organized and sent out for the benefit of the parent society and are normally composed of, or at least led by, individuals experienced in and prepared for the task. The advantage of the hunting-gathering/trading analogy is that it focuses on the social nature of the effort and forces corollary considerations such as the interrelationship of the parent and satellite groups. The materials and labor efforts expended by the parent group stem from conscious decisions and should naturally reflect the technical and economic capabilities and goals of the society, as well as its organizational concepts (Murphy 1983:85-86).

By viewing battle-related events as expressions of the goals of combatants, a wider behavioral understanding of the war can be obtained. In order to adhere to a generalist approach to the battle and obtain this broad understanding, this study also maintains strong underpinnings to the theoretical framework endorsed in an emerging subfield of archaeology, that of battlefield archaeology.

Battlefield Archaeology Theory

This area of archaeology where much of the theory employed in this study comes from is the growing discipline of battlefield archaeology. This subfield, which originally began as a "method to find relics or gun emplacements," has materialized "to its present form where the archaeological record is viewed as an independent data set that can be compared to historical documents, participant accounts, maps, and other sources to build a more complete and accurate picture of an event or develop new views of strategy and tactics" (Scott et al. 2009:429). The need for this type of archaeology has arisen from the frequency of times that wartime recollections are different and incomplete due to the chaos of battle (Freeman 2007). This field has further shown that "an integrated and careful (re-) survey of such sites [previously studied or relic hunted battlefields] can reveal much about the location and course of a battle simply from the distribution of artifacts" (Freeman and Pollard 2001:8). These artifacts can then be placed into "distribution maps that can demonstrate the location and relative density of battlefield artifacts, which in turn define the limits of the site and indicate levels of activity" (Scott et al. 2009:25).

Despite the continued beliefs of some that the term "battlefield archaeology" may be too restrictive in terrestrial archaeology because it suggests a focus only on the battle and fails to regard any other archaeological remains encountered during a project (Southerland and Holst, 2005:2), this term may prove to be an excellent moniker for maritime battlegrounds in which no additional archaeological remains are to be encountered. In a study such as the one conducted here, which entails treating each site as an individual artifact and requires no excavation or evaluations of the site, the term "battlefield archaeology" and the theories presented within the discipline may best define large-scale maritime battle seascapes. Although it may appear strange

to some that an area of ocean can be deemed a battlefield, and despite the fact that battlefield archaeology surveys have traditionally been rooted in terrestrial landscapes, the sub discipline has already successfully been applied towards several naval seascapes.

Many of these successful studies have been based upon the precepts of battlefield archaeology first laid out by Douglas Scott and Richard Fox during their 1984-1985 intensive archaeological survey of the Little Bighorn Battle site. Drawing upon the tenant of archaeology that human behavior is patterned, Scott and Fox speculated that battlefields should contain patterned physical remains because combatants fight in specific formations and behave in a manner conforming to their training. By studying the Little Bighorn Battle site in view of these guidelines, Scott and Fox were able to successfully survey the battleground and offer startling new interpretations of the way the battle transpired (Fox 2003:xii,xv; Scott et al.2009:431). Through the work on the Little Bighorn site, Fox was able to show that

> [w]ar, though hardly a credit to humanity, is a distinctly human enterprise. Combat behavior is, from the archaeological perspective, no more and no less susceptible to analyses than any other form of human endeavor. Battlefields, the theaters for war, represent the sites at which armed adversaries engaged in combat. Armaments—weapons and equipment—are the implements of war, and few battles have been fought without them. It is thus not asking too much to expect that battlefields are replete with the remains of armament. These are the residues of warring behavior, the records of tactics and strategies, of decisions and responses, of successes and failures (Fox 2003:5).

Since this intensive battlefield survey, battlefield archaeology projects have been carried out in a number of countries and have covered a multitude of different wars to test the historic record and offer new interpretations based upon the physical remains left on the battleground. Recently, however, archaeologists have taken the concepts of regulated and patterned behaviors apparent in terrestrial battles and have applied the same precepts to naval battles to document and provide insight into engagements that took place at sea. Since "[a] 'historic battlefield' is a defined space

in which organized groups of armed people did regulated violence upon on another" (Schofield et al. 2002:9), there is no reason why that "defined space" cannot represent an area of sea.

Even though surveys of sunken naval vessels like USS *Monitor* and the submarine H.L. *Hunley* have been conducted off North American shores and several surveys have been undertaken on warships sunk during World War II, many of these surveys have been site specific and intended to assess the condition of shipwrecks or recover them for preservation and study (Friends of the *Hunley* 2005; NOAA 2008, 2009; The Mariners' Museum [2010]). A recent reexamination of the *Hunley* site by Matt Russell and Dave Conlin, however, has sought to study holistically the engagement between *Hunley* and *Housatonic* as an interrelated battle and to examine the wreck sites of each vessel in relation to one another (Russell and Conlin [2010]).

By restudying the relation of the wreck sites of these two vessels, Russell and Conlin have been able to make some interesting observations and generalizations about the engagement between them. Historic documents coupled with archaeological research have shown that the crew of *Hunley* carefully planned the attack on *Housatonic* and chose to torpedo the Union ship towards the stern even with the mizzen mast, where the sharp deadrise of *Housatonic* would prevent its crew from exchanging small arms fire with the submarine. Further archaeological examination revealed that the torpedo spar of *Hunley* was mounted on the bottom of the submarine, contrary to historical documents that situated the torpedo spar atop the submarine. This placement of the torpedo ensured that the explosion occurred well below *Housatonic's* waterline and resulted in a successful sinking with only one torpedo. While the physical remains of the vessels offer valuable insight into the attack, the spatial orientations of each vessel also provide an opportunity for analysis of the event.

Russell and Conlin discovered that both *Hunley* and *Housatonic* sank while facing into the ebbing tide coming out of Charleston Harbor. *Hunley* sank nearly 1000 feet due east of *Housatonic.* These vessel orientations provide the opportunity for continued analysis of the event and can provide hypotheses for why *Hunley* ended up sinking. This can also help archaeologists seek to answer the question of why *Hunley* rests eastward of *Housatonic* and whether the ebbing tide was too strong for the men of *Hunley* to maneuver against or if they took the submarine to the seabed to wait for the tides to change and were unable to resurface (Russell and Conlin [2010]). By following Scott and Fox's principles of battlefield archaeology, Russell and Conlin have been able to re-approach the *Hunley/Housatonic* battle from an entirely different perspective and have been able to show how battlefield archaeology concepts can be applied to a small-scale battle between two vessels.

On a larger scale, John Broadwater's work on interpreting the battle of Yorktown as one in which terrestrial and maritime components come into equal play has shown that naval battles and terrestrial landscapes are often interrelated. Broadwater argues that, even though naval battles often occur many miles away from land and over many miles of sea, the battle is often shaped by the geography and political ideals of the warring nations (Broadwater [2010]). Broadwater further asserts that "naval battles can only be fully interpreted and given historic meaning by studying them as individual events within the larger context of natural, military, and political events within which they took place" (Broadwater [2010]). By archaeologically examining commonly researched and historically chronicled battlefields, Broadwater has shown that material remains of a battle can help shed new light and offer new interpretations to battles previously thought to be completely understood.

It is in the same footsteps of these successful naval battlefield surveys that this study falls and, drawing upon much of the theory generated within battlefield archaeology, hopes to illuminate the Battle of the Atlantic off North Carolina with a new and exciting light. Unfortunately, however, for a battlefield archaeology survey to confirm or dispute the historic record, an actual archaeological survey must be conducted to reveal any disparities between the written and physical records. This is where this study differs from the actual field of battlefield archaeology. Since a survey to ground-truth each event location presented here is far beyond the scope of this thesis, and many of the historic events related, such as attack locations and survivor rescue locations, have not left any physical traces, each historic coordinate is treated as an intangible archaeological and geographical "artifact" that can be mapped using GIS software to show areas of battle activity. This is possible since the events that have not left physical remnants in the study area have often left behind tangible traces in the form of historical accounts and geographical coordinates that can be mapped into the battlefield GIS.

While these historical coordinates can add error to the finalized GIS, only the actual sinking locations of vessels may differ when they are discovered, since any historic event that does not leave a physical trace in the archaeological record must be accepted as accurate and will not be changed by future shipwreck discoveries. As noted by Schofield (et al. 2002:16), "the majority of these [historical events] are conceptual or technological rather than physical 'terrain' to be experienced directly," they nevertheless represent a "surprisingly large number of 'features' present in the battlespace which played a large part in the battle as it unfurled" and must therefore be mapped to represent the extent of the battle. This will effectively allow two different battlefield maps to be generated using GIS. One will be a historical map of the battle revealing all historic events of the Battle of the Atlantic in North Carolina waters, while the other

will be an archaeological battlefield map revealing known and speculated final resting locations of war casualties. Once definitive locations of war casualties are discovered through future surveys, only one point in the GIS database will potentially need to be changed to reveal discrepancies between historic sinking locations and the actual locations of the vessels.

Furthermore, since coastal waters under United States jurisdiction during World War II, as well as shipping routes, convoy routes, and zones of Allied patrol, follow real-world coordinate systems, these can also be mapped to represent the battlefield in its entirety without defining the battlefield simply in terms of where ships sank. Another distinction between this study and terrestrial battlefield archaeology is that battlefield surveys are generally conducted where "armed adversaries engaged in combat" (Fox 2003:5), whilst the Battle of the Atlantic revolves around an armed adversary attacking a generally unarmed merchant marine. This thesis, however, posits that since the merchant marine is bounded by travel regulations, especially during times of war, and that since these wartime regulations are often governed by military bodies, a great degree of artifact patterning should exist. Similarly, while the objective of a submarine is to remain elusive and undetected, the U-boats attacking merchant shipping off North Carolina had to sacrifice complete safety for the possibility of sinking merchant vessels, which necessarily mandated that the German submarines follow predictable and patterned paths to maximize successes.

While shipping routes represent the ideal, merchant shipmasters undoubtedly exercised some leeway in how strictly they followed these routes and, similarly, the U-boat captains had the freedom to maneuver their boats in response to shipping densities, which caused individual behavioral patterns to exist across the battleground as evidenced by the coordinates of events occurring offshore. It is by mapping these individual behavior patterns in relation to one another

that the entirety of the battle can be represented through the anthropological concept of "the battlefield pattern" created by Scott and Fox (1987:126). The battlefield pattern

> is based on the recognition of individual behaviors as they are represented in the artifactual record. The integration of individual behavior patterns results in the identification of unit patterns…The battlefield pattern, then, integrates unit patterns to provide general behavioral aspects relevant to the progress or chronology of the fight…Thus the battlefield pattern is formed from a composite analysis of all artifacts in the archaeological record…These traces are left behind in patterns that can be interpreted (Scott and Fox 1987:126).

In order to effectively track the patterns of battle activity and provide analysis of "behavioral aspects" of the Battle of the Atlantic in the waters of North Carolina, the theoretical framework of another discipline had to be employed.

GIS Theory

The additional theory utilized in this study revolves around the use of GIS for historical studies. GIS software has allowed historians and archaeologists to perform research in relation to geographic references and has augmented their work by allowing the spatial analysis of patterns, people, and even archaeological features. By creating multiple GIS layers, a researcher can present the attributes of the particular item being added to the dataset. Through the presentation of the location and attributes of a historical or archaeological feature, a much more in-depth view of that particular event or artifact can be ascertained (Knowles 2002:viii). GIS software thus "digitally links locations and their attributes so that they can be displayed in maps and analyzed" (Knowles 2002:xiv). It is this spatial linking of events to their geographic locations that separates GIS from other relational databases and that allows spatial analysis of events and locations to be conducted (Conolly and Lake 2006:3).

In order to analyze events spatially, however, the theoretical description of space used in the analysis must be known. The Western world has been strongly influenced by two main visions of space. One view is that "the **relative concept** views space as a positional quality of

the world of material objects or events" (Conolly and Lake 2006:3). The other viewpoint maintains that "[t]he **absolute concept** views space as a container of all material objects, which exists independently of any objects that might fill it" (Conolly and Lake 2006:3). These concepts can be explained simply by picturing adjoining earthworks on a battlefield. The relative concept of those earthworks would be that they are next to each other. If a non-scaled map of the earthworks were drawn, the two earthworks would still appear relative to one another but without dimensional data. The absolute concept would view those same earthworks as appearing next to each other but would also factor the distance between them into the equation. This would be similar to redrawing that same map but drawing it to scale. Now both earthworks would appear in an absolute relation to one another and not simply in a relative orientation.

In the application of GIS to archaeology, these two concepts of space most commonly manifest themselves into two types of spatial geometrics, those of topology and those of Euclidean geometry. These spatial geometrics differ in that,

> **Topology** distinguishes spatial objects that should be considered different on account of the way in which they relate to their neighbors and, for that reason, it has a close affinity with the relative model of space. For example, suppose an excavation plan were drawn on a rubber sheet, then topology is concerned with those aspects of the recorded features that remain invariant when the sheet is stretched or knotted, but not cut or folded. These include stratigraphic relations such as 'contains' and 'abuts', but not the areas covered by different deposits (Conolly and Lake 2006:4).

On the other hand,

> **Euclidean geometry** is the geometry that most of us are taught at school. Devised by Euclid around 300 BC, it is an example of a *metric* geometric, that is, one which includes the concept of distance between points such that the distance from point *A* to point *B* is the same as that from *B* to *A*. Euclidean geometry has long been associated with the absolute concept of space…Returning to the example of an excavation plan, Euclidean geometry allows one to measure the areas covered by different deposits as well as to state the stratigraphic relations between those deposits (Conolly and Lake 2006:4).

Since this study is concerned with the overall boundaries of a maritime battle as well as the distances between events, shipping routes, minefields, and state borders, the analysis used in this study will be based on Euclidean geometry, and by default, upon the concept of absolute space. This is appropriate, however, "[s]ince Euclidean geometry allows one to distinguish a larger number of transformations than topology it may be considered more 'specific'" and since, "[i]n GIS terms, a more specific geometry supports a larger number of meaningful questions about the spatial relations in a database" (Conolly and Lake 2006:4).

It is important to realize that while a GIS digitally links events to their geographic locations, the theoretical premise behind using GIS software is far more comprehensive than simply creating geographic maps. This is because the

> advantage of a GIS over traditional mapping is that a GIS permits the organization of different components of the same map into different thematic map layers (and thus [is] often referred to as *thematic mapping*), which is the basic way that spatial data are organized within a GIS environment. In practice this means that in one GIS digital display many different elements may be combined, each of which may be individually turned on or off, queried, modified, reclassified, and edited. Many analytical functions, such as spatial queries, can operate across one or more layers depending on the need of the GIS analyst. Map layers, or subsets of individual layers, can also be combined to produce new maps at will, providing potential insight into relationships between elements on different themes (Conolly and Lake 2006:17).

It is for this theoretical background and for the powerful analytical and display capabilities that GIS software was chosen for this study rather than simpler mapping software that could geographically represent the battlefield, but that would fail to provide the diagnostic capabilities of a GIS.

Thesis Structure

The broad nature of this study has mandated research at multiple archival repositories, study of many historical documents, and the use of multiple computer software programs to determine the overall extent of the Battle of the Atlantic in the waters of North Carolina.

Chapter Two, Methodology, identifies the different avenues of historical and cartographical research conducted during this study as well as details the creation of the battlefield GIS and the types of analysis conducted using historical documents and the GIS. Although this chapter reveals where historical research was conducted, it does not provide insight into what the historical documents reveal about the battlefield. This is instead discussed in Chapter Three and Chapter Four.

Chapter Three, The Germans Attack, provides a historical account of the initial U-boat operations off the American coast and traces their attacks along the American coastline until their captains discovered the productive waters of North Carolina. At this point, the chapter chronicles the battle as it pertains to the waters off North Carolina. Chapter Four, America Fights Back, discusses America's desperate struggle to counter the U-boat threat wreaking havoc along the coastal shipping routes. This chapter reveals major historical components of the battlefield and ultimately reveals how the U-boats were defeated along the American Coast. This background history provides the basic framework for the analyses of the following chapters.

Chapter Five, Understanding the Battlefield, is a statistical breakdown of major themes and key components of the engagement. These statistical analyses provide a greater understanding of which nations contributed to events within the study area, how many vessels were involved, and what types of vessels were involved in the battle. Although many additional statistical observations could be made about the battlefield, this information provides the basic knowledge of the battlefield required to understand the spatial analyses of Chapter Six.

This chapter, The Geography of the Battlefield, reveals geographical trends apparent within the battlefield and uses geospatial analytical tools to depict the individual spatial elements of the battlefield that contribute to the battlefield as a whole. These analyses also attempt to

provide a visual representation of the historic events discussed in the history chapters as well as provide geographical boundaries to the statistical analyses conducted in the proceeding chapter. These supplemental geographical analyses then provide the grounds for examining the full extent of the battlefield and for answering the primary research question of this study and for providing some conclusions about the battle in the waters off North Carolina. These conclusions are discussed in the final chapter of the thesis along with limitations to the study, the potential implications of the study, and avenues for further research.

Conclusion

As a wide-ranging study attempting to delineate boundaries of the Battle of the Atlantic in North Carolina waters and provide insight into the events contained within the battleground, this thesis has drawn upon the theoretical framework of generalist archaeological studies, battlefield archaeology, and GIS as a means of archaeological analysis. Expanding upon the notion of ships viewed as artifacts utilized by Murphy, Price, and Richards, this study focuses on events and features of a maritime battle as individual artifacts that can be analyzed to show widespread trends and patterns of the naval engagement as well as isolate the boundaries of the Battle of the Atlantic in one geographical region. Furthermore, this study finds its basis in the recent successful maritime battlefield archaeology surveys of Russell, Conlin, and Broadwater, which provide some of the precedent for the application of battlefield archaeology theory to maritime engagements.

Even though defining the boundaries of the battlefield could be accomplished through simple mapping software, GIS theory is employed in this study so that additional meaningful analysis of the battlefield, combatant vessels, and events within the battlefield can be conducted. It is through this analysis, and by spatially linking all known wartime incidents off the North

Carolina coast during World War II, that it is possible to present North Carolina's Battle of the Atlantic and its geographical boundaries in an entirely new and exciting light. In order to present these events and geographical boundaries, however, a careful research plan was followed to ensure that battle specific events and features were fully researched so they could be added to the GIS. The historical research and creation of the GIS are chronicled in the subsequent chapter.

CHAPTER TWO: METHODOLOGY

Introduction

In order to reveal the extent of the Battle of the Atlantic as it occurred off North Carolina fully and accurately, much research had to be conducted that spanned several disciplines. With a large amount of coastline and a large dataset of U-boat attacks, vessel losses, survivor rescues, convoy routing changes, and coastal defense installations to analyze, the project quickly became multifaceted, requiring historical research, geographic research, and archaeological theory to produce a GIS model that would accurately depict North Carolina's waters during World War II. To make this undertaking more manageable, the study was broken into several different stages of historical research, GIS creation, and analysis. The historical research phase consisted of collecting pertinent historical documents from multiple archival repositories and secondary sources. The second phase consisted of converting historic coordinates of events and attributes into shapefiles for incorporation into the battlefield GIS. Finally, the third phase of the study entailed the statistical and spatial analysis of events and attributes so as to provide a wider understanding and answer research questions posed by this study. This chapter chronicles the phases of the study in the order they were undertaken beginning with historical research.

Historical Research

Before undertaking any research in the National Archives, a list of merchant vessels and U-boats sunk or attacked in North Carolina waters had to be created so that time could be maximized by searching for records pertaining to events specific to North Carolina. An initial search was conducted through a list of allied merchant vessels attacked during World War II on the website uboat.net. This website chronicles the U-boat war in many aspects, and the information contained within its pages comes from archival resources and painstaking research.

Unfortunately, the website fails to list which archives were used for research and which record groups each primary document came from. This shortcoming meant that the website could only be used to obtain a listing of vessels attacked or sunk off North Carolina. Once names of vessels believed to have been attacked or sunk were obtained, they were transferred to a list used during archival searches and compared to the listing of vessels attacked and sunk during 1942 contained in the book *Torpedo Junction* (Hickam Jr. 1989:329-338). Additionally, tables of vessels lost in Freeman's (1987) edited version of the Eastern Sea Frontier (ESF) War Diaries from January to August 1942 and Rohwer's *Axis Submarine Successes of World War II* (1999) helped confirm that the vessels placed into the study list was comprehensive and included all known vessels attacked or sunk due to the war or to accidents occurring while on wartime patrols. This information allowed structured primary research to be conducted.

Primary Sources

Once the list of vessels believed to have taken part in events within the study area had been created, vessels were added to a Microsoft *Access* database that was generated with empty fields for information obtained about each vessel ranging from former names, to build characteristics, and ultimately to coordinates of various actions along the vessel's route that could be displayed within the GIS. Many specifications of each ship were added using the searchable *Lloyds Register of British and Foreign Shipping*, available for the years from 1930 to1945, on plimsollshipdata.org. This searchable register covered most vessels in the database and allowed many database fields to be populated before archival research commenced.

The next phase of historical research consisted of research at both National Archives I and National Archives II. Prior research projects revealed that the Archives I building in Washing D.C. contained vessel sinking reports of the United States Coast Guard (USCG) and

that the National Archives II building contained information from the United States Navy pertaining to U-boat actions along the East Coast. This knowledge enabled quick retrieval of record group boxes and allowed more time to be spent searching archival material and less spent searching through finding aids. While at the National Archives I building, fellow Program in Maritime Studies student Eric Ray, who helped with archival research as a research assistant, searched boxes from Record Group 26, Records of the U.S. Coast Guard, for information pertaining to vessels in the database. Several boxed series within this record group provided information for this study. These series included: World War II Reports Concerning Merchant Vessels sinking, 1938-2002; War Casualty Section Survivor's Statements, 1941-1945; and War Casualty Section Casualty Reports 1941-1946. These documents greatly supplemented those gathered from the Archives II building.

Research in Archives II concentrated on Record Group 38, (Records of the Office of the Chief of Naval Operations, 1875-2006), and Record Group 428, (General Records of the Department of the Navy, 1947-). Series of boxes in Record Group 38 that contained valuable information pertaining to attacks on merchant vessels and locations of engagements included: Tenth Fleet Convoy & Routing Casualty Files; the Office of Naval Intelligence Security Classified Administrative Correspondence 1942-1946; and the Records Relating to Naval Activity During World War II, World War II War Diaries. An additional series from this record group that provided detailed routing information for 1943 was the Office of Naval Intelligence Planning Branch (Op 16X/op 23X/op 32X) Reference File 1941-45 – Naval District Orgn. & Personnel & Convoy Routing Instructions. From Record Group 428, the boxes in the series Office of Information Ship Files 1940-1958, proved helpful for obtaining newspaper articles written about torpedoed ships as well as articles about how the German submarine threat was

countered by Allied forces. While much of the research at the archives was conducted in these record groups, additional research was undertaken in the cartographic records branch of Archives II.

The cartographic section of Archives II revealed charts of American shipping routes during peacetime that could be compared with changes made to shipping and convoy routes during the war. An additional fascinating find came in the form of captured U-boat manuals containing information about the American East Coast (Figure 2.1). These manuals contained landmarks for navigation, locations of coastal defenses, and extensive charts of shipping routes, ocean depths, and currents along the coast. These charts even included the type of ocean bottom sediments found at different depths, allowing U-boat officers to rest their vessels on a sandy ocean floor during daylight hours when Allied defensive forces were able to spot them on the surface. Any useful, or potentially useful, item found in the National Archives was photographed using a digital camera.

These images, along with a photograph of the record group box of each document recorded, were added to an individual digital folder for each vessel, chart, or u-boat handbook on a laptop computer. This allowed information for each event to be accessed quickly for each area of the *Access* database and the GIS. Using these sources in conjunction with one another provided many attack, sinking, and rescue details. Since a battlefield is not simply delineated by where victims fall, additional historical sources had to be consulted in order to plot other elements of the Battle of the Atlantic, including changes in shipping routes, locations of minefields and anchorages, and zones of aerial coverage.

Fortunately, much of this information comes from the same sources. Information about changes in shipping routes early in the war is included in the ESF War Diaries located at the

National Archives, and Freeman's edited volume of the months from January 1942 to August 1942 allows the changes in routes to be easily identified (1987). Unfortunately, Freeman's (1987) edited volume of the ESF War Diaries does not include the appendices of the diaries, which are where changes in shipping routes are commonly located. For this reason, the website uboatarchive.net became invaluable. This website contains transcribed and searchable copies of the ESF War Diaries for the first five months of the war including the diaries' appendices. Multiple changes in merchant shipping routes are found within these war diaries. These changes occurred in December 1941, and the end of February 1942 (NANCF 1941:21-24,ch. 3; ESF 1942a:1,chap. 4; ESF 1942a:1-4,Appendix I).

After the completion of the Cape Hatteras minefield and implementation of the coastal convoy system in May 1942, the routes were undoubtedly changed since the old routes traversed through the minefield (ESF 1942a:1-4,Appendix I; ESF 1943:6-7,chap. 5). Unfortunately, these specific routing instructions have remained elusive despite all research. These routes, however, are presumably identical or very similar to those documented in May 1943 by the United States Fleet Headquarters, which began supplying coastal convoy routing data in 1943 and for which routing instructions were discovered at National Archives II (United States Fleet Headquarters 1943). These documents allowed the changes in routes, from merchant vessels sailing along the coast unescorted to the implementation of convoy routes, to be added to the GIS to observe how the activity of the battlefield changed when the routing of merchant vessels changed.

In addition to supplying information for shipping routes, the ESF War Diaries also revealed the boundaries of the ESF, the location of the Cape Hatteras Minefield, and the safe anchorage contained within the minefield (NANCF 1942b:1,chap. 1; ESF 1943:1-13,chap. 5; Freeman 1987:1). Each month of the War Diary also lists the types of aircraft available at the

different air bases along the coast allowing the aerial coverage off North Carolina to be plotted. By researching all historical elements that contributed to the campaign off North Carolina, it is possible to generate various GIS layers that represent the battlefield in its entirety. While this primary historical research is invaluable, it unfortunately did not allow coordinates for each vessel in the study area to be added to the *Access* database.

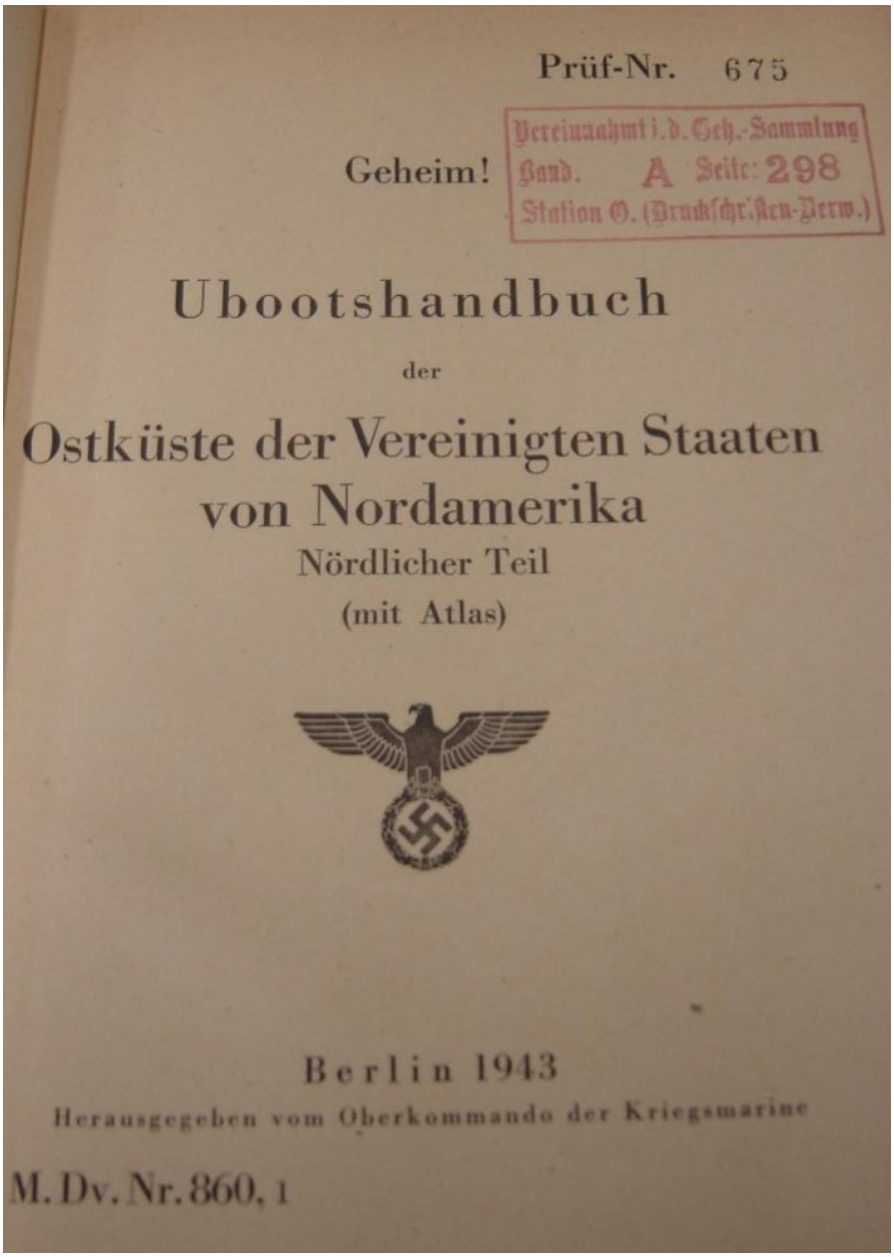

FIGURE 2.1. Captured German U-boat handbook for the East Coast of North America (National Archives II, College Park, MD.)

Secondary Sources

Since, reports for roughly six percent of the total number of vessels studied were not found at the National Archives, information for those vessels had to be obtained from secondary sources. The majority of these remaining vessel coordinates were populated using the list of U-boat attacks provided as an appendix to the book *Torpedo Junction* (Hickam Jr. 1989:329-338). These coordinates are presented in the form of German B.d.U. quadrants exactly as Hickam Jr. transcribed them from German Records. The B.d.U. quadrants are overlays of the world's oceans using a grid system that breaks apart latitude and longitude into a series of letters followed by several numbers that corresponded to coordinates around the world. These grids allowed the U-boat command to track its U-boats and permitted vessel commanders to relay their locations without having to broadcast their position in the clear (Hickam Jr. 1989:328). The gridded quadrants were then converted using a downloadable German MQK (Marine Quadratkarte) converter available on the Spanish website u-historia.com (2008). The accuracy of this conversion software was checked using vessels for which the latitude and longitude were known and comparing these coordinates to software conversions of the grid system in Hickam Jr.'s book. Once the program's accuracy had been verified, coordinates for those vessels not located in the National Archives were added to the database by converting their grid locations to latitude and longitude. After converting the grid locations to latitude and longitude, the database contained at least one event location for almost all vessels in the database.

The remaining few vessels for which no information was found included the USCG Vessels *Jackson* and *Bedloe,* which were sunk by a hurricane in 1944 while on a war patrol (Hagner 1944:1). Recreational divers have since discovered these ships, but they do not commonly publish the coordinates. For this reason, NOAA's Automated Wreck and Obstruction

Information System (AWOIS) Database was consulted for coordinates for these shipwrecks. This database was also used to obtain coordinates for the wreck of *U-701,* also discovered by divers who have not published exact coordinates, and for which historical coordinates provided by the airplane that sunk *U-701* place the event too far out to sea (First Bomber Command 1942:1). To supplement the historical research undertaken at the National Archives and through secondary sources, cartographic and geographic research had to be conducted to give meaning to coordinates obtained from the historical documents.

Cartographic Research

Since the overall objective of this study focuses of defining the geographical extent of the Battle of the Atlantic off North Carolina, the collection of large amounts of geographic information and charts was done to ensure the finalized GIS represents all geographic components of the battle. While these charts are useful because they can be georectified and overlaid as layers into the GIS, they also provide invaluable information about the shipwreck locations, navigational buoys, and danger areas. This helps convey the historic information found through textual research in an easy-to-understand visual format. Although different GIS clearinghouses and internet servers provide charts that can be incorporated into the study area GIS, the importance of using contemporary charts to understand the seascape as it appeared during the war cannot be understated. For this very reason, multiple contemporary charts and geographic coordinates were collected so that a greater understanding of the study area could be obtained.

Charts

Cartographic research consisted of collecting charts of shipping, charts of vessel casualties, charts of ports of call, and German U-boat manual charts from the cartographic records section at

National Archives II as well as obtaining historic NOAA charts from the years 1939-1945. Charts found at the National Archives can be overlaid into the GIS as a layer to visually depict changes in shipping routes as well as the number of vessels sunk along the coast as the war progressed. The NOAA historic charts were useful for locating buoys that the navy used as reference points when they created merchant vessel shipping routes. Some charts from 1945-1947 also give more accurate locations of the final resting spot of some vessels in the database (Figure 2.2).

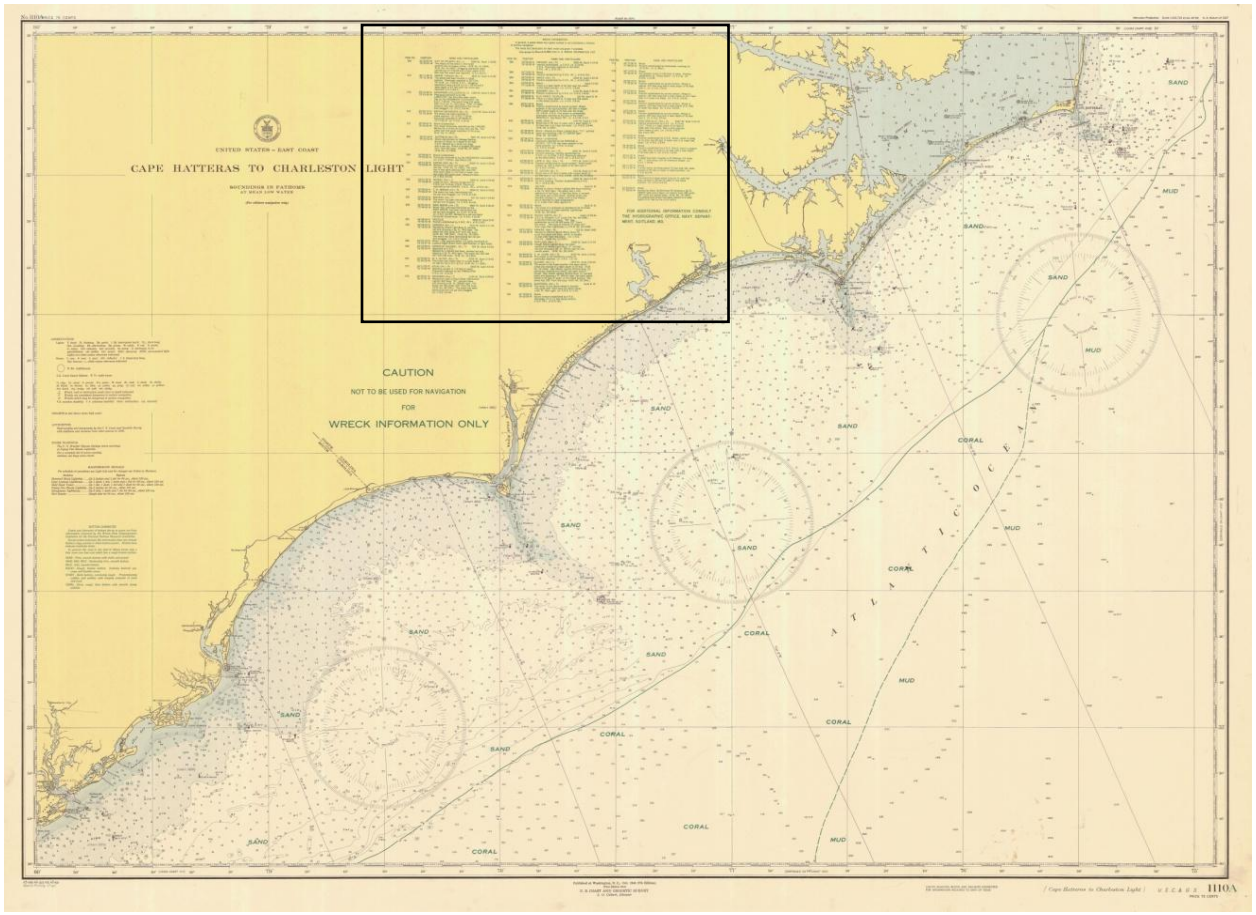

FIGURE 2.2. Chart of North Carolina with the coordinates of shipwrecks listed (shipwreck coordinates highlighted by author) (NOAA Historical Chart Collection, Cape Hatteras to Charleston Light, Chart No. 1110A, April 1947).

These resting locations were placed into the database to give more precise sinking locations to vessels that were surveyed or remained partially above water shortly after their

sinking, allowing the navy to accurately plot merchant vessel hulk locations. These charts also provide a visual representation of the Cape Hatteras Minefield that could be compared to the one plotted into GIS using coordinates from the ESF War Diaries.

USCG Light Lists

While the NOAA charts provided a visual representation of where some navigational buoys were located, they failed to provide accurate coordinates for those buoys. Tracing a straight line from the chart margins to see which coordinates intersected with the buoy location would induce too much error into the study and would misrepresent their actual locations in the GIS. This meant that the actual geographic coordinates of each buoy had to be discovered. After additional research into the East Coast buoy system and a helpful pointer from Maritime Studies student Nat Howe, it was discovered that the Coast Guard produces lists of aids to navigation in their annual Light List. By searching through online library databases such as WorldCat, several copies of the 1942 Light List were discovered. Unfortunately, due to financial constraints, East Carolina University's Joyner Library was not able to request the Light List publications through inter-library loan. After additional search, a 1945 Light List was discovered for sale through an online retailer and purchased in the hopes that the buoy locations had not changed since 1942.

Upon receipt of the 1945 Light List, the author discovered that the publication contained a column for each buoy that showed the date of the last time the buoy's location was changed (United States Coast Guard [USCG] 1945). This allowed each navigational buoy's location to be verified and plotted into an *Excel* spreadsheet and stored for use when shipping routes were mapped into the GIS. Fortunately, several weeks into the Fall 2009 semester, Joyner Library managed to allocate additional funds to inter-library loan and the author received a copy of the

1942 Light List (USCG 1942). This allowed a final check to ensure that the locations of the navigational buoys remained constant throughout World War II before all the routes were created as GIS shapefiles. Once all the project's historical and cartographic research was completed, the painstaking processes of visually depicting each battle-related event and statistically and geographically analyzing it to delineate battlefield boundaries began.

Analysis

The analytical component of this study revolved around three different aspects. The first phase consisted of creating an overall "site map" of all battle related events and features that shaped the way the battle transpired. The second phase of archaeological investigation and interpretation revolved around statistically examining prominent themes and characteristics evident within the battlefield. The final component included taking each different historic event occurring within the battlefield and plotting it in maps that display historic trends in their geographic extents.

GIS Creation

To effectively create an overall map of battle-related events, many GIS shapefiles had to be created to incorporate events and characteristics of the battlefield ranging from shipping routes, to minefields, to areas of aerial patrol, to coastal boundaries, and eventually to all battle related events for which historical coordinates were recorded. Although the end product of mapping each element was easy to visualize, the steps required to achieve that end goal required the use of multiple computer software programs and the transcription of many geographic coordinates and event characteristics into those programs.

To map each change to the shipping routes, the ESF war diaries and the Mercantile Atlantic Coastal Routing Instructions (United States Fleet Headquarters 1943) were first

searched in order to find which buoys were used for navigation at various points throughout the war. Each of these buoys and the distance and direction that a ship was to pass them by was then transcribed into an *Excel* spreadsheet. The Coast Guard Light Lists (1942, 1944) were then consulted for the historic locations of each buoy used in coastal navigation. Once the locations were found, they were added to an overall spreadsheet of buoy locations in degrees, minutes, and seconds. Next, a separate spreadsheet was made for each northbound and southbound route change, and the coordinates of each buoy were converted from degrees, minutes, and seconds into decimal degrees to make them easier to place into the GIS. Locations of each buoy were then mapped in Google *Earth.* Since the shipping routes were based upon passing the buoys at a specific distance and direction, measurements had to be taken off the buoys for every stage in each route. This was done using *Earth's* ruler tool, which gives measurements in distances and angles so that the coordinates through which the vessel was required to pass could be plotted.

Once these coordinates were discovered they were added to a finalized *Excel* spreadsheet for each shipping route. Finalized points were then plotted in GIS as different types of shapefiles. For routes used at the end of 1941, which routed vessels through corridors, polygon shapefiles were created to depict the width of the shipping routes. After U-boats began attacking vessels along the American coast, the routes were moved and no longer allowed shipmasters to proceed within a several mile wide corridor but required them to precisely follow a direct route leading from navigational buoy to navigational buoy. Since these routes were much narrower than the shipping corridors of late 1941, polyline shapefiles were used to represent each route. This remains true for convoy routes initiated after May 1942. Since the changes in routes for February 1942 required shipmasters to follow different ocean depth contours between navigational buoys, a 1942 NOAA historical chart was georectified in GIS and overlaid over the

study area. This allowed the routing lines between buoys to be modified so that they followed the differing depth contours. After each shipping route had been mapped, boundary lines for American coastal defenses were plotted.

This element of the GIS was relatively easy to create as a shapefile. This is because the American coastal defense boundaries encompassing North Carolina were only changed twice during the war. The initial boundaries were established when the North Atlantic Naval Coastal Frontier (NANCF) was created at the end of 1941 and extended from the border of Maine and Canada to the southern border of Onslow County, NC. The eastern boundary was set by drawing a line that connected a series of offshore coordinates between the northbound and southbound boundaries. These boundaries meant that the First, Third, Fourth, and Fifth Naval Districts belonged to the NANCF (NANCF 1941:4,chap. 1,10,Appendix III). In February 1942, the NANCF was renamed the Eastern Sea Frontier (ESF) after the Sixth Naval District was added to this Frontier, extending the Frontier's southern boundary to a point between St. Johns and Duval Counties in Florida, and making it easier for the ESF to route ships along most of the east coast (NANCF 1942b:1,chap. 1). Since coordinates of both coastal boundaries are included in the NANCF War Diaries and the ESF War Diaries, it was simple to convert the coordinates into decimal degrees and place them into an *Excel* spreadsheet.

After the coordinates were placed into a spreadsheet, the coordinates were mapped in *ArcMap* as polyline shapefiles to delineate boundaries of the NANCF and ESF. Since the polyline shapefiles did not allow much analysis of the waters contained within the polyline to be conducted, the polylines were then converted into polygon shapefiles so that the area of the frontiers and the events that took place within these boundaries could be analyzed. This was done by keeping the northern, southern, and eastern boundaries the same as the polyline

shapefile and by adding points along America's eastern coastline to represent the western boundary of the frontier. Once these boundaries were created, it was possible to begin mapping all historical events for which coordinates were known and to determine which events occurred within zones that American coastal defenses patrolled.

The plotting of each historical event for which coordinates are known was the most difficult aspect of creating the GIS of the battle in North Carolina waters. This step required many different phases of study and transcription to make certain that battle-related events were plotted correctly. The initial portion of this element required creating empty fields within the *Access* database in which coordinates of historical events believed to have occurred in the waters off North Carolina could be entered. Additional empty fields were generated next to the coordinate fields so that any specific actions that occurred at those coordinates could be defined along with their date and time. Once several blank fields had been created within the database, documents photographed at the National Archives for each vessel were searched for any mention of coordinates and actions so that they could be transcribed into the database in chronological order.

Unfortunately, not every action listed, ranging from sinking reports to radio intercepts of distress calls, revealed the location where the action occurred. This meant that only the events for which coordinates were given could be added to the database along with the corresponding detail of what type of event occurred. Once the historic documents had been consulted and the events added to the database in chronological order, coordinates for each event were converted into decimal degrees. Next, a list of each vessel in the *Access* database, and the locations and dates of each event along those vessel's routes, was exported into an *Excel* spreadsheet.

By exporting this list into an *Excel* spreadsheet, the spreadsheet data could be added directly to the GIS using the "add data" function in *ArcMap.* Since the spreadsheet contained the latitude and longitude of each event in separate columns, it was easy to select these columns as the ones that *ArcMap* would plot as X and Y. By repeating the process multiple times and selecting different columns containing event coordinates each time the process was repeated, it was possible to quickly add all events to the GIS. Unfortunately, simply adding all of these points to the GIS as point shapefiles severely limited the amount of information gleaned from the points. This is because the points simply represented events occurring during the war and provided no way of observing the paths of individual vessels as they traversed the waters of North Carolina from one known event location to another. This method also only allowed the events that occurred during the war to be viewed at one time and did not allow the events for each month to be observed in order to analyze any shifts in battle activity as the war progressed. For these reasons, many more shapefiles were created depicting different types of information to make future analysis and manipulation of the data easier.

The first modification done to the data consisted of making a point shapefile for each vessel in the database. RENCI graduate student, Laurynas Gedminas, who helped with much of the GIS setup and analysis, did this step of the process. By creating a separate shapefile for each vessel, events for that specific vessel could be viewed without the added clutter of all other events. This also meant that a polyline shapefile could be created that connected each of the different event points so a vessel's path could be mapped. The lines could also be broken apart into multiple segments so event points along the line could be time stamped and the line animated to draw through each point as it occurred in history. Although the animation tool of the GIS software is an excellent instrument to use for public outreach and visualization, it did not

allow all of the research questions to be tested and was therefore not completed for this study. Once each vessel's route was generated by completing the line shapefiles, additional point shapefiles were created to depict events occurring by month.

Since the shapefile representing all events occurring within the battle area would limit the number of analyses that could be conducted, additional point files were created for the months of January 1942 through July 1942 so that the center of activity for the battle could be plotted for each month. Since there are few events occurring after July 1942, events for the remaining years of the war were grouped onto three different point files depicting events occurring in 1943, 1944, and 1945. Upon completing these shapefiles, battle analysis could be conducted for each month and year of the war. Since these shapefiles represented all events occurring during the battle, and not just those that would leave behind physical remains, additional shapefiles were created to depict areas where large accumulations of archaeological features could be expected.

This was done by taking the *Excel* spreadsheet of all events and modifying it to only contain locations of known or speculated resting locations of war casualties. Once this had been done, the known and speculated locations were added to the GIS as point shapefiles representing known and potential locations of archaeological features still remaining in the battlefield. To allow further analysis of vessel losses throughout the war, these locations were further divided into months and years in the same fashion as the shapefiles representing all events. Once these different shapefiles and map overlays were created, it was possible to move on to the second phase of archaeological study, which consisted of statistically analyzing the events within the study area.

Statistical Analysis

Although the events and characteristics of the battlefield can be analyzed in numerous ways, several important battle elements and vessels that could provide a greater understanding of the battlefield were chosen for analysis. In order to begin this analysis, however, the study area needed to defined using *ArcMap* since many events were initially included in the *Access* database because events were referred to as "occurring east of Hatteras" in historical documents. Once the borders of North Carolina and the boundaries of the ESF were created in *ArcMap*, it was discovered that many of these historic events actually occurred beyond the North Carolina's territorial waters and the ESF boundaries. After the events were filtered to only include events occurring within the northern and southern borders of North Carolina and within the eastern borders of the ESF, it was possible to examine the action types, nationalities, and vessels present within the study area so that statistical observations could be made.

This was done by exporting the attribute table of all the events occurring within the study area and the characteristics of each vessel contributing to those events back into an *Excel* spreadsheet of pertinent information. Once this overall spreadsheet had been created, it was possible to copy the spreadsheet's columns into additional spreadsheets depicting information to be statistically analyzed. This allowed characteristics of vessels ranging from nationality, to vessel type, to gross tonnage, and to date of build to be analyzed, allowing portrayal of overall characteristics and observations about key components of the battle to be made. Similarly, these *Excel* spreadsheets allowed data to be arranged in a chronological order to determine if the characteristics of the battle within North Carolina's regional waters followed the same patterns reported by the ESF for the entire coast. Finally, the spreadsheets allowed the most successful

U-boats to be compared in terms of vessels attacked versus vessels sunk as well as gross tonnages destroyed by each individual U-boat.

In order to portray this information in an attractive and easily understandable manner, the *Excel* spreadsheets were exported into a student version of *OriginPro* 8.1, which is a data analysis and graphing software package (OriginLab, Northampton, MA). This software package allowed statistical information to be presented in the visual form of charts and graphs that convey a large amount of information very quickly. The power of these charts in presenting statistical characteristics comes from their ability to depict multiple variables in relation to one another and to show the trends that are discussed throughout historic documents. These statistics then provide a greater understanding of the events, nationalities, and vessel types within the study area. This understanding then provides the basic knowledge required to begin visualizing how the battle played out and allows the geographic locations and geographic analysis of the battle to carry more meaning.

Spatial Analysis

Although the main question driving this thesis focused on the feasibility of mapping the boundaries of a naval battle that spanned from 1942 to 1945, multiple other geographical analyses were conducted to represent smaller aspects of the battle that contributed to the overall extent of the engagement. To do this successfully, several different battlefield maps were created in *ArcMap*, each requiring the use of different geospatial analysis tools and different shapefiles created throughout the process of generating the GIS. Although many of these analyses rely upon the same dataset, the different maps portray diverse ways of observing the battlefield in relation to historic trends in activity, shipping routes, and U-boat attacks.

Despite the fact that the seascape and the events contained within it could also be analyzed in numerous other geographical ways that depict additional spatial trends, these analyses provide a basic glimpse of the trends occurring and allow the overall seascape affected by the battle to be observed. Similarly, while other increasingly sophisticated geostatistical analyses could be run on the datasets, the amount of information pertinent to this study gleaned from these analyses became muddled. For this reason, the temptation to run geostatistical analyses solely for the sake of running them was resisted so that only information crucial to this study would be depicted. While this does not mean that additional analysis cannot be conducted to answer different research questions, it does mean that only the analyses that contributed directly to the research questions are mapped and included here. It is these simple analyses that allow the overall geographical trends in the battle to be understood and provide the information required to delineate the extents of the entire battlefield.

Conclusion

Taking a broad approach to the data collected through historical research and statistically and geospatially analyzing it allows for a comprehensive overview of the Battle of the Atlantic as it transpired off North Carolina. By using the geographical extents of the battlefield and specific locations of events occurring within it, historic trends in the battle could be observed, and trends occurring within North Carolina's waters compared to trends in the entire battle off the American coast. Similarly, preliminary statistical observations were made about the battlefield that have opened venues for future comparative analysis with other regions where the Battle of the Atlantic took place. By following a structured methodology and resisting the temptation to become too focused on specific sites and events occurring within the battle a model for mapping naval battlefields based upon their material remains as well as the intangible

evidence of battle event locations only left behind in the historic documents has been made. It is these historic documents and the events they reveal about the Battle of the Atlantic that will be addressed in the following chapters.

CHAPTER THREE: THE GERMANS ATTACK

Background

On March 16, 1935, Hitler proclaimed military independence and began rebuilding the German U-boat fleet despite sanctions banning U-boat construction set by the Treaty of Versailles (League of Nations 1919; Bekker 1974:26). By doing so, he set in motion the events that would lead to the loss of 787 U-boats and the lives of over 30,000 German officers and sailors sent to submerged graves in waters around the world during World War II (Kemp 1997:7-8). These losses deprived Germany of nearly 60 percent of all U-boats constructed before and during the war (Botting 1979:16). While the loss of lives and U-boats is massive, it seems somewhat miniscule when compared to the damage these submarines inflicted on the merchant marine of Allied and neutral nations throughout the war.

This is especially impressive since U-boat captains began the war at a severe disadvantage since Hitler imposed strict regulations on their use. These restrictions included requiring U-boat crews to warn any boats that were not armed merchant ships or escorted by warships before firing upon them and placing passenger ships off limits to submarines. Despite these limitations, U-boat crews obtained great successes (Ruge 1957:60-61). As early as September 1939, U-boats managed to sink 40 ships amounting to 153,000 gross tons through direct engagement and another 31,000 gross tons by laying mines. In October 1939, U-boats managed to sink an additional 135,000 gross tons with torpedoes and 29,000 gross tons with mines (Ruge 1957:60-61). By June 1940, Germany finally possessed enough U-boats to implement a new tactic designed to inflict maximal damage on the Allied convoy system. This tactic, aptly named “wolf-pack,” called for U-boat commanders to delay attacking convoys until multiple U-boats closed on the convoy’s position (Busch 1955:40-41). With these new tactics,

Donitz boasted, "I will show that the U-boat alone can win this war" (Editors of Navy Times 1962:104). As if to prove this point, multiple U-boats attacked Convoy HX-72 on September 20, 1940, sinking 11 merchant ships. In October 1940, another two convoys were attacked by U-boats resulting in the loss of 31 ships, bringing the total number of losses for that month to 63 ships totaling 352,000 gross tons. On December 1 and 2, 1940 Convoy HX-90 was attacked five times resulting in the loss of 10 ships and an escort vessel. This brought the total losses since beginning the war to 1,026 Allied and neutral ships weighing over 4 million gross tons (Editors of Navy Times 1962:107-108).

Despite foul weather in the Atlantic limiting attacks at the beginning of 1941, the U-boats were able to maintain an average of 225,000 gross tons sunk through March 1941. Then from March through May, the U-boats destroyed 818,000 tons of Allied shipping (Editors of Navy Times 1962:108-109). As 1941 started to come to a close and Allied shipping losses continued to climb America managed to preserve a neutral stance in the war. Despite hiding behind the façade of neutrality early in the war, however, America had already aggravated Germany by sending fifty destroyers to England in return for a 99-year lease on Bermuda, as well as openly radioing positions of German fleets to England (Busch 1955:41-42). It is partially because of these actions that Germany was so eager to bring the war to America as soon as America's veil of neutrality was lifted one "infamous" day in December 1941.

The Battle Comes to America

On December 7, 1941, when Japan bombed Pearl Harbor, it became evident that the United States would no longer remain diplomatically neutral in the war and that the spread of aggression across the globe was inevitable. On December 8, the U-boat *Befehlshaber der Unterseeboote* (B.d.U.), which gave operational commands and recorded the locations of U-

boats at sea, acknowledged this fact and noted in its command diary that, "Japan has started hostilities against England and USA--an event of great importance which must also, in a very short time, affect the former restriction of U-boat warfare in the Atlantic" (Befehlshaber der Unterseeboote [B.d.U.] 1941:254). Just one day later, all German U-boats received Standing Order No.14, which gave them operational freedom to attack and sink any American vessel or any vessel assisting the United States in its war against Germany. Furthermore, lifting restrictions against American vessels allowed the German B.d.U. to begin planning an attack on American waters. Pleased with the thought of attacking the United States on its home front, Admiral Karl Doenitz, the acting commander of the B.d.U., quickly requested twelve large U-boats from the Naval War Staff for an offensive against the American Coast. In his plea to obtain these U-boats, Doenitz explained,

> The lifting of all restrictions regarding U.S.A. ships and the so-called Pan-American safety zone has been ordered by the Führer. Therefore, the whole area of the American coasts will become open for operations by U-boats, an area in which the assembly of ships takes place in single traffic at the few points of departure of Atlantic convoys. There is an opportunity here, therefore, of intercepting enemy merchant ships under conditions which have ceased almost completely for some time. Further, there will hardly be any question of an efficient patrol in the American coastal area, at least of a patrol used to U-boats. Attempts must be made to utilize as quickly as possible these advantages, which will disappear very shortly, and to achieve a "spectacular success" on the American coast (B.d.U. 1941:255).

On December 10, the Naval War Staff informed Doenitz that he could have six U-boats for his attack against America, but that the remainder of the requested U-boats would be kept along the Mediterranean and Gibraltar shipping routes (B.d.U. 1941:257).

With the number of U-boats available to Doenitz cut in half, he regretted that he would not be able to achieve the "spectacular success" originally hoped for, but continued to plan an attack on America nevertheless. As he weighed options for attack, Doenitz concluded that with just six U-boats the best course of action would be to spread them along the American Coast to

take advantage of America's inexperienced forces. He also reasoned that if he spread out his attacking U-boats too much, American defenses would be strengthened along the entire coast resulting in spoiled hunting grounds and no chance of shifting operations later. Doenitz, therefore, concluded that initial operations would take place along the northern half of the American East Coast. He believed that if the U-boats struck first in the Caribbean and Gulf of Mexico, the United States would still buffer defenses in northern waters that were closer to Germany. If the U-boats attacked in northern waters first, however, Doenitz believed the Americans would not know the true capabilities of the German submarines and would not strengthen their southern defenses, allowing the U-boats' theater of operations to be shifted later in the war in order to continually obtain success in American waters (B.d.U. 1941:258).

On December 19, the Naval War Staff gave Admiral Doenitz permission to send *U-67, U-107,* and *U-108* to American waters once these three submarines finished their current operations, and were refitted and refueled at Lorient. The same day, Doenitz revealed that *U-128* would also be refueled in Lorient and should be ready to sail in Operation *Paukenschlag* or "Drum-roll," the aptly named attack on shipping off the American coast (B.d.U. 1941:274-275; Hickam Jr. 1989:2). The addition of *U-128* to the list of submarines sailing in *Paukenschlag* gave Doenitz his final U-boat for the offensive against America. *U-66, U-109, U-123, U-125,* and *U-130,* were the other vessels chosen for the cross-Atlantic voyage. After much preparation, *U-125* left port on December 18 and *U-123* departed on December 23 as the two lead vessels in the fleet. *U-66* followed on Christmas Day, *U-109* and *U-130* left on December 27. To the chagrin of Doenitz, who already sent far fewer submarines than he wanted, *U-128* did not return for refueling until December 24 and could not join Operation *Paukenschlag* (B.d.U. 1941:271,279,281,282,284).

Following Doenitz's strict orders to stay out of sight as long as possible and to commence operations only after they received word to initiate hostilities, the submarines of Operation *Paukenschlag* began their voyage across the Atlantic to patrol American waters between the St. Lawrence and Cape Hatteras. The five U-boat commanders received orders halfway through the voyage that the commencement date of *Paukenschlag* was January 13, 1942, unless a particularly valuable Allied naval vessel or merchant vessel over 10,000 tons could be sunk during the voyage (Hickam Jr. 1989:4,8). At midnight, January 1, 1942, Kapitänleutnant Reinhard Hardegen, commander of *U-123,* noted in his Kriegstagebüch (KTB), the patrol diary of the U-boat arm, that it was the "[b]eginning of a new year in the North Atlantic" and that the "boat can look back on a successful year and we all go confidently into the new year in the hope of new successes, which will contribute to the end of the war" (Hardegen 1941-1942:4). It is unlikely that Hardegen could have predicted the extent of the "new successes" he would encounter along the American Coast.

On the night of January 11, Eastern War Time (EWT), (the morning of January 12 in German time) two days before *Paukenschlag* was to begin, Hardegen and the crew of *U-123* spotted a large steamer they believed belonged to the Holt Shipping Company and weighed over 10,000 gross tons. Figuring he was still some distance from American waters and probably would not alert American defenses to the incoming U-boats, Hardegen decided to attack. After planning his attack and getting his submarine into position, Hardegen fired a well-placed G7a torpedo from tube three that caught the merchant vessel just aft of its funnel. As the merchant vessel began settling by the stern, the radioman sent out a distress signal that said *Cyclops* of 9,076 gross tons was sinking and needed assistance. After it became apparent that the vessel would not immediately sink, Hardegen fired a *Coup de Grace* from 600 meters, which broke

Cyclops in half and sent it to the bottom. While the vessel was slightly lighter than the 10,000 gross tons Hardegen hoped for, a valuable target had been sunk nevertheless. Hardegen quickly fled the area and continued on course toward the American coast hopeful of arriving at his patrol area in time to commence Operation *Paukenschlag.* Unfortunately, for Hardegen, the attack on *Cyclops* put him behind schedule and another U-boat captain would be the first to draw blood in North American waters (Hardegen 1941-1942:10-12; Hickam Jr. 1989:8).

The early morning of December 13, according to the German time kept in the U-boats, found Korvettenkapitän Ernst Kals, commander of *U-130,* already following and plotting an attack on a merchant vessel in the waters off Newfoundland. Once ahead of the vessel, Kals set up his shot and attacked in "the first beat of the drum" (Kals 1941-1942:11). The torpedo, fired from tube one, struck *Frisco* after 72 seconds. The crew of *Frisco* quickly began sending distress messages, so Kals hurriedly fired a *Coup de Grace,* at the vessel he believed to be a 6,000 gross ton tanker, which set *Frisco* ablaze, and sped away. Just over eight-and-a-half hours later, *U-130* loosed another torpedo at a roughly 7,000 gross ton vessel. After 54 seconds, the torpedo stuck its target, causing the merchant ship stop moving and to list slightly to starboard. Realizing that the vessel would not sink, Kals decided to fire another torpedo.

While the torpedo was underway, the merchant vessel suddenly sprang back to life and began making headway, causing the torpedo to miss. Immediately, Kals set up for another shot and fired a *Coup de Grace* from tube 2. After 24 seconds, the torpedo stuck the merchant vessel between its bridge and funnel. Quickly the stern of the vessel rose out of the water and the entire ship slipped beneath the surface leaving a growing oil slick in the water. Satisfied with his second kill, Kals turned his submarine away, leaving another vessel, *Friar Rock,* on the bottom of the Atlantic (Kals 1941-1942:11-12). In the course of a day, Kals sank two merchant ships

without exposing his submarine to any danger, something Germany's U-boat arm had ceased to experience in waters throughout most of the rest of the world. Unfortunately, for Kals, he was somewhat rusty in his estimations of gross tonnage. It turned out the vessel *Frisco* that he believed to be of 6,000 gross tons was only 1,582 gross tons, and *Friar Rock* was only 5,427 gross tons (Lloyds Register of Shipping 1942-1943:FRI-FRO, 1942-1943:FRE-FRI). Although these first three attacks occurred in waters off Canada and not within boundaries of the United States' NANCF (Figure 3.1), US coastal waters would soon become the German stalking grounds (Freeman 1987:1).

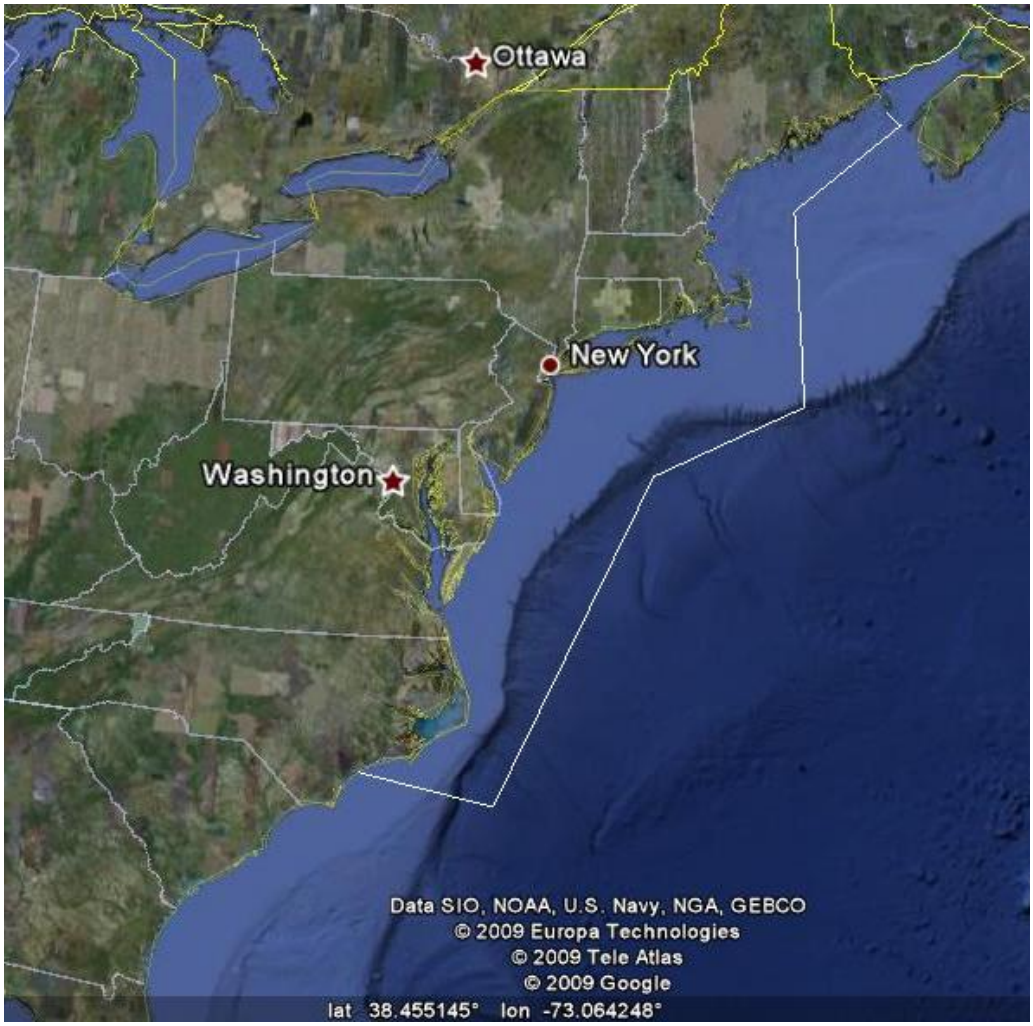

FIGURE 3.1. Initial Boundary Line of the North Atlantic Naval Coastal Frontier, Google Earth Image Adapted by Author from Coordinates Provided in the North Atlantic Naval Coastal Frontier War Diary (Freeman 1987:1).

Not to be outdone by Kals, Reinhard Hardegen quickly recovered the ground he lost attacking *Cyclops* and entered his patrol area off New York on January 14. Upon arriving off the coast, Hardegen was surprised to see lights coming from towns around Narragansett Bay and the Montauk Lighthouse beacon still brightly burning. Even more surprising, however, was the large tanker Hardegen spotted leaving port with its lights illuminated. Incredulous that the Americans were still acting as if they were not at war, Hardegen decided not to press his luck and to sink the tanker with a spread of two torpedoes. Unfortunately, for Hardegen, the first torpedo either missed the tanker or did not explode, and the second torpedo, despite exploding in a terrific column of fire and mushroom cloud of smoke, left the vessel afloat. Almost instantly, the crew of the merchant ship sent out a distress message on the 41-meter short-wave signal stating that they had been torpedoed or struck a mine and identifying the vessel as the 9,577 gross ton *Norness.*

Realizing the size of the vessel, Hardegen ordered another torpedo fired at the ship. Again, a tremendous flare and column of smoke rose skyward, but the hardy merchant vessel remained on an even keel. The crew of *U-123* fired yet a forth torpedo and after counting down the seconds could not believe their luck, there were no sounds of impact. Aghast at what was occurring, Hardegen noted that "[m]issing a stopped target is not possible. Now I have to sacrifice a fifth torpedo…" (Hardegen 1941-1942:12). The fifth torpedo quickly found its target and sent the stern of *Norness* to the bottom of the Atlantic, causing its bow to point 30 meters skyward, as an "interesting menace to navigation, which surely has to be dispersed by the Americans" (Hardegen 1941-1942:12-13). Early the next morning, German time, Hardegen proceeded closer to the New York coastline observing tugs and trawlers moving about with lights illuminated and could spot the lights inland continuing to burn. Soon he picked up a

distress message from the 4,113 gross ton *Dayrose* which was sinking off Cape Race, Canada, the victim of *U-552* which had recently entered Canadian waters separate from the *Paukenschlag* group (Hardegen 1941-1942:13-14; Hickam Jr. 1989:329).

By 0941 German Time or 0341 Eastern War Time (EWT) on December 15, Hardegen had found another target, this time the steamer *Coimbra*. The steamer's brightly lit lights helped Hardegen swing *123* into position for an attack. When the steamer was 800 meters distant, Hardegen ordered a G7e torpedo fired. Again, the torpedoes of *U-123* caused a dramatic display, lighting up the sky and silhouetting everything on the ocean in an explosion that made the *Norness* attack appear to be "mediocre fireworks" (Hardegen 1941-1942:14-15). A quick *Coup de Grace* was then fired, causing the vessel to sink by the stern and leaving the bow sticking out of the water much like *Norness*. Amused by his own handiwork, Hardegen noted, in his KTB for January 15 that "[t]hese are some pretty buoys we are leaving for the Yankees in the harbor approaches as replacement for the lightships" (Hardegen 1941-1942:15). Feeling that he had warned enough vessels of the dangers of travelling on the east/west shipping routes, Hardegen decided to move his submarine along the north/south routes off the New Jersey coast. Only once in this transition did Hardegen have to crash-dive for an aircraft that dropped four poorly aimed bombs, prompting Hardegen to claim that the "Yankees have much to learn" (Hardegen 1942:15).

All too eager to teach the Yankees some lessons, Hardegen continued his patrol close inshore along shipping routes running from Cape Hatteras to New York and Delaware Bay. Just before dawn on January 17, the crew of *U-123* spotted a freighter and decided to use their last loaded stern torpedo before heading out to deeper water to spend daylight hours on the ocean bottom and reload torpedoes. Although the freighter only had one lamp on its mast and was

travelling with darkened navigational lights the early morning glow made it an easy target for *123*. Hardegen cut across the vessel's bow 600 meters ahead of it and then waited until the freighter was directly astern before firing a torpedo. After nearly a minute, the torpedo struck and sent the vessel to the ocean bottom before smoke generated by the torpedo impact settled. Feeling confident about the lack of defenses in American waters, Hardegen decided to keep his submarine on the surface and head for waters further south where radio messages revealed more shipping crossed. After crash-diving five times to evade aircraft, *U-123* finally reached its destination. Soon after arriving, *U-123* was welcomed to the area by the sight of a giant fireball and the sounds of two of *U-66's* torpedoes striking the tanker *Allan Jackson* in the coastal waters that would become synonymous with U-boat attacks and the most dangerous waters in the world for merchant ships (Hardegen 1941-1942:16-18; Hickam Jr. 1989:11).

The North Carolina Hunting Grounds

After leaving port on Christmas Day, Korvettenkapitän Richard Zapp had taken his submarine *U-66* straight across the Atlantic, attempting to remain out of sight of any Allied vessels and not attacking any ships during his voyage. On January 9, Admiral Doenitz sent a message to all submarines involved in Operation *Paukenschlag* revealing patrol areas for each vessel. The grids given to Richard Zapp for his patrol included the waters along the North Carolina coast, particularly those around Cape Hatteras (B.d.U. 1942:11). These waters geographically presented submarines with great chances for success as "[h]undreds of ships used the wide, warm Gulf Stream that swerved near Cape Hatteras to sail north to the ports of North America and Europe. Southbound ships, not wanting to sail against the Gulf Stream or swing too far out into the open ocean, were forced near the jutting North Carolina Coast. It was a natural choke point" (Hickam Jr. 1989:11). Since arriving in his patrol area on January 13, Zapp

had remained quiet, not sinking any vessels and monitoring merchant vessel activity in his grids. The United States Navy was about to make his task of finding ships much easier, however. On January 17, the German B.d.U. intercepted an American radio message ordering steamers heading to northern ports to aim for Cape Hatteras, or as close inshore as they could safely navigate. The Americans had just routed northbound vessels into the waters where *U-66* lay waiting (B.d.U. 1942a:22).

The crew of *U-66* did not have to wait much longer for its first target to enter their patrol area. Early in the morning on January 18, the 6,635 gross ton *Allan Jackson,* loaded with 72,870 barrels of crude oil, passed 50 miles seaward of Cape Hatteras on a clear calm night. Since leaving Cartagena, Columbia, the master of *Allan Jackson* had not received any information about U-boats in American waters and continued to travel without zigzagging. Unfortunately, for the crew of *Allan Jackson,* this straight path of travel and the ships' speed of ten knots made it an easy and appealing target for the crew of *U-66*. After carefully planning his attack and exploiting the moonless night to get into position, Zapp unleashed his first two torpedoes of Operation *Paukenschlag.* Several seconds later, the first torpedo found its mark, striking *Allan Jackson* forward of the bridge on the starboard side. Before the crew of *Allan Jackson* could respond, the second of Zapp's torpedoes struck behind the deckhouse and broke the stricken merchant vessel in half, causing it to sink within five minutes as the first vessel sunk east of North Carolina. Unfortunately, it would not be the last sunk in these waters, as the lingering smoke and flames of *Allan Jackson* had already served as a beacon to guide *U-123* into the waters off Hatteras (Office of the Chief of Naval Operations [OCNO]:1942d; United States Coast Guard [USCG] 1944a:1; Hickam Jr. 1989:11-13).

Despite spotting several tankers that morning, Hardegen was not able to get *123* into position before daylight and decided to spend the day submerged and resume his hunt at nightfall. Coming to the surface on the night of January 18, Hardegen felt confident he could use his remaining torpedoes in the calm starlit conditions that greeted him and began taking his submarine back towards Cape Hatteras on a voyage of unprecedented destruction off the American Coast. Within three hours of beginning the evenings' patrol, Hardegen spotted the lights of another steamer and set up an attack. Before firing a torpedo, he spotted an additional three steamers he hoped he could catch after sinking his current target. Just after 2315 EWT, one of *U-123*'s torpedoes struck *Norvana* just aft of its funnel from close range. Almost immediately, *Norvana* plunged into the Atlantic stern first, taking its entire crew of 29 sailors to the bottom. The only evidence the United States Navy received suggesting *Norvana* had been sunk was a battered and empty lifeboat from the ship found at sea four days later. Hardegen, understanding that his duty was to sink Allied ships, did not stop to look for survivors and proceeded to follow the other three steamers at maximum speed. While tracking these three vessels, the crew of *123* spotted another vessel off their starboard side and decided to set up for an attack since they were already ahead of it. When it came closer, they discovered that it was a very small ship and decided not to waste one of their last three torpedoes on it. Although the other three steamers escaped, Hardegen learned a valuable lesson while following them. He discovered that the merchant vessels were navigating using the lighted buoys posted along the coast. Deciding to exploit this newly gained knowledge, he began following the buoys (Hardegen 1941-1942:19; USCG 1944q:1-2; Rohwer 1999:74).

Hardegen's discovery of the navigational buoys soon paid off as he found another target within a mere half hour of following the buoys. After following this vessel for almost three

hours, the crew of *U-123* set up for a shot and eased to within 250 meters of the merchant ship to avoid missing with the few remaining torpedoes. Hardegen ordered the torpedoes set to a running depth of two meters to prevent them from running into the bottom since the submarine was operating in a scant seven to eight meters, not nearly deep enough to crash dive. Once everything had been calibrated, Hardegen ordered one torpedo fired at 0309 EWT on January 19, and watched it jump out of the water twice and skim along the surface until it struck its target and exploded with such force that debris from the torpedo and the merchant ship *City of Atlanta* rained down on the submarine's deck. As Hardegen took his submarine on a "victory lap," *City of Atlanta* capsized to port and sank with its bow protruding out of the water. Spotting additional steamer lights on the horizon, Hardegen sped off to intercept them leaving *City of Atlanta* burning and three survivors, of the original crew of 49, clinging to wreckage for six hours until they were finally rescued (Hardegen 1941-1942:19; USCG 1944n:1-2).

Within a short amount of time, *U-123* caught up to the vessels on the horizon and the lights onshore backlighted the silhouettes of five different ships. Hardegen decided to save his torpedoes and to attack the lead vessel with his deck gun. After swinging his submarine into the wake of the tanker *Malay*, Hardegen ordered the tanker shelled just an hour and a half after *U-123* had claimed its last victim. After several successful hits on *Malay's* engine room, the tanker ceased progress and began to burn. Feeling the tanker had enough for the time being, Hardegen started chasing the other steamers in an attempt to sink them with his remaining two torpedoes. After two of these proved to be too fast for the submarine to catch, the crew of *U-123* intercepted a distress message from *Malay* revealing its size as 8,207 gross tons. Astounded that the vessel was actually that large, Hardegen decided to head back to it and finish it off with a *Coup de Grace.* Before turning back, however, Hardegen waited to destroy another merchant vessel that

he spotted heading his way. Since one of his engines was acting up because of a broken cooling hose, Hardegen had to get into position using only one engine.

Despite this problem, Hardegen still managed to loose a torpedo at 0600 EWT. The torpedo quickly travelled the 450 meters to *Ciltviara* and broke the vessel's back. Satisfied with yet another kill, Hardegen began to head back towards *Malay*, which had just radioed that it had put the onboard fire out and was operational again. Guessing the direction of the vessel, Hardegen proceeded at full speed until his crew could smell the burning tanker in the distance. As *Malay* came into sight, Hardegen also spotted *City of Delhi* entirely stopped as it recovered one of its lifeboats (Hardegen 1941-1942:19-22). Despite this being the easier target, Hardegen sped towards *Malay* noting that it "annoyed me that the tanker was underway again and I wanted to spoil his joy over it" (Hardegen 1941-1942:20). Soon the crew of *Malay* spotted *U-123* in the early morning light and attempted to outmaneuver the submarine.

At 0645 EWT, Hardegen fired his final torpedo and caught the fleeing tanker just ahead of the engine room telling it to "[b]lame yourself for sending a hasty report of about [sic] being operational" (Hardegen 1941-1942:21). Certain that he destroyed the tanker, Hardegen proceeded to deeper waters before the morning became too bright. Soon, however, the men aboard the 16,966 gross ton *Kosmos II* spotted the submarine on the surface and thinking it was damaged attempted to ram it. Hardegen, wishing that he had torpedoes remaining, decided it best to outrun the merchant ship since both engines were operational again and he needed to enter deeper waters where he could crash dive in the event his submarine was spotted by an aircraft.

While *Malay* never did sink, Hardegen nevertheless delivered a hefty blow to merchant shipping along the Eastern Seaboard and quickly reported his success to Doenitz who replied

with the message, "To the Paukenschläger *Hardegen*. Bravo! Very well drummed" (Hardegen 1941-1942:22; Hickam Jr. 1989:16-17). On January 24, Hardegen received another message from B.d.U., revealing that he would receive the Knight's Cross for his patrol and in a ceremony that took place within *123's* control room, Hardegen's crew presented him with a temporary medal made by the crew. Emboldened by his success and the prestige given him, Hardegen sank two more vessels with gunfire alone while crossing the Atlantic and speeding for a homeport to receive his actual Knight's Cross (Hardegen 1941-1942:24-29). Although Hardegen immediately expressed regret that the attack on the American Coast had to be conducted with so few U-boats, he hoped that the other *Paukenschlag* U-boats still in American waters were having as much success as his crew and submarine had.

Hardegen did not need to wish for success for his fellow U-boatmen too hard, as they were finding similar unchallenging conditions all along the American Coast. Just over an hour before Hardegen sunk *City of Atlanta,* Zapp struck again, sending the Canadian Passenger Liner *Lady Hawkins* to the bottom. Of the approximately 300 *Lady Hawkins* passengers and crew members who entered the water that morning of January 19, only 71 were rescued on January 28 (Freeman 1987:34,40; Hickam Jr. 1989:13). On January 22, Zapp most likely sent the 5,335 gross ton *Olympic* to the bottom with two stern fired torpedoes. *Olympic* disappeared without a trace but was travelling from Curacao to Baltimore and likely crossing the area Zapp was patrolling when he reported firing two torpedoes and that the targeted "Steamer breaks apart midships and sinks within one minute" (Hickam Jr. 1989:19; Rowher 1999:74). Late the next evening, EWT, Zapp finished his *Paukenschlag* patrol with his own dramatic finale. Taking his submarine on patrol a few miles southeast of the Diamond Shoals Light Buoy, Zapp managed to place his vessel in the path of two northbound merchant vessels, one the 8,017 gross ton *Venore,*

and the other the 8,139 gross ton *Empire Gem* (Lloyd's Register 1941-1942:VEN, 1942-1943:EMP).

As *Venore* approached the Diamond Shoals Light Buoy, *Empire Gem,* which had been visible astern since noon, continued to gain on *Venore* until it was only a mile or two astern. Seizing the opportunity to catch two ships travelling close together, Zapp acted quickly and fired at *Empire Gem. U-66*'s torpedoes struck *Empire Gem* and set it ablaze. Feeling the shock aboard *Venore* and spotting the other merchant vessel burning, the crew of *Venore* began to panic. Without permission, the crew, some of whom had seen the submarine motor past the burning *Empire Gem,* began to ready the lifeboats while the captain radioed the engine room for more speed. When one of *U-66's* torpedoes struck *Venore,* any remaining semblance of composure left the crew. One member jumped off the stern of the merchant vessel, while three lifeboats where launched. Since the vessel was travelling at a speed of over ten knots, two of the lifeboats were destroyed once they touched the water and the other barely managed to escape with two crewmembers aboard. Shortly after, another of *U-66's* torpedoes caught *Venore*'s number nine ballast tank and severely rocked the vessel. Quickly the vessel's engines were cut and the remainder of the crew began abandoning ship, leaving the *Venore* in a sinking condition. Satisfied with his kills, Zapp took his submarine to deeper waters to prepare for the return voyage to France, leaving two more merchant vessel hulks littering the ocean bottom off North Carolina (OCNO 1942a; USCG 1944s:1-2; Freeman 1987:16-19; Hickam Jr. 1989:19-21).

Both *U-109* and *U-130* also recorded more kills along the American coast before they ended their patrols. *U-109,* after being plagued with a faulty gyrocompass, poor weather, and six torpedo misses, finally claimed its first success on January 23 when it sank *Thirlby. U-109* struck again on the last day of the month sending *Tacoma Star* to the bottom. With its American

coastal patrol over, *U-109* began its trip back across the ocean, sinking *Montrolite* and *Halcyon* on the way (Bleichrodt 1941-1942:1-36; Freeman 1989:329-330; Rohwer 1999:76-77). *U-130,* which had not had any success in northern waters after January 13, began moving south along the East Coast and sank *Alexandra Höegh* on January 21, *Veranger* on January 25, and *Francis E. Powell* on January 27 (Kals 1941-1942:19,22,23; Hickam Jr. 1989:22,329). While none of these attacks occurred in North Carolina waters, some believe *U-130* also attacked *Halo* with its deck gun off Diamond Shoals on January 27 (Hickam Jr. 1989:22,329; Rohwer 1999:76). This seems extraordinarily unlikely, however, as Kals KTB for the same day does not record an attack with the submarine's deck gun. Furthermore, the KTB states that Kals was in a different grid than the attack occurred and had grounded his boat at a depth of 52 meters to avoid two surface vessels with Asdic during the entire duration of the attack (Kals 1941-1942:24). While the attack on *Halo* remains a mystery, the final *Paukenschlag* U-boat, *U-125,* definitively sank its only victim in waters east of North Carolina on January 26.

Despite Doenitz ordering Kapitänleutnant Ulrich Folkers *U-125* into Grid CA, which included the heavily travelled waters off North Carolina, *U-125* had not sunk any Allied vessels by January 22 (B.d.U. 1942:11,29). Upset that he had not destroyed any ships, despite firing six torpedoes at potential targets, Folkers radioed that he was going to patrol further south in Grid DC in hopes of finding new targets. Before reaching the DC grid, however, Folkers stumbled upon dense southbound shipping traffic in grids CA 58 through CA 88 (B.d.U. 1942:38). Despite reporting that *U-125* had three bow torpedo tubes out of order and an empty stern tube, Folkers managed to attack a stopped tanker, *Olney* on January 25 with two torpedoes. One torpedo was a dud, but Folkers radioed that the detonation of the other torpedo could be heard aboard *125* and counted the attack successful. Unfortunately for Folkers, the crew of *Olney*

reported being attacked by a submarine, but sustaining no damage to their ship (B.d.U. 1942a:38; Rohwer 1999:76). Possibly gaining a boost of confidence from this attack, Folkers managed to get his submarine into position for another attack four minutes after midnight, EWT, on January 26. The outcome of this attack was not in question, as the crew of *U-125* watched *West Notus* slip beneath the waves, and reported to B.d.U. "Sank a 7000 ton freighter in CA 8797 on 26 January" (B.d.U. 1942a:38; Hickam Jr. 1989:22). Unfortunately, for the crew of *West Notus*, their ship was reported as lost somewhere in the Caribbean during the month of February, long after survivors of the attack perished just miles off the coast of North Carolina (Coman Jr. and Gibbs 1949:317; Rohwer 1999:76). On January 28, Folkers received orders to return to port and began his trek across the Atlantic (B.d.U. 1942a:40).

Although the *Paukenschlag* boats began heading to their homeports after their extraordinary success, the American coast would not receive any respite from the U-boat onslaught. Just one day after *Paukenschlag* officially began, additional smaller U-boats began arriving off the Canadian coast to continue the attacks begun with *Paukenschlag*. As soon as reports of operation *Paukenschlag* reached Doenitz, however, the primary American hunting grounds were shifted to the waters off North Carolina. It did not take much to convince Doenitz to make these waters the primary patrol areas for his U-boat fleet since both the Germans and the Americans already recognized that the attacks of Hardegen and Zapp exposed the most productive waters along the American East coast. The primary battleground off the American Coast had been set in the waters off North Carolina, an area that "was starting to be called a new name by the freighter and tanker crews: Torpedo Junction" (Hickam Jr. 1989:22).

The NANCF made no pretense of the fact that the waters off Cape Hatteras were already becoming a hotspot for U-boat activity. The numbers of vessels sunk in these waters alone was certainly a cause for concern. In the War Diary of the NANCF, the Frontier revealed,

> The sinking of the *Norness* was the signal for the opening of an unprecedented submarine attack upon the merchant shipping in the coastal waters. In the remaining 17 days of the month, 13 vessels were lost through enemy action. The worst day of all was the 19th, when three ships went down off Cape Hatteras. This area, where the land reaches out almost to the 100-fathom curve, proved to be a favorite hunting ground for the U-boats. The losses in these waters during the month were six vessels, almost half the total for the whole Frontier (Freeman 1989:21).

If the NANCF had known that *West Notus* was sunk east of Hatteras, the total number of ships lost in these waters would have been exactly half of all ships lost within Frontier waters. Unfortunately, just recognizing the most dangerous area for shipping would not stop the U-boat offensive. This was especially the case as Hardegen returned from his patrol and presented his report to B.d.U. on February 8, touting opportunities available to U-boats off Hatteras.

The B.d.U. summarized Hardegen's patrol stating that, "The expectation of encountering many independently routed ships, clumsy handling of ships, slight, inexperienced sea and air patrols and defenses was so truly fulfilled that conditions had to be described as almost completely of peacetime standards" (B.d.U. 1942:67). Hardegen "found such an abundance of opportunities for attack in the sea area south of New York to Cape Hatteras that he could not possibly utilize them all: At times there were as many as 10 ships in sight that were sailing with lights on peacetime courses" (B.d.U. 1942:67). If the promising reports of Hardegen were not enough to reinforce Doenitz decision to keep sending U-boats to the coast of North Carolina, the additional merchant ships already being sunk off the Carolina coast certainly were.

On February 3, *U-106's* Kapitänleutnant, Hermann Rasch, reported heavy ship movements off Norfolk and Cape Hatteras, and that, despite many ships now travelling darkened

and zigzagging sharply, he managed to destroy three of them. One of those, the 15,355 gross ton Swedish vessel *Amerikaland*, which was "one of the largest and fastest freighters in the world," was sunk on the night of February second in the waters off Hatteras (Lloyds Register of Shipping 1942-1943:AME-AMM; Hickam Jr. 1989:31). Before all survivors of *Amerikaland* had been recovered or the United States Navy even announced the sinking, Rasch's message relating his successes around Hatteras began drawing additional U-boats to this area. As Rasch took *U-106* away from America, having utilized all his torpedoes since he had missed targets with five of them and had three dud torpedoes, *U-107* and *U-108* came to take his place (B.d.U. 1942:53-54; *New York Herald Tribune* 1942a; Hickam Jr. 1989:31-32, 330).

On February 6, Oberleutnant zur See Harald Gelhaus and *U-107* moved into the waters off North Carolina and sent *Major Wheeler* to the bottom without a trace. As late as February 17, representatives of the Baltimore Insular Line, which *Major Wheeler* operated through, were still attempting to discover whether the United States Navy knew the fate of the ship (Kiggins 1942). Unfortunately, for the Baltimore Insular Line, and United States Navy, the crew of *U-107* would take the whereabouts of the ship with them back across the Atlantic on February 15 (B.d.U. 1942:77). Soon after Gelhaus destroyed *Major Wheeler,* Korvettenkapitän Klaus Scholtz, in *U-108*, moved into the area around Hatteras, and sank *Ocean Venture* on February 8, *Tolosa* on February 9, and *Blink* on February 11 (B.d.U. 1942:65; Hickam Jr. 1989:39, 330). The crew of *Tolosa* would never be heard from again, and only six of *Blink's* 30-man crew would survive after spending 66 hours in a lifeboat watching 17 of their crew pass away from exhaustion and exposure. Three additional members of the crew died in the torpedo blasts and four other survivors vanished from sight after boarding a life raft (*New York Herald Tribune* 1942b; Hickam Jr. 1989:39).

On February 14, *U-432* torpedoed and sunk the neutral passenger-cargo ship *Buarque* off Currituck Inlet, marking the first act of aggression towards a Brazilian ship by a German submarine in World War II and the first vessel sunk by a type VII U-boat in American waters. While only two passengers of the 83 people aboard perished in the attack, the event sparked such outrage amongst Brazil's leaders that the sinking was not immediately announced. Since it was Carnival time, officials feared the public might riot and destroy the property of German nationals in Brazil. When *Buarque* survivors finally landed at Norfolk, many women refused photographs until they could apply makeup to disguise the effects of seasickness, and a five-year-old boy named Freddie Ferreira even declined a jelly desert because he said it reminded him of the ocean waves (*Christian Science Monitor* 1942; *New York Times* 1942a; Lenton 1967:85; Hickam Jr. 1989:42). Despite the passengers scare, they were finally on solid ground and could seek respite from the ravages of the sea.

Unbeknownst to the NANCF, which had just been renamed the Eastern Sea Frontier (ESF) on February 6, and the merchant ships sailing around Hatteras, they were also about to get a brief respite from the U-boat onslaught as the next wave of submarines were just leaving or preparing to leave their home ports in France. After the sinking of *Buarque* on February 14, the next attacks off North Carolina did not occur until February 27 and 28, when *Marore* and *Leif* were sent to the bottom. *Marore* was destroyed by *U-432* which was still operating off the American Coast and just reentered the waters of North Carolina, and *Leif* was sunk by *U-653* another type VII U-boat that had just been given operational freedom to operate off the American coast on February 16 (B.d.U. 1942:79,101-102,121; Lenton 1967:124; Freeman 1987: 43; Hickam Jr. 1989:330). These two events helped the ESF realize that the brief respite only

occurred because German submarines were crossing the Atlantic and the incoming U-boats would resume the battle with full vigor.

In an unexpected turn of events, however, these two attacks did not quite mark the beginning of renewed aggression off the North Carolina coast. The next major wave of U-boats would not begin their attacks until March 7 when *U-155* torpedoed and sunk another Brazilian vessel, *Arabutan.* Fortunately, for the crew of *Arabutan,* only one member of the crew, who was asleep in his bunk, perished in the attack. The rest of the crew abandoned the stricken ship in an orderly fashion, undoubtedly led by Elyseu Propheta Nascimento who had seen this entire scenario played out less than a month before when he was a crew member aboard *Buarque* (*New York Times* 1942b:5). As Nascimento sat in Norfolk shaking his head in disbelief at his terrible streak of luck, several additional U-boat commanders were steering their vessels toward North Carolina, destined to litter the ocean floor with the hulks of merchant ships and the bodies of their crews in a streak of attacks more severe than any the ESF had previously witnessed. After the initial attack on March 7, "the submarines maintained the most severe attack yet felt on this coast. In the course of 14 days, 21 ships were sent to the bottom" (Freeman 1987:94). Fifteen were lost in North Carolina waters and another two were damaged (Freeman 1987:127; Hickam Jr. 1989:331-332). The most activity occurred when "[e]ight vessels, almost onethird [sic] of the total for the month, were destroyed in the three days from the 16th through the 18th. After that the velocity of the sinking rate diminished, but as the month ended, vessels were going down at an average of one a day" (Freeman 1987:94). This month the successful German submarine commanders were Kapitänleutnant Erwin Rostin in *U-158,* Kapitänleutnant Johannes Liebe in *U-332,* Kapitänleutnant Johann Mohr in *U-124,* Kapitänleutnant Walter Flachsenberg in *U-71,*

Kapitänleutnant Reinhard Hardegen in *U-123*, Oberleutnant zur See Georg Lassen in *U-160*, and Heinrich Schuch in *U-105* (Hickam Jr. 1989:331-332; Rohwer 1999:84-87).

Erwin Rostin started the string of carnage by sinking the 2,609 gross-ton *Caribsea*, which he mistook for a coastal patrol vessel, on March 11, and the 11,641 gross-ton *John D. Gill* on March 12. Of *Caribsea's* 28 crew members, 21 would not survive the sinking and another 23 of the 49 men aboard *John D. Gill* would perish at sea (B.d.U. 1942:129-130; OCNO 1942f; USCG 1944h:1,2; USCG 1944m:1,2). Rostin would strike again on March 14, severely damaging the 7,118 gross-ton *Olean* with two torpedoes, and once more on March 15, this time destroying the 6,952 gross-ton *Ario* with one torpedo and approximately 20 shells from *U-158's* deck gun. Fortunately, for the crews of both vessels, the casualty rates aboard each were slightly less, with six of the 42 men aboard *Olean* dying in the attack and another eight of the 34 men aboard *Ario* losing their lives (USCG 1944b:1,2; USCG 1944j:1,2). After Rostin destroyed *Ario*, he sent the report of his accomplishments back to B.d.U. and began his transatlantic voyage. The message must have taken Doenitz aback slightly as Rostin reported that the Cape Hatteras Lighthouse was operating like it was peacetime and that the enemy surface and aerial patrols off the coast of North Carolina were virtually nonexistent (B.d.U. 1942:129). This was still the case on March 16, when Johann Mohr brought *U-124* into North Carolina waters destined to become one of the most successful U-boat captains to operate in that zone.

Before arriving off the American coast, Mohr had sunk one merchant ship, *British Resource*, on March 14 north of Bermuda. Once Mohr entered the fruitful waters off North Carolina, however, he continued to attack with an intensity that the U-boat high command had not witnessed since Hardegen first arrived off the American coast during Operation *Paukenschlag* and turned the waters around his submarine into a veritable killing field. In a

quick streak of attacks, Mohr would sink most of the ships the ESF reported lost between March 16 and 18. On the night of March 16, the crew of *U-124* spotted a vessel travelling off Hatteras entirely blacked out and decided to set up for a shot. After getting into position, *124* loosed one torpedo, which struck the Honduran vessel *Ceiba* on the port side beneath the bridge. Within three minutes, the ship had listed over and sunk, leaving those passengers lucky enough to get into life rafts afloat at sea. Shortly after, the submarine surfaced in the middle of the life rafts and an officer aboard *U-124* began questioning the survivors as to the name and tonnage of the vessel they had sunk. Once they received an answer that did not match the actual gross-tonnage of the vessel that the Germans had recorded in their register books, the submarine officer corrected the survivors, informing them of the actual size of their ship. Upon finding out that *Ceiba* was merely carrying bananas and had women and children aboard, the U-boatmen appeared surprised and left the scene. Sadly, those aboard *Ceiba* would not be discovered until March 18, at which point only six survivors remained of the 38 crewmembers and 12 passengers originally aboard. Before the Destroyer *Hambleton* managed to recover the survivors, Mohr struck again (B.d.U. 1942:139-140; OCNO 1942g; Freeman 1987:146).

On the evening of March 17, the crew of *U-124* spotted a group of southbound merchant vessels passing the Diamond Shoals Buoy and attacked. At 1750 EWT, one of *U-124*'s torpedoes slammed into the stern of the American Tanker *Acme* killing 11 and causing extensive structural damage to the vessel but leaving it afloat. As the captain of *Acme* told the rest of his crew to stand by the lifeboats, two airplanes flew by and dropped at least one depth charge where they believed the U-boat launched its attacked. Then the Destroyer *Dickerson,* which was in the vicinity, spotted a periscope and carried out an attack. *U-124* escaped unscathed, however, and as the USCG Cutter *Dione* and the navy tug *Umpqua* proceeded towards *Acme* to rescue its crew

and tow the vessel to port, the crew of *124* was busy preparing for another attack. Mohr swung his submarine around after attacking *Acme* and lined up a shot on the Greek vessel *Kassandra Louloudis,* heading south behind *Acme.* At 1915 EWT, Mohr sent another torpedo streaking through the waters of the Diamond Shoals. This torpedo ran its course and connected with the Greek ship. This time, however, the vessel would not remain afloat and sank with three masts and two stacks showing. The crew of *Dione,* who had just finished recovering the survivors of *Acme*, brought their small cutter toward where *Kassandra Louloudis* had just been sunk. In a stroke of good fortune, the men aboard *Dione* found the entire crew of the Greek vessel alive. After recovering the 20 survivors of *Acme* and the 35 crewmembers of *Kassandra Louloudis,* the crowded Coast Guard cutter made its way towards Norfolk to put them ashore (Navy Department Division of Naval Intelligence 1942:Table B; OCNO 1942h; USCG 1942, 1955; Freeman 1897:144,146). Mohr, on the other hand, still had torpedoes to use before turning to port and he intended to utilize them.

An hour and a half past midnight on March 18, the crew of *U-124* spotted another tanker 22 miles southwest of the Diamond Shoals Buoy. This vessel was the 9,647 gross-ton *E.M. Clark* carrying 118,000 barrels of heating oil destined for New York. Utilizing squally conditions, Mohr managed to bring *124* close to *E.M. Clark* and fired one torpedo into the tanker's port side, which buckled the deck and brought down the foremast and radio equipment. While the crew of *Clark* attempted to rig an emergency radio, another of Mohr's torpedoes ripped through the stricken vessel, sinking it in ten minutes and ensuring its cargo would never reach New York (OCNO 1942c:7, 1942e; USCG 1944f:1,2). By the night of March 18, EWT, Mohr had travelled south of Cape Lookout and found two more tankers. Hardly able to believe his luck, Mohr fired two torpedoes into the tanker *Papoose* at 2235 EWT, and another two into

the tanker *W.E. Hutton* at 2310 EWT. Both tanker crews quickly abandoned their vessels and left them afloat. *W.E. Hutton* would sink an hour and five minutes after it was attacked, but *Papoose* would continue to drift for two days before finally sinking (USCG 1944k:1,2, 1944l:1,2; Freeman 1987:145,146). Despite having already established himself as one of the most successful U-boatmen to operate off the American Coast, Mohr still had four more torpedoes and plenty of fuel.

While Mohr did not sink any vessels on March 19 and March 20, this was beneficial since he saved his remaining torpedoes for three fully loaded tankers. Two of these torpedoes were used 15 minutes after midnight on March 21, when Mohr attacked *Esso Nashville* laden with 106,720 barrels of fuel oil. The first torpedo struck just aft of the bow causing little damage, but the second torpedo struck just aft of amidships and broke the vessel in half, causing the entire crew to abandon the ship. The bow of *Nashville* ultimately sank, but the stern was towed into port, fitted to another vessel, and put back into service. The crew of *124* was unaware of this, however, and counted the vessel as a total loss before speeding off to severely damage the 11,355 gross-ton *Atlantic Sun* a couple of hours later. Had Mohr realized the tanker was loaded with 156,840 barrels of crude oil, he may have used his final torpedo to ensure that the tanker sank, but for whatever unknown reason, Mohr decided to save that torpedo for another day and another vessel. That unfortunate vessel, the 5,342 gross-ton *Naeco,* would come into the crew of *124*'s sight early on the morning of March 23. In a virtually perfect attack, Mohr sent his final torpedo into the port side of *Naeco,* just aft of amidships. The blast of the torpedo ruptured the tanker's deck, ignited its cargo of 72,000 barrels of kerosene, and broke it in half. Unlike *Esso Nashville*, however, *Naeco* would not be salvaged and the crew would not escape without casualties as 24 of the 38 men aboard perished in the oil fire or from drowning after

jumping overboard (B.d.U. 1942a:139-140; USCG 1944c:1,2, 1944g:1,2, 1944i:1,2). Mohr utilized his final torpedo in this attack, having fired all that his submarine carried with devastating results in an astonishing nine days. As soon as he could, Mohr radioed B.d.U. his successes in his now-famous verse:

> The new moon-night is black as ink.
> Off Hatteras the tankers sink.
> While sadly Roosevelt counts the score.
> Some fifty thousand tons – by Mohr. (Miller 1996:295)

Mohr's success earned him the Knights Cross and made him one of the most successful U-boat commanders in American waters. This sortie also allowed him to join Erwin Rostin as one of the German heroes for the month of March.

Although Mohr and Rostin certainly were the most successful U-boat commanders off the American coast during March, they were not the only successful commanders. On March 16, at about 1400 EWT, *U-332* torpedoed and sank the 11,728 gross-ton *Australia* laden with 110,000 barrels of fuel oil destined for New York, and at 1015 EWT on March 19, *U-332* torpedoed and sank *Liberator* carrying 11,000 tons of sulfur (USCG 1944d:1,2, 1944p:1,2). The sinking of *Liberator* was an unfortunate event since the entire attack might never have occurred had the gun crew of *Liberator* not fired upon a vessel they identified as a submarine at 0220 EWT the morning of March 19. With a couple well-placed shots from *Liberator's* four-inch gun, the gunners managed to score two hits on the vessel they believed to be a submarine and claimed they saw it roll over. Unfortunately, for the crew aboard the USS *Dickerson*, the well-aimed shots were directed at their vessel, which had been zigzagging and following *Liberator* northward (COMINCH 1942:4; Freeman 1987:103-104). One shell "entered the chart house where it detonated. As it exploded it killed a seaman outright and inflicted mortal wounds upon the Commanding Officer, the sound operator, and the radar operator all of whom were in the

charthouse" (Freeman 1987:104). Severely damaged, *Dickerson* headed towards Norfolk for repairs, and the Captain died just minutes before reaching port and hearing that *Liberator* had been torpedoed and sunk just a few hours earlier (Freeman 1987:104). Losing one of the few destroyers the ESF had to an attack by a merchant ship was not something the Frontier could afford as additional U-boats were still moving into the area.

On March 20, *U-71* torpedoed *Oakmar* just outside waters patrolled by the ESF, then moved into the zone off Diamond Shoals where *Dickerson* would have been patrolling had *Liberator* not damaged it. The absence of this patrol vessel allowed Kapitänleutnant Walter Flachsenberg to bring *U-71* close to Diamond Shoals during daylight hours on March 26 and to sink *Dixie Arrow*, carrying 86,136 barrels of crude oil, with three torpedoes (USCG 1944e:1,2, 1944r:1,2; Freeman 1987:148,154,478). That night, one of the ESF's old enemies, Reinhard Hardegen, made his presence back in American waters known, by sinking the American decoy ship USS *Atik*, ex-name *Carolyn*, somewhere off North Carolina in a strange series of events that the US Navy would only learn about through German radio broadcasts and by recovering Hardegen's KTBs after the conclusion of the war.

Upon arriving off the American coast, Hardegen approached a merchant ship generating lots of steam and with the name *Carolyn* written on it. After thinking the amount of steam being produced looked suspicious, Hardegen decided to write it off as being overcautious and attacked the vessel with one torpedo, causing the ship to settle with a list to port. As the crew aboard the torpedoed ship started launching a lifeboat, the merchant vessel turned towards the submarine and began to close the distance between the two vessels. As Hardegen immediately turned his submarine away, he witnessed the crew of *Carolyn* dropping tarps and covers to reveal several guns that quickly opened fire. Fortunately, for Hardegen, the shells from the deck guns missed,

but 20-mm machine gun bullets began strafing his deck mortally wounding a crewmember as a "20 mm round detonated in his right thigh, ripped open the flesh from the hip joint to the knee and partially removed it. One could not see if the bone had been shattered. The leg was only hanging on small flaps of skin" (Hardegen 1942:9-12).

As the U-boat continued turning away, it was obscured by *Carolyn's* smoke. Suddenly, however, the U-boatmen witnessed several large objects flying through the air towards their submarine. As these settled into the water, large geysers showered the U-boat. Quickly Hardegen realized his mistake, *Carolyn* was firing depth charges out of launchers and he was still on the surface. After running a quick pressure check, Hardegen crash-dove and got a safe distance away. Once composure had been regained aboard *U-123,* Hardegen returned to *Carolyn* and fired a *Coup de Grace* at the submarine decoy, which sent the vessel to the bottom of the Atlantic. As *Carolyn* sank heavy detonations were heard within the submarine, possibly from the *Carolyn's* exploding boilers or depth charges that remained aboard the stricken ship (Hardegen 1942:9-12; Navy Department 1946:1,2). If the explosions were caused by armed depth charges detonating as the ship sank, this may explain why none of the navy sailors aboard *Atik* were ever seen again (Hickam Jr. 1989:117). When Hardegen made his report of this sinking to Doenitz, Doenitz must have been mystified since he had reprimanded some inexperienced U-boatmen earlier in the month for making claims that the United States was using submarine decoy ships. Doenitz knew that most of these claims were just from inexperienced crews blaming their lack of success on merchant ships behaving strangely instead of on their own inability to fire torpedoes. After all, Doenitz reasoned that, "It is scarcely to be expected that the enemy who is so short of shipping should employ vessels which must be valuable to him as submarine decoy ships, especially so as the chances of success for these craft

in this war have shown themselves to be very small" (B.d.U. 1942:123). Now that a seasoned officer like Hardegen had confirmed the use of decoy ships, the U-boats would have to remain cautious. If these decoy ships were the best idea the Americans could muster to counter the U-boats this late in March, however, future prospects for the Germans in American waters looked promising.

This assumption was further confirmed at the end of March as Georg Lassen brought *U-160* into North Carolina waters and sank *Equipoise* on March 26 and the American passenger-freighter *City of New York* on March 29, and *U-105* destroyed the Norwegian tanker *Svenør* 300 miles east of Hatteras (USCG 1944o:1,2; Freeman 1987:209). Unfortunately, for the ESF, as March ended, April did not look any more promising because there was no lull in U-boat activity towards the end of the month, as was the case in previous months.

In the waters around Hatteras, now the preferred hunting grounds for German submarines, the tempo of attacks remained constant for the entire month of April. The ESF could do little but admit they had been severely defeated once again. Their summary of the month was quite bleak:

> April was almost an exact repetition of March. Twenty-four vessels, a total of 138,121 tons, were sunk in the last 30 days. Thus, once again, the ESF was the most dangerous area for merchant shipping in the entire world. Of the 73 ships sunk by U-boats in April, 33% went down in the Frontier. Seventeen, or 23% of the world total, were lost in the Mid-Atlantic area, the second largest theater of U-boat activity. The remaining 33 sinkings were scattered fairly evenly over the face of the oceans (Freeman 1987:166).

The only difference between this month and previous months within the ESF was that not one individual U-boat captain turned the waters of North Carolina into his personal stage of devastation, but that many different commanders, sank merchant vessels. The German list of successes for North Carolina alone was atrocious, reading: *U-84* – one ship sunk; *U-109* – one ship sunk; *U-123* – one vessel sunk, one damaged; *U-136* – one ship damaged; *U-160* – three

vessels sunk, one damaged; *U-201* – one ship sunk; *U-203* – two ships sunk, two damaged; *U-402* – one ship sunk; *U-552* – five ships sunk; *U-571* – two ships sunk; *U-572* – two ships sunk, one damaged; *U-654* – two ships sunk; *U-754* – two ships sunk (Hickam Jr. 1989:332-333; Rohwer 1999:88-92). As distress calls from merchant vessels continued to clutter airwaves off the coast for the first two weeks in April, the ESF appeared to have very little to look forward to for the remainder of the month. About the only positive thing that had occurred in Frontier waters during these first two weeks happened after *U-160* sunk the British passenger liner *Ulysses* with three torpedoes on April 11.

After leaving Panama destined for Halifax, *Ulysses* was damaged in a collision with another ship in the Florida Straits. Since *Ulysses* was not able to travel at full speed, the Commander-in-Chief of the Atlantic and West Indies provided the master with a safer route to follow towards Halifax. The master ignored these routing instructions, however, and took his damaged vessel straight up the coast towards Norfolk without notifying any naval office. This prevented the ESF from providing aerial or surface support for the vessel as it traversed the dangerous waters off North Carolina and placed *Ulysses* right in the path of *U-160*. Quickly, Lassen ordered three torpedoes fired at the 14,647 gross-ton ship, which sank it in thirty minutes. Fortunately, the crew of *Ulysses* was able to send a distress call with their location, which was received and checked by a B-17 aircraft. After finding lifeboats in the water, the B-17 directed the destroyer *Manley* to the site of the sinking. What awaited the crew of *Manley* must have astounded them. Loaded into ten lifeboats were all 290 passengers and crewmembers of *Ulysses* only one of whom sustained an injury (Lloyds Register of Shipping 1942-1943:ULS-UMT; Sixth Naval District Public Relations Office 1942:1-7; Freeman 1987:193-194,219). Everyone aboard *Ulysses* was fortunate, but the event greatly aggravated the ESF who knew that it was hard

enough to protect merchant vessels whose whereabouts they knew, but to protect merchant vessels that were not sailing on prescribed shipping routes was virtually impossible. They also knew that not every merchant crew would be lucky enough to send out a distress signal with locations provided and that something needed to change. The ESF needed to win this battle raging just miles off the coast of America, and for that, they would almost need a miracle.

The ESF never could have predicted that that "miracle" would appear just three days later on April 14, in the form of two radio messages, the likes of which had not been heard before in the Frontier. Both messages came from the destroyer USS *Roper*. The first proclaimed, "At 0345 Roper (DD) reports she sighted sub on surface in 35-55 N., 75-13 W. Engaged with gunfire. Sub crew abandoned ship and sub apparently sank. Made two runs dropping DC's. Will stand by until daylight and endeavor to pick up survivors" (ESF 1942b:Serial #84,Appendix VII). The second message, received after daylight, stated, "ROPER picked up 29 bodies including 2 officers from sub she attacked at 35-55 N., 75-13 W. at 0130 April 14. Hull in 20 fathoms. Divers to investigate" (ESF 1942b:Serial #85,Appendix VII). By April 18, it was official, a navy diver had discovered the wreckage of the German submarine, identified as *U-85* through personal effects found on the bodies of the crew, lying on the ocean bottom just miles out of Oregon Inlet. As the details began to pour in, the ESF was able to reconstruct the events of *Roper*'s attack on *U-85*. Early in the morning on April 14, the radar aboard *Roper* picked up a contact approximately 2,700 yards away. Very shortly afterwards, the sound operator picked up the sounds of rapidly turning propellers in the same direction. As *Roper* began to move towards the contact, one of the lookouts spotted a small wake in the distance running away from *Roper*. The speed aboard the destroyer was then increased to 20 knots and a pursuit began.

As the distance between the vessels began to decrease, the unknown vessel turned sharply to port. In anticipation of a possible stern fired torpedo, the crew of *Roper* kept the destroyer slightly to the starboard side of the fleeing vessel. When the distance between vessels had been reduced to 700 yards, the wake of a torpedo was seen heading towards *Roper*. It quickly passed by the port side of *Roper* and vanished. The fleeing vessel then cut sharply to starboard and was illuminated by the searchlight aboard *Roper*. Immediately, the crew of *Roper* recognized it as a submarine now only 300 yards ahead. Almost instantaneously, gun crews aboard the destroyer opened fire with machine guns, mowing down the German sailors as they attempted to operate their guns. Soon after, fire was brought to bear with one of *Roper's* three-inch deck guns. The range was quickly found and one of the three-inch shells struck the submarine's conning tower (Figure 3.2). The crew of *Roper* then watched the submarine sink, leaving about 40 members of its crew swimming on the surface. Fearing a trap, the crew of *Roper* sped through the survivors floating in the water and dropped 11 depth charges on the spot where the submarine had gone down before standing-by for daylight. In the morning, a PBY aircraft appeared and dropped another depth charge on an oil slick and debris that was over the site of the attack. As *Roper* reproached during daylight all they found left in the water was oil, debris, and dead bodies. After recovering the bodies and dropping four more depth charges on another sound contact, *Roper* proceeded back to port carrying 29 German corpses and the distinction of being the first vessel to sink a submarine in Frontier waters (Freeman 1987:178-180). While the remainder of the month would still be difficult for the ESF, this event at least gave them a small glimmer of hope that the submarines could be defeated.

Conclusion

At U-boat headquarters, the loss of *U-85* was not realized until April 20, after the crew of the submarine failed to respond to multiple messages asking them to report about their patrol (B.d.U. 1942b:28). This must have taken Doenitz entirely by surprise as he wondered if it was possible that the Americans were finally starting to defend their coastline. Could it be that after four extraordinarily successful months for the German submarines the Americans had finally decided to fight back?

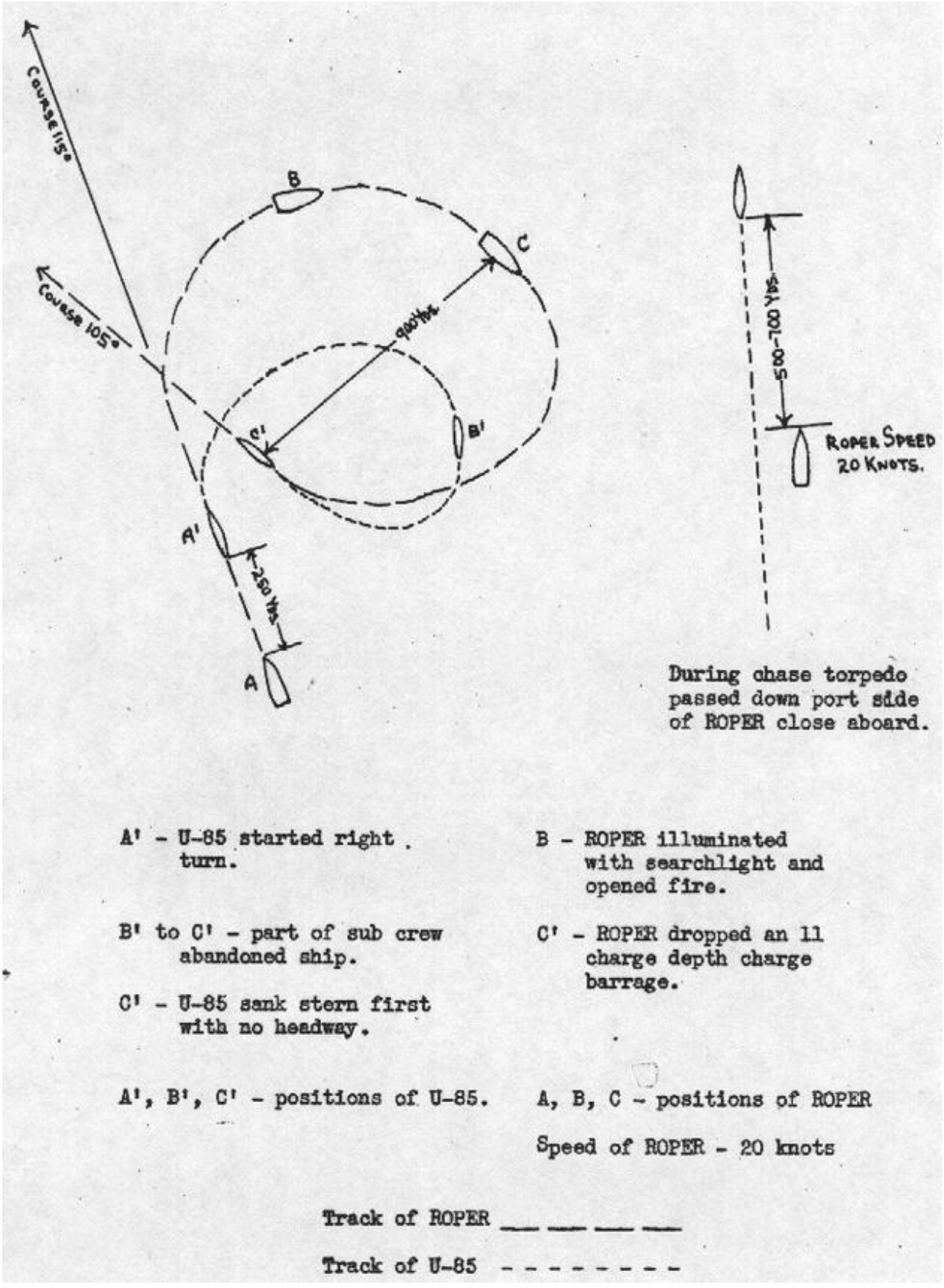

FIGURE 3.2. Diagram depicting USS *Roper's* attack on *U-85* (ESF 1942b:Appendix III).

CHAPTER FOUR: AMERICA FIGHTS BACK

Introduction

Unbeknownst to Doenitz, American forces had actually been attempting to fight back the previous four months. As far as preparing and planning for battle against German submarines was concerned, the Americans had reviewed many scenarios and drafted operational orders before the United States even entered World War II. Most naval officials believed that, should America enter the war, attacks by U-boats, would be inevitable since the long coastline of America's East Coast made it difficult to protect merchant vessels while it provided excellent hunting grounds to enemy submarines. They assumed that, since U-boats had operated successfully off the American coast during World War I, it was reasonable to surmise that the Germans would again attack with their vastly improved submarines during this war (NANCF 1942a:4,chap.II). For this very reason, the United States navy began to revitalize plans for coastal defense that were created as soon as World War I ended.

These once theoretical plans, drafted in 1927 under the Naval directive "FTP-155," created hypothetical boundaries for Naval Coastal Frontiers by dividing American waters into different zones. Each Coastal Frontier, if actually created, would be responsible for defending American ports, harbors, and merchant shipping within that Frontier. FTP-155 further divided each Frontier into incrementally smaller sections and subsections known as Naval Districts, sectors, and sub-sectors, intended to help facilitate planning and ensure better defenses. The theoretical boundaries were modified between 1935 and 1940 in order to definitively create these Frontiers, and to provide commanders of each Coastal Frontier with the executive power to instate rules and regulations within the Frontier they commanded. In March 1941, after the navy finally legitimized the idea of "Coastal Frontiers," by getting permission from the Secretaries of

War and of the Navy to create positions for commanders and staff, Admiral Adolphus Andrews became the first official Commander, North Atlantic Naval Coastal Frontier (CNANCF) (NANCF 1941:9-14,Appendix 3). The NANCF boundaries included

> The First, Third, Fourth and Fifth Naval Districts, with coastal boundaries extending from the International Boundary to the southern extreme of Hatteras Inlet. This area was divided into three sectors: New England sector, New York sector, Delaware Chesapeake sector. These sectors were further subdivided into the Portland sub-sector, Boston sub-sector, Newport sub-sector, Long Island sub-sector, New Jersey sub-sector, Delaware sub-sector and the Chesapeake sub-sector. (NANCF 1941:10,Appendix III)

On December 7, 1941, these boundaries were modified slightly and extended further south to Onslow County, NC (see Figure 3.1). Within these waters, Andrews and the staff of the NANCF were given the following responsibilities:

> A. The Defense of the North Atlantic Naval Coastal Frontier.
> B. The Protection and Routing of Shipping.
> C. The Support of the United States Fleet.
> D. The Support of the Army and associated forces within the Frontier. (NANCF 1941:5,chap.1)

While Andrews knew immediately that his task would be futile with the assets provided by the United States Navy, he set about preparing the forces he had available and began the long and tedious process of attempting to ready the NANCF for an already battle-hardened enemy. The process of readying nearly an entire coastline for a war against German submarines would be a slow one that consisted of mustering the few American forces available and hoping the U-boats delayed their attacks until sufficient naval vessels were available for escort and patrol duties. In the end, however, Admiral Andrews knew that the U-boats would soon be on their way and that if he could not provide convoy escorts or sufficient surface and aerial patrols, he must begin bringing merchant vessels into waters where they had a greater chance of being protected.

Merchant Vessel Routing

Given that the number of naval vessels available within the NANCF was so severely limited, Admiral Andrews determined that one of his first orders of business, in the event the U-boats crossed the Atlantic, was to route merchant vessels through corridors that were easier to patrol and protect. This was quickly decided upon since the current American shipping lanes stretched many miles off the Atlantic Seaboard (Figure 4.1) and were well known and documented by German Intelligence (Figure 4.2).

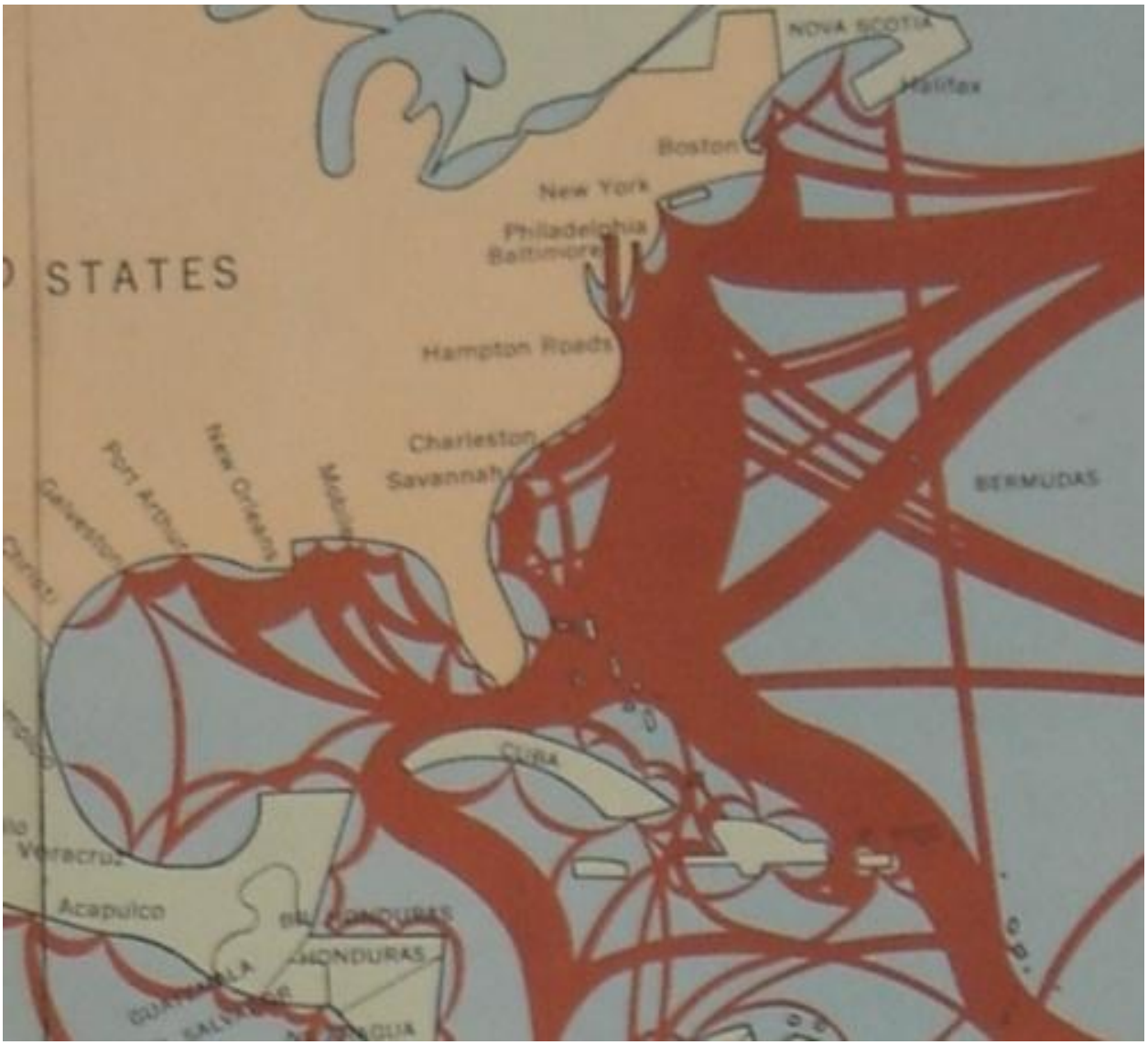

FIGURE 4.1. Shipping Routes off the Eastern Seaboard in 1940 (National Archives, Cartographic Records Branch, College Park, MD).

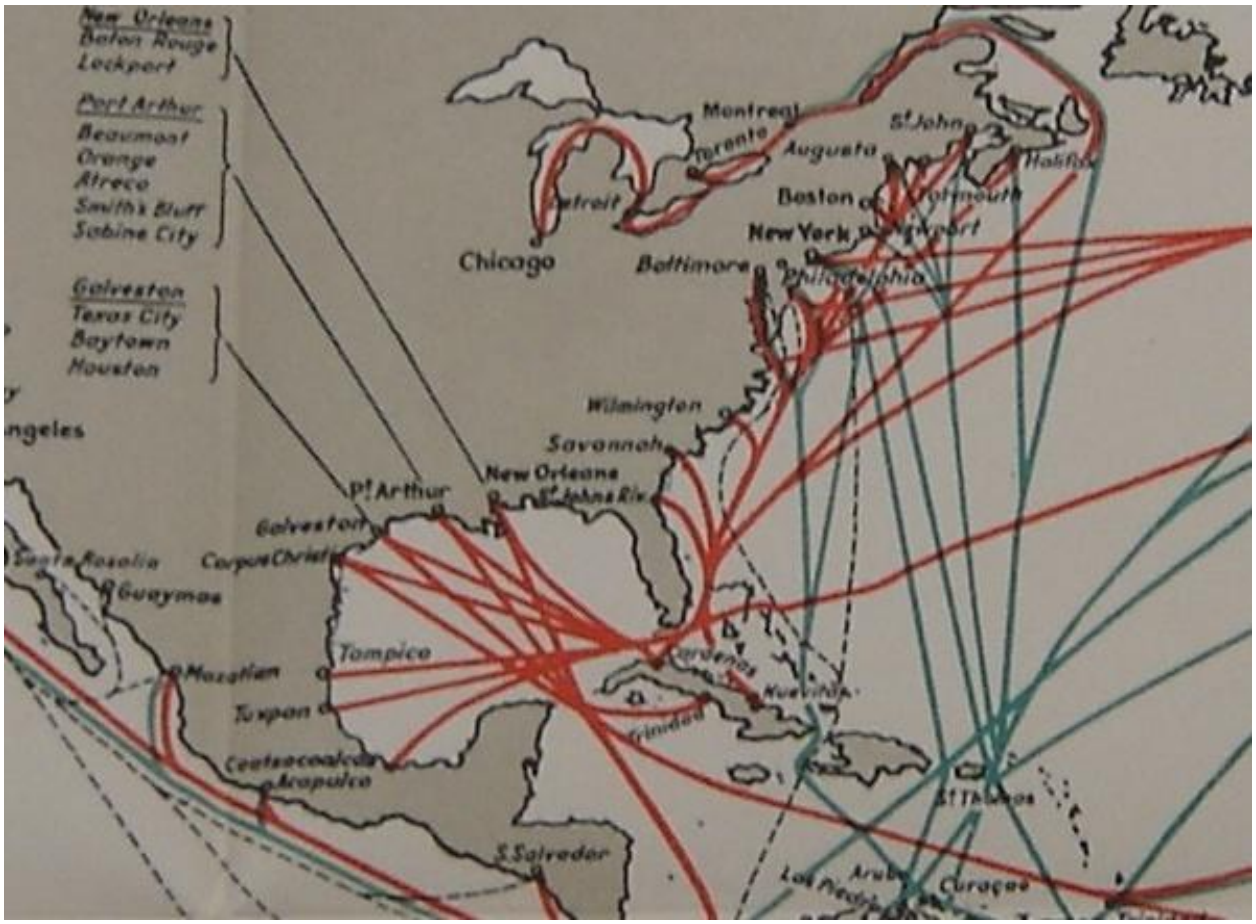

FIGURE 4.2. German chart depicting shipping routes off the East Coast in 1937 (National Archives, College Park, MD).

Since the shipping routes along the Eastern Seaboard were well established, Andrews decided that the best way to hinder U-boat attacks, should they occur, was to delineate shipping corridors that would be implemented once hostilities began. The original corridors were constructed by creating an imaginary "reference line" that ran along the coast connecting various aids to navigation. Northbound shallow draft vessels would be routed close to this reference line while shallow draft southbound traffic would be routed a couple miles inshore of the reference line. Three to six miles seaward of the reference line would be the corridor for all other southbound traffic, and all other northbound vessels would be required to operate seven or more miles seaward of the line. By bringing all traffic within known corridors, patrol vessels could ensure more efficient coverage and better protect merchant vessels. On December 22, 1941,

these routes were slightly modified so that all deep draft, northbound vessels would proceed nine miles seaward of the reference line to allow a three mile barrier, vacant of traffic, between deep draft vessels heading north and south. By keeping this area clear of traffic, it would prevent vessels that were blacked out and zigzagging from running into each other (NANCF 1941:20-23,chap.3). With plans set and shipping routes ready to be implemented, the NANCF would claim, "[t]his December has been a period in which the whole structure of defense built up during the past years -- plans, material, and forces was being organized for a test of strength. But at no point within the Frontier has the structure been actually tested by enemy action" (NANCF 1941:24,chap.3). Unfortunately, for the Frontier, it would not have to wait long for these plans to be tested.

After the sinking of *Norness* in Frontier waters on January 14, 1942 and the subsequent torpedoing of vessels within the Fifth Naval District, which encompassed the waters of North Carolina, it became evident that modifications to the shipping routes must be initiated. On January 22, Admiral Andrews changed the routes slightly to route vessels sixty miles seaward of Diamond and Wimble Shoals in hopes that the U-boats operating close to shore would be bypassed. When this failed to produce the results Andrews was seeking, the routes were shifted back inshore eight days later and every vessel was commanded to travel "as close to shore as safe navigation" allowed (ESF 1942a:1,chap.4). It was quickly discovered, however, that masters of merchant ships were ignoring the established shipping routes fearing collision with other darkened ships. This finding greatly disturbed Admiral Andrews, who was now considered the Commander Eastern Sea Frontier (CESF) after the Sixth Naval District was transferred to the NANCF from the Southern Naval District on February 4, and the NANCF was renamed the Eastern Sea Frontier on February 6. This change gave Andrews control of waters from the

international boundary of coastal Maine to the border between St. John's County and Duval County in Florida (Figure 4.3) and allowed him to modify most East Coast shipping routes. By changing the routes again, Andrews hoped to curb inappropriate behavior by merchant shipmasters (NANCF 1942b:1; chap. 1; ESF 1942a:1-2,chap. 4; Hickam Jr. 1989:6).

FIGURE 4.3. Boundary line of the Eastern Sea Frontier upon addition of the Sixth Naval District to that Frontier, Google Earth image adapted by author from coordinates given in the North Atlantic Naval Coastal Frontier War Diary (NANCF 1942b:1, chap.1).

On February 25, CESF recommended to Admiral King, Commander-in-Chief United States Fleet (COMINCH), that the shipping lanes should once again contain a buffer area of at least two miles between north and southbound traffic. King quickly agreed to this proposal and on March 6, he gave Andrews permission to change the shipping routes. This time, Andrews

requested that the Routing Officer in the Third Naval District draft a proposal for shipping from New York to Key West following many aids to navigation and never allowing the north and southbound lanes to come within two miles of each other. Additionally, the ESF discovered that vessels routed around Diamond and Wimble Shoals during daylight hours were relatively free from attack and mandated that all vessels modify their speeds to pass through these dangerous waters only during daylight. Another discovery of the Frontier was that many vessels were leaving ports in South America and the Caribbean, not passing routing information on to the ESF, venturing well out to sea beyond Frontier waters, and being sunk without any chance of protection. In order to prevent these needless losses, Andrews and King agreed that vessels sailing from these southern ports should be required to enter Frontier Waters and shipping lanes between Cape Canaveral and Cape Hatteras so the Frontier could attempt to provide them with protection as they rounded "Torpedo Junction." With shipping routes modified, the ESF began to wait and hope that keeping merchant vessels close to shore would stop or hinder U-boats operating relatively unchallenged (ESF 1942a:2-3, chap. 4, 1942a:appendix 1). Unfortunately, the Frontier soon discovered that individually routed merchant ships were still being sunk at an alarming rate, and that, until a convoy system was feasible, other measures intended to make coastwise sailing safer needed to be implemented.

The Cape Hatteras Minefield

One of these measures, intended to reduce the destruction German U-boats were causing in the deadly waters of North Carolina, began getting serious consideration by COMINCH and CESF. This option would ultimately become one of the Frontier's worst blunders of the war. The idea consisted of placing networks of mines along the coast to ward off U-boats and allow merchant vessels to travel along the coast in relative safety. The idea of emplacing passive

defense systems was not new as ideas ranging from submarine nets to minefields had been discussed well before the United States entered the war. Admiral King, who was just the Chief of Naval Operations (CNO) at that time, measured the best locations for minefields should the US enter the war, and had already ordered mines placed in front of several important navy bases and harbors. Soon after the Japanese attack on Pearl Harbor, however, the Navy rapidly expanded passive defenses and deployed additional minefields. On January 15, 1942, a naval meeting was held in Washington to determine additional defensive measures. In an effort to provide extensive minefield coverage off the East Coast, the CNO proposed that mines should be planted from Cape Cod to Cape Ann.

While the First Naval District attempted to acquire ships necessary for laying minefields and waited through weather delays, the CNO suggested that the Third Naval District mine the waters off New York as well. This proposed minefield was immediately greeted with reservation by Admiral Andrews, who believed the minefield would be more of a danger to shipping than a hindrance to enemy actions. The CNO dismissed these concerns after some deliberation and felt that the potential for minefields to deter submarines was worthy of the effort it would take to maintain them (Freeman 1987:50-61). While Andrews remained leery about placing mines around busy shipping lanes and harbors, it quickly became evident to him that the naval high command was entirely in favor of implementing minefields and he had little choice but to move ahead with the CNO's proposals (ESF 1943:2,chap.5). As laying the Cape Cod to Cape Ann minefield was delayed, however, Andrews' objections began to carry some weight and in a lengthy letter to the CNO, he advised that placement of any additional minefields be reconsidered. Andrews expressed that the best way to curb the U-boat threat was a quick offense against the submarines, that vessels required to patrol minefields could be better used elsewhere,

and that mines would not safeguard the relatively unprotected waters the U-boats were already operating in (Freeman 1987:50-62). While the CNO capitulated for the time being and ordered that instillation of minefields be put on hold, it would not take long for the Navy to be obliged to act on Andrews' admonishment that "Mine fields are a menace to friendly as well as enemy vessels. To require the Frontier to protect friendly vessels from its own weapons is a task that should be forced upon it by the enemy – not voluntarily adopted" (Freeman 1987:61). Unfortunately, for the navy, the number of merchant vessels falling victim to U-boats necessitated discussion of additional minefields just two months later. This time, however, the deadly waters off North Carolina and particularly those around Cape Hatteras became the center of discussion.

In February 1942, the Commander of the Inshore Patrol of the Fifth Naval District submitted a proposal for laying mines all along the coast in areas that appeared favorable for U-boat operations. The proposal suggested that since the current number of surface craft and aircraft available was far from adequate, the next best way to combat the German U-boats was through minefields. By April 1942, the CNO and CESF had modified and debated the proposal for additional mined areas until two emerging ideas were considered more thoroughly (Freeman 1987:191-193). While the CESF still did not fully believe minefields would solve any of the navy's problems, it was evident that one option would be implemented and he must attempt to choose the one he believed to be the lesser of two evils (ESF 1943:3,chap. 5). The first option consisted of placing 30,000 mines seaward of the coastal shipping lanes to provide a defensive barrier from Cape Hatteras to Cape Canaveral. This barrier would allow merchant ships to ply coastal waters beyond the reach of U-boats and would allow aerial and surface craft coverage to be consolidated behind this line. The drawbacks of this type of mining would be the cost, both

monetarily and in personnel, of setting the mines, keeping them serviced, and continuously sweeping shipping channels for loose mines. The mine barrier advocates could not guarantee that submarines would not penetrate the defense to make an attack, nor that the minefield would not hinder surface craft attempting to chase a U-boat. Additionally, any vessel that found itself adrift would run the risk of entering the minefield.

The second choice revolved around placing a series of mined anchorages along the East Coast so that vessels could stop at a safe anchorage during nighttime hours when U-boats attacks were prevalent. By placing six anchorages along the coast, the Navy could ensure relative safety for merchant vessels from the Florida Straits to New York. The anchorage option would only require 14,000 mines, which would decrease the expense of laying and maintaining minefields and would require fewer patrol craft to monitor. The downsides of using mined anchorages included the fact that merchant ships would need to be routed further out to sea to get around the minefields, further exposing them to U-boats during the day and making it harder to provide them with coverage, and requiring them to plan their travel times around stopping at anchorages. This would ultimately increase the travel time required to complete a voyage and slow transportation of supplies (Freeman 1987:191-193). It was also feared that, "50 vessels huddled together present a large and attractive target to any submarine bold enough to breach the integrity of the field" (Freeman 1987:192). In the end, the Navy decided that it would be more economical and safer to install a series of anchorages along the East Coast and charged Admiral Andrews with the task. Andrews quickly suggested that areas below Hatteras be mined first and gave Cape Hatteras and Cape Fear top priority for the installation of minefields (Freeman 1987:193).

Throughout April 1942, plans for the Cape Hatteras minefield continued to be rehashed and revised until a projected deadline of May 22, 1942 was drafted for completing the mined anchorage. Despite the priority of mine laying that Andrews placed on the North Carolina fields, work was begun first off Key West, Florida in the Southern Sea Frontier. This meant that installing the mined anchorage off Cape Fear, and another one off Cape Canaveral, was postponed until necessary manpower and vessels required to patrol all four anchorages could be mustered. Even though the completion of these two anchorages was postponed, the Commander of the Fifth Naval District felt there were still too few vessels to guard the Hatteras Anchorage. Despite these concerns, Admiral King, newly appointed COMINCH (who at this time still maintained the position of CNO), ordered Commander-in-Chief, Atlantic Fleet (CINCLANT), Royal Ingersoll (who was given this position when King was promoted) to continue preparations for laying the minefield and to establish a task force to carry it out (ESF 1943:4,chap. 5; Runyan and Copes 1994:107,114). The commanders of the vessels *Keokuk* (*AN-5*), *Miantonomah* (*CMc-5*), *Monadnock* (*CMc*-4), *Wassuc* (*CMc-3*), and any other vessel capable of assisting establishing the minefield were ordered to head north as soon as the Key West anchorage was completed.

The minefield envisioned by the naval high command consisted of two separate crescent shaped legs curving so as to cover Cape Hatteras with around 2,860 mines. At the western end of the minefield a safe passage was to be left free of mines so that merchant vessels could enter the anchorage. This passageway into the anchorage would be guarded by a former lightship that would perform the dual functions of watching for enemy traffic, and informing neutral and allied vessels of how to proceed into the anchorage. As the navy continued to make preparations for the anchorage, it became evident that in order to house the patrol vessels and their crews a section base was needed in the vicinity. Ocracoke Island was quickly chosen and a small base

established to provide support for the patrol vessels assigned to the minefield (ESF 1943:4,5,12,chap 5). This base quickly became a complex and expensive undertaking requiring the complete attention of a competent officer. Andrews decided to appoint Coast Guard Officer, Captain Henry Coyle the responsibilities of "organization and supervision of the anchorages and dispatching of vessels from the anchorages at Lookout Bight, Hatteras Cove, and Cape Fear," and gave him the title "Convoy Dispatcher, Hatteras, Lookout and Cape Fear Area" (ESF 1943:5-6,chap. 5). In early May, the Navy began laying marker buoys to delineate the zone for the minelayers that would soon be heading to Hatteras. On May 6, 1942, in a Notice to Mariners bulletin, the Navy officially disclosed that there was a "danger area" around Cape Hatteras that needed to be avoided (Figure 4.4) (ESF 1943:6,chap. 5).

On May 20, a more specific notice in Hydrographic Special Warning No. 175 delineated the exact boundaries of the "danger area." This notice read:

> A dangerous area has been established off Cape Hatteras as follows: from a point on the beach of Ocracoke Island in Longitude 75°58' West, thence due South to Latitude 34°53' North, thence due East to Longitude 75°31' West, thence Northeasterly to Latitude 35°05' North, Longitude 75°22' West, thence due North to Latitude 35°08' North, thence Northwesterly to Latitude 35°17' North, Longitude 75°28' West, thence due West to the beach. Within this dangerous area a safe anchorage is being established, bounded on the South by the parallel 35°06'18" North, on the East and West by the meridians 75°40' West, and 75°47' West, respectively, and on the north by the coast line. The anchorage area is marked by four buoys each painted White and showing a flashing White light. (ESF 1943:6-7,chap. 5)

On May 22, the Commandant of the Fifth Naval District (ComFive) ordered Coyle, the newly appointed Convoy Dispatcher, Hatteras, Lookout and Cape Fear Area, to make preparations for 24-hour patrols of the minefield that was in the process of being laid and to ensure these patrols kept merchant vessels clear of the minefield. To perform this task, Coyle was given only five 83-foot Coast Guard cutters, and the converted fishing trawlers *YP-388* and *YP-389*, which were still on their way after being lent from the Third Naval District. This small

group of vessels was given the unimposing title of the "Hatteras mine field patrol" (Headquarters Fifth Naval District 1942:9; ESF 1943:7,chap 5; Freeman 1987:328,352).

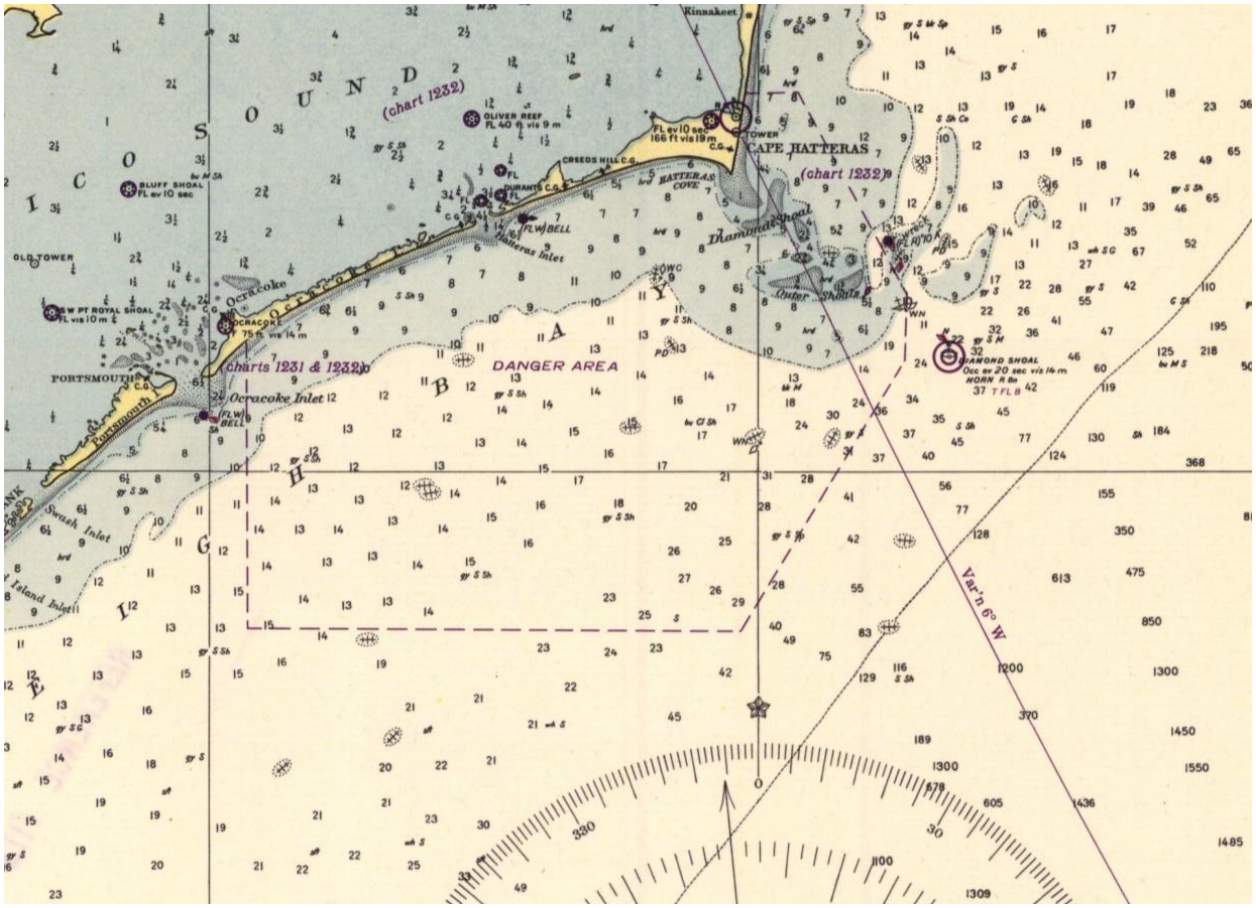

FIGURE 4.4. Chart Depicting "danger area" off Cape Hatteras. (NOAA Historical Chart Collection, Cape Hatteras to Charleston Light, Chart No. 1110, September 1942).

Finally, by the end of May, the minefield had been completed. In the end, the field consisted of two crescent shaped fields each 17 miles long and overlapping in the center for a distance of two miles, and spaced approximately a mile and a half apart in the center. The easternmost leg (leg No. 2) consisted of three separate rows of mines, each spaced 500 yards apart, that began south of Cape Hatteras Light and bent southwest towards Ocracoke Inlet. The westernmost leg (leg No. 1) consisted of four rows of mines, also spaced 500 yards apart, commencing just northeast of Ocracoke Inlet and curving northeast towards Cape Hatteras Light. In each row, "[t]he individual mines were laid with chain moorings at three different case levels:

15 feet, 30 feet and 60 feet. There were three different spacings [sic] of mines: 425 feet apart in row number 1; 240 feet apart in row number 2 and in row number 3; 200 feet apart in row number 4" (ESF 1943:12,chap. 5). Upon completion of the minefield, 2,500 mines littered the waters off Cape Hatteras in the hopes of protecting the anchorage from the threat of U-boat attacks (Figure 4.5). The only thing left for the Fifth Naval District to do was patrol the minefield and wait to see if it proved effective.

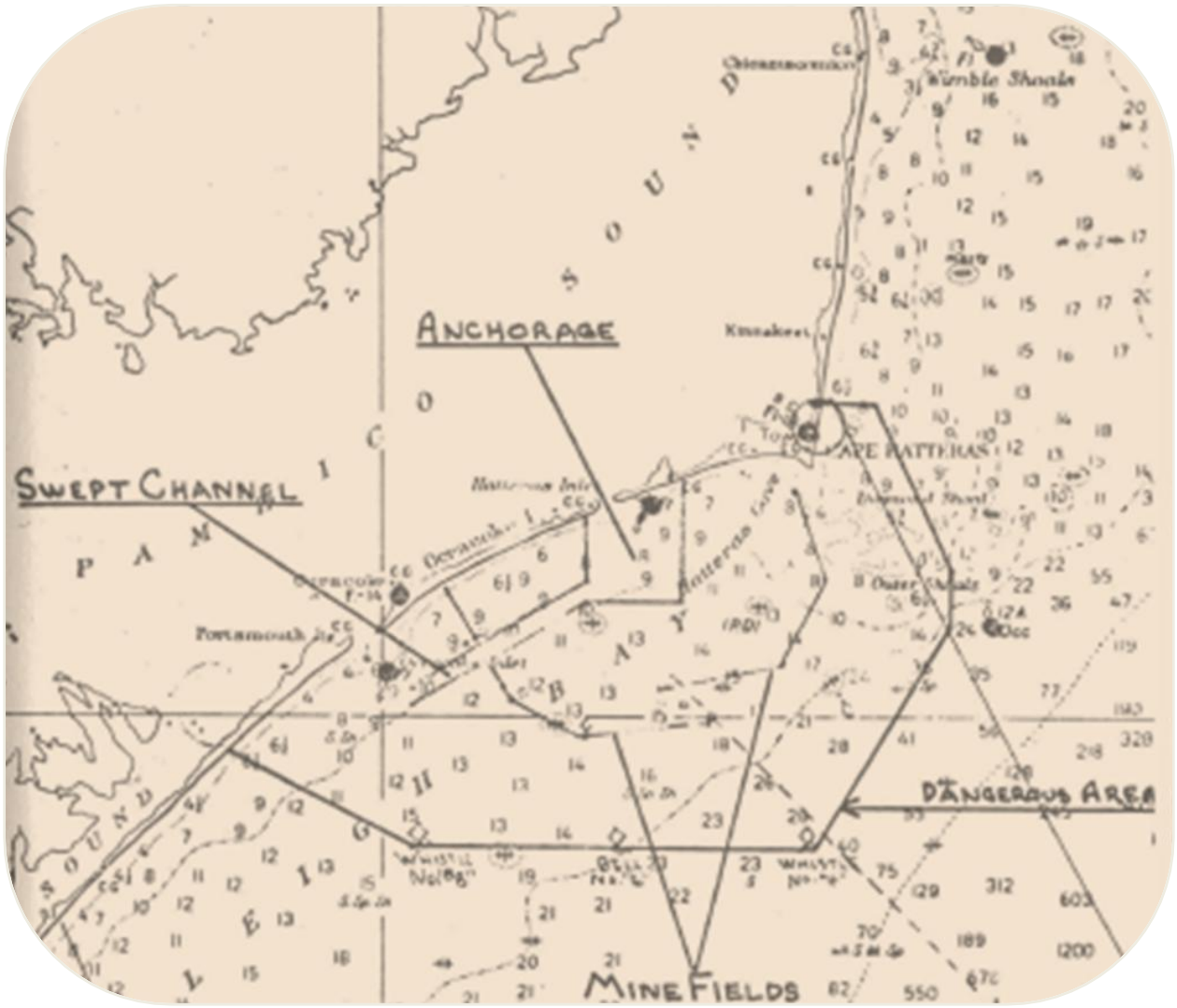

FIGURE 4.5. Locations of the Minefield and Anchorage in Relation to the "danger area" (Freeman 1987:421b).

The Fifth Naval District would not have to wait long to observe the effectiveness of the minefield. Unfortunately, the demonstration of the minefield's potential had nothing to do with the purpose for which it was intended. In the first week of May, before the minefield was laid, the tanker *F.W. Abrams* left Aruba destined for New York with 90,000 barrels of oil. The master was provided with sailing instructions by the British at Orangestad, Aruba, but these instructions said nothing about the minefield scheduled for completion by the end of the month. After an uneventful passage from Aruba *Abrams* entered North Carolina waters on June 10, about two weeks after the completion of the minefield. That evening the tanker pulled into the Cape Lookout Anchorage escorted by CG-*484* to an area where the ship could stay overnight. The next day a heavy rainstorm and severe waves set in which caused *Abrams* to lose sight of CG-*484*, which was attempting to escort the tanker out to the open sea. Unfortunately, the *Abrams'* master still had not been warned about the minefield around Hatteras, and he attempted to steer his vessel back to sea without an escort.

While blundering through the rainstorm, *Abrams* was suddenly jolted by an explosion at 0640 EWT. A call for help was sent out and the master assessed the situation. When he realized the vessel would not sink immediately he attempted to have his crew drop anchor (a gutsy move in waters full of U-boat activity). *F.W. Abrams* rotten luck continued though as the anchor chain fouled and could not be freed. The vessel continued to drift helplessly and moved further into the minefield. At 0717 EWT, a violent explosion again rocked the starboard side of the Abrams. Although still afloat, *Abrams* was heavily damaged and in a precarious position still within the minefield. Twenty minutes later, *Abrams* tripped a third mine and the starboard side of the vessel was blown open causing it to start sinking by the bow. The crew of the stricken vessel

quickly abandoned ship in lifeboats leaving *Abrams* and its 90,000 barrels of oil to the ravages of the Atlantic (Figure 4.6).

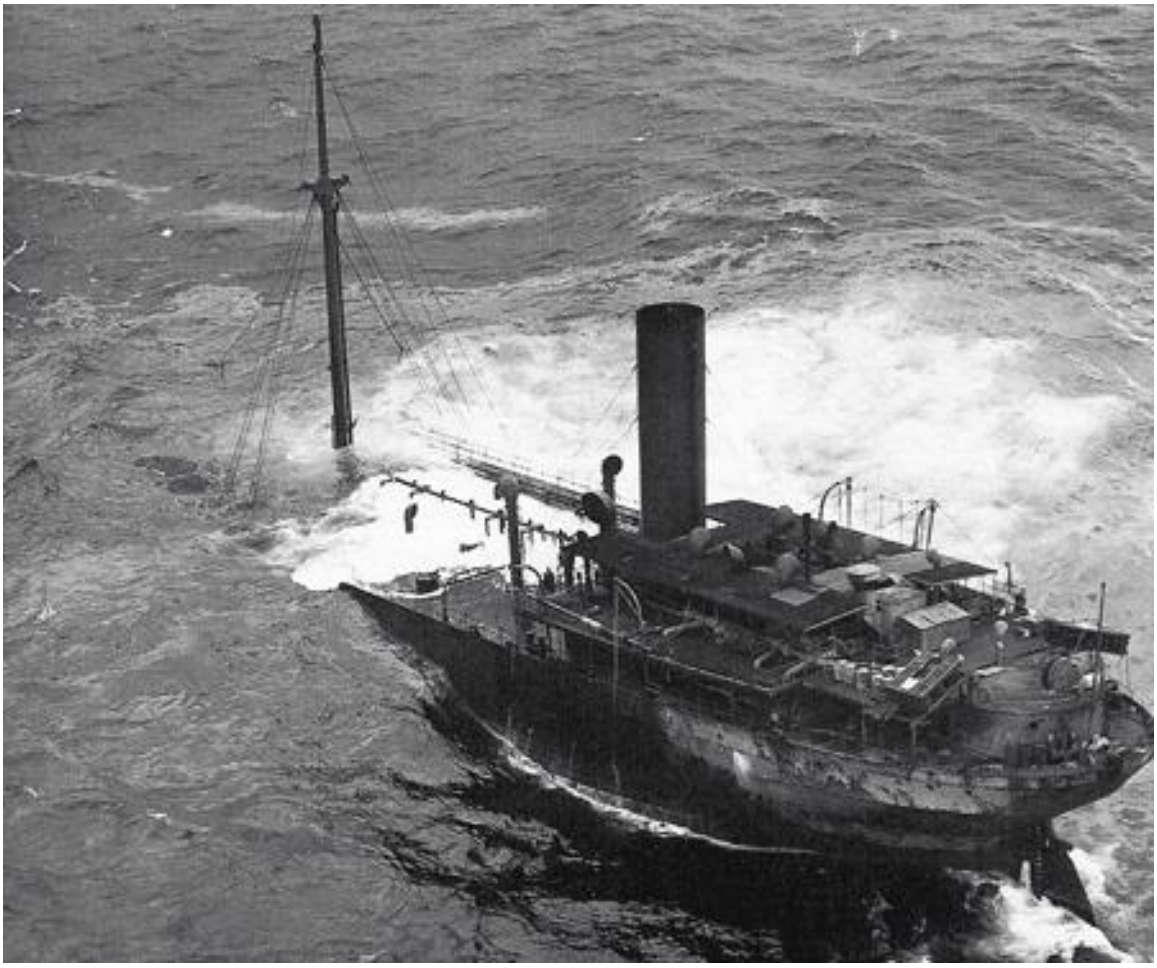

FIGURE 4.6. *F.W. Abrams* sinking in the middle of the Hatteras minefield (Courtesy of the National Archives, College Park, MD).

When Captain Coyle contacted the Coast Guard vessel to find out why *F.W. Abrams* was not protected he began getting strange and conflicting stories. Men aboard the vessel reported that the master of *Abrams* had refused to follow orders and would not respond to blinker signals. Once on shore, reports from the Coast Guard men became even stranger with some reporting that they were travelling on a different heading than others, and several reporting that they had even seen the wake of a torpedo before *Abrams* was sunk (ESF 1943:7,8,chap. 5; Freeman 1987:345-346). While the fabricated stories continued, one fact remained, the Cape Hatteras minefield had

claimed its first victim and given credence to Admiral Andrews' claim that minefields "are a menace to friendly as well as enemy vessels" (Freeman 1987:61).

Unfortunately, for the Fifth Naval District, this would not be the only event impelled by the implementation of the minefield. By early June, converted fishing trawlers *YP-388* and *YP-389* had assumed their roles as patrol vessels at the Hatteras Minefield. With the sinking of *F.W. Abrams,* these vessels were needed to warn merchant shippers of the minefield. They were very ill suited for the job of patrolling in the open ocean, however. On their way down the coast, the vessels had been outrun by a convoy they were supposed to be escorting because the convoy was too fast, even though it was travelling a mere 8.5 knots. On top of their lack of speed, they constantly had to stop into ports for minor repairs required by the abuse of the ocean upon the vessels.

Regardless of these setbacks, the two YP boats successfully arrived in North Carolina waters and dutifully took up their patrol missions. On one five-day patrol offshore, from June 11 to 16, *YP-389*'s crew discovered that their 3 inch 23 caliber gun would not fire due to a faulty firing spring. When the vessel returned to the Ocracoke Inlet section base for provisions, the *YP-389's* commander, Lieutenant R.J. Philips, requested that the gun be fixed before the vessel sailed again. Soon after, however, word was received from the operations base at Morehead City that since the vessel was operable it was to resume its patrol duties. With his request unfulfilled, Philips took the small vessel back to the outskirts of the minefield on June 17 (Headquarters Fifth Naval District 1942:3-6, 9, 10; ESF 1943:8,chap. 5; Freeman 1987:352,353). As Phillips began heading back to the minefield, he had no way of knowing that a very frustrated U-boat captain was closing in on the same position.

Kapitänleutenant Horst Degen had left Lorient on May 20, 1942, in *U-701*, with full provisions and ready to sail to the productive waters off the American coast. Degen and his crew were excited to sail and hoped to have the same success the *U-123* and *U-66* had off Cape Hatteras. The *701's* war cruise started slowly and few ships were spotted while crossing the Atlantic. Once across the Atlantic, the *701* attempted to chase a passenger liner only to discover that the vessel was the Swedish ship *Drottningholm* carrying Axis diplomats. Frustrated that he had wasted a day and a half chasing a false target, Degen swung his submarine back towards America. Shortly after this event, Degen spotted another vessel heading east. This vessel turned out to be a 15,000-ton British liner which would have been an extraordinarily valuable target, but the vessel was too fast and Degen had to call off the chase after losing another day and a half.

On June 12, just off the Atlantic shelf, *701* was spotted on the surface by an allied aircraft and had to make a crash dive. *U-701* was able to dive to a depth of 40 feet before the aircraft dropped a spread of five bombs, which straddled the U-boat and caused the submarine's lights to fail and glass from many instrument panels to shatter. The crew of *701* quickly repaired the damage, but their nerves were slightly frazzled and they realized they had to be extra careful and watchful while on the surface. That evening *701* moved into Chesapeake Bay and proceed to lay mines across the entrance to the shipping channel. After successfully laying these mines, *U-701* headed for Hatteras where it was given "freedom of action" to sink merchant vessels. On June 16, Degen attempted to sink an 8,000 ton freighter with two torpedoes. Both torpedoes missed and the freighter continued on its way unscathed. This additional annoyance coupled with the stifling heat the U-boat crew was subjected to from the warm waters of the Gulf Stream caused Kapitänleutenant Degen much aggravation and increased his desire to sink something. Had Degen known that his mines in the Chesapeake Bay had already sunk two ships and severely

damaged two more, he may have been less annoyed with a patrol boat he thought attempted to ram him on the night of June 17 and attempted to depth charge him on June 18 (B.d.U. 1942b:78-79,117; OCNO 1942b:10-12; Hickam Jr. 1989:267-261,281).

When Degen brought his submarine to the surface on the early morning of June 19, he again saw a small patrol boat that he assumed was the same one from the previous two days and, fearing that his U-boat was falling into a trap, finally let his frustrations boil over. Unfortunately, for the crew of *YP-389* the patrol boat driving back and forth between the minefield buoys happened to be theirs. Around 0220 EWT on June 19, *U-701* surfaced inshore of *YP-389* and immediately began firing machine gun tracer bullets at the patrol boat, followed shortly after by shells from the U-boat's 88mm deck gun. The crew of *389,* taken completely off guard, sounded the alarm and desperately attempted to man their two 30 cal. machine guns since the 3 in. gun was broken. The patrol boat also turned to present its stern to the U-boat in an attempt to present the attacker with as small a target as possible. Once the crew of *389* realized their machine guns were not having any effect, other than directing the submarine's shellfire towards the vessel, all firing was ceased and the vessel attempted to outrun the U-boat. On two occasions, *YP-389*'s crew released spreads of two depth charges to try to slow their assailant. Since the charges exploded too deep, and one turned out to be a dud this proved a futile effort. After an hour and a half of the vessel being shelled "to splinters" and the loss of six men out of the 24 man crew, the order was given to abandon ship.

Phillips let the remaining 17 crewmembers abandon the ship over the side, since the rafts had been destroyed and the lifeboats could not be reached, while he took over steering the vessel. Once the men were overboard, Phillips left the throttle of *389* wide open and jumped overboard to rejoin his crew. *U-701* followed the patrol boat and unrelentingly shelled it until it finally

sank about a half hour later. At approximately 0730 EWT, surviving crew members of *YP-389* were picked up by two coast guard cutters fortunate to be alive after being shelled for an hour and a half by, semi-armor-piercing, incendiary, and high-explosive shells in an engagement Degen would later call "a wasteful and untidy piece of work" (Headquarters Fifth Naval District 1942:1-5,7; ESF 1943:8,chap. 5; Freeman 1987:354).

Although not sinking by striking a mine within the Hatteras Minefield, this patrol by a vessel ill-suited for the task and without proper weaponry, underwater listening devices, or degaussing equipment, contributed to the loss of six sailors and a craft never built for the open sea. The loss of *YP-389* caused the ESF to rethink their defensive barriers and postpone construction of any additional minefields until vessels capable of patrolling them could be spared, since *YP-389* was assigned because "no ships adequate to the task were available in the Frontier" (ESF 1943:8,chap. 5; Freeman 1987: 355). While a second vessel had been lost in connection with the Cape Hatteras minefield, the last and most destructive event within the minefield still had yet to occur.

At 0430 EWT the morning of July 14, 1942, 19 ships in convoy KS-520 left port near Hampton Roads, Virginia, for a voyage south through the waters of the ESF. By 0700 EWT the next morning, the ships had rounded Cape Hatteras and continued south. Maintaining a course just inside the 100-fathom curve, the convoy passed 20 miles outside Ocracoke inlet at 1600 EWT without any problems. Five minutes later, a contact was picked up and bombed by the convoy escorts without result. This contact aroused the suspicion of the convoy escorts and extra vigilance was put into scanning the horizon for submarines. Despite this extra vigilance, a torpedo struck SS *Chilore,* lead vessel in the second column of ships at 1620 EWT, sending a geyser of water over the vessel, which momentarily obscured it from the air escorts. Unable to

react quickly enough and alter course, *Chilore* was struck by a second torpedo one minute later. Moments after the second torpedo rocked *Chilore, J.A. Mowinckel,* lead vessel of the convoy, was shaken by a violent explosion (Freeman 1987:411-412). The blast of the torpedo was devastating:

> The shock of the blow ran down through the entire ship, breaking china in the galley, overturning chairs and tables, knocking men off their feet. Black water shot in a great plume over the poop deck. Dense, pungent smoke poured into the after compartments bringing with it the smell of gas and powder. The steering machinery was carried away as the explosion blasted a hole 20 by 20 in the stern of the Mowinckel. One man was killed outright, while 20 were injured, some severely (Freeman 1987:412).

As the convoy began to break apart to avoid additional attack, a torpedo struck *Bluefields*. The submarine carried out its entire attack in less than six minutes before popping to the surface in the middle of the convoy and being fired upon, aerial bombed, and depth charged in an attack that, depending on the account, may have sunk the German Submarine *U-576. Chilore* and *Mowinckel* despite being severely damaged were still afloat, but *Bluefields* slipped beneath the surface by 1700 EWT. After securing the corvette *Spry* as an escort for the two stricken vessels, they were permitted to run for the safety of the North Carolina shoreline while the convoy continued south. Since the attack destroyed *Mowinckel's* steering machinery, the master had to steer using its engines, which caused the vessel to follow a wavering course. With *Spry* in the lead, the vessels began their journey towards shore.

The route chosen by the commodore to take the vessels to shore put them on a direct path to Hatteras Inlet. This path, also led them directly through the "danger area" discussed in the notice to mariners. Unfortunately, the notice only referred to a "danger area" and many mariners simply thought this zone had become a graveyard of sunken ships and underwater hazards, not a minefield. While the *Spry's* commander knew the danger area was a minefield, he did not know exactly where he was since he had taken part in the hunt to find the submarine that attacked the

convoy. By doing so, he had made so many changes in position and speed that he could not plot the *Spry's* exact location. Using dead reckoning in attempting to figure out where they were, the commander accidently positioned all three vessels 60 miles south of where they actually were (Figure 4.7). Had the vessels really been at this point, the course of 315^{o} the vessels followed would have allowed them to reach shore south of the "danger area" (ESF 1943:10,chap. 5; Freeman 1987:413-415). Adding to the confusion was that the Convoy Commodore aboard *Mowinckel* knew exactly where the ships were but had a "rather hazy recollection" about anchoring around Hatteras, and the master of *Mowinckel* claimed he was told the restrictions around Hatteras no longer applied (Freeman 1987:415).

With this misinformation, the three vessels took the most direct course toward land. As the vessels continued towards shore, the commander of *Spry* became uneasy about the route and radioed *Mowinckel* to get their position. *Mowinckel* responded that they were 20 miles SE of Hatteras Inlet. Fearing the ships would end up in the minefield, *Spry's* commander suggested a route change that would bring the ships well south of Hatteras. The crew aboard *Mowinckel* heard this transmission incorrectly and when they plotted the course they heard transmitted, realized it would take them north of Hatteras and through dangerous waters, so they kept their heading and did not send a response to *Spry*. Although still uneasy about the situation, the commander of *Spry* decided not to resend his transmission because he did not want to question the Convoy Commodore's decision since the Commodore, although retired, was a senior officer. Shortly after, the three vessels passed one of the patrol boats stationed on the outskirts of the minefield.

Seeing that the merchant ships were led by a naval vessel, the patrol boat decided not to contact the small convoy and resumed its patrol. As the ships closed on the minefield, a blimp

began dropping smoke bombs to alert the convoy to the danger they were heading toward, but the Commodore assumed the blimp was just warning them that submarines were in the vicinity and continued steaming ahead.

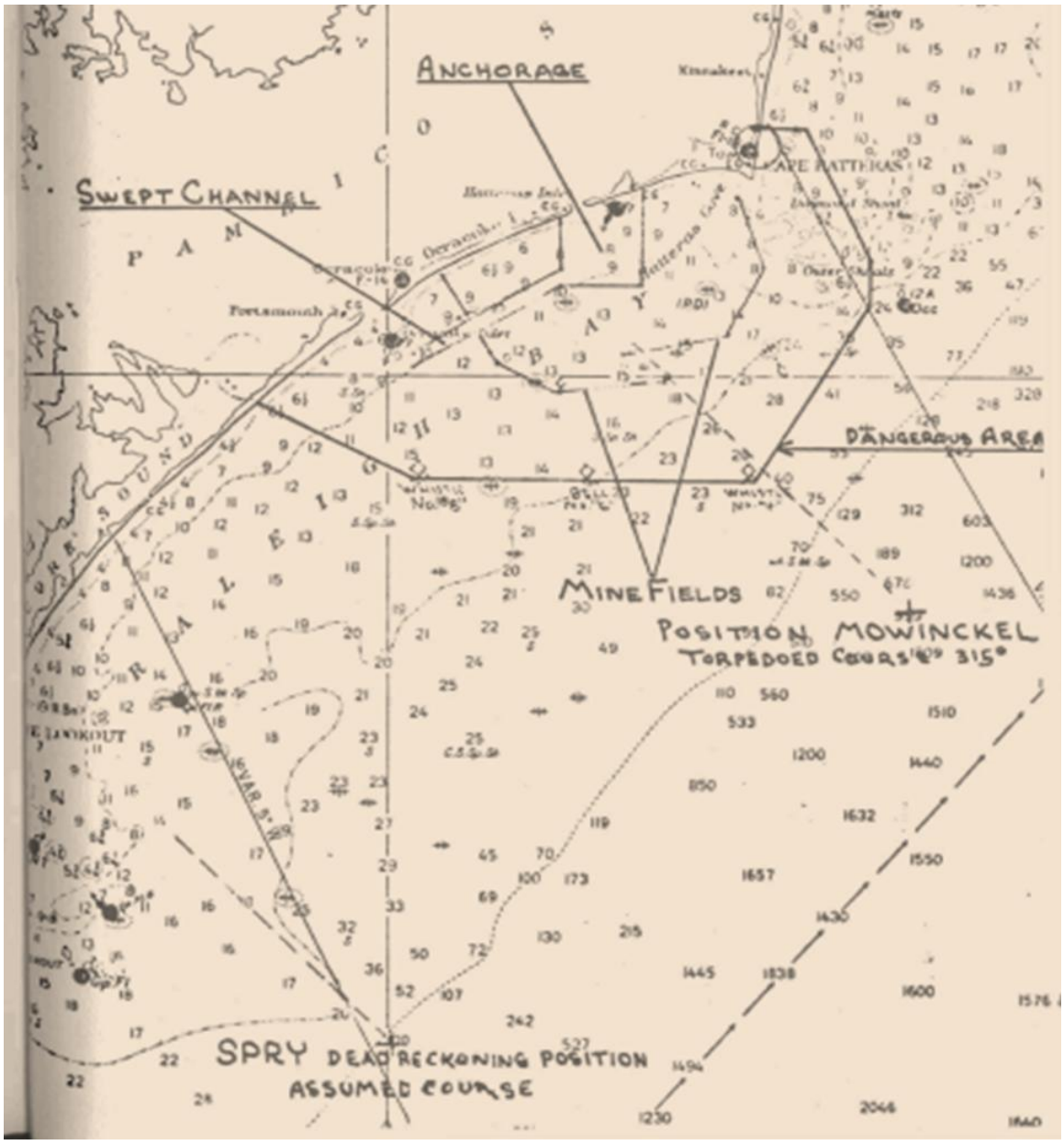

FIGURE 4.7. Paths of *Spry, Chilore,* and *Mowinckel* leading into the Hatteras minefield (Freeman 1987:421b).

In a final warning, the crew of patrol boat *462*, which had just returned from taking gasoline to a YP boat that ran out of fuel at sea, attempted to chase down the three vessels,

signaling as fast as they could and even firing the boat's guns into the air. Unfortunately, the vessels continued on their way and at 2000 EWT, several loud explosions shook the night air. *Chilore* and *Mowinckel* had both passed over contact mines in the Hatteras minefield and been shaken by explosions, while *Spry* escaped danger. While the two merchant crews, fearing they had been torpedoed, abandoned ship, *462* caught up to *Spry* and informed the commander of the danger. The commander of *Spry*, realizing for the first time where he actually was, knew he could do nothing for the merchant ships and followed *462* out of the minefield before heading south to try to catch up with convoy KS-520.

The crews of *Chilore* and *Mowinckel* soon reached shore in lifeboats, while the merchant ships remained afloat within the minefield. Over the next few days, channels were swept to the vessels so that they could be towed in and salvaged. On July 19, two tugs were sent to recover the merchant ships, but at 1630 EWT, one of these, *Keshena*, struck a mine and sank almost instantly. Finally, the remaining tug removed *Chilore* and *Mowinckel* from the minefield and brought them to Ocracoke for basic repairs before they were sent to Hampton Roads for salvage. Unfortunately, the *Chilore's* terrible saga was not complete until 1700 EWT on July 23, when the vessel capsized and sank while being towed past Cape Henry. *Mowinckel*, on the other hand, made it safely to Norfolk, but the Hatteras Minefield had claimed two more victims and severely damaged another (ESF 1943:8,chap. 5; Freeman 1987:415-419).

These events were the last needed to convince ComFive to begin lobbying for removal of the minefield. ComFive suggested to CESF that the minefield could be replaced with anti-torpedo netting. Admiral Andrews agreed with this suggestion and on July 21, 1942, forwarded the proposal on to COMINCH with his personal approval. Andrews further stated that he had never been in favor of the minefield and its usefulness was obsolete. In fact, the convoy system

along the coast had been initiated before the minefield was completed, nearly relegating it pointless from the beginning. CESF also added that the term "danger area" might be giving merchant captains a false sense of security because they did not realize the area was mined. Admiral King sent his response on August 4, stating that anti-torpedo netting was not practical in the waters around Hatteras and the minefield would remain. He did capitulate, however, that the area could be declared mined so that merchant shipmasters would understand the severity of straying into those waters. An additional problem with the minefield soon became evident as well.

The small vessels that were patrolling the minefield required constant maintenance at the section base on Ocracoke and often could not put to sea if the weather worsened. The wear and tear on the vessels and crews also seemed superfluous since only one merchant ship used the anchorage between August 6 and November 6. Andrews again petitioned Admiral King on November 6 to allow the minefield to be swept and deactivated, but to allow the area to still be referred to as a "danger area" on charts and not reveal the mines were gone (ESF 1943:8-11,chap. 5). King retorted, saying that minesweepers could not be spared because they were "in such constant demand at the time for maintaining swept channels at the entrance to important harbors" and that the matter would be taken up again the following spring (ESF 1943:11,chap. 5). In April 1943, CESF again pressed the matter with COMINCH, this time employing an entirely new tactic. Andrews noted that no vessel had been lost to U-boats in Frontier waters since July 15, 1942, and that the minefield was destroying the economy of the Outer Banks. The later argument was based on the Department of the Interior's Deputy Coordinator of Fisheries stating that restrictions on fishermen in the area had already decreased the catch by a staggering 80,000,000 pounds.

On April 21, 1943, Admiral King agreed that the minefield should be removed but left removal of the mines to the Fifth Naval District. Removal was begun on June 7 and, despite the fact that many mines would not fire and heavy storms hindered the operation, the work was completed by September 25. Although only 1,303 of the 2,500 mines originally laid were recovered, the CESF considered the operation a success. Due to the undetonated mines, however, the area continued to be labeled a "danger area" through the rest of the war and is still labeled as such today. With the sweeping of the minefield, a destructive chapter in Fifth Naval District waters was closed (ESF 1943:11-13,chap. 5). The ESF would sum up the minefields history most succinctly:

> Thus ended the "Battle of the Hatteras Mine Field." In retrospect, it is easy enough to consider that the sanctuary failed to accomplish its intended purpose of saving ships from submarines; that to the contrary, four ships were lost. On second thought, however, it is clear that the project was undertaken at a time when one could not predict the manner in which the U-boat campaign would develop; the simple fact was that there were not enough escort and patrol vessels or planes to drive the subs from our shore, and that some kind of defense had to be made as a stop-gap. That was exactly the function of the Hatteras mine-protected sanctuary. Considering the outcome, it is fortunate that the shift of U-boat concentrations permitted the well-intentioned sanctuary to pass into "innocuous desuetude." (ESF 1943:13,chap. 5)

Although the Hatteras Minefield never lived up to the expectations placed upon it by the naval high command, it was not necessarily because the minefield was not effective but more likely because the minefield was replaced by a more effective alternative.

The Convoy System

With the valuable lessons the United States Navy learned during World War I about how convoys offered the best form of protection against submarine attacks, it seems surprising that none were initiated off the coast of America when U-boat attacks seemed imminent. Despite these lessons, the outbreak of hostilities found no American convoys plying the waters of coastal America. While the naval high command agreed that methods of fighting submarines had

changed very little since WWI and that convoys and aircraft were still the best ways to combat them, they also recognized that a convoy's strength was only as good as its escorts and a poorly protect convoy could be more disastrous than letting vessels travel independently. With these considerations in mind, Admiral King requested that Admiral Andrews begin drafting a plan for initiating a convoy system on February 12, 1942.

Upon requesting input from the commanders of each naval district as to their thoughts on coastal convoys, Andrews received votes of overwhelming opposition to the idea of starting a convoy system at this time since the Frontier could not provide adequate convoy escorts. After further discovering that an average of 120 to 130 merchant vessels sailed each day in Frontier waters, Andrews agreed that the convoy system would not work. By the estimates of Andrews, the number of naval vessels required to operate an effective convoy system would be 64 ships, twice the number capable of convoy escort currently available. Convoy duty would also require additional ships to take over tasks currently performed by the better vessels so that they could be assigned to the convoys. In light of these observations, Andrews passed his recommendation along to Admiral King, suggesting the convoy system be postponed until the current efforts of protecting merchant shipping failed, and sufficient escort vessels and aircraft could be spared. Admiral King heeded this advice, and on March 6, ordered initiation of any coastal convoy system put on hold (Freeman 1987:23,52-56,107).

The desire for coastal convoys did not go away, however. On March 6, the same day Admiral King ordered postponement of any convoys, the Commander of Task Force 21 suggested that, based on the predictions of U-boat attacks for the month, it might be advisable to alter cross-Atlantic convoys already in place to allow some of their escorts to assist coastal convoys. When the Frontier discovered that altering these convoys by even one day would

deprive the British of 30,000 tons of supplies per month the idea was overturned. The following day March 7, CINCLANT filed a recommendation for additional protective measures that could be instated along coastal routes. These measures included routing supplies and troops by rail along the coast as far as they could be sent and by tightening up control and administration in the naval districts so shipping delays were minimized, allowing the naval vessels already in use to be utilized more effectively.

On March 16, Admiral King, who was still interested in initiating a coastal convoy system, ordered CINCLANT, CESF, Commander Gulf Sea Frontier (CGSF), and Commander Caribbean Sea Frontier (CCSF) to each send a representative to a meeting in the Navy Department. It was King's intention to have these representatives discuss a convoy system extending from the East Coast into the Caribbean and to present him with their recommendations. The meeting discovered that the number of vessels departing from Caribbean and Gulf ports was divided equally, requiring two separate convoy routes. For these convoy routes to function properly, the representatives recommended two separate southern termini, one at Key West and the other at Guantanamo. They also suggested that a convoy leave each port every three days. The Key West convoy would depart at 0200 EWT on the days it sailed, pass through the Florida Straits and continue north along or slightly westward of the Gulf Stream. The Guantanamo convoy would follow an unbroken path westward of the Gulf Stream.

While the Frontier representatives expressed hope that the convoy systems could eventually move ships all the way to New York, they conceded that the naval craft required did not exist at this time and that Hampton Roads, Virginia, would have to be the northern convoy terminus. Vessels continuing north would proceed individually during daylight under the protection of aircraft. Admiral King quickly approved these recommendations and speculated

that the Key West to Hampton Roads convoy could be initiated by May 15 and the Guantanamo Bay to New York convoy by July. Although this conference laid the groundwork for a future convoy system, it also highlighted the severe lack of adequate naval escorts available in the Frontier. To protect merchant ship convoys effectively, the conference suggested the Frontier would need 31 destroyers and 27 corvettes or PCs. Only three destroyers, zero corvettes, three PCs, and five SCs currently existed in the entire ESF, all of which were performing other important duties (Freeman 1987:107-111,169).

Throughout April, the ESF could only plan and schedule future convoys while the U-boats continued to attack and sink merchant ships. Again, the waters of Cape Hatteras proved to be the most dangerous waters as thousands of tons of shipping were sent to the ocean floor by German torpedoes. Realizing the danger the waters off Hatteras presented, Admiral Andrews suggested that ComFive implement a makeshift convoy system with vessels laying overnight at Cape Lookout, then proceeding as a convoy in the morning around Cape Hatteras and Diamond Shoals under the escort of naval vessels. Andrews thought that this would minimize vessel losses around Hatteras and would require only forty naval craft rotating in and out of service. ComFive replied that a system to this effect was almost in place already as northbound vessels were leaving the Lookout Anchorage under escort and all vessels heading southbound were given aerial support (Freeman 1987:174-175).

Furthermore, for ComFive to initiate a full convoy system, he would still need more naval craft specifically assigned to his naval district than the Navy could currently provide. With this information, Admiral Andrews went back to drafting plans for a convoy system that would actually work given the limited numbers of convoy escorts available. On April 29, he realized that breaking the available convoy escort vessels up into the five convoy escort groups required

to initiate a convoy system from Key West to Hampton Roads would leave the convoys without sufficient escorts and vulnerable to attacks. Andrews then proposed that the date of implementing the convoys should be deferred until additional convoy escorts could be assigned.

While this was a sharp blow to the Frontier's defensive measures, Andrews also recognized that the safety of merchant vessels could be bolstered by requiring vessels to sail in daylight, to anchor at night in safe anchorages, and to form short convoys with other merchant vessels while travelling through dangerous waters. This system would require that vessels sailing from the Florida Straits anchor at Jacksonville, Florida, the first night of their voyage, at Charleston, South Carolina, the following night, and at Cape Fear, off North Carolina the third night. Small convoys could then be established before vessels sailed around Cape Hatteras during daylight the next day (Freeman 1987:174-177). While this "proposal to extend the defense system south of Hatteras was admittedly less than that which could be obtained from an adequately escorted convoy…the dangers inherent in the broken daylight voyages and the protected anchorages were far less than those to be expected in an inadequately protected convoy" (Freeman 1987:177). Even though Andrews originally proposed that the convoy system should be delayed beyond the middle of May, a fortuitous change occurred in the ESF during May that made initiation of the convoy system by May 15 feasible. This turn of events came from the navy freeing up many destroyers from other duties to add 100 more days of destroyer patrol in the Frontier while also increasing the number of adequate patrol boats and aircraft by 20 percent. To ensure that the convoy system could be initiated by May 15, Andrews quickly drafted schedules for air coverage and convoys that allowed one convoy to leave the Chesapeake, and one to leave Key West, every three days. Departure days were staggered so the

convoys would not arrive too soon after the other convoy left to ensure port administrators had enough turnaround time to prevent routing and docking confusion.

Although ships faster than 14 knots or less than 8 knots were excluded from these convoys and were still routed independently, they were encouraged to follow routes relatively free of danger and travel only during daylight. Andrews also added another provision to ensure the safety of slower vessels, which required that the Hampton Roads to Key West convoys incorporate a slow convoy into every third sailing rotation. With these measures in place, Andrews contacted shipping companies to obtain a list of competent shipmasters who could be designated convoy commodores and vice-commodores (Freeman 1987:266-267; Hickam Jr. 1989:247-249). As the pieces for the convoy system were set into place by the ESF, patrol schedules were drafted so that

> Convoys leaving from Hampton Roads would be covered on the first day by planes from Langley Field, Norfolk, and Elizabeth City; on the second day from Cherry Point at daybreak and from Wilmington and Charleston thereafter. On the third day planes from Charleston would cover the coast as far as Jacksonville where they would land. On the fourth day the patrolling force would take off from Banana River, and on the fifth day from Miami. Planes from these bases would perform two flights -one in the morning and one in the afternoon. Those from Banana River and Miami would be controlled by the Commander Gulf Sea Frontier and all the others by the CESF. In such fashion relatively strong and constant air cover could be assured. (Freeman 1987:266)

Finally, on May 8, Andrews ordered the port officials at Hampton Roads and Key West to ensure that all vessels in port on May 10 and 11 capable of running in convoy be held over to create two trial convoys.

On May 14, convoy KS-500 left Hampton Roads for Key West, and on May 15, northbound convoy KN-100 left Key West. While both convoys suffered the inevitable frustrations of trying to get merchant captains to obey orders and stay in formation, as well as attempting to shuffle ships that joined the convoy along the way into formation, these minor

annoyances "could not hide the fact that both convoys brought all their vessels through safely and on time" (Freeman 1987:269-270). While these vessels arrived safely, Andrews knew that another convoy must make the trip along the coast before the convoy system could be considered functional. On May 17, several merchant vessels began assembling at Hampton Roads to form the second southbound coastal convoy KS-502. Eventually eleven ships and several escorts arrived and the convoy was scheduled to depart the morning of May 20.

At 0622 EWT on the 20th, the convoy departed the anchorage and began the voyage south. Although the convoy was intended as a ten-knot convoy, the Brazilian merchant ship *Mogy* kept falling out of formation and slowing the convoy to eight knots. Despite the delay caused by *Mogy,* the convoy rounded Cape Hatteras without any problems and continued southward until a fire was noticed onboard the merchant vessel *Bluefields.* While this event caused some initial concern, the naval escorts quickly discovered it was an internal fire in *Bluefields* cargo hold. After combating the fire, *Bluefields* and the British armed trawler HMS *Coventry City* were sent to Beaufort so *Bluefields* could obtain repairs. With the exception of this event, and the crew of the Coast Guard Cutter *Dione* having to threaten some merchant crews that they would shoot the lights off their vessels if they did not put them out, the convoy proceeded safely into Key West without having lost any vessels due to enemy action (Freeman 1987:272-275; Hickam Jr. 1989:251-257). Finally, after five and a half months of planning, debating, and acquiring escort vessels, the American Coastal Convoy system began to take shape and the ESF began to think that for "the first time it is possible in 1942 to look forward with some confidence to the future security of the shipping in our coastal waters" (Freeman 1987:271).

After these initial successful convoys, it would be just a matter of time before problems experienced with the merchant ships were smoothed out and the convoy system could prove its worth. The ESF continued to run the KS/KN convoys from Norfolk to Key West and back until August 1942 when these convoys were superseded by even better systems running from New York to Key West and from New York to Guantanamo, Cuba. These convoy routes then operated until VE day with only minor routing changes as navigational buoys were moved or removed. While the coastal convoy system did not entirely eliminate the U-boat threat and prevent any more merchant vessels from being sunk, the system was operated with great success for the remainder of the war with less than a dozen merchant ships sunk or damaged while in these convoys.

Of these few casualties, five were lost or damaged by mines laid in the Chesapeake Bay by *U-701* and not from direct attack by a submarine. The small number of vessels lost or damaged throughout the rest of the war is outstanding when compared to the number of vessels that travelled in these convoys. In total, 5,009 merchant vessels and 1,817 convoy escorts travelled in the KS/KN and NK/KN convoys from the time they were implemented, resulting in a loss rate of merely 0.0016 % of all vessels travelling in these convoys (Headquarters of the Commander in Chief, United States Fleet, and Commander Tenth Fleet 1939-1945:51,53,55,chap. 4). These phenomenal rates finally showed that, through the effective use of escort vessels and properly implemented convoy routes, the war against the U-boat in East Coast waters could be won. Similarly, merchant ship crews could, for the first time since the German submarines arrived in American waters, look forward to relatively uneventful coastal passages and hope to pass through "Torpedo Junction" with their lives. While the successful use of convoyed merchant vessels and increasing numbers of naval escorts helped immensely with

changing the tides of the war, one additional aspect of convoy support and coastal patrol cannot be overlooked in the ESF's struggle against the U-boat. This aspect, which also follows the storyline of the Frontier's constant struggles with inadequate numbers of patrol craft, is the aerial support available during the war.

Aerial Coverage

To the consternation of the NANCF, December 1941 brought about the sobering reality of how terribly ill equipped the Frontier was for a potential submarine war. Not only did the Frontier severely lack suitable naval vessels, but a look into the numbers of adequate aircraft available also revealed an alarming lack of aircraft capable of performing anti-submarine duties offshore. In the entire Frontier, only 103 aircraft existed. These planes merely consisted of "51 trainers, 18 scouts, 14 utility, 7 transports, 6 patrol, 3 torpedo, 3 fighters, and one bomber…3/4 of which were unsuited to the task assigned" (Freeman 1987:6). Quickly these aircraft were assigned inshore coverage areas around important naval bases and harbors, while the Army Air Forces were given responsibility for patrolling waters offshore since the Naval Frontiers did not have adequate aircraft. While US forces established several aerial patrols, they recognized that most of these would not be able to defend against the potential threat of submarines offshore but hoped they would provide advanced before any merchant vessels were sunk. By receiving an advanced warning, the Frontier might intercept incoming submarines and better utilize their limited forces (Freeman 1987:9-10). Unfortunately for the Frontier, the rapidity with which German submarines brought the war to American waters in January 1942, did not allow offshore patrols to provide much of an advanced warning. Even if they had been able to do so, it is unlikely the forces available could have curbed the blows to merchant shipping.

Despite Admiral Andrews requesting that the navy assign an entire squadron of aircraft to the NANCF, the remainder of January found few aircraft available for patrol duty. Amphibious Coast Guard aircraft flying out of fields at Salem, MA, Floyd Bennett, Long Island, and Elizabeth City, NC, did not carry munitions with which to sink submarines. Additionally, Army airplanes patrolling 40 miles offshore from Maine to Wilmington, NC, only carried enough fuel for a few hours of patrol and contained no weaponry. Several lighter than air ships scanned the coastline around New Jersey and two flights of bombers per day left from Westover, Mitchel, and Langley Fields, cruised 600 miles out to sea looking for targets, then returned to base (Freeman 1987:24-25). These scant air patrols were all the Frontier could muster to protect the Eastern Seaboard at the beginning of the war. Each coastal frontier received a glimmer of hope at the end of January, however, when the Navy informed them that Atlantic Fleet aircraft could be used within the respective coastal frontiers they were stationed as long as these missions did not interfere with the regular obligations of the Fleet aircraft.

Three more utility aircraft were also taken from the Atlantic Fleet and stationed at Elizabeth City, NC, in the hopes of combating the U-boats that had already shown that the waters off Hatteras were their best hunting grounds. Admiral Andrews further endorsed a request sent from the air base at Elizabeth City to Admiral King asking for the addition of 12 more aircraft to the base's fleet. Andrews suggested that several of the 20 Royal Air Force PBY-5 aircraft stationed at Elizabeth City should be manned and added to the roster of available patrol planes. King responded that the Navy understood the Frontier's needs for more aerial patrols but that additional airplanes were not available and would not be until the production rate of aircraft was increased. King's response left the Frontier with only three additional utility planes and the extremely limited use of Atlantic Fleet aircraft by the end of January 1942 (Freeman 1987:24-

26). This meant that "January closed as it began with the warning that any increase in the forces assigned to the Frontier, would be 'dependent on future production.' Such words were indicative of the general plight of every command in all of our armed forces. There were not planes or ships or trained men enough to go around" (Freeman 1987:26).

To increase effectiveness of forces available for patrol duty off Cape Hatteras, ComFive drafted a plan for protecting the Fifth Naval District. This plan divided these waters into three different lanes between latitudes "38-00N and 37-00N and 35-30N, and Lat. 34-00N" (Freeman 1987:28). The first sector between 38-00N and 37-00N would be patrolled by Army planes from Langley, the sector between 37-00N and 35-30N would be patrolled by the Fleet Air Arm, and the third sector between 35-30N and 34-00N would be patrolled by the Naval Air Stations within the Frontier (Figure 4.8). These aircraft were to assist the nine Inshore Patrol surface vessels currently operating in the Fifth Naval District in defending the 28,000 square miles of water contained within the district's boundaries.

To add to this daunting task, ComFive was told of severe limitations pertaining to the Atlantic Fleet aircraft and informed that many crewmembers were still undergoing training and not yet available for combat flights. ComFive pointed out that the Fifth Naval District could function more effectively if the capabilities of the air base at Elizabeth City were utilized since the base could house 300 men and 50 officers, as well as additional planes, bombs, and fuel. This location would be optimal for allowing planes to quickly take off and hunt for U-boats around Hatteras, but currently only three utility planes from Elizabeth City were assigned to offshore patrols (Freeman 1987:26-30). Another four planes were eventually added to the Fifth Naval District "but three were experimental and the fourth was a utility requiring an hours [sic] notice before it could be ready for flight with a depth bomb" (Freeman 1987:30). At Langley,

Army bombers also could not divert more than two flights per day over Fifth Naval District waters, further limiting the effectiveness of ComFive's operational plan.

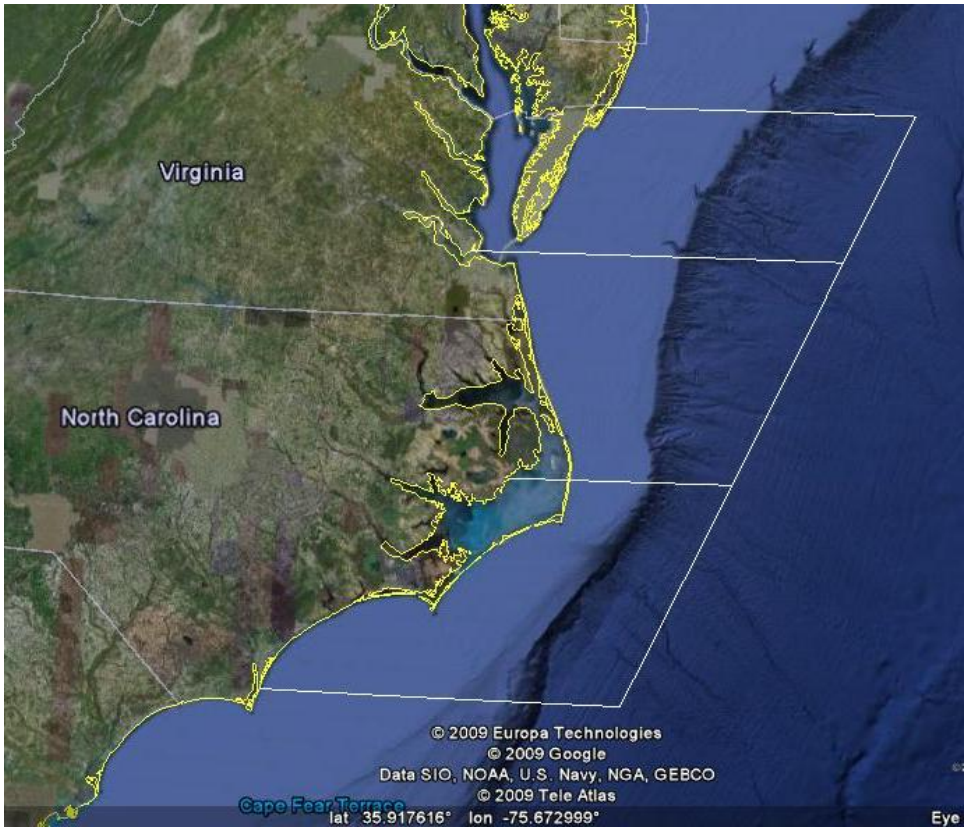

FIGURE 4.8. Sectors of naval and aerial coverage within the Fifth Naval District at the end of January 1942 (Google Earth Image, Paths Added by Author).

The strength of the plan was again limited when it was discovered that many land-based bomber pilots were not trained in the use of naval weaponry and could not properly deploy delayed trigger bombs and depth bombs. This, coupled with the inability to rapidly communicate between surface craft and air forces because information was routed through different departments severely hampered the otherwise well-planned and potentially effective defensive measures outlined by ComFive. Despite shortcomings, three aircraft began patrolling off Cape Hatteras, with the Diamond Shoals Light Buoy as the center point of their patrol, on January 25. During the rest of the month, no additional merchant ships were attacked in these waters, a dramatic change from the eight vessels attacked between January 18-25. This change

gave ComFive some hope that with enough aircraft the U-boat war in American waters could be won (Freeman 1987:30-32).

Unfortunately, for the Fifth Naval District, February would not bring any additional aircraft to the frontier as all planes made available for the Navy were being added to Fleet Squadrons until they contained enough aircraft to assist in the Coastal Frontiers while still carrying out their daily training flights and normal oceanic convoy escort tasks. Additionally, Admiral Andrews and ComFive received word from the Office of Naval Operations that informed them the Royal Air Force PBYs currently at Elizabeth City were about to be overhauled and sent to the British Isles. By this time, the Commandant of the Coast Guard also became weary of watching his facilities operate at less than full capacity while merchant ships were destroyed off American beaches and requested that the Bureau of Aeronautics add 46 airplanes to Coast Guard bases. The Bureau of Aeronautics quickly approved of the distribution of 40 OS2U-3 aircraft to Coast Guard bases throughout the country. On February 9, Admiral King greatly helped the East Coast war effort by requesting these aircraft only be assigned from Salem, MA, to St. Petersburg, FL, and not throughout the entire US. This request was approved on February 13 and the aircraft were slated for delivery to East Coast bases between February 27 and March 11. This change resulted in no additional air support added to the Frontier during February, but the hopes of increased aerial defenses for March (Freeman 1987:46-48).

On March 12, Admiral Andrews proposed what he called “scarecrow patrols” to help keep U-boats underwater, forcing them to travel at a slower rate and out of position for attack on merchant vessels. For the past three months, the ESF had noticed that German submarines would crash dive at the first sign of aircraft even if the airplane was unarmed. With this in mind, Andrews thought the ESF could exploit the U-boats protective diving routines and suggested the

"scarecrow patrols" be made of unarmed airplanes flown by civilians with the sole purpose of forcing the Germans to submerge. Although the proposal seemed feasible and offered a sound measure for combating the U-boat threat, Admiral King quickly shut down the idea under the guise of "operational difficulties" (Freeman 1987:95). This left the Frontier without the use of civilian aircraft, and the OS2U-3 aircraft scheduled for deployment into the ESF between February 27 and March 11 were delayed in being transferred.

Finally, on March 28, 70 OS2U-3 aircraft were assigned to the Frontier for anti-submarine duty. While only 15 were currently operational at the Naval Air Station in New York, the remaining aircraft were slated for delivery to various coastal Naval Air Stations at a rate of four airplanes per day. Additionally, Admiral Andrews was temporarily given one squadron from Carrier Replacement Group 9 that could be used for anti-submarine patrol and attack. This addition brought the total number of naval aircraft within the Frontier to 86 and the total number of Army aircraft to 84. Of these, 19 navy planes were stationed at North Carolina bases, while an additional 6 PBYs were located at Norfolk. Army airplanes that could contribute to combating U-boats in North Carolina waters included four B-25s at Wilmington, NC, four B-25s at Charleston, SC, four B-17s, two B-18s, and four B-25s at Langley, VA, and three DB-7s at Savannah, GA (Freeman 1987:112-113, 130-131). Although these aircraft fell short of Admiral Andrew's initial hopes March, "[t]he most encouraging thing about March was not so much the actual material increase in our strength as the indications, growing throughout the month, that in the weeks to come the results of our increasing production will be felt in this Frontier" (Freeman 1987:113).

In keeping with the terrible luck of the ESF, April would not be the month increasing production was felt throughout the Frontier. Despite slightly increased numbers of aircraft, ESF

waters continued to be the deadliest for merchant shipping in the world because available air and surface vessels were still spread too thin across a massive amount of ocean. Despite the addition of 126 aircraft into the Frontier, with 48 of these going to the Fifth Naval District, the Frontier could not prevent German submarines from sinking about the same numbers as they destroyed in March. It was readily evident to the ESF that the aircraft available still only allowed coastal defenses to react to U-boat attacks and not preventatively patrol for them at all times and keep them from surfacing (ESF 1942b:3,Appendix IV, Freeman 1987:203). Quickly, Andrews and the commanders of the Naval Districts were becoming anxious and demoralized about the outlook for the next few months. Despite their anxiety and acknowledging that "[t]he outlook for May is still almost as disturbing as it was at the beginning of April" they still believed that "pessimism should be tempered somewhat by the recognition that ships and planes are gradually accumulating along this coast and a protective system of considerable strength has been devised for the merchant vessels in our coastal waters" and that the month of May still may hold some hope for changing the tides of the battle (ESF 1942b:4, chap. 1). On April 30, however, when German U-boats sunk two merchant ships in the Frontier, projections for May began to look bleak.

Then, in a twist of fate, at the beginning of May, something unprecedented since the U-boats arrived off the American coast occurred. The first 17 days of the month saw no merchant ships lost in Frontier waters, and during the remainder of May only four ships were sunk within. This was a startling accomplishment considering that estimates of the Frontier placed more U-boats in coastal waters during May than any other month to date. Commanders in the ESF quickly recognized that some of this success could be attributed to an additional 20 percent increase in vessels and airplanes. These additional forces allowed U-boats to be hunted with

unprecedented force off the coastline and accounted for many more sightings and attempted attacks, one of which resulted in the confirmed sinking of a U-boat.

Additionally, as the convoy system was initiated mid month, airplanes could be used more efficiently by having them escort convoys instead of randomly patrolling for chance sightings of surfaced U-boats, trails of a periscopes, or silhouettes of submarines just below the surface in clear waters of the Gulf Stream. Even airplanes still used for patrols were becoming more effective as their pilots received better training and became more familiar with their instruments and weaponry as well as how to attack the U-boats more precisely (Freeman 1987:247-249).

On May 15, one of these patrol planes, the CG OS2U 5771 flying from Elizabeth City, spotted a slight wake 12 miles distant and investigated. After closing the distance, the pilot saw what he believed to be a submarine on the surface. After confirming that his radioman saw the same thing, he set up his attack. Using clouds for cover and throttling down to 1/4 speed to reduce engine noise, the pilot got a mile and a half from the submarine before its crew became aware of the plane. The submarine began a quick crash dive, leaving two crewmembers still standing on the deck. In a near textbook attack, the pilot leveled off 50 feet above the water and dropped two depth bombs, set for a depth of 50 feet, 150 feet in front of the submarine's conning tower. As the pilot swung the airplane around to look for damage, he soon spotted wood strips and oil coming to the surface in an arc away from the spot of the attack.

Shortly after this, several additional CG airplanes, an airship, and the destroyer *Ellis* relieved the CG plane. Over the course of several hours, *Ellis* delivered several depth-charge attacks by following the oil slick on the surface. Although the submarine was never confirmed sunk, a large chunk of deck planking came to the surface along with more oil and bubbles at least

suggesting the submarine was heavily damaged and proving that the American coastal defenses were becoming better at orchestrating and carrying out attacks (Freeman 1987:258-259). Finally, it seemed that diligence in training and utilizing the available forces was beginning to pay off and there might be more hope for June. Additionally, the increase in aircraft specifically assigned to the Navy grew to total 172 aircraft during May, with 45 stationed within the Fifth Naval District as of May 26. The additional planes provided a great increase in the number of aerial patrols and convoy escorts that could be flown in June.

In June, the ESF again stated that, by their best estimates, there were more U-boats operating in Frontier waters than at any other month during the war, yet these submarines destroyed only 13 vessels during the entire month. Furthermore, four of the vessels sunk were destroyed by striking mines laid by U-*701* in the Chesapeake Bay, an action that could not be prevented no matter how many planes were patrolling the seas. In addition to June being another successful month for the ESF, as the losses of vessels in the Frontier were kept to a manageable level, it was also a month for creating more efficient future plans. Early in the month, Admiral Andrews recommended that the different commandants of the Naval Districts should set up Anti-submarine warfare (ASW) training centers within their districts that had standardized layouts and facilities for training (Freeman 1987:331-332. Once these centers were established in Boston, New York, Cape May, Norfolk, and Charleston, they were furnished with an "Attack Teacher, the Dome Teacher in anti-aircraft (AA) machine gun fire, [a] lookout training room and a library and reading room where all available ASW publications, both US and Allied, would be readily accessible to officers of anti-submarine (A/S) vessels" (Freeman 1987:332). Andrews also suggested to Admiral King that, for the first time, the 209 naval aircraft available would allow implementing several submarine killer combat groups.

These groups would be responsible for limited patrol in especially dangerous waters, but their true value lay in their ability to respond quickly to U-boat sightings and to exhaustively track and destroy those submarines. One final suggestion that Andrews made to King was intended to make land-based Army aircraft more effective in anti-submarine operations. Since land-based aircraft could be kept ready to fly at a moment's notice, Andrews suggested that additional airfields should be established along the East Coast that land-based craft could use to follow operational shifts by U-boats. These airfields would be sparsely equipped and manned, but would have enough fuel and bombs to refuel and refit aircraft at these locations without having to cut their patrols short so they could make it back to the Army base they had left. These aircraft would also, for the time being, be transferred to Navy control and the specific Naval District in which they were operating to streamline command and control of A/S operations. While this recommendation was not carried out during June, it helped the Frontier look forward ending the war in American waters as the coastal defenses became more efficient and better trained (Freeman 1987:331-334, 370). In light of these factors, the ESF felt confident enough to express that

> When one considers the overall picture of the A/S warfare during the past month, two things are immediately apparent. The first is that despite the increasing number of enemy submarines actively engaged in these waters, returns per U-boat are steadily diminishing. This gratifying result can be traced directly to the fact that various methods of A/S warfare developed during the past six months are now reaching a healthy maturity. It is to be noticed also that constant effort is being made to increase the strength of the effectiveness of all of our weapons and men engaged in the attack against underwater intruders. These two things give some tangible grounds for hope that the most disastrous period of sub warfare on this coast is now over (Freeman 1987:334).

Fortunately, for the Frontier, July would corroborate these hopeful claims.

At the end of July, the Frontier again claimed that more U-boats were operating in Frontier waters than at any other time since the first merchant vessel was sunk on January 14.

Despite the Frontier estimating that approximately 16 U-boats were operating off the East Coast each day of July, only two merchant vessels were lost to direct enemy action early in the month, and none were lost during the remainder of July. Although very few merchant vessels were sunk, the Frontier accounted for its busiest month of the war to date, with 62 U-boat sightings, 23 sound contacts, and 41 attacks carried out against submarines (Freeman 1987:408).

The ESF attributed much of the success in July to the "growing air strength in the Frontier" which "has tended to reduce greatly the sphere of effective action by the submarines. The airplane, properly used, has proved of increasing significance in the kind of warfare which has been the main preoccupation of the ESF in this first half year of war" (Freeman 1987:408). On multiple occasions, pilots of aircraft spotted U-boats on the surface and delivered precise depth bomb attacks on crash-diving submarines. Several attacks resulted in U-boats being blown into the air by the force of the bombs and severely damaged. Multiple attacks, including one on July 14, resulted in the generation of oil slicks, bubbles, and debris rising to the surface causing pilots to suggest they could have destroyed the submarines by setting their depth bombs to 20 feet instead of 50, something they should have already done considering the success scored by Lt. Harry Kane a week earlier (Freeman 1987:409-410).

On July 7, 1942, at 1015 EWT, Lt. Harry Kane took his Army A-29 number 41-23392 on a routine patrol intending to fly from Cherry Point, NC, to the 100-fathom curve, then north along the curve and back. Three hours and 57 minutes into his patrol, Kane spotted U-*701* on the surface five miles away on his aircraft's port side. As Kane lined his plane up for an attack, the submarine dropped below the surface while Kane was still two miles away. Not giving up and steering a course straight for the submerged U-boat, Kane rapidly closed the distance to the still frothy surface where the submarine dove. As the A-29's navigator and bombardier looked down

from a height of 50 feet above the submarine, they could still spot the U-boat's outline in the clear waters of the Gulf Stream.

Quickly three MK 17 depth bombs, set for 25 feet were dropped, the last two of which appeared to fall directly on the submarine (Figure 4.9). About 15 seconds later, it appeared that air bubbles were rising to the surface. These bubbles were soon followed by the figure of a man. Suddenly, a group of between 25 and 50 men arrived on the surface, having abandoned the submarine while it was underwater. Kane swung back by and dropped a raft and life preservers before radioing the location of the submarine survivors and heading back to Cherry Point for fuel. While all but seven surviving U-*701* crewmembers drowned over the course of the next two days and nights, the event marked the first successful sinking of a German submarine by aircraft in ESF waters, and more remarkably in the deadly waters off the coast of North Carolina (First Bomber Command 1942:1,7; Freeman 1987:427-430; Hickam Jr. 1989:306-312,338). The July 14 attack by the two CG airplanes is also of interest because if the crews had set their charges to detonate at a shallower depth and indeed destroyed that submarine, they would have sunk *U-404* off Hatteras.

An additional attack on the 14th by two Navy OS2U-3s would also have spared three additional vessels from being torpedoed if it had been successful, as the pilots believed it had been. This is because the submarine these two aircraft severely damaged instead of destroyed was U-*576* operating in waters around Hatteras and the 100-fathom curve. On July 15, the severely damaged *576,* commanded by Kapitänleutnant Hans-Dieter Hienicke, spotted heavily guarded convoy KS-520 and managed to slam two torpedoes into *Chilore,* one into *Mowinckel,* and one into *Bluefields.* This attack sent *Bluefields* to the bottom and forced the other two out of the convoy and into the Cape Hatteras Minefield where they would be more severely damaged,

eventually causing *Chilore* to sink while under tow. Although U-*576* was most likely sunk after carrying out this attack when it was bombed by escorting aircraft and rammed by *Unicoi*, the sinking of the U-boat several days earlier could have spared several merchant vessels from destruction (Freeman 1987:409-413,418-419, Hickam Jr. 1989:315-318).

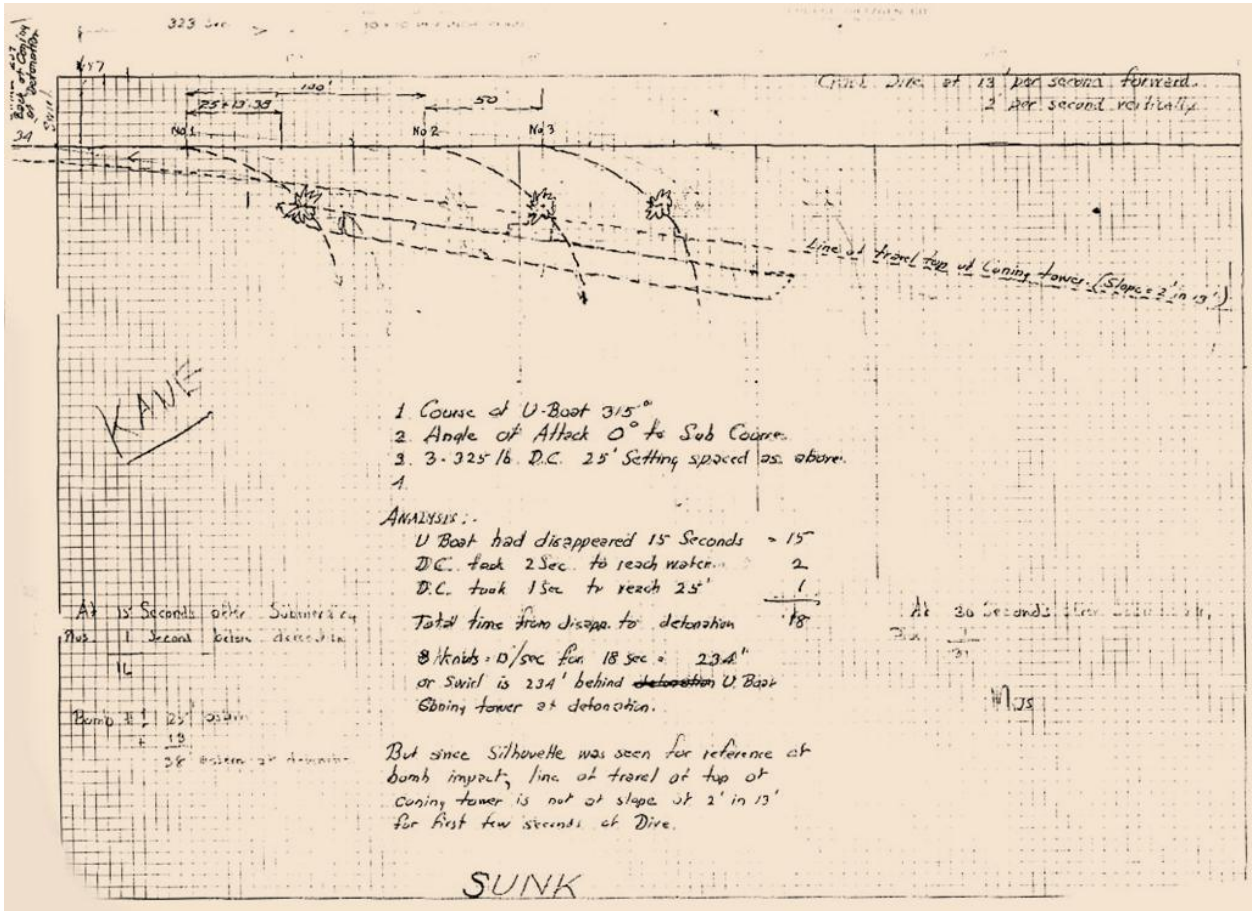

FIGURE 4.9. Diagram of Lt. Harry Kane's aerial attack on *U-701* <http://www.uboatarchive.net/U-701KaneAttackDiagram.htm>.

While the ESF learned a valuable lesson about ensuring that the resilient U-boats were actually sunk in an attack, they also managed to make it through the month losing only two merchant vessels to direct submarine action. They also learned the valuable lesson that it "is certain that with his [the German enemy's] customary flexibility he will shift to new methods of attack, but in the last month it has been possible to demonstrate that he can be beaten even when using the short and most effective weapon in his command" (Freeman 1987:411). This ultimate

realization would be what the ESF needed to give it hope for the successful future outcome of the war in American waters.

Resolution

At the end of July, it was obvious that the ESF had come a long way since April when 24 merchant vessels were destroyed in Frontier waters and only one German submarine was sunk. Since that time, Frontier forces had destroyed five more German submarines, three of which were sunk off North Carolina, the very waters that once teemed with U-boat activity and the burning hulks of torpedoed merchant ships (Hickam Jr. 1989:338). On the other hand, the number of merchant vessels sunk, in proportion to U-boat activity, within the Frontier had decreased dramatically. In May, the month following the devastating days of April, not one merchant vessel was attacked in Frontier waters during the first 17 days. After this span of relative peace, only four merchant vessels were sunk within ESF waters. Off Cape Hatteras, U-boats kept their distance, only torpedoing merchant ships well out to sea and beyond the coastal waters of North Carolina (Freeman 1987:274; Hickam Jr. 1989:334,335). The ESF did not attribute the lack of merchant vessel attacks within the Frontier to a lack of submarines either. Based upon the number of submarine sightings and allied attacks, the Frontier believed that there were at least 11 U-boats operating off the American Coast in May. One of these, *U-352*, had arrived off North Carolina as early as May 2.

Upon arrival in this area, the crew of *352* had not spotted any merchant shipping and had made several crash-dives to avoid allied air patrols. On May 5, the submarine's crew received a report that there might be a convoy headed south from Norfolk and decided to set a trap for it by lying in wait off Cape Lookout. After four days, the lookouts finally spotted a vessel they determined worthy of sinking on the afternoon of May 9. After maneuvering *352* so that the

unknown vessel was directly ahead, a torpedo was fired. Unfortunately, for the crew of *352*, the vessel they fired on was the USCG Cutter *Icarus.* As the torpedo sped through the water, it missed *Icarus* and exploded 200 yards off its port quarter. As the "General Quarters" alarm sounded aboard *Icarus,* the captain turned the vessel towards the spot where the explosion had occurred since sounds of propellers could be discerned in that direction. Arriving at the swirl left by the torpedo, *Icarus* dropped five depth charges before swinging back around and delivering another pattern of three charges in the same spot.

The CG crew soon spotted a large amount of air bubbles rising to the surface, and dropped another depth charge on top of them. After wheeling about again, the CG vessel dropped one more depth charge on the rising air bubbles. One minute later, the crew of *Icarus* watched the submarine surface, and instantaneously greeted it with machine gun fire. Once the cutter was maneuvered, the three-inch gun was trained upon the submarine and opened fire. The first shell skipped across the water and slammed into the conning tower, the second round missed, and the following six shots all pummeled the side of *U-352* as its crew came pouring out the conning tower. Once the men aboard *Icarus* determined that the German crew was abandoning the U-boat and not manning its guns, firing ceased and the submarine began sinking. After the submarine disappeared, one more depth charge was dropped on top of it, bringing an oil slick to the surface, and the German survivors were picked up (Freeman 1987:259-261). The sinking of *U-352* brought additional hope to the ESF. In the span of one month, two German submarines had been sunk, one by a naval vessel and the other by a Coast Guard vessel. Both events even occurred before implementation of the convoy system, which was begun just days after the sinking of *U-352,* helping the Frontier realize that they were effectively transitioning from a medley of makeshift patrol craft into a legitimate fighting force.

While it would have been beneficial for this transition to have occurred earlier, it certainly transpired at an important time as more U-boats than any previous month entered Frontier waters during June. Despite the increase in the number of U-boats operating during June, the number of vessels destroyed by submarines did not increase proportionally. Only thirteen vessels were lost to torpedoes or shells fired by U-boat and the mines the *U-701* laid across the Chesapeake Bay destroyed another four. Even with the additional loss of *F.W. Abrams* in the Hatteras Minefield, sinkings within the ESF for May totaled only 18 vessels. Although this number was close to the number lost in March and April, the ESF considered this a success since there were more U-boats in American Waters than ever before and because only four merchant vessels where sunk while sailing in a convoy (Freeman 1987:331). While North Carolina waters still contained six of the vessels lost, seven including *Abrams*, and another two damaged, the rapidity with which vessels were lost in these waters was also severely curtailed (Freeman 1987:369; Hickam Jr. 1989:335-336). The Frontier managed to reduce these numbers even further in July.

During July, a month when the ESF believed there were as many as 16 U-boats operating within American waters, the Frontier managed to reduce losses from enemy action to two ships. The first sinking occurred on July 3, when *U-215* torpedoed and sank *Alexander Macomb*, sailing in a convoy east of Boston. Quickly, one of the escorting British Trawlers, *Le Tigre*, found the submarine just below the surface and dropped two depth charge patterns on top of it. The depth charges instantly blew the submarine to the surface before it sank to the bottom. The second loss occurred on July 15, when *U-576* torpedoed and sunk *Bluefields*, travelling in a convoy east of Hatteras. Although *Chilore* and *J.A. Mowinckel* were also damaged in this attack and *Chilore* and *Keshena* sank after running into mines in the Cape Hatteras minefield,

Bluefields was the only vessel sunk by enemy action in the once deadly Cape Hatteras waters during the entire month. In this attack, however, the attacking submarine, *U-576,* was likely also lost, resulting in the second German submarine sunk in the waters of North Carolina during July and the fourth sunk off North Carolina overall. The losses of the submarines, *U-215, U-576* and *U-701,* in July meant that, for the first time since the United States entered the war, the ESF had managed to destroy more German U-boats than the submarines destroyed merchant vessels (Freeman 1987:409,411-420,442,427; Hickam Jr. 1989:317-318). With renewed vigor and confidence that the U-boats could be defeated, the ESF prepared for August.

In August, however, something unexpected happened; not one vessel was attacked in the waters off North Carolina. On a more impressive scale, not one ship was attacked within ESF waters. As American defenders continued to patrol, they looked out across an empty expanse of ocean dumbfounded. Where had the U-boats gone? It would not be until the end of the war that the ESF would have the answer to this question. On July 19, Doenitz had made a difficult decision; in the B.d.U. operations book he entered:

> In the sea area off Hatteras successes have dropped considerably. This is due to a drop in the traffic (formation of convoys) and increased defence [sic] measures. Of the boats stationed there in the recent period only two, *U 754* and *U 701* have had successes. On the other hand *U 701* and *U 215* have apparently been lost, and *U 402* and *576* badly damaged by depth charges or bombs. This state of things is not justified by the amount of success achieved. The two remaining boats (*U 754* and *458*) will therefore be removed. With this development has set in which might have been expected earlier. For occasional operations by single boats and minelaying operations in harbor entrances, areas along the east coast of America will come under consideration as before. (B.d.U. 1942c:39)

With this message, Doenitz effectively did what the Americans had been attempting to do for months; he ended the U-boat war against the American East Coast for the remainder of 1942 and, more or less, for the remainder of the war. It is unlikely that Doenitz felt no U-boat could

be successful against the American convoys it is probably that, in terms of cost Doenitz felt it was time to fully transition his U-boats south.

This southern transition of forces was something he had been planning ever since Operation *Paukenschlag*. As soon as Doenitz's U-boats began their attacks on America, Doenitz knew that they would have a limited amount of time to attack the American shipping lanes before the United States mustered a strong defense against the submarines (B.d.U. 1941:258). In all likelihood, Doenitz probably thought the Americans would react quicker than they did, which is why he began transitioning U-boats further south before the northern hunting grounds were entirely depleted of targets. As early as February, the ESF noticed a discernable southward shift in U-boat operations, suggesting that in the following months the South Atlantic would become the main theater of U-boat operations. This shift was slightly clearer in April as more attacks took place south of Hatteras and not as many occurred in the northern waters of the Frontier. Finally, during May, when the merchant vessel losses in the ESF were severely reduced, it became apparent that the U-boat hunting grounds had officially transitioned to waters of the Southern, Caribbean, and Gulf Sea Frontiers (Figure 4.10) (Freeman 1987:45,166,248).

In May, "the U-boats struck in the Caribbean and the Gulf with devastating effect. In these two general areas 15 ships were accounted for in April while in May the total sinkings for both the Gulf and Caribbean was 80" (Freeman 1987:247). As the Gulf and Caribbean remained the primary zones of U-boat operation for the next few months, it became obvious that the voluntary transition of U-boats to the south had spared the ESF from having to eradicate entirely the submarines operating within their territorial waters (Freeman 1987:331). Shifting the U-boats operational area all but signaled the end of the battle for the ESF and the end of U-boat activity in North Carolina waters.

This is not because the U-boats never attacked off North Carolina again, but that by transitioning U-boats to the south, the Germans let the ESF build up their defenses and submarine hunting doctrine. This meant that the few submarines Doenitz permitted to return would never attain the same victories the Germans enjoyed during the first four months of 1942.

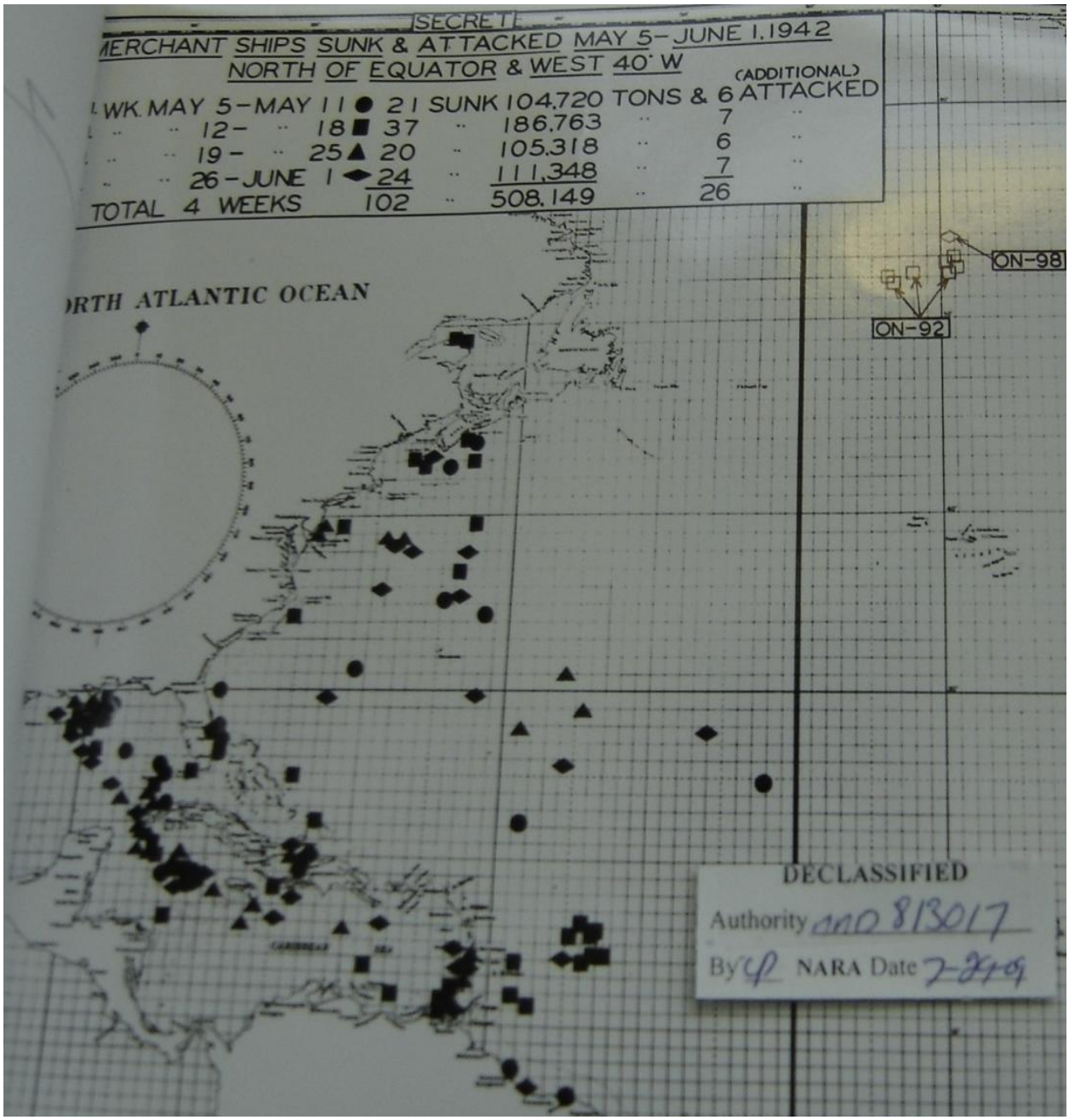

FIGURE 4.10. Chart depicting U-boat attacks from May-June 1942, which clearly shows a shift in U-boat activity to the south Atlantic (Photo Courtesy of the National Archives, College Park, MD).

When Doenitz finally sent a U-boat back to Hatteras at the end of March 1943, after a period of six months since the last submarine had patrolled these waters, it was not because he believed the vessel would be extraordinarily successful after the hiatus in U-boat attacks, but that he had to assign the vessel a patrol area since it could not reach the Caribbean due to overheating batteries. This submarine, *U-129* would sink one vessel south of Bermuda on April 2, and one well out to sea southeast of Hatteras on April 24 before entering North Carolina.

Upon entering this area, the crew of *U-129* managed to sink only one vessel, *Panam,* on May 4 before proceeding into deeper waters and expending the rest of their torpedoes by missing two ships with six torpedoes. Despite these meager results, Doenitz decided that he would send three more boats to scout for merchant vessels sailing around Hatteras (B.d.U. 1943:180,212,221,278,317,338; Commander Fifth Naval District 1943; Rohwer 1999:163,165). Unfortunately, for Doenitz, his U-boats would not sink another vessel off Hatteras until December when *U-129* swept back through American waters. While patrolling along the American Coast, the crew of *U-129* spotted the merchant ship *Libertad* sailing in a convoy and managed to get close enough to sink it with a spread of torpedoes on December 4 (B.d.U. 1943:370; Commander Eastern Sea Frontier 1943). The next time a U-boat would torpedo a vessel off North Carolina would not occur for almost a year at a time when the United States Navy felt the "submarine threat was beaten. Submarines still had nuisance value, but their threat was gone" (Navy Department 1945:3).

The next merchant vessel torpedoed in the waters of North Carolina would also be torpedoed more out of happenstance than because Doenitz desired to reopen the American East Coast as a theater of operations. Since the Allies were sinking U-boats at an alarming rate, Doenitz knew that it might not be possible for U-boats to resupply while at sea and encouraged

U-boat captains to end patrols with enough supplies to reach a friendly port in the event that provisions could not be acquired in the open ocean. One such boat, *U-518* received these orders on August 7, 1944, whilst on the way to the Caribbean. In order to ensure that his U-boat would not need supplies before reaching port, the captain of *U-518* decided to transfer his operational area to the waters off Hatteras on August 11.

Although *U-518* arrived in its patrol area in mid August, it would not make an attack until just after midnight, EWT, on September 12. In the early morning hours, the crew of *U-518* spotted the unescorted liberty ship *George Ade* sailing on its maiden voyage. *George Ade* was blacked out and travelling north, destined for New York, on a clear sea with moderate swells. Neither crew could have predicted that those moderate swells were the beginning of a hurricane moving northward behind *George Ade*. Once the captain of *U-518* maneuvered his submarine into position, a torpedo was fired which struck the liberty ship on the starboard side near the rudder (B.d.U. 1944:515,525; OCNO 1944:1; *The Washington Post* 1944:3). The torpedo struck with a "dull thud" but with tremendous force that threw a sheet of water 25 feet high over the stern of the vessel. The damage was severe:

> Deck buckled across #4 hatch. Plates buckled on both sides above waterline amidships. Stern plating aft buckled extensively. After peak tank holed and flooded, shaft alley flooded, shaft driven ahead and Kingsbury thrust telescoped. Steering engine destroyed immediately and rudder damaged and inoperative. Deck winches aft lifted from foundations and steam lines broken. Bulwarks port side forward of main deck housing cracked. Rudder stock driven up through deck, carrying parts of deck up 2'. Berths and lockers in Armed Guard quarters aft knocked down. Main engines probably knocked out of line and were secured immediately as ship was out of control. (OCNO 1944:1)

Despite extensive structural damage, the hardy Liberty ship remained afloat and its entire crew, although severely shaken, remained alive. Quickly, crews manned the guns aboard *George Ade* as another torpedo wake was spotted passing directly under the Liberty ship and off into the distance. Several men thought they spotted the submarine on the surface and a couple of

shells were fired toward it, but by the time the flash of the gun's muzzle died away, the submarine had vanished. Fortunately, for everyone aboard *George Ade*, the submarine did not attack again and the vessel continued to drift dead in the water with its crew sending out distress signals. Early in the afternoon on September 12, the crew of USS *Escape* (*ATR-6),* found *George Ade* and managed to secure a tow line to it before heading towards shallower waters while the Coast Guard cutters *Jackson* and *Bedloe* came to render assistance and protect the crippled ship.

By the night of September 13 *ATR-6 and George Ade* were off Wimble Shoals making an excruciating one knot whilst being pummeled by rising waves and increasingly fierce winds. Around noon on September 14, the towline parted while the ships were about 12 miles off Bodie Island and *George Ade* began drifting out of control towards shore. The crew quickly dropped one anchor in 13 fathoms of water, which was carried away before they dropped another with 60 fathoms of chain attached. This one managed to hold while the engines of *George Ade* were gently run to prevent the ship from drifting anymore. As the crew of *George Ade* hoped their anchor would hold, they were pummeled by 100-knot winds and 50 foot high waves until the seas finally calmed nine hours later. In the morning, the towline was reattached and the vessel towed towards Chesapeake Bay. In one final insult to the already damaged merchant vessel, *George Ade's* propeller fell off on the afternoon of September 16 just hours before it was towed into port for repairs where the entire ships compliment of 67 stumbled off the ship weather-beaten but alive (OCNO 1944:1-2; *The Washington Post* 1944:3). Sadly, for the crews of *Jackson* and *Bedloe*, the same could not be said for them.

After coming to the assistance of *George Ade*, both vessels had been caught in the hurricane and foundered. Of the 37 men aboard *Jackson*, only 19 would be rescued after

spending 58 hours afloat at sea. Only 12 members of *Bedloe's* 38-man crew would survive 51 hours adrift. These men were lucky to be alive after their vessels were battered by 100-foot waves during the hurricane and the crews were incessantly harassed by sharks and stung by Portuguese Men-of-War after their ships sank (*The Washington Post* 1944:1). While the loss of these two vessels was a very unfortunate event for the United States Coast Guard and the ESF, there was an uplifting part to it. During the entire year of 1944, the Atlantic weather had proven more deadly than German submarines off North Carolina since no additional vessels were attacked the during remainder of the year. The loss of no vessels and only one damaged due to enemy action gave the ESF hope that the war had been won in their waters and that 1945 would witness no U-boat activity in the waters off North Carolina.

The ESF's wish for no U-boats in 1945 did not come true entirely as a couple of submarines were sent as a last-ditch effort in the spring of 1945. On April 14, one of these submarines torpedoed and sank the merchant ship *Belgian Airman*, loaded with a cargo of sorghum and dairy feed, off the coast of North Carolina. Quickly, 46 of the 47 man crew were rescued and brought to shore after one man died while attempting to jump into a lifeboat, hit his head, fell overboard, and drowned (CESF 1945; ESF 1945a:1-2,chap.2). The *Belgian Airman* was the last merchant ship sunk by German U-boat in the waters of North Carolina. Just nine days later, the Norwegian vessel *Katy* became the last vessel attacked off North Carolina. Despite being torpedoed, *Katy* remained afloat and proceeded under its own power to Lynnhaven Roads, Virginia, for repairs. The U-boat or U-boats that attacked these two merchant vessels remain a mystery, however, as the ESF quickly sought the submarines and discovered two U-boats, *U-857* and *U-879*, and probably destroyed both of them before they could report any successes.

While *857* is tentatively credited with the attacks, the patrol areas and final coordinates of both submarines are not known since neither submarine was positively sunk (ESF 1945a:3,chap. 2; Rohwer 1999:199). Although the ESF reported two "probable sinkings" in the waters off Virginia and North Carolina on April 18 and April 30, neither was definitively confirmed. The event on April 18 was carried out by a blimp and several surface ships on a series of sonobouy contacts that gave "positive evidence of a submarine." Once the vessels concluded their attack, the sonobouys "indicated [a] successful attack" (ESF 1945a:87,Appendix E). The attack carried out on April 30, had similar results. After the crew of the American patrol frigate USS *Natchez* spotted a submarine's periscope and schnorkel on the surface on April 29, *Natchez,* and destroyer escorts *Thomas, Coffman,* and *Bostwick* carried out a series of searches and depth charge attacks on the submarine which immediately submerged. Over the course of the next seven hours, the American vessels made nine attacks bringing lots of oil to the surface before the contact was lost. Since the attack occurred in 1,323 fathoms, positive confirmation of the attack was impossible at the time (ESF 1945a:115,117,Appendix E). Regardless of whether these attacks sank the two submarines, *U-857* and *U-879* were never heard from again and no further attack was ever carried out in the waters off North Carolina.

Although one enemy submarine was spotted patrolling off Hatteras at the beginning of May, and one submarine sank the merchant vessel *Collier*, travelling off Rhode Island loaded with 7595 tons of coal, on May 5, the waters of the ESF had become a dangerous place for U-boats to operate. Within three hours of the attack on *Collier*, three American vessels, *Ericsson, Moberly,* and *Atherton* had sonar contact on the submarine just five miles from the spot of the attack and began laying down a barrage of depth charges. Soon oil and debris with German markings began floating to the surface. On May 6, divers confirmed that this attack resulted in

the sinking of another German submarine in ESF waters. This U-boat was lost with all hands just two days before the official German surrender of their submarines (ESF 1945b:1-2,chap. 1; ESF 1945b:1,chap.3). Finally, the ESF had defeated the German submarines and had even sunk one of the last U-boats destroyed by the Allies in war related incidents. After five long years of planning, fighting, and incessant patrolling, the forces of the ESF claimed victory in the form of a German submarine lying on the bottom of the Atlantic off Rhode Island. With jubilance, the ESF expressed,

> So ended the Battle of the Eastern Sea Frontier, about sixty miles from the scene of the first sinking on 13 January 1942 when the tanker NORNESS was torpedoed. In the intervening forty months, 114 merchant vessels, 678,669 gross tons, and five men-of-war were sunk by submarine action. An additional 23 ships were damaged by submarine attack but reached port after the action. Two merchant vessels and one British trawler were sunk by enemy mines and two ships damaged by enemy mines reached port. Six submarines were definitively sunk and at least two more probably sunk. (ESF 1945b:2-3,chap. 2)

Conclusion

As each vessel's hulk and the bodies of its crew came to rest on the bottom of the, they presented future generations with a valuable opportunity to observe the destruction German U-boats brought to the American Coast during World War II and to learn about an often forgotten time in American history when victory in the Battle of the Atlantic was not certain. Unfortunately, not all individuals respect the sacrifices the many men who died off North Carolina made while attempting to keep the shipping lanes open and supplies flowing to America's allies overseas. It is for this reason that a boundary needs to be applied to the abstract area defined by the term "Battle of the Atlantic" off the North Carolina coast. By using these historical events and the coordinates of each to analyze where the most U-boat activity occurred, and using theories of battlefield archaeology to define limits of the battle, protective boundaries

can be instated to safeguard these relics of American history and offer a small tribute to the many brave sailors that plied the deadly waters off North Carolina in World War II.

CHAPTER FIVE: UNDERSTANDING THE BATTLEFIELD

Introduction

Before geospatially defining the battlefield's extent and hotspots of activity within it, it is important to understand the events and vessels that comprise the battlefield. Since locations of many events historically defined as occurring "east of Hatteras" were first included in the *Access* database, it was important to discover how many actually occurred within North Carolina waters. This task was greatly simplified by adding the point shapefile representing all historical events to *ArcMap,* along with the line shapefile of ships' routes, and the polygon shapefile of the ESF boundaries. Once each of these elements had been imported into *ArcMap* along with a shapefile outlining the state (Figure 5.1), the events shapefile could be edited so it contained only those points occurring within the latitudes of North Carolina.

Since the purpose of this study was to delineate battlefield boundaries within North Carolina waters, the ESF boundaries were selected to represent the easternmost extent of North Carolina waters. This was done since the American Navy selected these boundaries to mark waters under their protection, which meant that events occurring beyond these borders were not recognized by the United States as occurring within American waters. Once these broad boundaries were selected, the events shapefile was edited so that only events occurring within these boundaries were chosen for analysis (Figure 5.2). Upon determining which events occurred within North Carolina waters, statistical analysis of these events became possible. This chapter analyzes these events in several different ways beginning with the broadest battlefield elements and narrowing the research to reveal minor statistical trends within the battlefield.

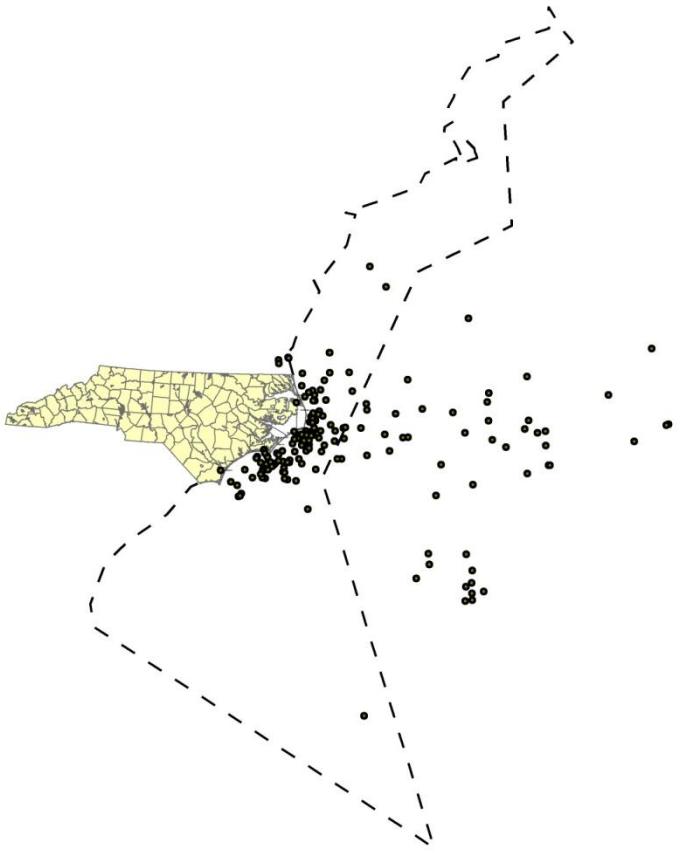

FIGURE 5.1. Locations of all historical events listed as occurring "East of Hatteras" in historical documents.

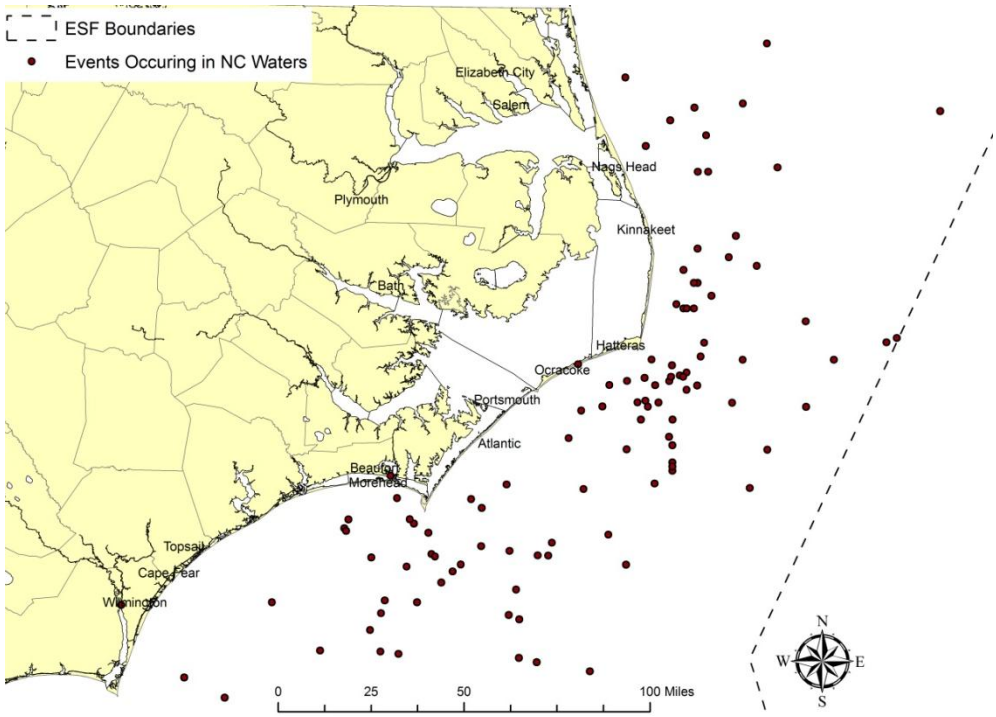

FIGURE 5.2. Events occurring within the waters of North Carolina.

The statistical analysis begins by examining the number of events that took place within the study area as well as the nationalities that contributed to battle-related events. Once the major nationalities are revealed, it becomes possible to analyze how costly the battle was to each nation in terms of vessels and gross tonnages lost or damaged. The cost of the battle can then be studied in relation to the chronology of the battle to determine if trends identified in historic documents are prevalent in the regional waters of North Carolina. The remaining analyses conducted determine what vessel types were most affected by the battle and which U-boats were most successful.

Event Statistics

Upon completion of editing the events shapefile so that it only consisted of actions occurring within the territorial waters of North Carolina, it was discovered that 71 different vessels contributed to 142 events for which coordinates are known or speculated. These event types range from attack locations, to attack types, to sinking locations, to survivor rescues, and even to those locations where disabled vessels were towed within the study area. While event locations will not be discussed in this chapter, the proportions of the events contained within the study area can be seen in Table 5.1. The most numerous events occurring are German U-boat torpedo attacks on merchant vessels. This type of event accounts for 50 of the 142 historical events, or 35.2% of all events occurring, suggesting the study area's moniker of "Torpedo Junction" is quite fitting.

The next two most frequent events were the reporting of speculated and known vessel sinking locations. Speculated wreck locations accounted for 21.8% of event locations and known sinking locations accounted for another 14.8% of the events occurring within the study area. It is important to note, however, that due to the geographical nature of this study, these

percentages only represent events for which coordinate data was recorded at the time of the incident, or, in the case of known shipwrecks locations, subsequent surveys determined their final resting locations. This means that popular events such as survivor rescues and attempted attacks on U-boats for which no coordinates were recorded are statistically underrepresented. This data nevertheless, allows additional statistical observations about the battle to be made and reveals the major combatants within the battlefront.

Action Type	Frequency of Action	Percentage of Total Events
Known sinking location of a vessel's bow	1	0.70%
Known sinking location of vessel	21	14.79%
Last known location of vessel (possibly still afloat)	1	0.70%
Speculated vessel sinking location	31	21.83%
Stern of vessel towed for salvage	1	0.70%
Survivors rescued	3	2.11%
U-boat attacked (aerial bombs and ramming)	1	0.70%
U-boat attacked (aerial depth charge)	1	0.70%
U-boat attacked (gunfire, shellfire & depth charges	2	1.41%
U-boat attacked an Allied vessel with gunfire	1	0.70%
U-boat attacked an Allied vessel with torpedo(s)	3	2.11%
Vessel anchored at location	2	1.41%
Vessel and survivors taken to location	2	1.41%
Vessel attacked (shellfire)	3	2.11%
Vessel attacked (torpedo & shellfire)	2	1.41%
Vessel attacked (torpedo)	50	35.21%
Vessel attacked by friendly fire	1	0.70%
Vessel beached	1	0.70%
Vessel Caught in Hurricane	2	1.41%
Vessel collided with a war related shipwreck	1	0.70%
Vessel collided with another vessel	2	1.41%
Vessel docked for repairs	1	0.70%
Vessel foundered under tow	1	0.70%
Vessel struck mine/mines	4	2.82%
Vessel towed to location	4	2.82%

TABLE 5.1. Frequency and percentage of events occurring within the study area.

Events by Nationality

Further examination of the historical events reveals that 12 different nations are represented in the battleground. As could be hypothesized, American vessels comprise most of the events. The additional actions are divided amongst the remaining 11 nations in much smaller proportions (Figure 5.3).

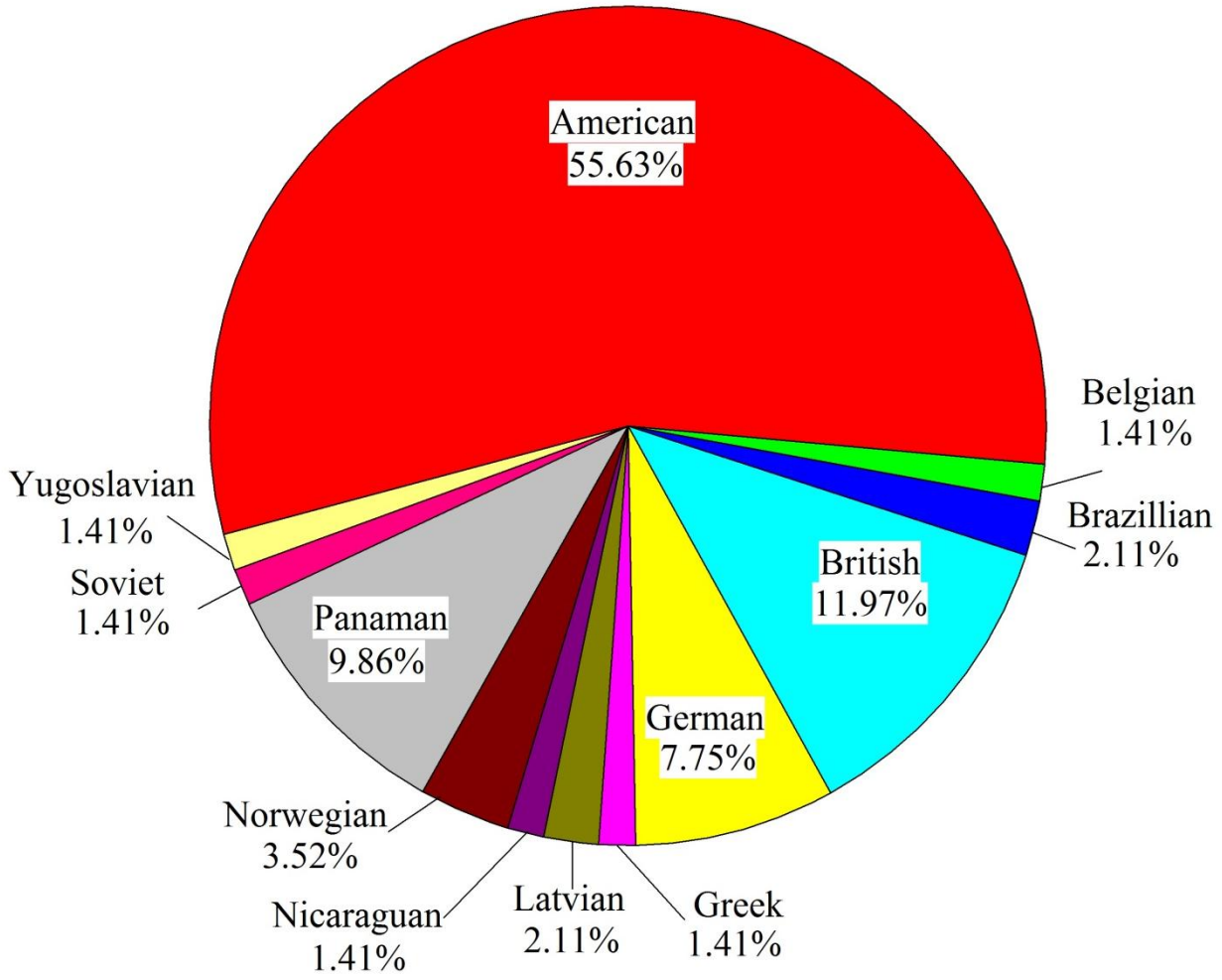

FIGURE 5.3. Nationalities of vessels that contributed to events within North Carolina waters, n=142.

While this diagram represents the nationalities of vessels that contributed to events off the coast of North Carolina, it does not represent the number of vessels involved from each nation. This is because some vessels like *U-576* torpedoed three merchant vessels in quick succession,

accounting for multiple events for which coordinates were recorded. By examining the nationality of each vessel and only counting the vessel once, as opposed to counting it each time it was involved in an incident, it is possible to represent the number of vessels involved from each of the 12 nations (Figure 5.4).

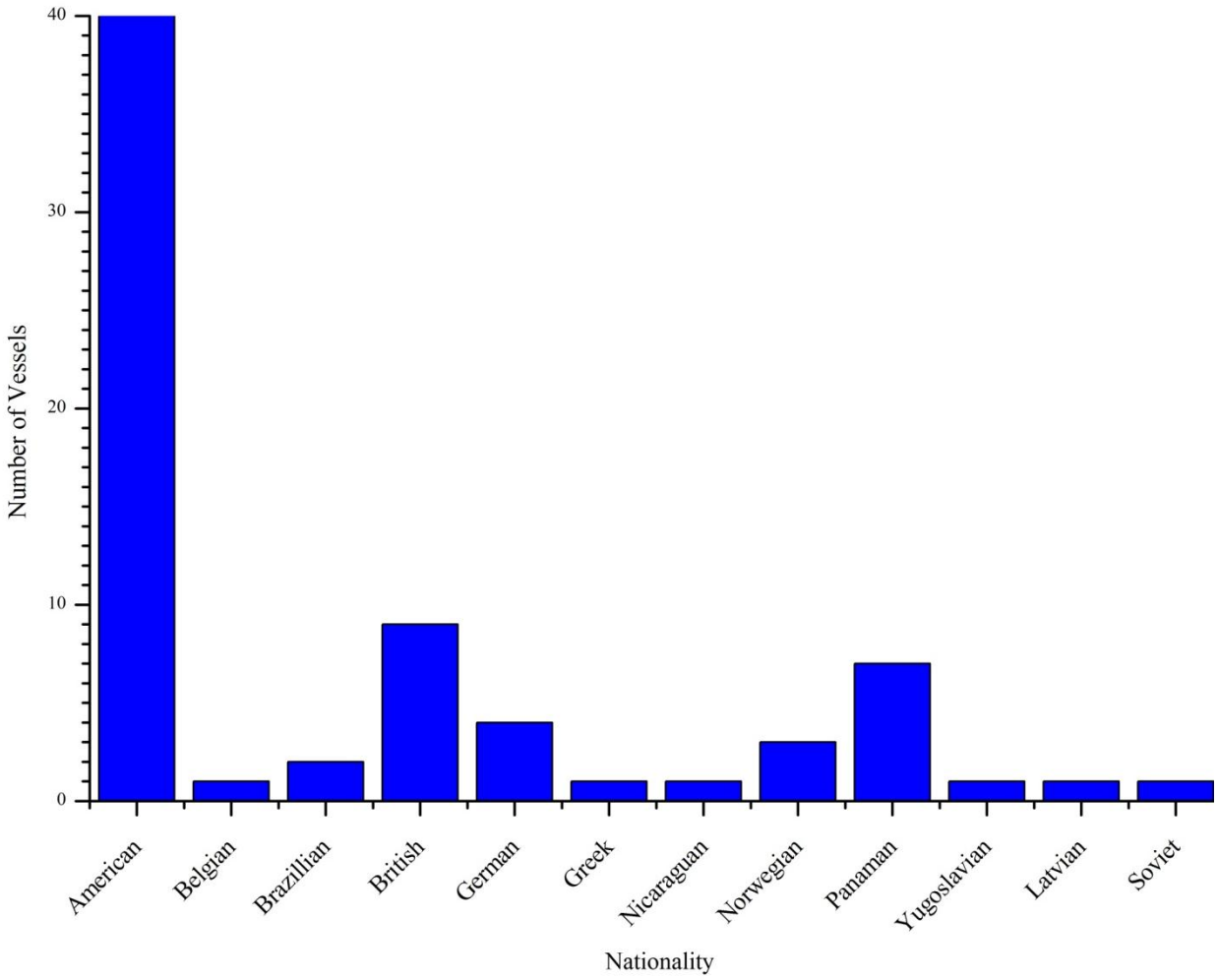

FIGURE 5.4. Number of vessels from each nation contributing to events within the battleground, n=71.

One important factor to consider is that most events occurring within the battleground are attacks on merchant vessels by U-boat. This means that each attack event also represents a German action. This also means that, in reality, the proportion of German actions and vessels in these waters is likely as high as the proportion of American actions. The difference, however, is

that the locations the U-boats attacked from are not represented in the Allied attack and sinking reports but are represented in the microfilmed German KTBs which are still in German. If ever anyone undertakes the painstaking process of translating these records, additional georefrenced information can be added to a GIS of the battle, fully representing the actions of the German U-boats in American waters. This will allow the battle to be viewed from the perspective of the German submariners and not just in light of the actions and reactions of Allied and neutral vessels.

Since the majority of events occurring within the battlefield are German attacks on Allied and neutral vessels, it is possible to break these events by nationality to represent which nations were most affected. The number of vessels sunk from each nation can also be plotted to show how many attacks resulted in a lost vessel. While this portrays the numbers of vessels attacked and sunk, it does not fully represent the destructive nature of the battle since additional ships were damaged and sunk due to war related accidents including collision, friendly fire, foundering while on patrol, or running into the Cape Hatteras minefield. By plotting the occurrence of each damaging event in relation to one another (Figure 5.5), a better understanding of the destructive nature of the battle can be obtained. While proportionally more American vessels were attacked and sunk than vessels of any other nation, they also accounted for more maritime accidents than any other nation, many of which had devastating results. With the exception of British and Panamanian vessels, more American vessels were sunk through accidents than vessels from other nations were sunk by U-boats.

These figures can be further analyzed to reveal the loss to each nation in terms of gross tonnage (Figure 5.6). Again, it is possible to see that American vessels accounted for the largest gross tonnage lost, with Britain a very distant second and Panama third. It is also apparent that

the American maritime accidents accounted for the loss of more gross tonnage than any other nation, again with the exception of Britain and Panama.

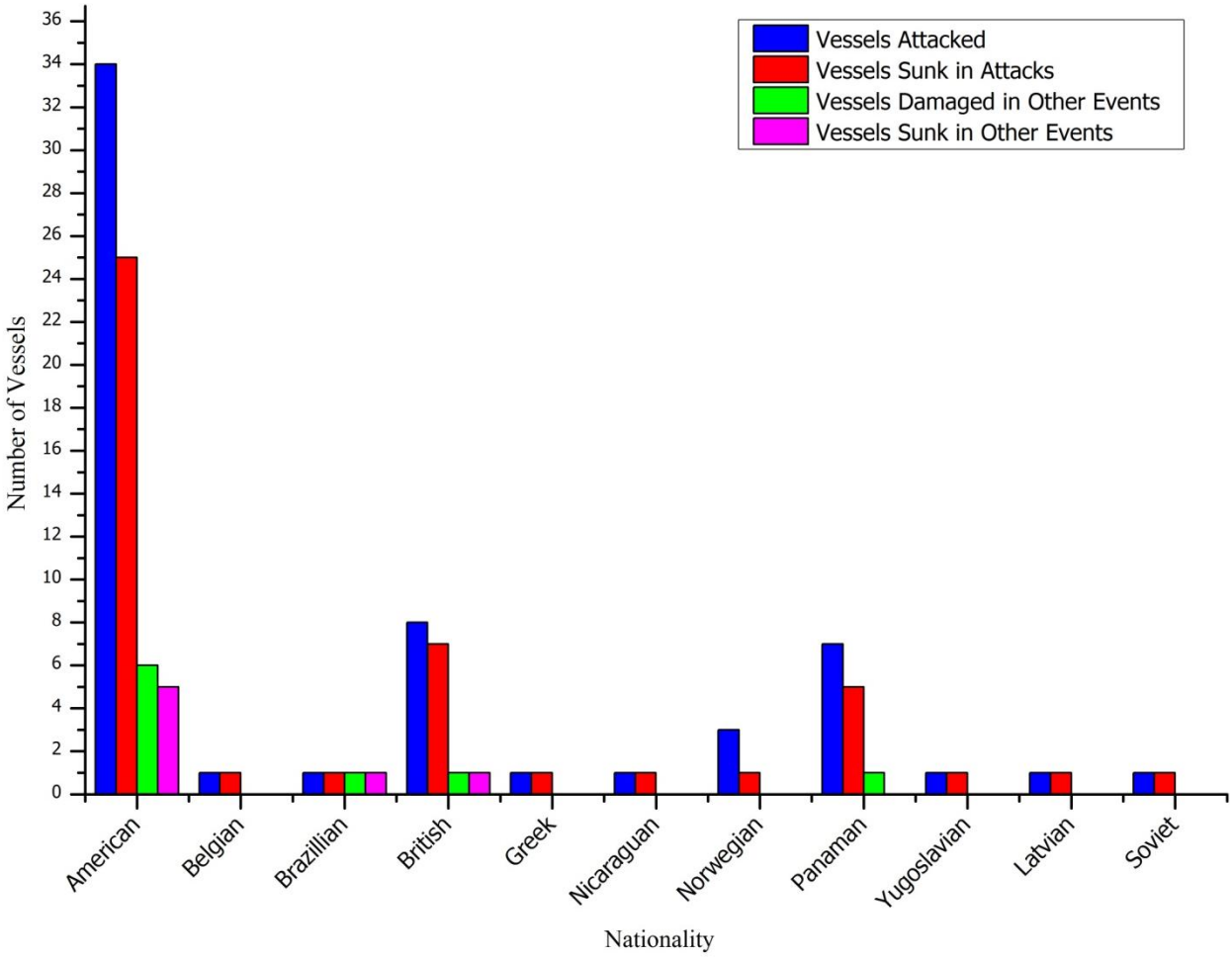

FIGURE 5.5. Number and nationality of vessels damaged and lost in battle related events.

When the gross tonnages lost are summed, the overall devastation wrought by the war off the North Carolina coast becomes evident. America lost 188,185 gross tons. Even when tonnages of the American military vessels sunk in the engagement are subtracted, America still lost 187,533 gross tons of merchant shipping. Belgium lost 6,959 gross tons, Brazil lost 8,387 gross tons, Britain lost 48,242 gross tons (excluding the armed trawlers *Bedfordshire* and *Senateur Duhamel*), Greece lost 5,106 gross tons, Latvia lost 3,779 gross tons, Nicaragua lost 2,063 gross tons, Norway lost 7,866 gross tons, Panama lost 25,681 gross tons, the USSR lost

5,284 gross tons, and Yugoslavia lost 3,289 gross tons. This means that the waters of North Carolina served as the catalyst for the loss of 304,189 gross tons of merchant shipping during the war, of which 278,172 were lost as a direct result of U-boat attacks. When these figures are analyzed based on chronology, the trends they reveal can help substantiate the historic record.

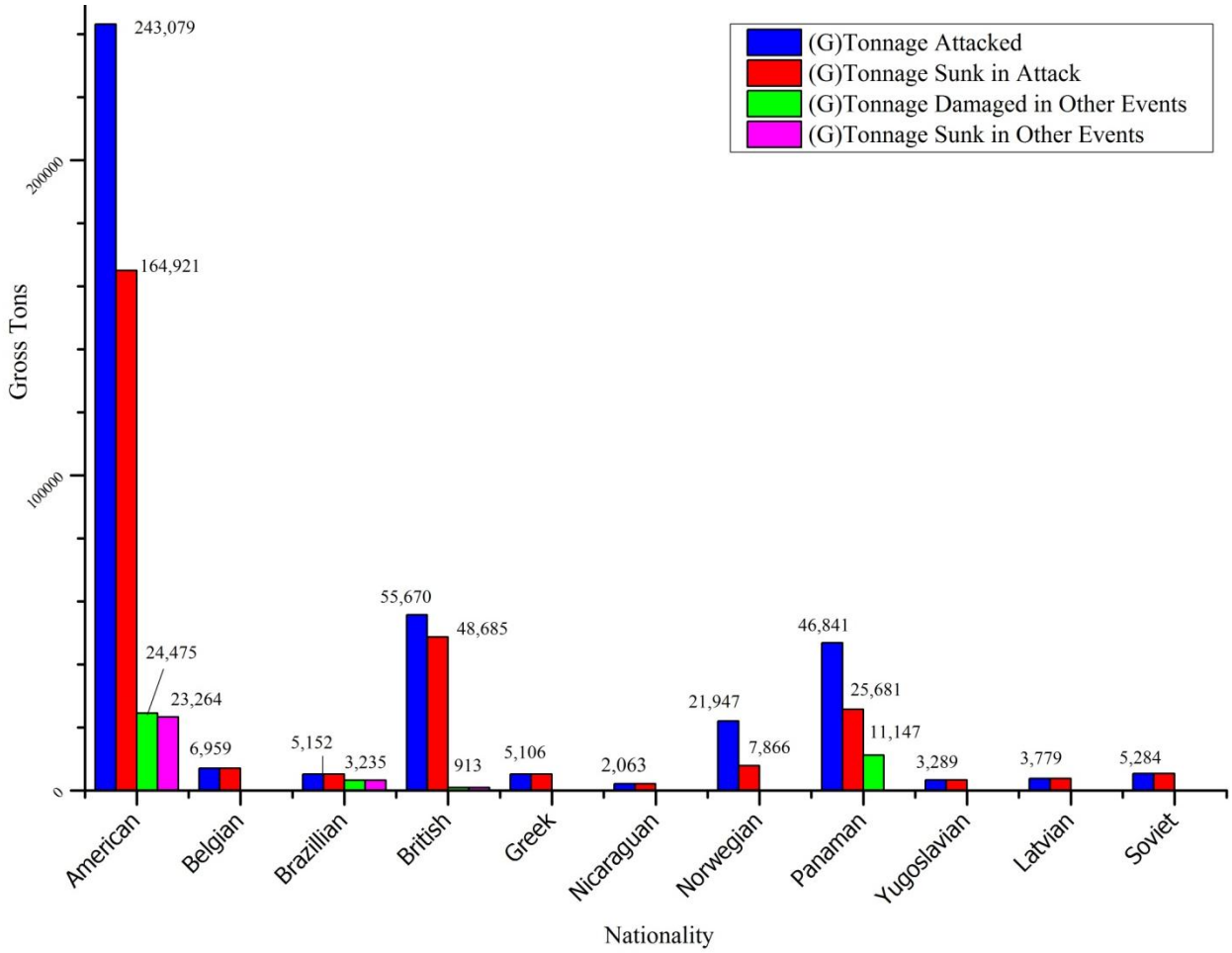

FIGURE 5.6. Gross tonnages damaged and lost in war related events.

Chronological Statistics

As revealed through historical research, the battle off the coast of North Carolina had virtually ended by the close of July 1942 with relatively few attacks or events occurring the remaining three years of the war. By chronologically charting the number of attacks and sinkings (Figure 5.7) within the study area as well the gross tonnages attacked and lost (Figure

5.8), it is possible to determine which months of the battle were the most costly. Although Doenitz originally ordered few U-boats to enter North Carolina waters during Operation *Paukenschlag*, the eventual appearance of Hardegen and Zapp in these waters caused January to be a relatively productive month for the U-boats off this shoreline. Despite the successes of these commanders around Hatteras, however, the number of attacks occurring off North Carolina dropped during February 1942 despite continued attacks in ESF waters (Freeman 1987:44).

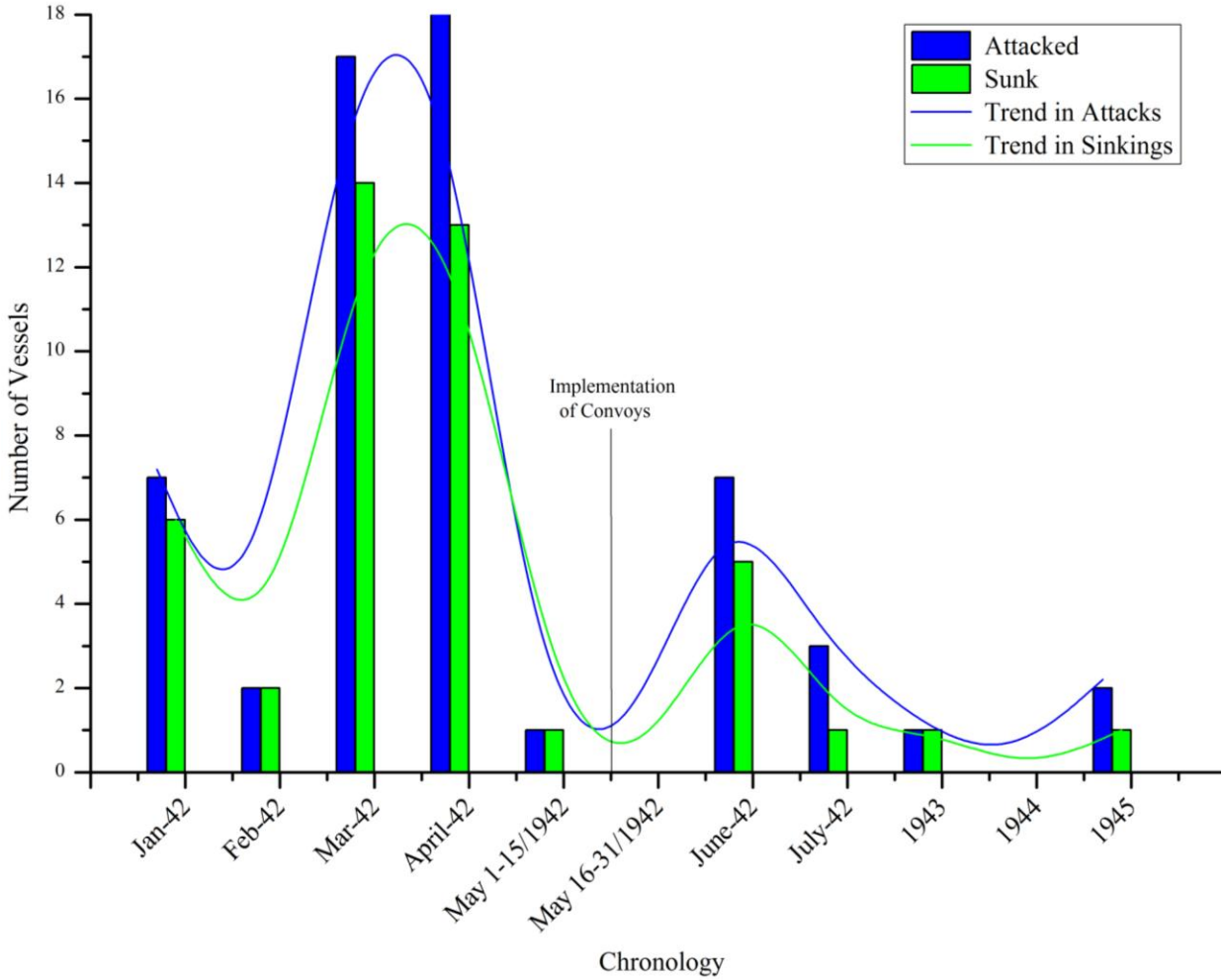

FIGURE 5.7. Number of vessels attacked and sunk throughout the war.

The months of March and April on the other hand would not witness this same decrease in attacks within the waters of North Carolina as both months saw increased U-boat attacks and sinkings. May 1942 remains an interesting phenomenon as very few attacks occurred in North

Carolina waters and the entire ESF (Freeman 1984:247).

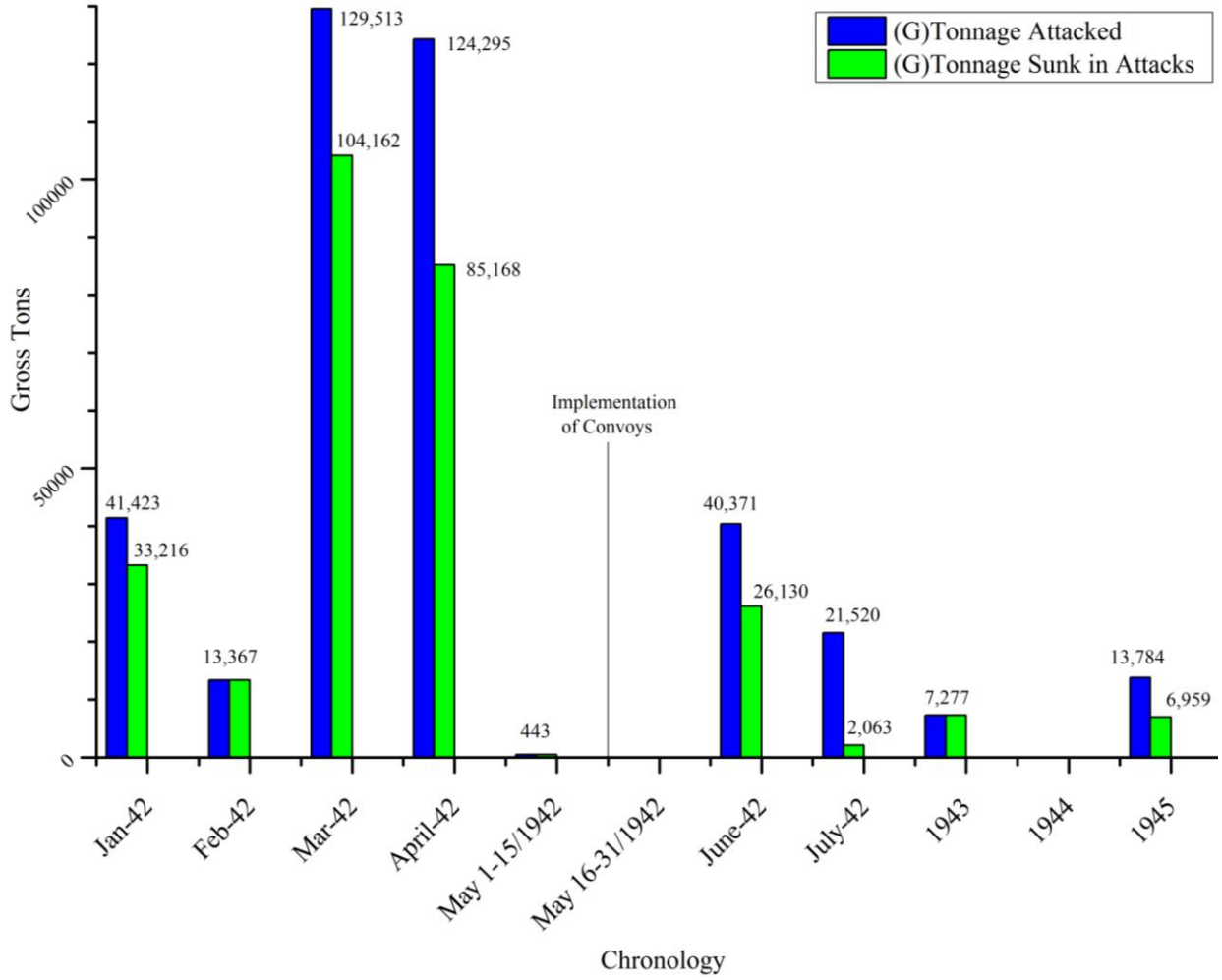

FIGURE 5.8. Gross tonnage of vessels attacked and sunk throughout the war.

Although the ESF officially initiated the coastal convoy system on May 15, 1942 (Freeman 1987:249), this does not explain the lack of attacks in North Carolina waters since no merchant vessels were attacked during the entire month and the only vessel lost was the British armed trawler HMT *Bedfordshire.* While the U-boats were able to recoup some of their lost opportunities in June 1942, it appears that Doenitz's shifting of U-boat operations to the south Atlantic and Gulf of Mexico, combined with his withdrawing of U-boats from Hatteras for the remainder of 1942, forever sealed the fate of the German submarines off North Carolina. After

the first six months of 1942, German U-boat successes would never again equal those obtained at the beginning of that year.

Despite April 1942 being the month that the most merchant vessels were attacked, it was not the costliest month in terms of vessels and gross tonnages lost. March 1942, witnessed the most vessels sunk and almost 20,000 gross tons of shipping more than the month of April. Similarly, while only two vessels were sunk in February, they accounted for more tonnage lost than in July when the ESF predicted there were as many as 16 German U-boats operating in Frontier waters (Freeman 1987:408). Even with increased numbers of U-boats operating in the waters of the ESF, it is readily apparent from the downward shift in attacks and losses, that U-boats reached the pinnacle of their success in North Carolina waters during March and April 1942. Unfortunately, for the Germans, these success rates could not be maintained after April 1942 and their success rate in terms of attacks, successful sinkings, and gross tonnages destroyed began declining once April ended.

Vessel Types

In order to recognize the objectives of U-boats in American waters, the types of vessels attacked and sunk off North Carolina can be charted to show which types of vessels U-boats sought to destroy and which types of vessels were more susceptible to maritime accidents (Figure 5.9). By examining the types of vessels attacked by U-boat, it becomes notably apparent that the two vessel types most commonly attacked were merchant vessels and tankers. The stark number of military vessels attacked or sunk by U-boat demonstrates that the German submariners had no intention of becoming involved in a battle of naval superiority but were merely interested in raiding commerce and destroying supply ships.

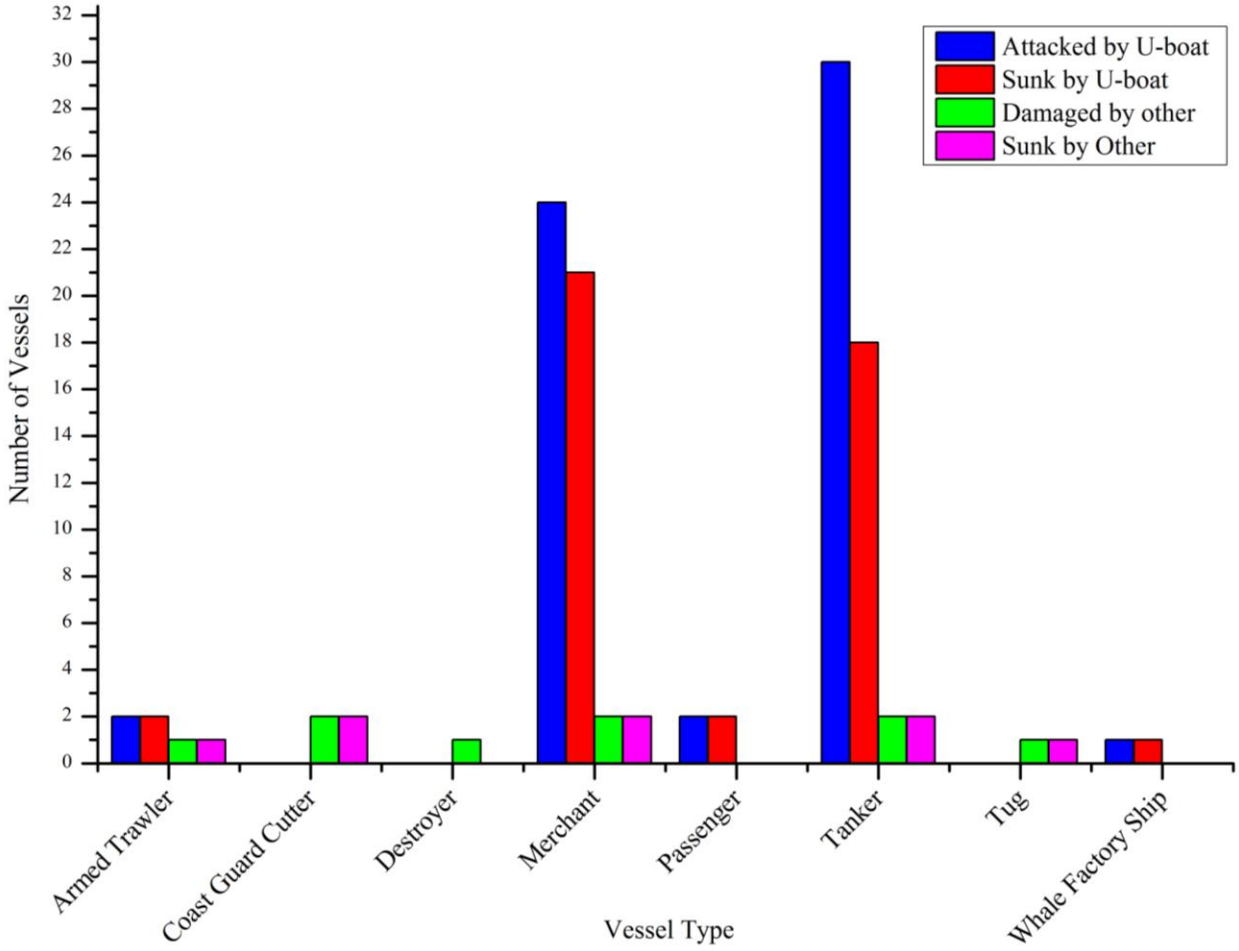

FIGURE 5.9. Types of vessels damaged and sunk in the battle.

Furthermore, the only two naval vessels sunk by enemy fire were armed fishing trawlers. This suggests that these vessels were merely targets of opportunity or the recipients of attacks by frustrated U-boat captains. The first armed trawler sunk was HMT *Bedfordshire*, sunk in the second week of May 1942, a month in which no other vessels were attacked, and the second was USS *YP-389* sunk by *U-701* after its commander, Horst Degen, thought he was falling into an Allied trap (Headquarters Fifth Naval District 1942:1-5,7; ESF 1943:8,chap. 5; Hickam Jr. 1989:216-218). Both events further illustrate that U-boat commanders sunk these vessels out of necessity or frustration and not because the Germans intended to include naval vessels as ships worth engaging off the North Carolina coast. Similarly, the majority of vessels damaged or sunk

in war related accidents were naval vessels and one yard tug responsible for towing the damaged vessels *J.A. Mowinckel* and *Chilore* out of the Cape Hatteras minefield (ESF 1943:8,chap. 5). This suggests that the continuous patrols these vessels endured made them more likely to become involved in a maritime accident. When the losses of all vessels are graphed in relation to tonnage attacked and sunk during the battle (Figure 5.10), another noteworthy trend is revealed.

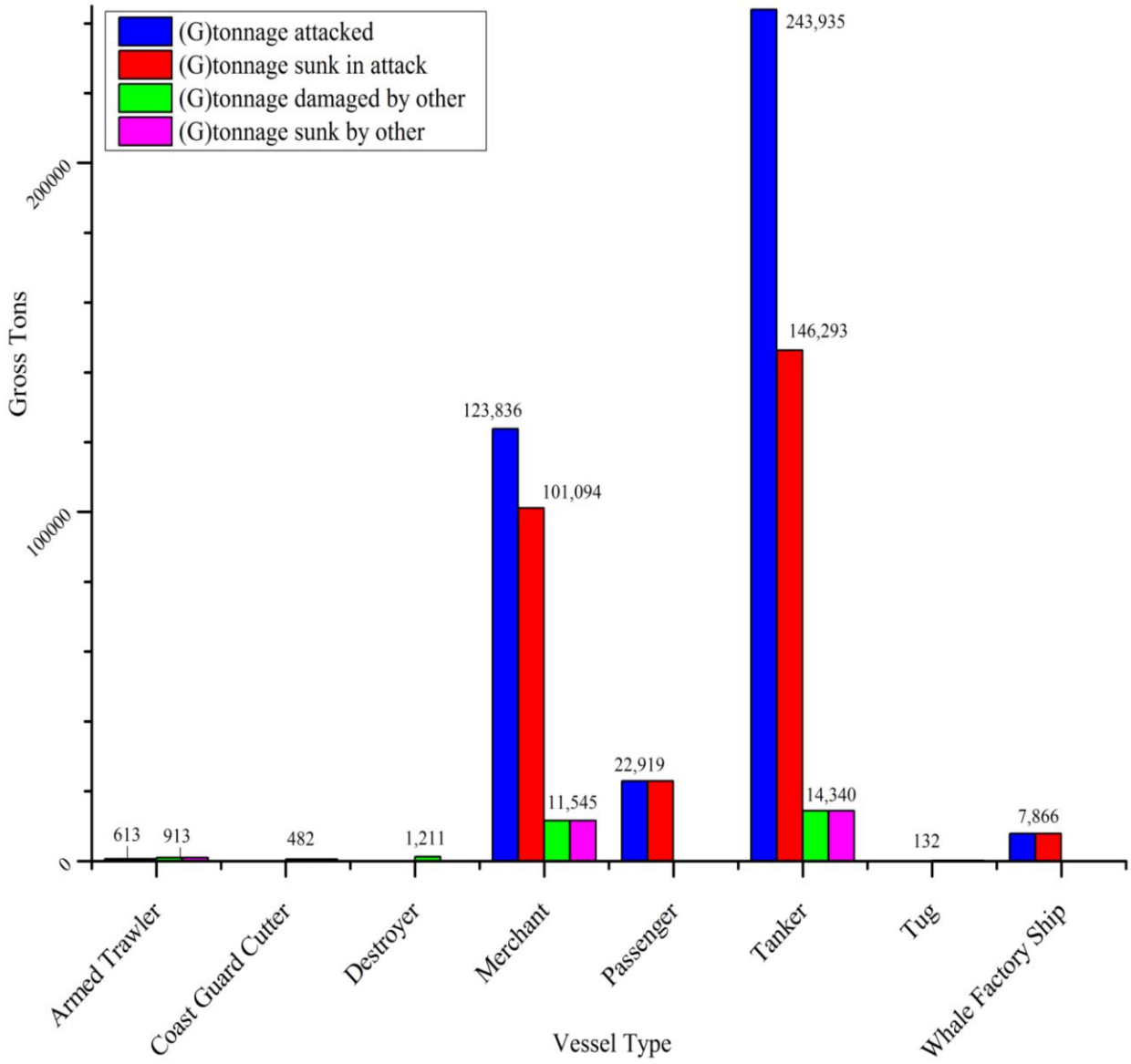

FIGURE 5.10. Gross tonnages of vessel types damaged and destroyed during the war.

While U-boats sank three more merchant vessels than tankers, tankers accounted for almost 50,000 more gross tons lost than the merchant vessels. This revelation allows additional

analysis regarding the sizes of merchant ships and tankers. This analysis reveals a large difference between the sizes of vessel types and accounts for the additional tonnage destroyed when tankers were sunk. This is because the average merchant vessel attacked in the battle was 5,150 gross tons while the average tanker attacked was 8,131 gross tons. Similarly, the average merchant vessel sunk weighed 4,973 gross tons while the average tanker sunk weighed 8,127 gross tons. There is also discrepancy between minimum and maximum sizes of these two vessel types. The smallest merchant vessel sunk was 2,063 gross tons and the largest was only 8,310 gross tons, while the smallest tanker sunk was 5,335 gross tons and the largest was 14,054 gross tons.

The loss of so many of these vessels is staggering when one considers that the Quonset Point, Rhode Island Naval Air Station training manual printed during the war reveals that

> [t]he massacre enjoyed by the U-boats along our Atlantic Coast in 1942 was as much a national disaster as if saboteurs had destroyed half a dozen of our biggest war plants….If a submarine sinks two 6000-ton ships and one 3000-ton tanker, here is a typical account of what we have totally lost: 42 tanks, 8 six-inch Howitzers, 88 twenty-five-pound guns, 40 two-pound guns, 24 armored cars, 50 Bren carriers, 5210 tons of ammunition, 600 rifles, 428 tons of tank supplies, 200 tons of stores, and 1000 tanks of gasoline. Suppose the three ships had made port and the cargoes were dispersed. In order to knock out the same amount of equipment by air bombing, the enemy would have to make three thousand successful bombing sorties. (Morison 2001:127-128)

When merchant vessel and tanker losses are examined in relation to the amount of supplies they could have provided to the war effort, it is no wonder the Germans were willing to send their U-boats across the Atlantic to ravage merchant shipping in the previously unmolested waters of America's Atlantic seaboard. The discrepancy between merchant vessel and tanker sizes and the survival rate of each vessel type brings to light two different characteristics that can also be analyzed. The first characteristic is whether there is any correlation between vessel size and

survivability, and the second is whether there is a correlation between the length of the vessel's career and the chances of it surviving an attack.

The correlation between vessel gross tonnages and chances of surviving an attack can be examined by creating a stacked bar chart for the merchant vessels and tankers where the x-axis represents ranges in gross tonnages in increasing order and the y-axis represents the percentage of vessels that survived or were sunk in an attack. Once a stacked bar chart is created for both vessel types, they can be examined to determine if there is any trend in survivability as gross tonnages increase. Charts for both vessel classes show some very interesting trends. The chart for the merchant vessels (Figure 5.11) reveals that merchant vessels larger than 6,500 gross tons begin to have a greater chance of surviving an attack. On the other hand, the size of tankers seems to have no effect on a vessel's chances of surviving an attack.

As the gross tonnage of tankers increases, there is little change in the proportion of vessel survival versus vessel loss (Figure 5.12). This may be due to the volatile nature of the cargoes carried by tankers or partially due to structural instability caused by the placement of hollow fuel bunkers throughout the tankers to transport fuel products. One other important statistic is missing, however, that precludes making a definitive conclusion about any correlation between vessel sizes and survivability. This is the number of torpedoes fired at each vessel. Once again, a translation of the German U-boat war diaries will fill in this gap in information and provide insight into the possibility that large tankers may have had a greater chance of survival than smaller ships, but were often torpedoed multiple times by U-boat captains wanting to ensure their destruction.

Although this same factor also prevents definitive conclusions from being drawn about the age of a vessel and the chances of it surviving an attack, this information can be plotted

nevertheless and can serve as an initial observation about how the lifespan of a vessel may have contributed to its chances for surviving an attack. These observations can then be tested by future studies that examine the number of torpedoes fired at each individual vessel. Preliminary analysis of the date range vessels were built during versus their chances for surviving an attack reveal that more modern vessels of both types stood a greater chance of surviving an attack.

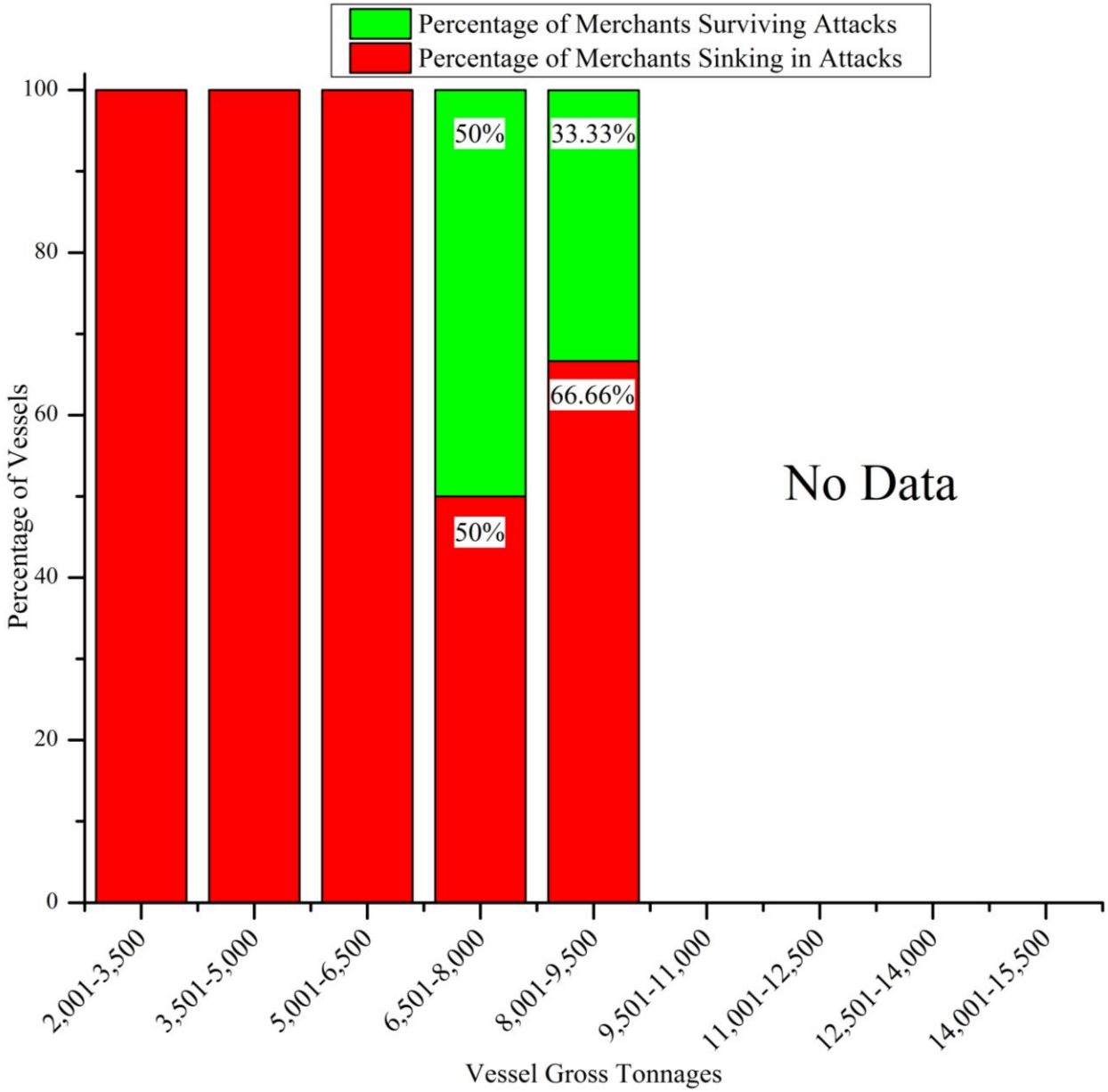

FIGURE 5.11. Proportion of merchant vessels surviving or sinking in an attack based upon ranges in gross tonnage.

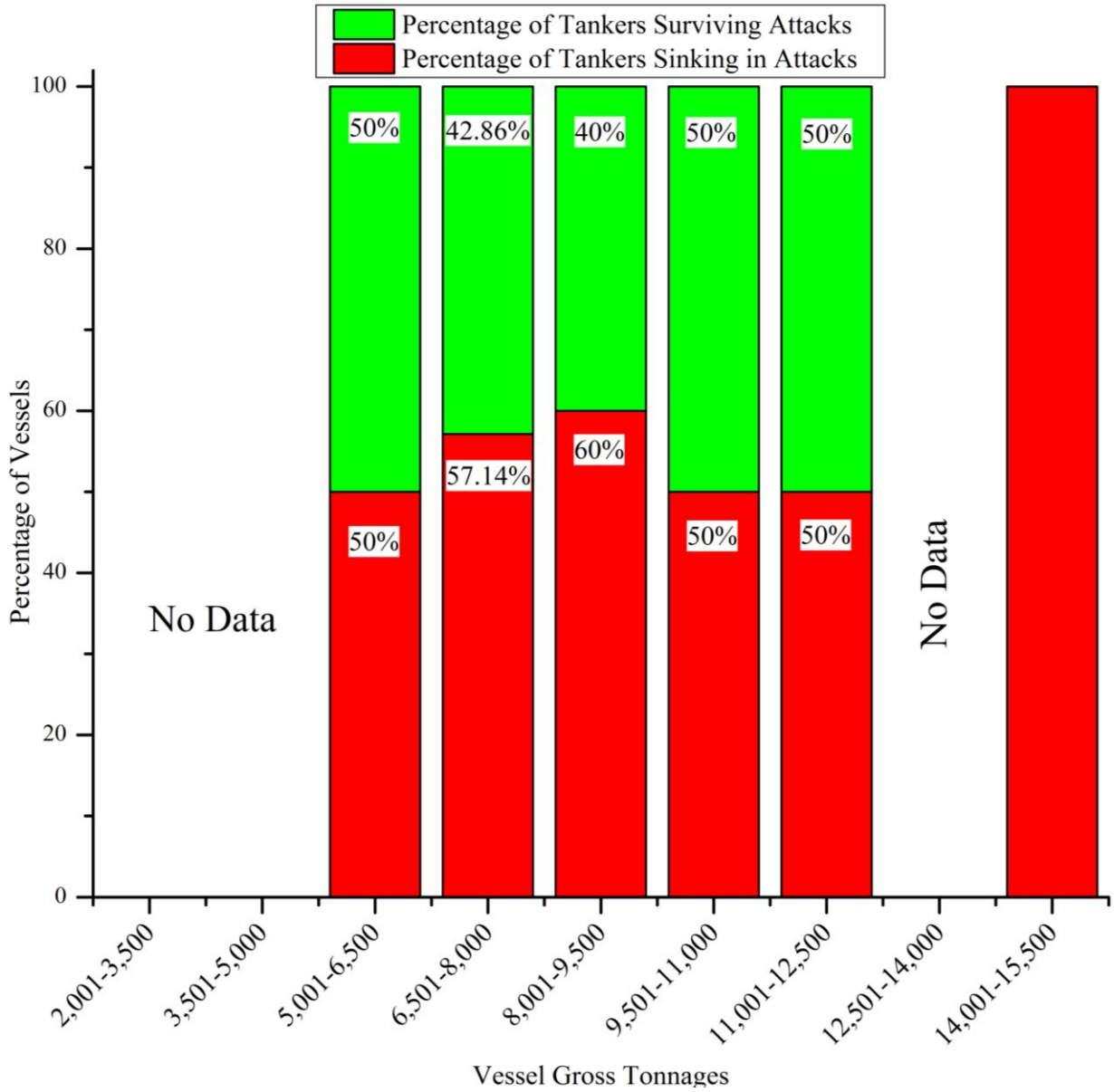

FIGURE 5.12. Proportion of tankers surviving or sinking in an attack based upon ranges in gross tonnage.

The stacked bar chart of merchant vessels (Figure 5.13) reveals that vessels built after 1920 had better prospects of being damaged than being sunk in an attack, while the stacked bar chart of tankers (Figure 5.14) portrays that vessels built after 1925 maintained increasingly greater odds for surviving an attack by a U-boat with the exception of those built between 1936 and 1940. This is because both tankers built between these dates were sunk in the attacks carried out on them.

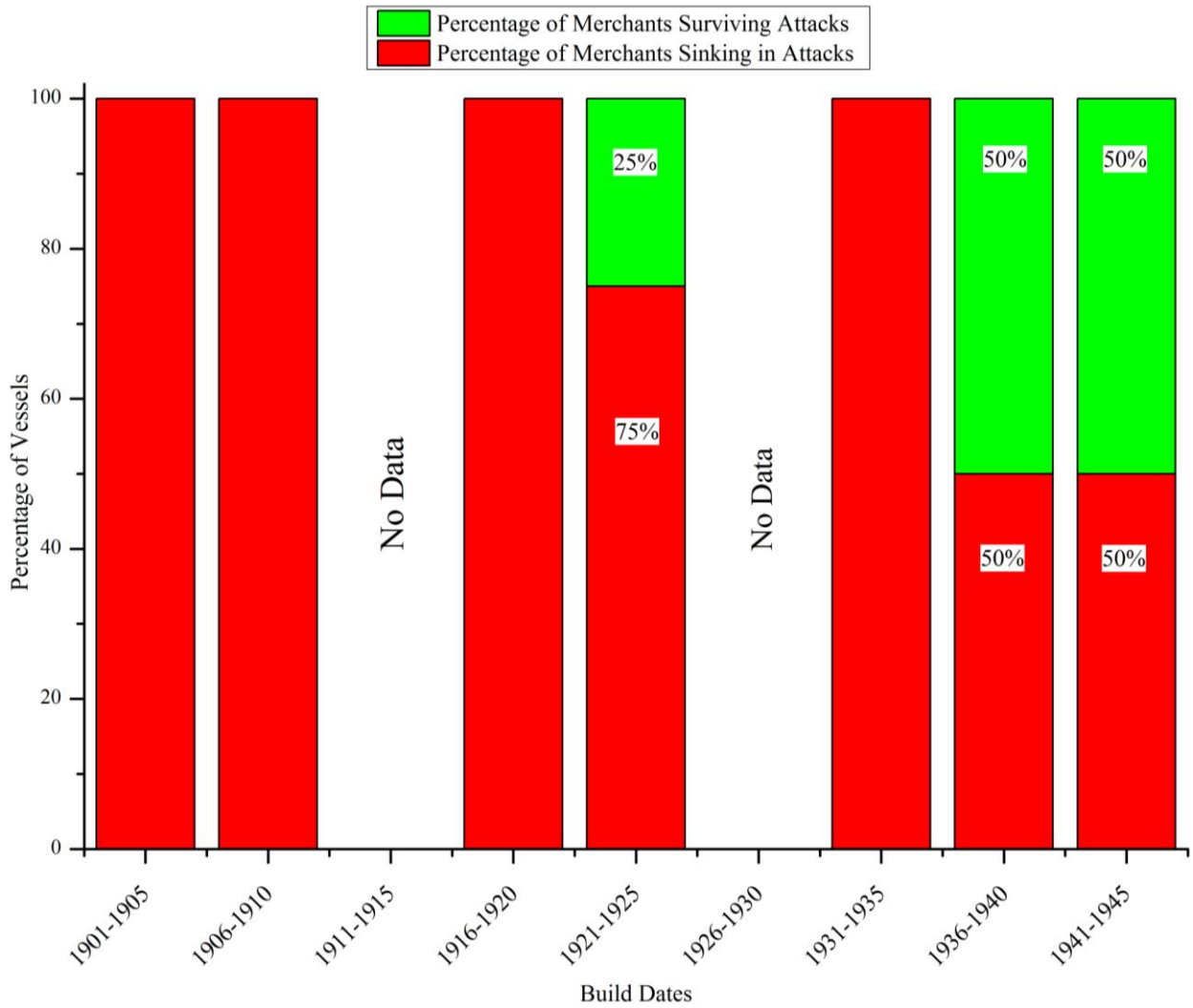

FIGURE 5.13. Proportion of merchant vessels surviving or sinking in an attack based upon ranges in build dates.

It should be noted again that while chances for survival appear better for newer vessels, this does not reveal how many torpedoes were fired at each vessel, or where those torpedoes struck each ship. Similarly, while it is tempting to claim that larger vessels could withstand a torpedo attack better than smaller ships, it must be noted that only three merchant vessels and 12 tankers survived attacks by U-boats, which makes the sample size far too small to make concrete statistical analyses about the probability of survival after a submarine attack. This also shows that while the size of a vessel may increase its chances of surviving an attack, the U-boats were nevertheless extremely efficient war machines armed with weapons capable of inflicting serious,

and often catastrophic, damage on vessels of any size or type that were unfortunate enough to pass in front of the watchful eyes of the German submariners. Since much of the previous analysis has focused on the losses incurred by the Allied and neutral nations, it is the deadly U-boats and their contribution to the battle that will be analyzed next.

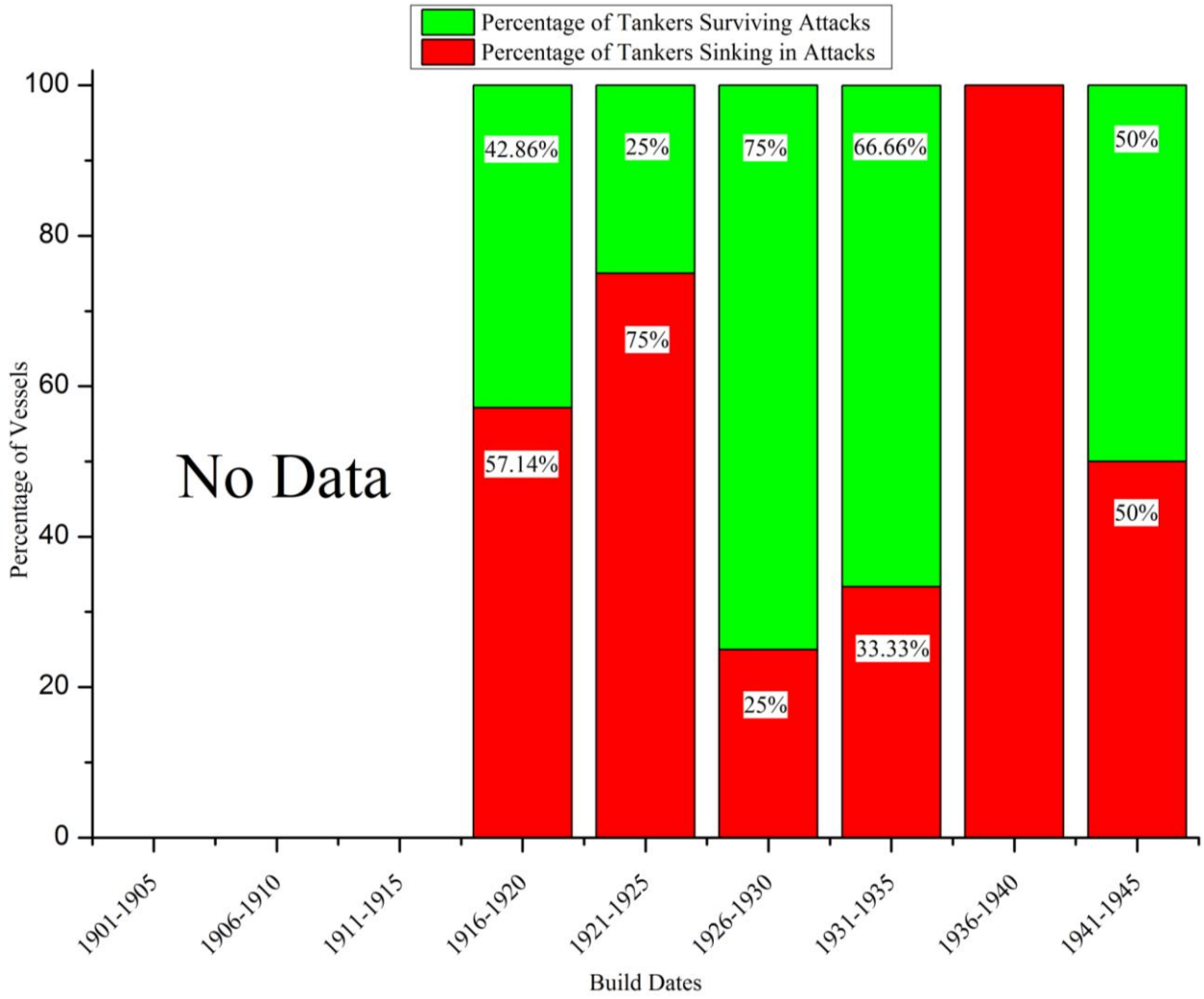

FIGURE 5.14. Proportion of tankers surviving or sinking in an attack based upon ranges in build dates.

The U-boats

Although the four German U-boats sunk within North Carolina waters receive the most attention from the diving and maritime exploration community, an examination of the submarines that attacked vessels off the coast of North Carolina reveals the presence of far more

submarines. There were 21, possibly 22, different U-boats responsible for attacks on vessels in the study area. The slight uncertainty in numbers is because precisely which submarine or submarines attacked *Katy* and *Belgian Airman* in 1945 remains a mystery. A graph representing each of these U-boats and the number of vessels they attacked and sunk (Figure 5.15) reveals an extraordinarily high success rate per U-boat. Only three U-boats, *U-136, U-518* and *U-576* sank fewer than half of the vessels they attacked in the waters of North Carolina. When one considers, however, that *U-576* torpedoed *Chilore,* which struck a mine in the Hatteras minefield attempting to reach port after the attack, and later sank while under tow, the success rate of *U-576* can be weighted slightly higher.

The most successful U-boat within the study area was *U-124* captained by Johann Mohr. Mohr attacked eight vessels, sunk six, and destroyed 41,084 gross tons of merchant shipping. Georg Lassen in *U-160* and Erich Topp in *U-552* are the second most successful in the number of merchant vessels sunk. Lassen, however, attacked one more vessel than Topp, but Topp had an astounding success rate, sinking every vessel he attacked. In terms of gross tonnage destroyed, the two commanders are again very close. Lassen sunk 36,731 gross tons of merchant shipping, while Topp sunk 37,037 gross tons. What is surprising, however, is that Reinhard Hardegen and *U-123* account for very little gross tonnage sunk. This is because reducing the study area to boundaries depicted in Figure 5.2 reveals that several vessels destroyed by Hardegen fall outside North Carolina's territorial waters. The gross tonnages attacked and sunk by each U-boat are represented in Figure 5.16.

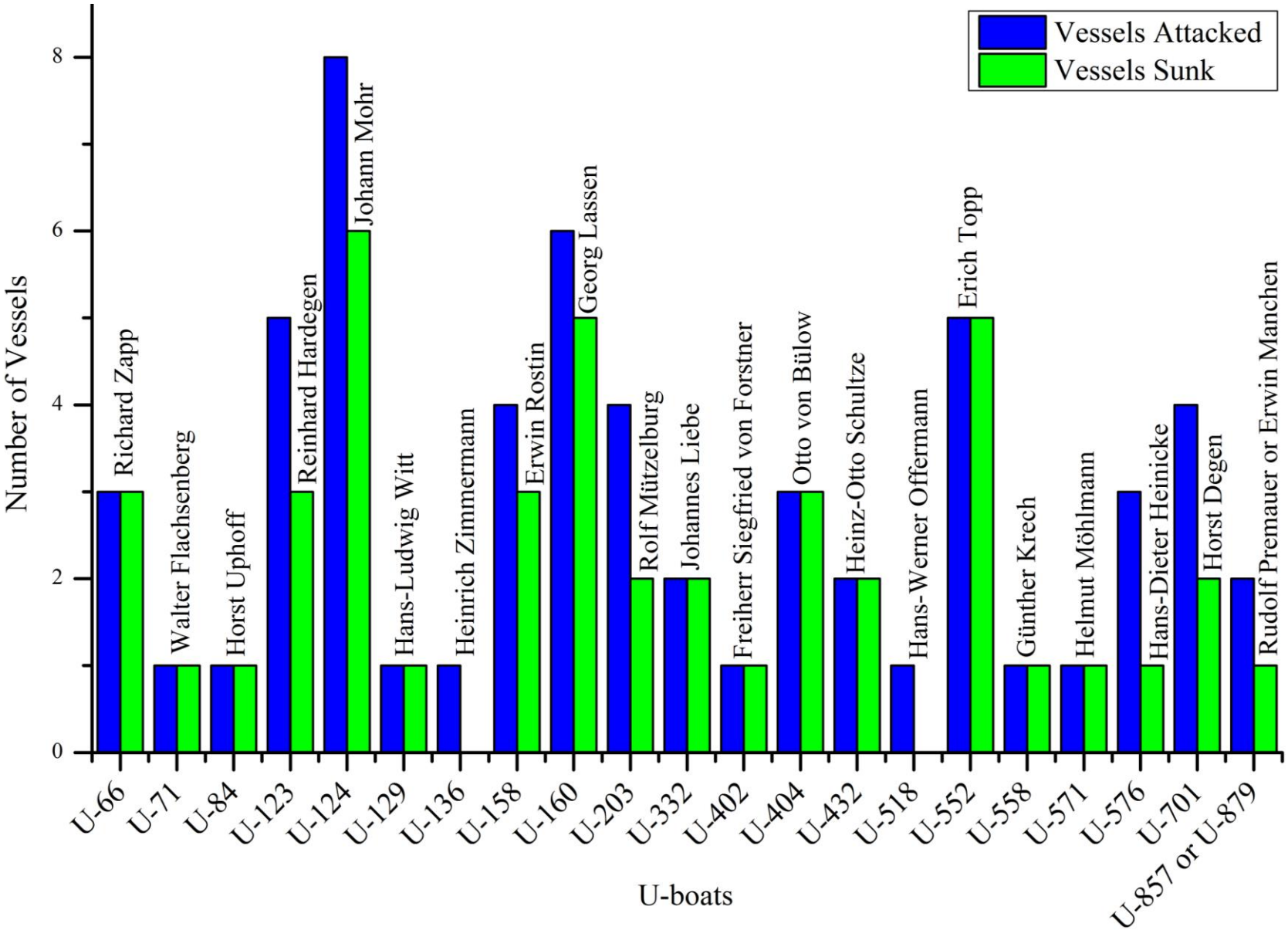

FIGURE 5.15. Number of vessels attacked and sunk by each U-boat commander in the study area.

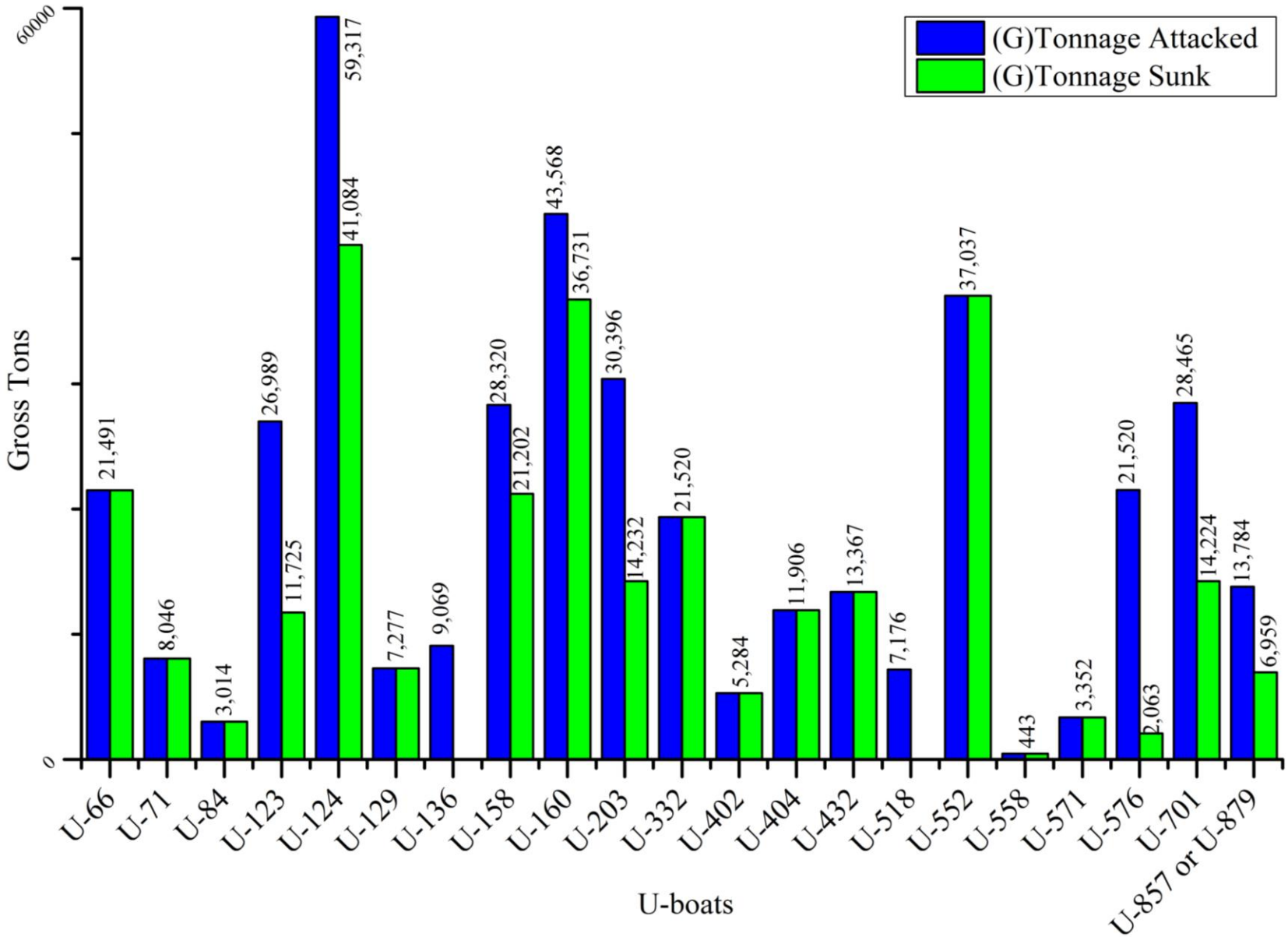

FIGURE 5.16. Gross tonnages of vessels attacked and sunk by each U-boat.

Conclusion

Even though the battle events, nationalities, tonnages, and other characteristics of the vessels contained within the battle area can undoubtedly be studied and analyzed in numerous other ways, this basic summation provides the background for the battlefield's geospatial analysis and provides a brief representation of the events, nationalities, and vessels contributing to the battle. By taking a generalist approach to this data, overall trends in events, types of vessels attacked, and most successful U-boats are revealed for the engagement off the North Carolina coast. It is these events and vessel characteristics that will be analyzed in the next chapter to place the battle events within their geographical context and to delineate the boundaries for the Battle of the Atlantic as it transpired in North Carolina's territorial waters.

CHAPTER SIX: GEOGRAPHY OF THE BATTLEFIELD

Introduction

Although the purpose of this thesis is to determine the overall extent of the Battle of the Atlantic in North Carolina's waters and to determine the feasibility of assigning geographical boundaries to that area based upon wartime events occurring within these waters, several other geographical interpretations of the battlefield will be explored first. These additional ways of analyzing the battlefield stem from this study's secondary research questions and provide information about the battle's supplementary characteristics and trends in a geographical context. By geographically examining the battle in relation to smaller trends, a greater appreciation of the battle can be obtained than by just examining the overall extent of the battlefield. Additionally, overall trends in the war off the American coast can be compared to trends occurring within the waters of a single state to determine if overall shifts in battle activity are mimicked on a statewide basis. This can reveal whether or not battle activity within North Carolina waters occurred randomly, or if it centered around certain geographical areas of the shoreline. This is done in this chapter by using basic geospatial analysis tools to determine smaller battlefield elements that help comprise the battle's totality.

By mapping smaller battlefield elements such as centers of activity, densities of activity, and extents of activity over time, analyses can be conducted that reveal hotspots of activity while at the same time revealing the extent of sea the battle transpired on. Additional analysis involving mapping vessel attack locations in conjunction with shipping routes provides an opportunity to analyze how effective the shipping routes were at keeping merchant vessels safe and how many vessels were following those routes when attacked. In a similar fashion, individual U-boats can be tracked across the seascape by mapping locations where they carried

out an attack. This allows observations to be made about the success of U-boats in regard to distances covered and areas patrolled. In conjunction, each individual element helps delineate the overall battlefield boundaries. Each of these analyses are discussed in further detail in this chapter beginning with measures of centrality and density of battle-related events.

Centrality and Density of the Battle

One way the battle can be analyzed is in terms of the centrality of battle activity. By analyzing where the geographic center of battle activity for each month fell, it is possible to determine to what extent the hot spots of battle activity shifted during the war. While overall battle activity along the American coastline transitioned from the East Coast to the Gulf of Mexico and Florida in a drastic southward shift in U-boat activity (Freeman 1987:45,166,248), this overall southern shift in activity is not apparent in the waters of North Carolina (Figure 6.1). Most battle activity remained in the waters between Cape Hatteras and Cape Lookout with a gradual eastern shift into deeper waters after the convoy system was initiated and brought merchant ships closer to the 100-fathom curve (Freeman 1987:411). Since there are so few events occurring in 1943, 1944, and 1945, these events are represented by year and not on a month by month basis.

Even though the centers of battle activity for these years, as well as for May 1942 are depicted, it is important to note that the dearth of events occurring during these times means there is not a large sample size of geographical events with which to weigh the battle's centrality. In addition to the battle centrality by month and year, the geographical center of all battle related events can be mapped (Figure 6.2). This point lies approximately 19.43 miles southeast of Ocracoke Inlet. The exact coordinates are given in Table 6.1.

When analyzed in light of the battle's historical record, these geographic centers of

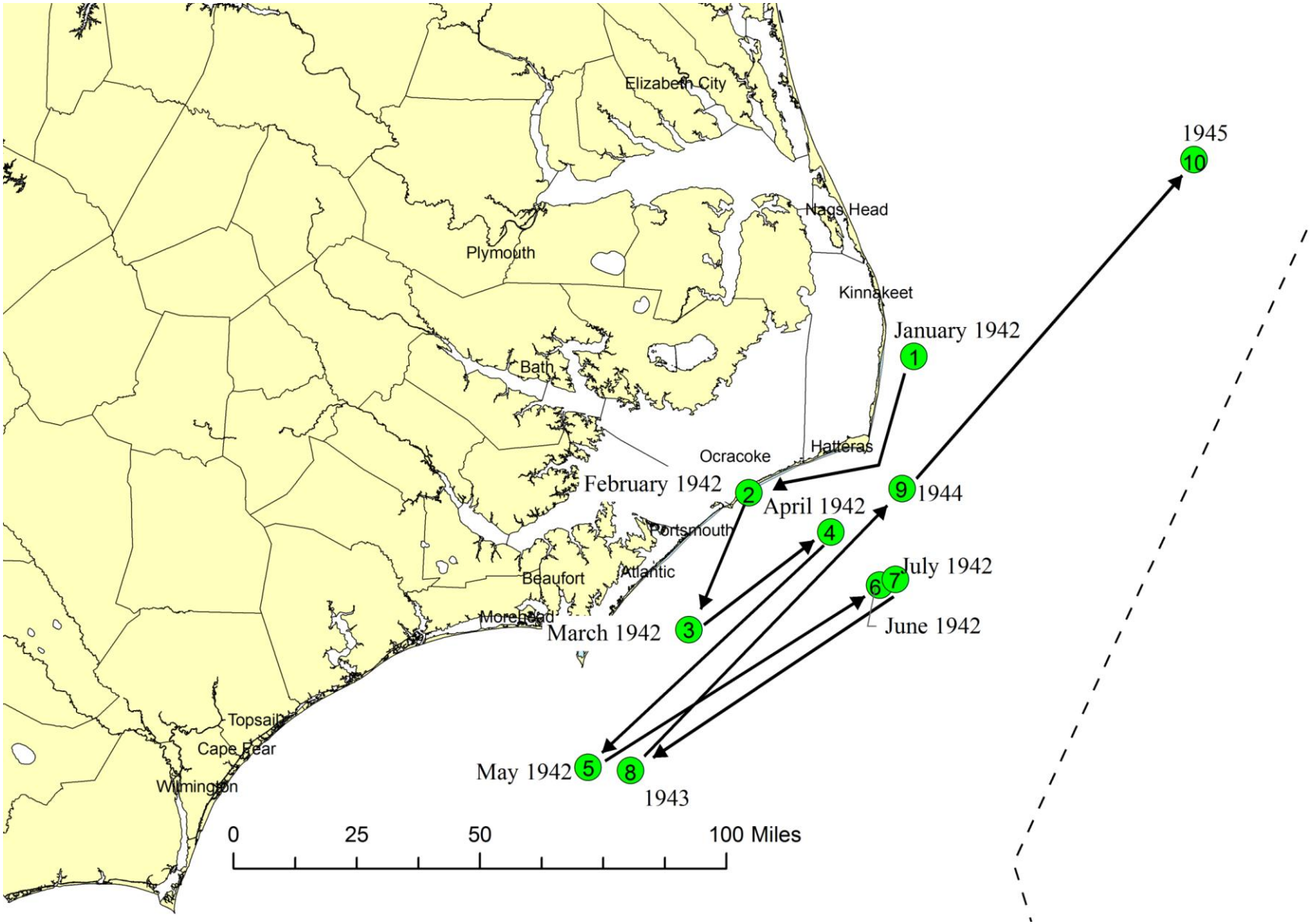

FIGURE 6.1. Centrality of battle activity throughout the war.

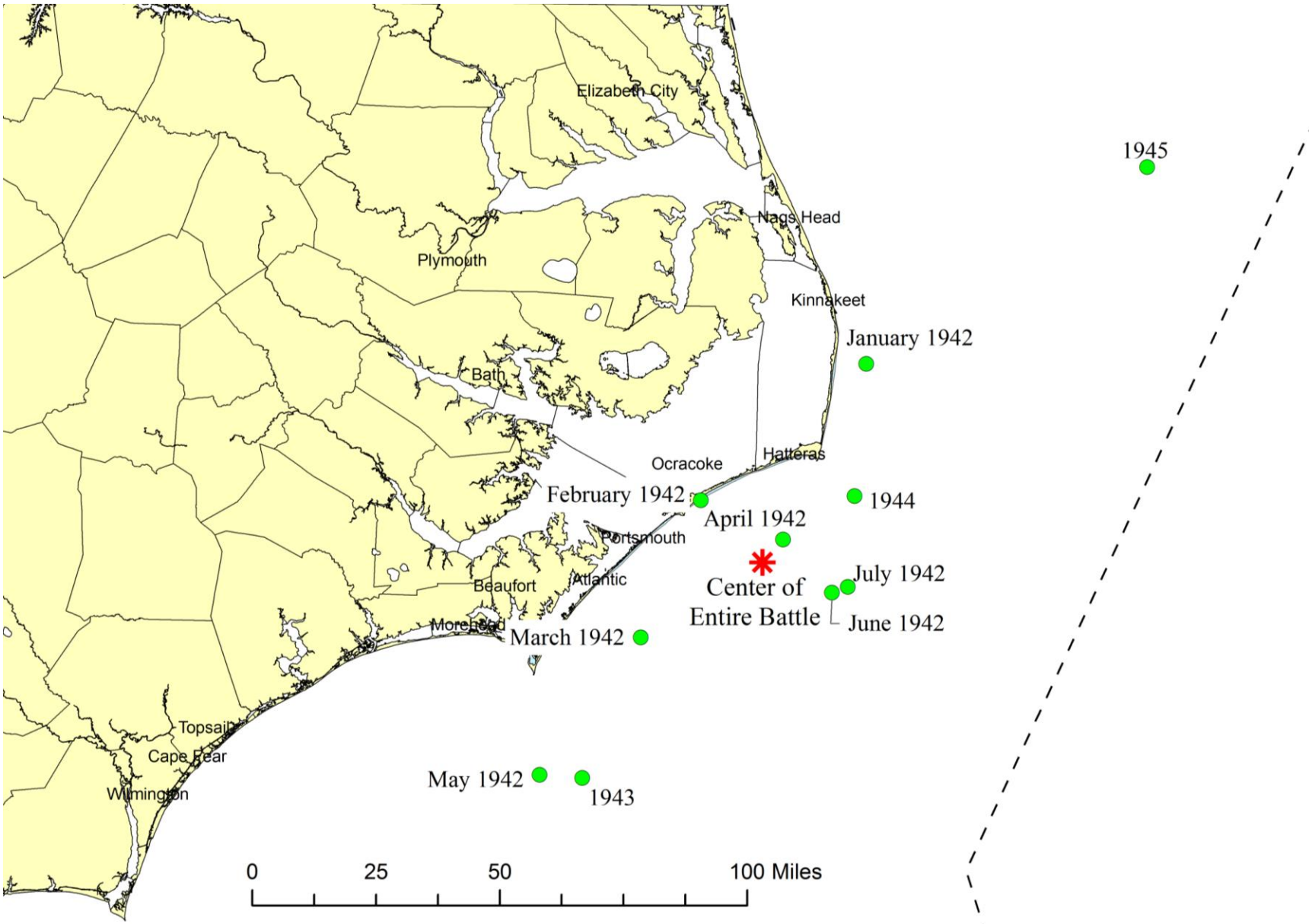

FIGURE 6.2. Centralities of battle events, including the center of activity for the entire battle.

activity add credence to the ESF's continuous observation that the waters around Hatteras were the U-boats preferred hunting grounds (Freeman 1987:21,27,50,94,166,174). Although the center points of battle activity help substantiate the historic record and are important for tracking the center of activity throughout the war, they do not depict the clusters of events that represent why the centrality of the battle is weighted the way it is.

In order to depict why the centers of battle activity occur in the locations they do, the density of battle events for a defined geographical area must be mapped to show where the majority of battle events took place. Since this analysis requires a defined area to determine the density of events occurring within that area, the smallest German Kreigsmarine grid square was chosen to define the areas for analysis. Since these smallest grid squares are six nautical miles by six nautical miles, results of the analysis are represented by the number of events occurring within a 36 square nautical mile rectangle around each event (Emmerich 2010). The map of this analysis (Figure 6.3) shows that because of the great amount of ocean the battle took place within, the density of events occurring within any 36 square nautical mile area remained quite small. The only area that had over six events occur lies off Avon, NC. The other areas with a high density of events are off the tip of Diamond Shoals, and where *U-576* attacked a convoy and was sunk in turn.

	Coordinates UTM Datum WGS 1984	Coordinates Lat/Long Datum WGS 1984
Center of All Battlefield Activity	18S 433864 3864300	34°.55' N 75°43' W

TABLE 6.1. Coordinates for the center of all battle activity.

This information is important because it shows the dynamic nature of the battle and that U-boats probably would not have obtained the same success had they all been ordered to the same grid square off Hatteras. This map also suggests areas where archaeological surveys may

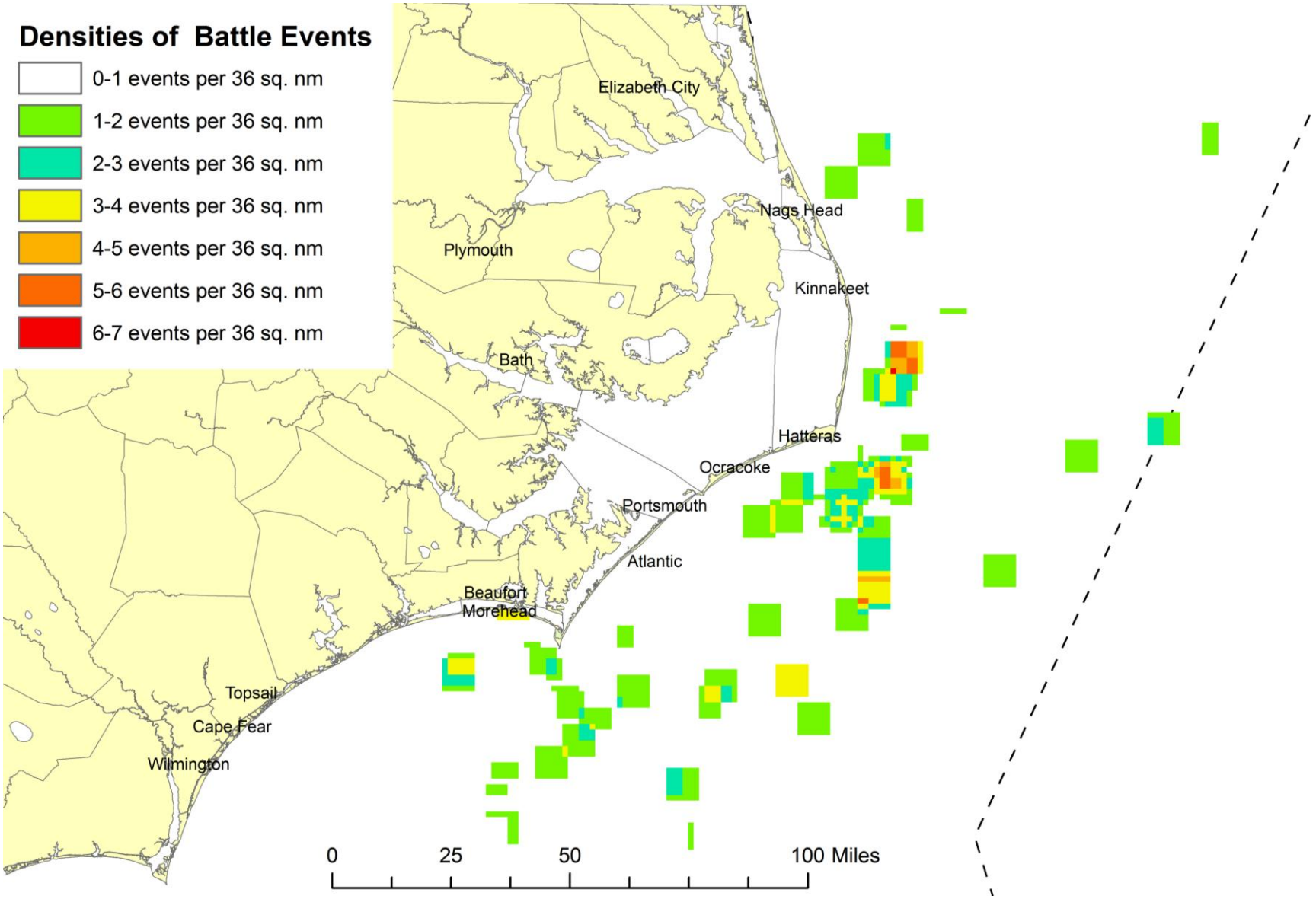

FIGURE 6.3. Densities of battle related events for the entire battle as defined by the area of sea contained in the smallest German Kriegsmarine grid square.

have the best success locating previously undiscovered shipwrecks. While measures of battle centrality and density represent geographical areas where most of the battle was centered or where many events took place, they fail to depict the geographical extent of the battle for a particular timeframe.

Battlefield Extents over Time

Since the geographical centers and density of battle events fail to represent the area of sea the battle took place in over the course of the battle, the events of each month and year can be outlined and mapped using a GIS "Convex Hull" tool to show the overall extent for each time span. The generation of convex hulls is akin to placing thumb tacks in a corkboard and stretching a rubber band around all the outer points so that every thumb tack is enclosed by the rubber band (Brimicombe 2003:75). This same concept can be applied to the historic events occurring during the battle by treating each event location as a tack in the corkboard and drawing a convex hull polygon around all points, then cropping it along the shoreline. Although analyzing battle events in this manner is beneficial because it depicts how much area of sea the battle took place over, it has one major drawback. Since the convex hull envelops all the events occurring in North Carolina waters for a particular time span by drawing a polygon around the outermost events, the extent of the polygon is severely affected by extreme outlying events.

Since outlying points affect the convex hull polygon, the battle area depicted by creating these polygons is often over representative of the area where most battle related events took place. Another limiting factor is that a convex hull polygon for 1945 cannot be created since the year consists of only two battle related events. Despite these shortcomings, some valuable observations can be made from the convex hull polygons. For the purposes of clarity, the battle was divided into two time spans and mapped with the convexes for those periods depicted.

Convexes for events occurring before implementation of the convoy system are mapped in Figure 6.4, and convexes for events occurring after the convoy system began are mapped in Figure 6.5.

While April 1942 was the month that the most merchant vessels were attacked within the study area, it was also the month that witnessed the greatest dispersal of events across the waters of North Carolina. Events for this month envelop an area of roughly 9,122 square miles of sea. After April, the polygons of battle activity become smaller and, by 1944, the three events for that year occur within a polygon of roughly 271 square miles. The two 1945 events occur within roughly 47 linear miles of one another. An additional interesting trend revealed by the polygons is that the events of February, March, and April 1942 are stretched from north of Cape Hatteras to south of Cape Lookout, while events occurring after these dates tend to be localized around one of the two capes.

This suggests that the extent of U-boat movements decreased after April or that there were fewer opportunities to attack merchant vessels travelling between the capes once the convoy system was implemented and convoys were routed into deeper waters. When the battle areas are charted (Figure 6.6), a fascinating discovery comes to light. The areas for each time span follow a similar trend as the attack chronology depicted in Figure 5.7. The months that witnessed the most U-boat successes were the same months U-boats appeared to spread out over a greater expanse of sea. This observation suggests a strong correlation between U-boat movement patterns and their success. It seems that by spreading out across North Carolina waters, U-boats could ensure more attacks than by patrolling the same zones as their counterparts and making themselves susceptible to the same American aerial patrols.

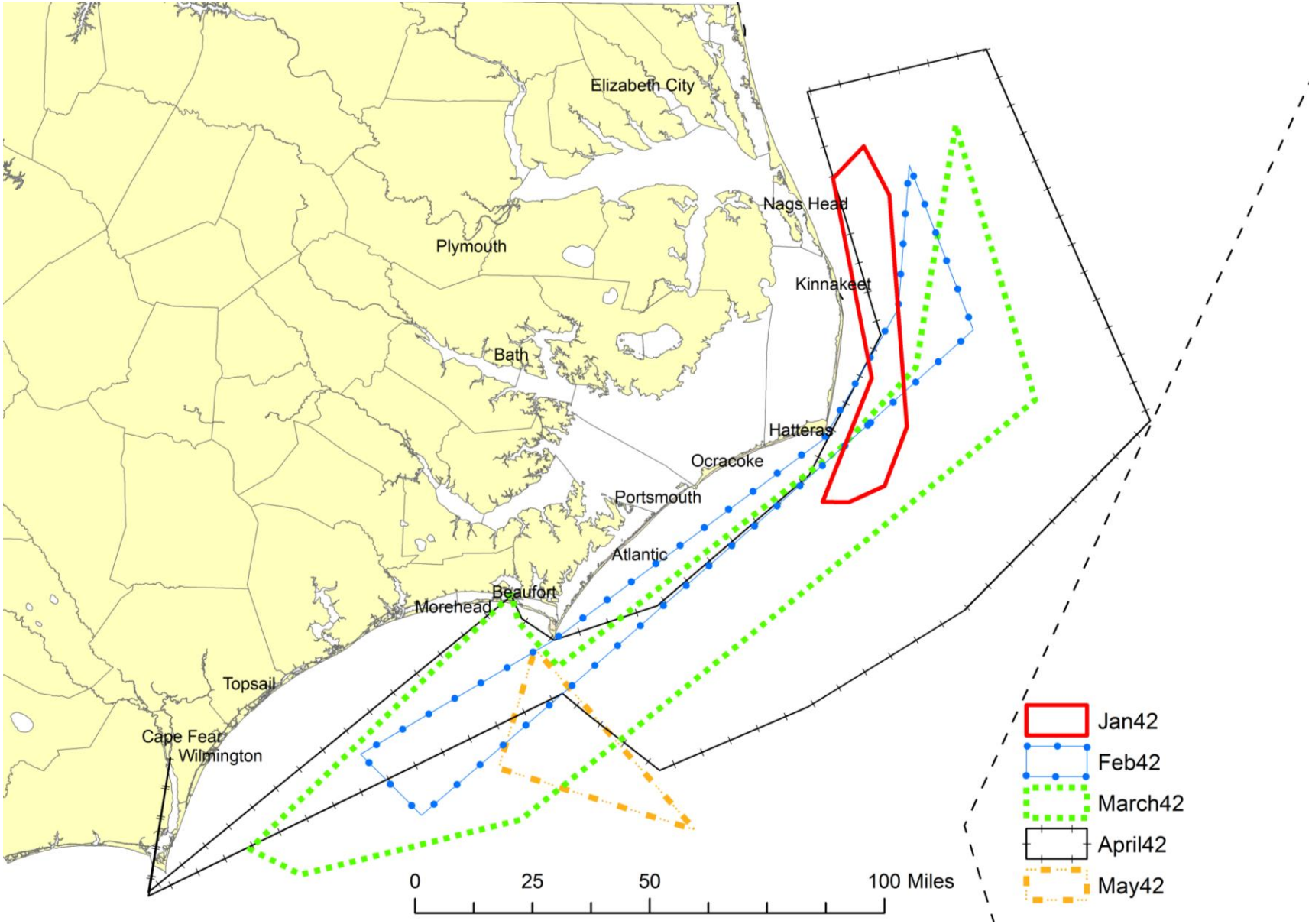

FIGURE 6.4. Convex hull polygons for the first five months of the battle.

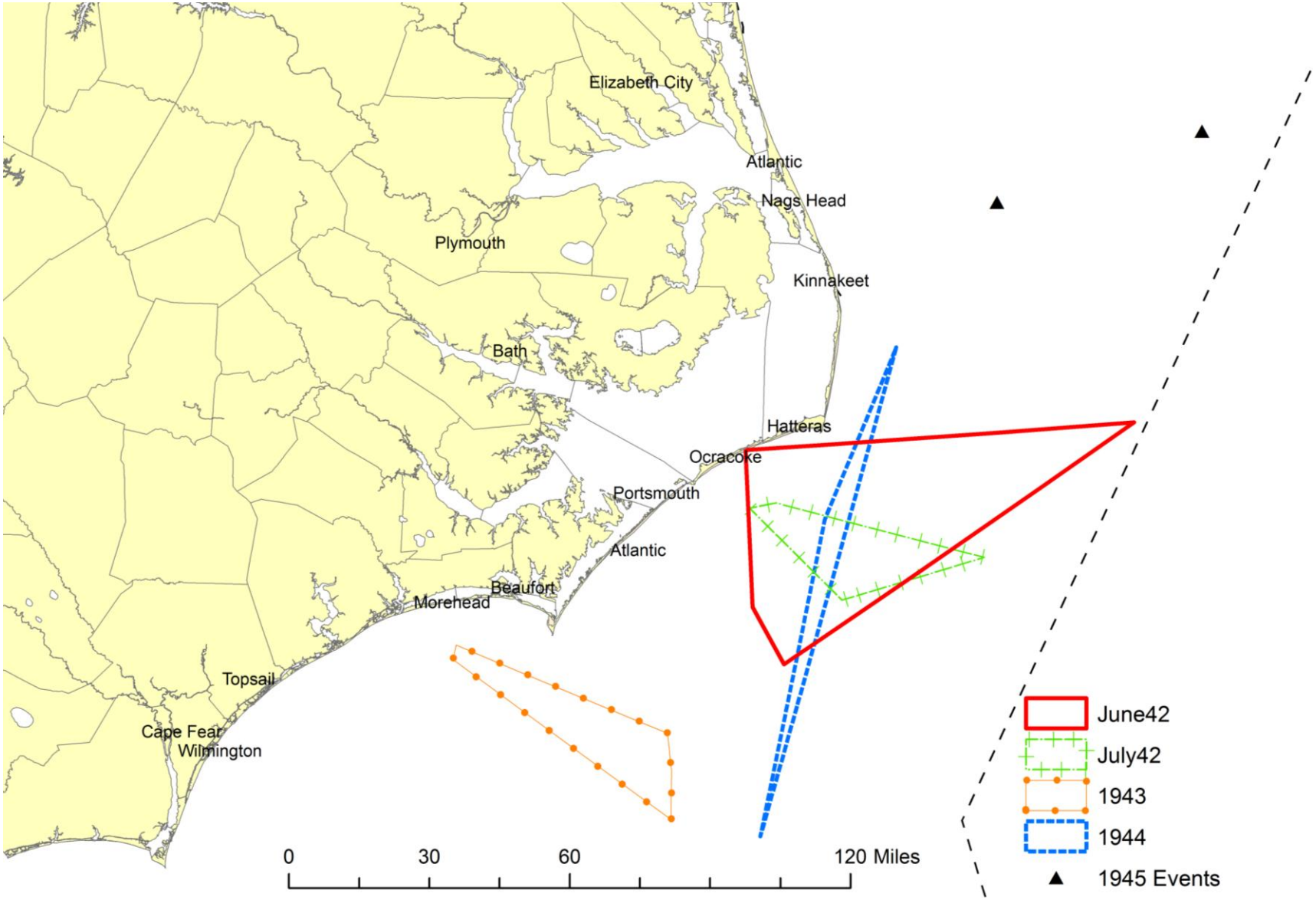

FIGURE 6.5. Convex hull polygons for the remainder of the war with 1945 event locations also depicted.

One additional noteworthy trend revealed by mapping the extent of the battle by time span is the number of events occurring well offshore, potentially signifying less than optimal route following by merchant shipmasters.

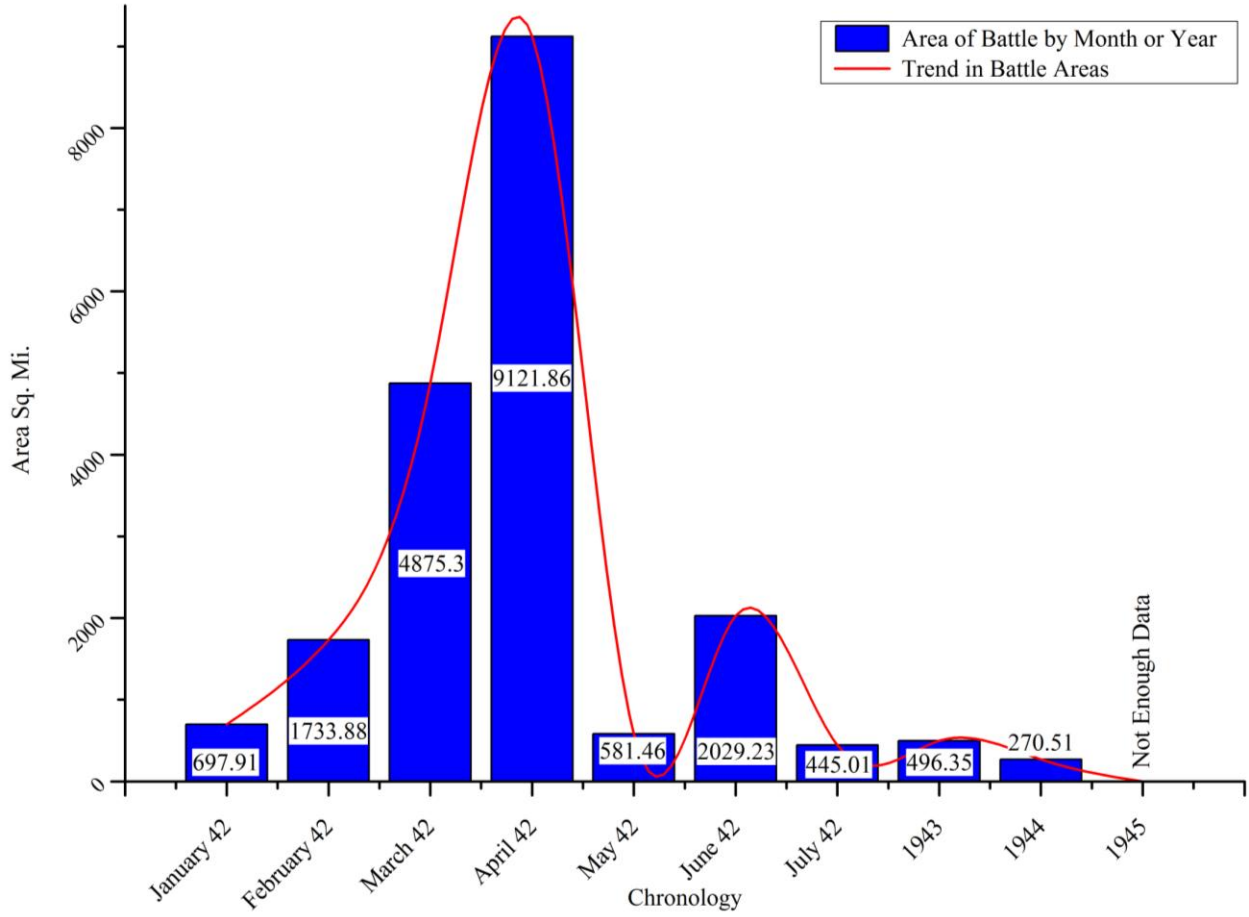

FIGURE 6.6. Trend in size of battle areas throughout the course of the war**.**

Routing Vs. Attack Locations

One characteristic of the event locations and convex hull polygons that quickly becomes apparent is that there are many events occurring beyond the buoys and routing lines used for coastal navigation and coastal shipping routes. This realization allows mapping of shipping routes for a particular time span in relation to routing dependent events during that same period to show the extent to which vessels were attacked while not following the shipping routes mandated by the ESF. To represent this information, events occurring during each month were

filtered so that only events dependent upon the vessel's route were selected. These events include where vessels were attacked, where they collided with other vessels, and where they ran into the Cape Hatteras minefield whilst not on a shipping route. Events involving military vessels were not included since patrol vessels were not bound by shipping routes. Similarly, events occurring after an attack, such as survivor rescues or striking a mine whilst fleeing an attack, that were not dependent upon shipping routes but more dependent upon ocean currents or random paths of retreat were not chosen for analysis.

As expressed in Chapter Four, the NANCF initiated merchant vessel shipping routes as soon as U-boats began appearing in Frontier waters and they infrequently changed them throughout the war. Since there are few route changes, it is possible to map the events of a particular time span with the corresponding shipping routes. In January 1942, the shipping routes that were initiated consisted of shipping corridors that followed a routing line connecting different lightships and other aids to navigation (NANCF 1941:20-23,chap.3). In January 1942, when it became apparent to the ESF that the waters around Hatteras were the favored hunting grounds of the German submarines, the shipping corridors were modified from January 22 through January 30 to carry vessels sixty miles seaward of Hatteras and hopefully around the patrolling U-boats. By January 31, it was obvious to the Frontier that this shift failed to work, so they again changed the routes to bring vessels as close to the coast as they safely could. This change was left in effect until March 6 (ESF 1942a:1-2,chap.4). When attack locations for January and February are mapped in relation to the initial shipping corridors, however, an intriguing pattern is revealed (Figure 6.7).

Virtually every vessel attacked was travelling along the original shipping corridors. This includes the three vessels attacked in January after the route was modified to direct ships 60

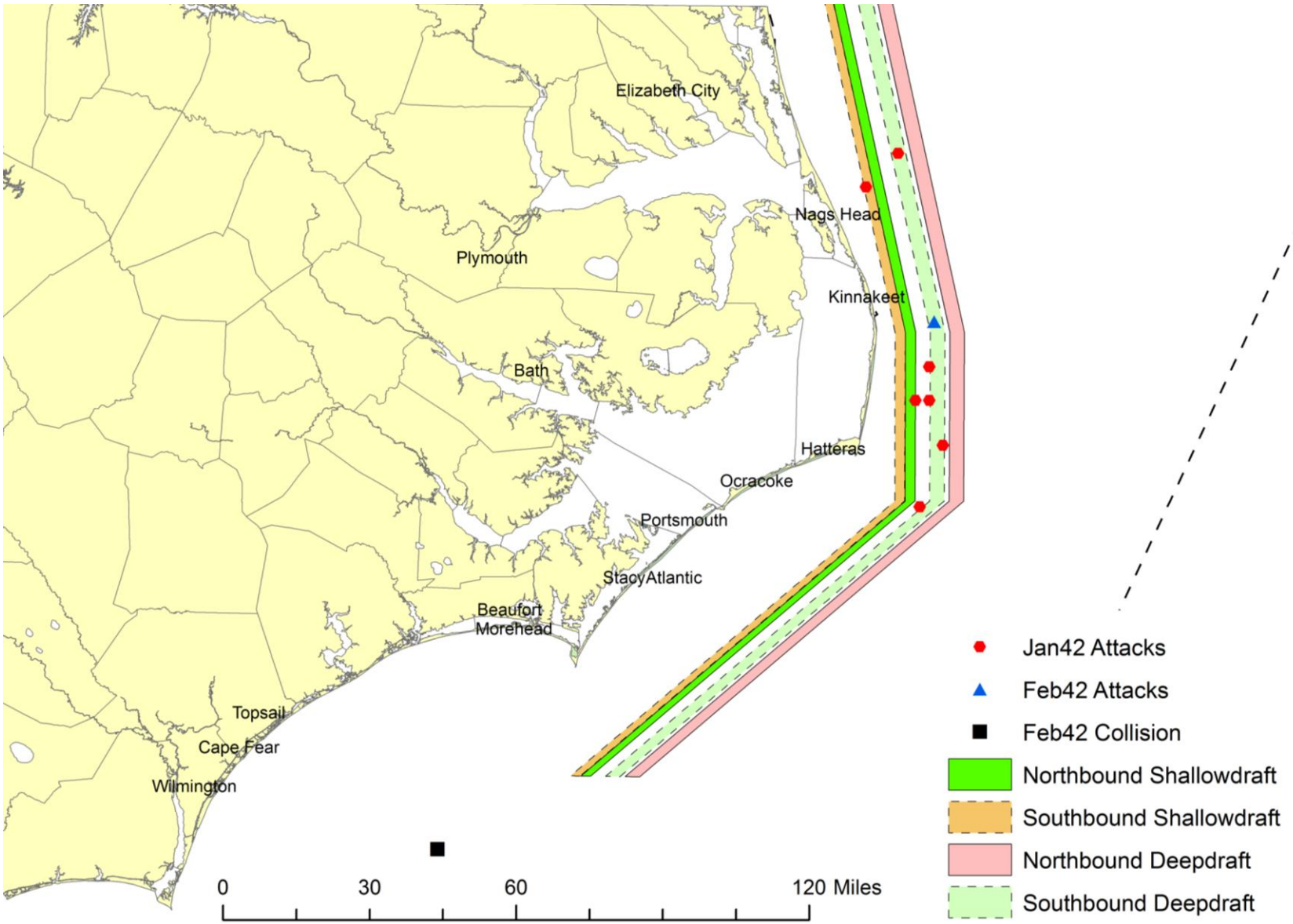

FIGURE 6.7. Attack locations for January 1942 and February 1942 in relation to the initial shipping corridors.

miles offshore of Hatteras. Similarly, the vessel attacked during February was travelling along the old corridors and not as close to shore as possible, and the one vessel involved in a collision appears to be in line with the shipping routes even though the routes did not span the entire state of North Carolina. Although events occurring along the routing line in January are explainable by the fact that Hardegen quickly realized merchant vessels were following the lighted buoys along the coast (Hardegen 1941-1942:19), it is interesting that not one attack occurred outside the original shipping routes during these two months. Although the reason no attacks occurred sixty miles off the coast of Hatteras or closer inshore would be a study in itself, it provides some interesting questions about the effectiveness of the NANCF in dispersing information about shipping route changes to port authorities around the globe. This is further exemplified the next time the shipping routes were modified.

At the end of February 1942, the newly renamed ESF discovered that shipmasters were not following routing orders because they feared colliding with other vessels that were blacked out and travelling as close to shore as possible. Although only one collision occurred in February, the ESF decided to move the shipping lanes once again. This time, however, corridors were not specified but specific lanes following many different aids to navigation were. The CNO approved these routes on March 6 (ESF 1942a:1-2,chap.4; ESF 1942a:Appendix I). These routes remained in place until late May when the laying of the Cape Hatteras minefield and implementation of the convoy system necessitated another change. Despite the specificity of the routes implemented at the beginning of March, mapping of attack locations for March and April in conjunction with shipping routes reveals some disturbing findings (Figure 6.8). Since no attacks occur on merchant vessels during May 1942, this month is not included even though the shipping routes remained in effect for most of that month.

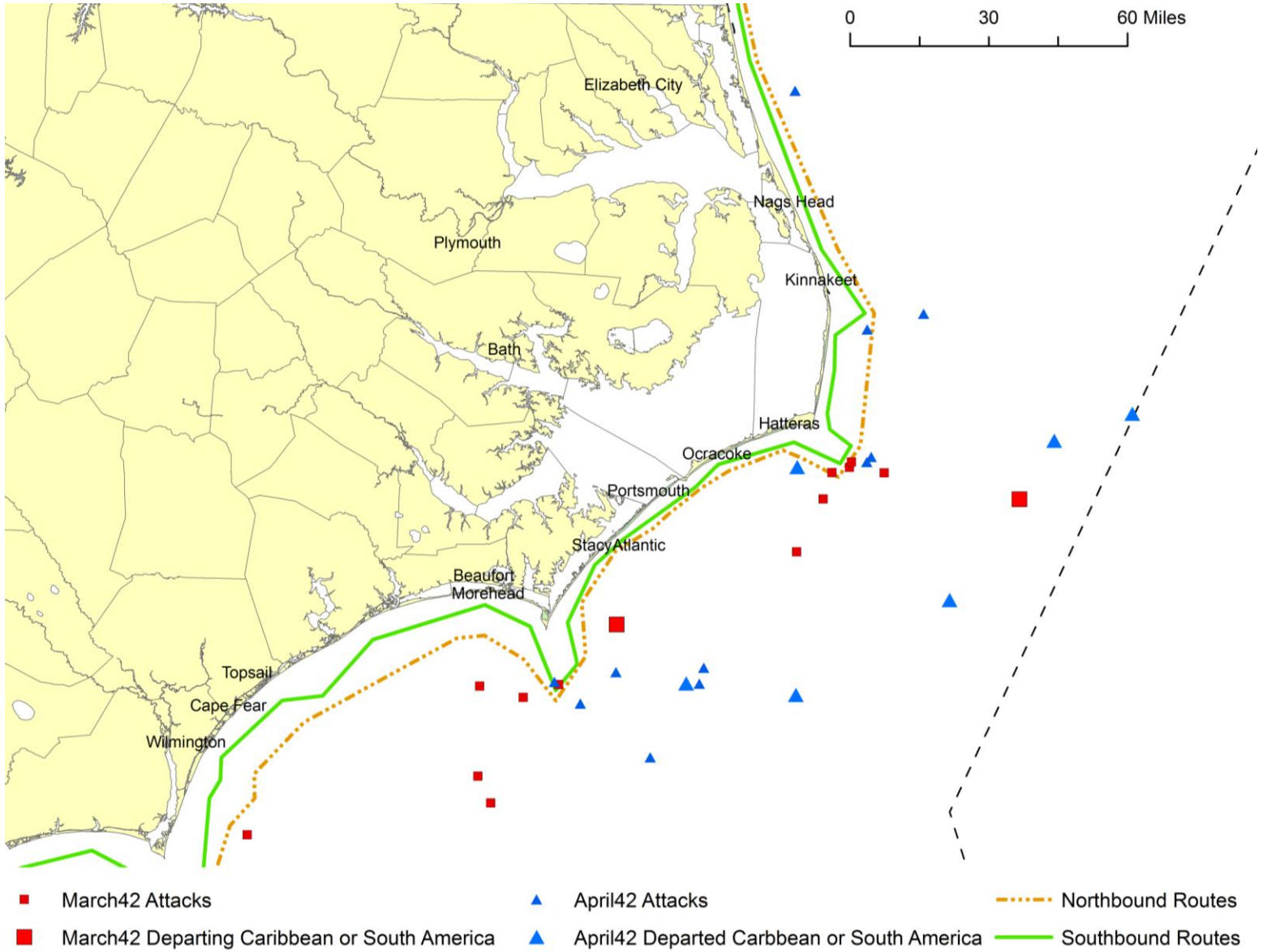

FIGURE 6.8. Attack locations for March 1942 and April 1942 in relation to the shipping routes for the corresponding period. Note the extraordinarily seaward attack locations of most vessels departing Caribbean and South American ports.

One feature that is quickly apparent from mapping these attack locations is that very few attacks during March and April occurred in close proximity to shipping routes. While there are likely many factors contributing to this occurrence, several are readily apparent in the historic record. The first is that as early as March 12, the ESF lamented the fact that many merchant vessels leaving ports in the Caribbean or South America were not reporting their sailings to the ESF and were travelling several hundred miles offshore along the coast destined for northern ports. For this reason, the ESF recommended that vessels should be ordered to enter American coastal shipping lanes between Cape Canaveral and Cape Hatteras so they could head north in waters patrolled by the ESF. The CNO quickly approved and dispatched this information to vessels in the Atlantic on March 17.

In theory, this dispatch should have brought merchant vessels closer to the American coast resulting in fewer attacks further out to sea. When the four easternmost attack locations are analyzed, however, they reveal that each vessel departed ports in the Caribbean well after March 17. One of these, *Chenango*, departed St. Thomas Harbor in the Virgin Islands on April 14, carrying instructions from the St. Thomas routing officer telling the shipmaster to stay well offshore of the American coast and to never come within 30 miles of Cape Hatteras (Routing Officer, St. Thomas, V.I. 1942:1). While additional research may assign some blame to the routing officer in St. Thomas for failing to read dispatches from the ESF, a failure in disseminating routing instructions on the part of the ESF must also be considered. This is especially the case when one considers that *E.M. Clark*, torpedoed on March 18, departed Baton Rouge, LA, on March 11 with routing instructions from the commandant of the Eighth Naval District informing him to follow the reference line established in January, a reference line that had theoretically been abolished since January 31 (Commandant Eighth Naval District 1942:1).

If the ESF could not effectively transmit routing information across naval district boundaries, one must question how effectively they were able to disseminate that same information to other nations.

The final historic factor that may have contributed to merchant shipmasters failing to follow the shipping routes is the abstract nature of the routes along certain areas of the coast. Off North Carolina, northbound vessels were supposed to follow the "approximate 10-fathom curve in Raleigh Bay," while southbound traffic was supposed to follow the "approximate 8-fathom curve in Raleigh Bay" (ESF 1942a:Appendix 1). With vessels blacked out and zigzagging, shipmasters may have found it too hard to follow bottom contours and decided to simply cut across Raleigh Bay to save time and avoid collisions, or, as was the case of *E.M. Clark*, they may have been following older shipping corridors which fit the pattern of attacks better than the newer routes. Whatever the reason shipmasters were not on the shipping routes, it appears that routes for March and April were not readily followed, and it may not have been the fault of disobedient shipmasters intent on delivering cargoes quickly with no regard for life. Even though the issue of blame has yet to be proven, the fact that vessels were not travelling along patrolled routes could have contributed to these months being the two most destructive in terms of U-boat attacks and successes.

Once the Cape Hatteras minefield was laid and the convoy system initiated, the ESF changed the shipping routes once again. This change was especially important since the old shipping routes went directly through the Hatteras "Danger Area." Unfortunately, documentation of route changes made in May 1942 has remained elusive after archival and historic research, so the shipping and convoy routes published in 1943 are used to represent routes for the remainder of the war. Presumably these routes are virtually identical to those

implemented in May 1942 because they are nearly the same as the routes used during March and April with the inclusion of a couple additional buoys to guide vessels around the Hatteras minefield and with convoy routes clearly defined. While routes for May 1942 will undoubtedly be discovered in time, it is unlikely that they will depict any noticeable differences from the 1943 routes.

After the convoy system was initiated in May 1942, most attacks on merchant vessels occurred along convoy routes for the remainder of the war (Figure 6.9). This is because three of the seven vessels attacked in June 1942 were travelling in convoys, while one more was escorted by a coast guard airplane and cutter (Commandant Fifth Naval District 1942; Freeman 1987:402,403). Similarly, every attack in July 1942 was carried out by *U-576* against the same convoy; the only attack in 1943 occurred on a vessel that became stranded from a convoy; and no attacks happened in North Carolina waters in 1944. The two 1945 attacks were on vessels sailing independently and probably captained by shipmasters who felt confident the war was virtually over in North Carolina waters (Commandant Fifth Naval District 1943; ESF 1945a:1,3,chap.2). Although the number of attacks taking place after April 1942 was severely diminished, their geographical extent is suggestive of how effective the ESF was becoming at combating U-boats. After implementing the convoy system, no attack occurred along individual shipping routes with the exception of the attack on *YP-389*, which was not following a shipping route but merely patrolling the Hatteras minefield outskirts. One way of examining the effectiveness of the ESF is to inspect how U-boat travel patterns changed throughout the battle. This can be done by mapping attacks carried out by individual U-boats in relation to the same time span breakdowns as above to determine if the range of attacks by individual U-boats changed.

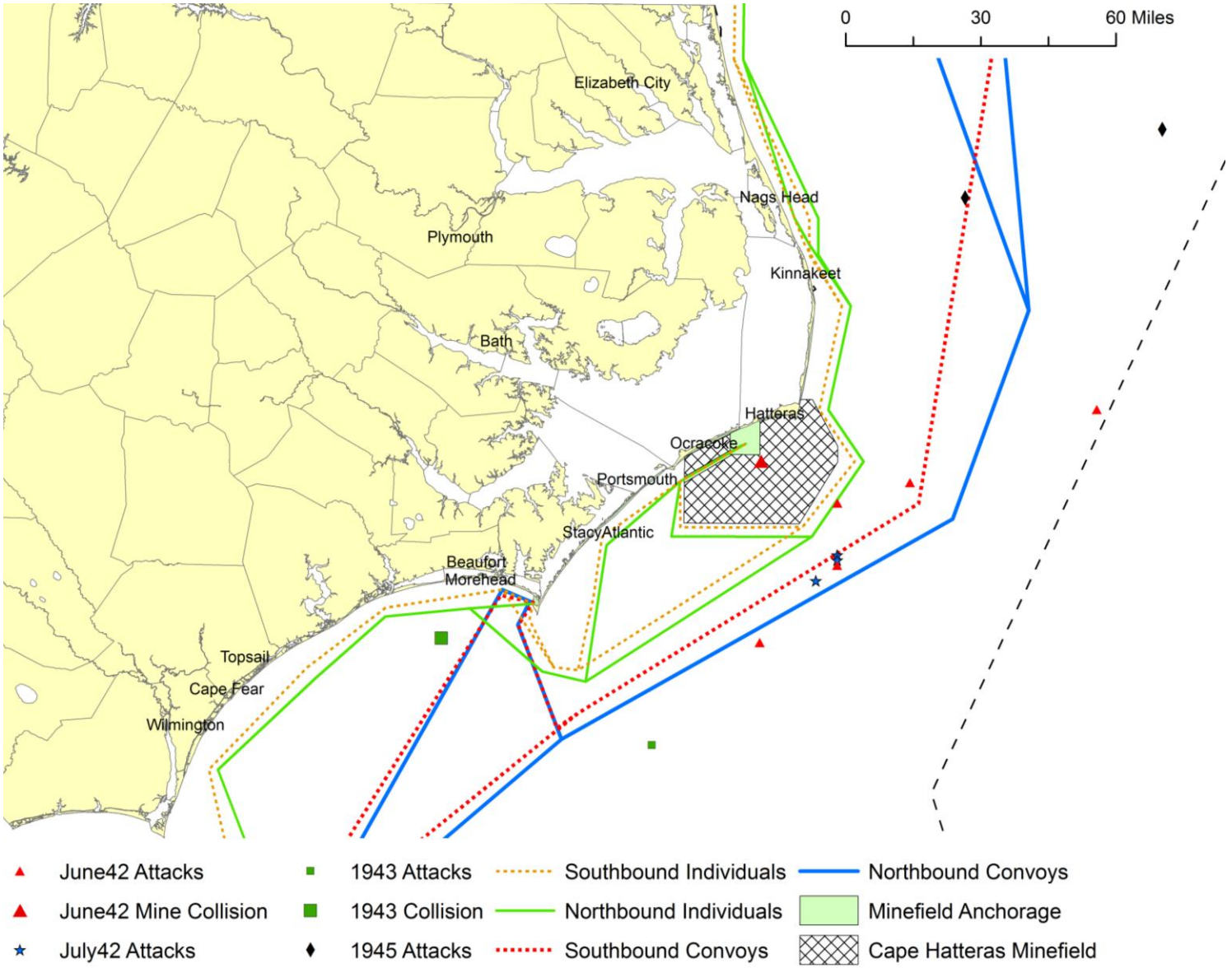

FIGURE 6.9. Attack and maritime accident locations for the remainder of the war in relation to the shipping and convoy routes for the corresponding period.

Individual U-boat Attack Locations

Since many of the previous analyses have focused on the battlefield's extent and the location of attacks on merchant vessels in relation to shipping routes, it is important to balance the study by observing where individual U-boats attacked. Examining the attack locations by U-boat allows two different observations about the battlefield to be made. The first observation simply reveals the operational range of each U-boat in North Carolina waters, and the second relates to the effectiveness of ESF patrols as the war progressed. Fortunately for the purposes of the study, the brunt of U-boat activity within ESF waters coincides with changes in the shipping routes, which allows attack locations to be broken down into the same chronological spans as the shipping route figures.

One aspect of the U-boat attacks for January and February 1942 (Figure 6.10) that is readily apparent is that attack locations for each U-boat are confined to a small area along the Outer Banks and that they follow a linear pattern along the shipping routes. Despite the confined area of attack locations, the freedom of the U-boats to move and operate along the coast is obvious when the dates and times of attacks are examined. Hardegen, in *U-123*, managed to travel approximately 61 linear miles along the coast of North Carolina in one day and attack five merchant vessels without being challenged by any American naval vessels or airplanes (Hardegen 1941-1942:18-22). Similarly, Zapp, in *U-66*, traveled approximately 68 linear miles from January 22 to January 23 and attacked three merchant vessels without putting his submarine in danger. Although *U-432* only attacked one vessel off North Carolina, the submarine was previously operating and sinking ships off Virginia before transitioning south and reporting "[m]uch careless air patrolling" (B.d.U. 1942a:87). Even though the submarines had not spread through all territorial waters of North Carolina by the end of February 1942, these initial attacks

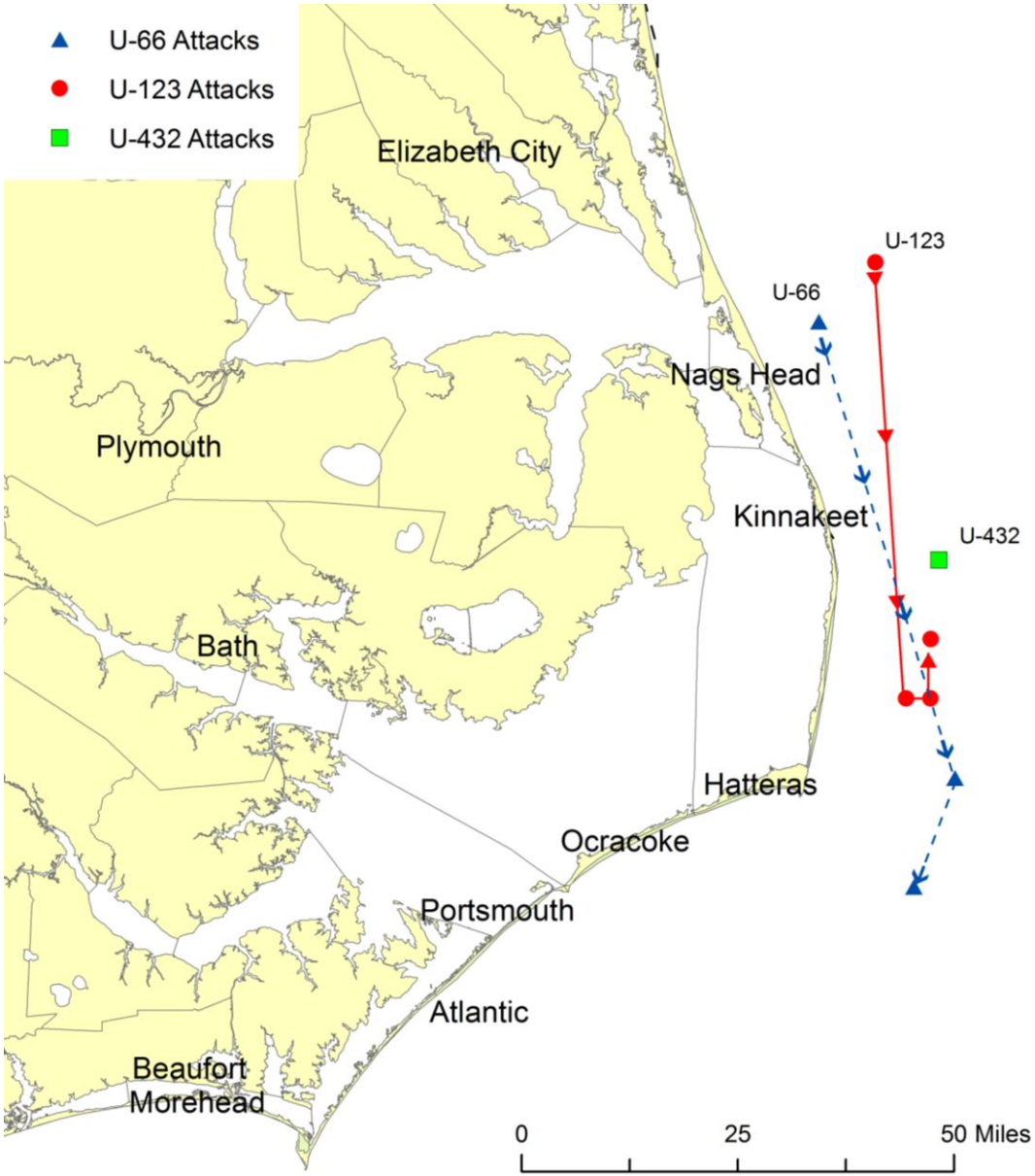

FIGURE 6.10. Attack locations by U-boat for January and February 1942.

helped the U-boat high command realize that their commanders should fully exploit North Carolina waters for the next few months. They further realized that submarines could attack with impunity because of the ineffectiveness of the ESF. This realization meant the worst two months for the ESF were about to occur.

By the time March and April 1942 ended, there was an evident expansion in U-boat activity and attack locations within the waters of North Carolina. These two devastating months witnessed twelve different U-boats enter the waters of the state and attack merchant shipping. In May, one additional submarine destroyed HMT *Bedfordshire*, the first naval vessel lost to enemy action off North Carolina. While the limited number of attacks during May began to signify a decrease in U-boat effectiveness within the ESF, the map of U-boat attack locations during these months (Figure 6.11) reflects the aggressiveness with which the U-boats waged war along the North Carolina coast.

During March and April, U-boats expanded the battle area, and distances travelled by the most successful U-boats also increased. *U-124* travelled approximately 152.3 linear miles between attacks. *U-158* transited approximately 175.2 linear miles of ocean between successful attacks. *U-160* travelled approximately 165.8 linear miles between attacks. *U-203* moved approximately 198.5 linear miles between attacks, cruising from north of Hatteras to south of Morehead City, and back to the Diamond Shoals. *U-552* logged approximately 172.5 linear miles between attacks. Although the number of miles travelled by the most successful U-boats during March and April suggests that they were able to operate with impunity, it must be noted that many U-boats attacked only a few merchant vessels and that two U-boats were sunk during these months.

This means that even though these months witnessed the loss of the most merchant vessels, successful U-boat captains had to work much harder for each victory. This alludes to the

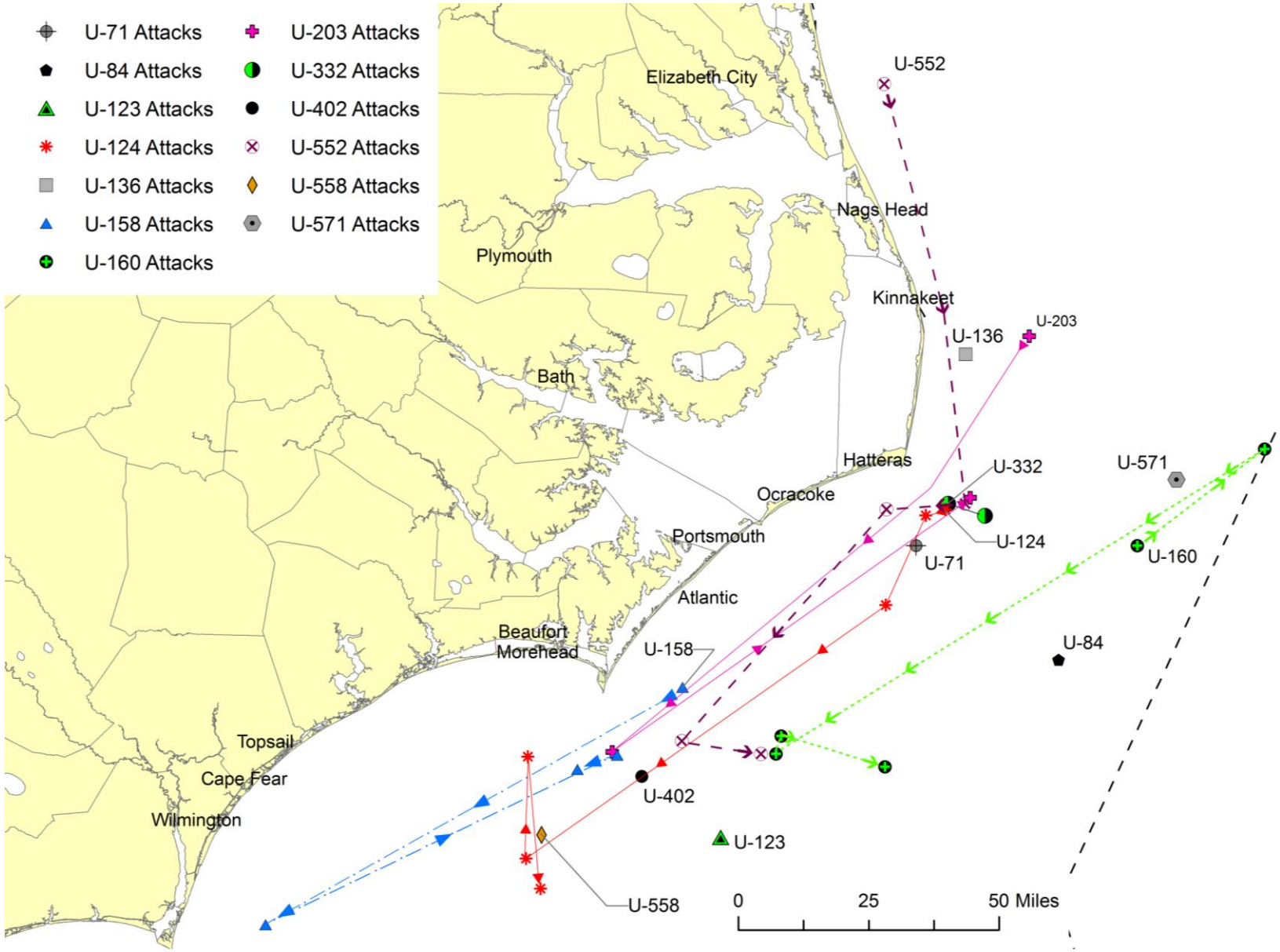

FIGURE 6.11. Pre-Convoy U-boat attack locations for March 1942 through May 1942.

fact that the ESF was becoming a more effective fighting force and that the directive to route merchant vessels around Hatteras during daylight was beginning to have an effect (ESF 1942a:2-3,chap. IV). Once the convoy system was initiated in the middle of May 1942, the U-boats would never again be able to move about in the same way. The map of attacks for the remainder of the war (Figure 6.12) clearly depicts how efficient the ESF became at routing vessels through the deadly waters off Hatteras and in hunting and destroying any U-boat that carried out an attack.

In June 1942, Horst Degen, in *U-701,* managed to travel approximately 152.8 linear miles between successful attacks in North Carolina waters; however, his patrol resulted in the loss of his submarine. The only other successful U-boat commander to appear in North Carolina waters during June 1942 was Otto von Bülow in *U-404.* After spending much of his patrol beyond ESF boundaries, Bülow entered North Carolina waters and successfully attacked three merchant vessels on June 24, all in approximately the same location. After these attacks, Bülow retreated into waters beyond the ESF for the remainder of his patrol (Hickam Jr. 1989:335,336).

In July 1942, only Hans-Dieter Heinicke in *U-576* attacked vessels within the waters of North Carolina. Heinicke torpedoed three vessels in the same convoy over a linear distance of approximately 14.1 linear miles (depending on the validity of the attack coordinates) before being sunk by the convoy's escorts. After this attack, only *U-129* attacked a merchant vessel in North Carolina waters during 1943. No vessels were attacked in 1944, and *U-857* or *U-879* (possibly both) attacked two vessels approximately 46.3 linear miles apart in 1945. The attacks on these vessels put the ESF on alert and both submarines were destroyed in waters off the American Coast demonstrating how skilled the ESF had become in hunting U-boats after the initial four months of attacks within American coastal waters.

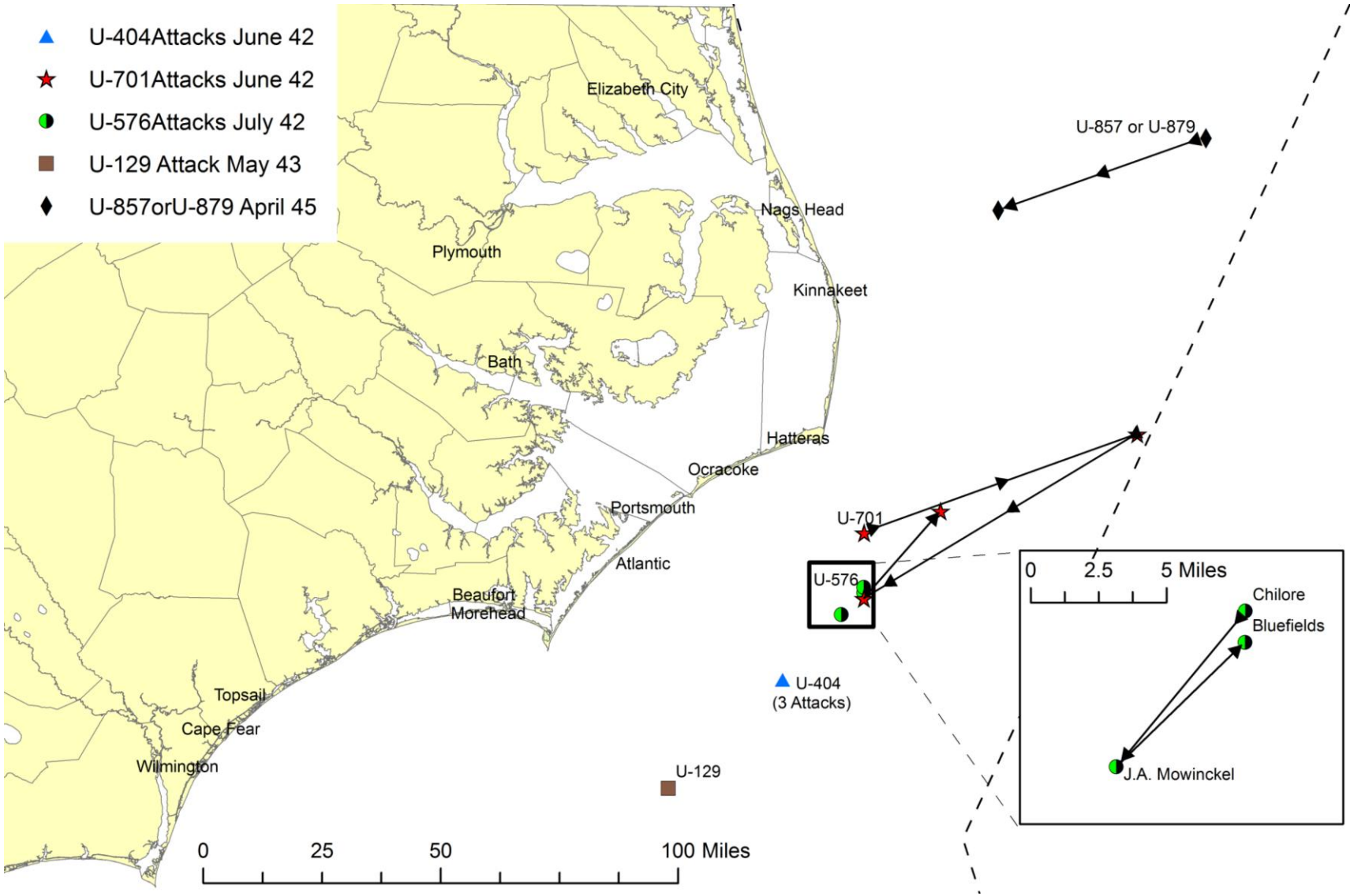

FIGURE 6.12. Attack locations for the remainder of the war with the attacks of *U-576* blown up to show clarity.

The rapidity with which the ESF was eventually able to combat U-boats, in conjunction with Doenitz shifting submarines south, is what eventually brought the battle off the coast of North Carolina to a close and kept the damages from being far worse and the engagement from lasting much longer.

Defining the Battlefield

Despite the fact that the U-boats were more or less beaten in North Carolina waters by the middle of 1942, whether by the ESF or because Doenitz ordered them to the Caribbean and Gulf of Mexico, they exacted a great amount of damage in the few months they appeared at "Torpedo Junction." In just six months, German submarines managed to litter the ocean bottom off North Carolina with hundreds of thousands of tons of shipping, thousands of barrels of oil, and the bodies of numerous sailors from Allied, Neutral and Axis nations alike. In these same few months, more merchant ships were sunk in North Carolina waters than off the coast of any other state, and several hundred war related events transpired in these deadly waters.

While geographical coordinates for only 142 of these events are currently known, the far-reaching extent of these events means that creating another polygon around them, to determine the battlefield's extent, would incorporate most events for which coordinates are unknown. The battle was not simply defined by where events took place, however, but also by shipping routes vessels followed, the minefield that claimed several victims, and vessel paths in the study area. For this reason, these factors were all used to delineate the boundaries of the battlefield. Inshore, shipping routes and the ports to which crippled vessels limped were used as boundary points to limit the battlefield's western extent, while entrance points of shipping and convoy routes into the study area were used to determine the southern and northern extents. The remaining borders were generated using the first historic event location inside the study area.

By using each element that contributed to the battle, the overall boundaries could be mapped (Figure 6.13) and represented without having to declare all North Carolina waters as the battleground. Upon completing the battlefield map it was possible to determine its geographical extent. The Battle of the Atlantic off North Carolina took place within an area of approximately 16,042.8 square miles over the course of four years. While hundreds of vessels traversed these waters during this same time span and naval ships and aircraft logged thousands of patrol hours sweeping these waters for German U-boats, this map represents the battlefield based upon events, geography, minefields, anchorages, ports, and shipping routes that in some way affected the course of the battle.

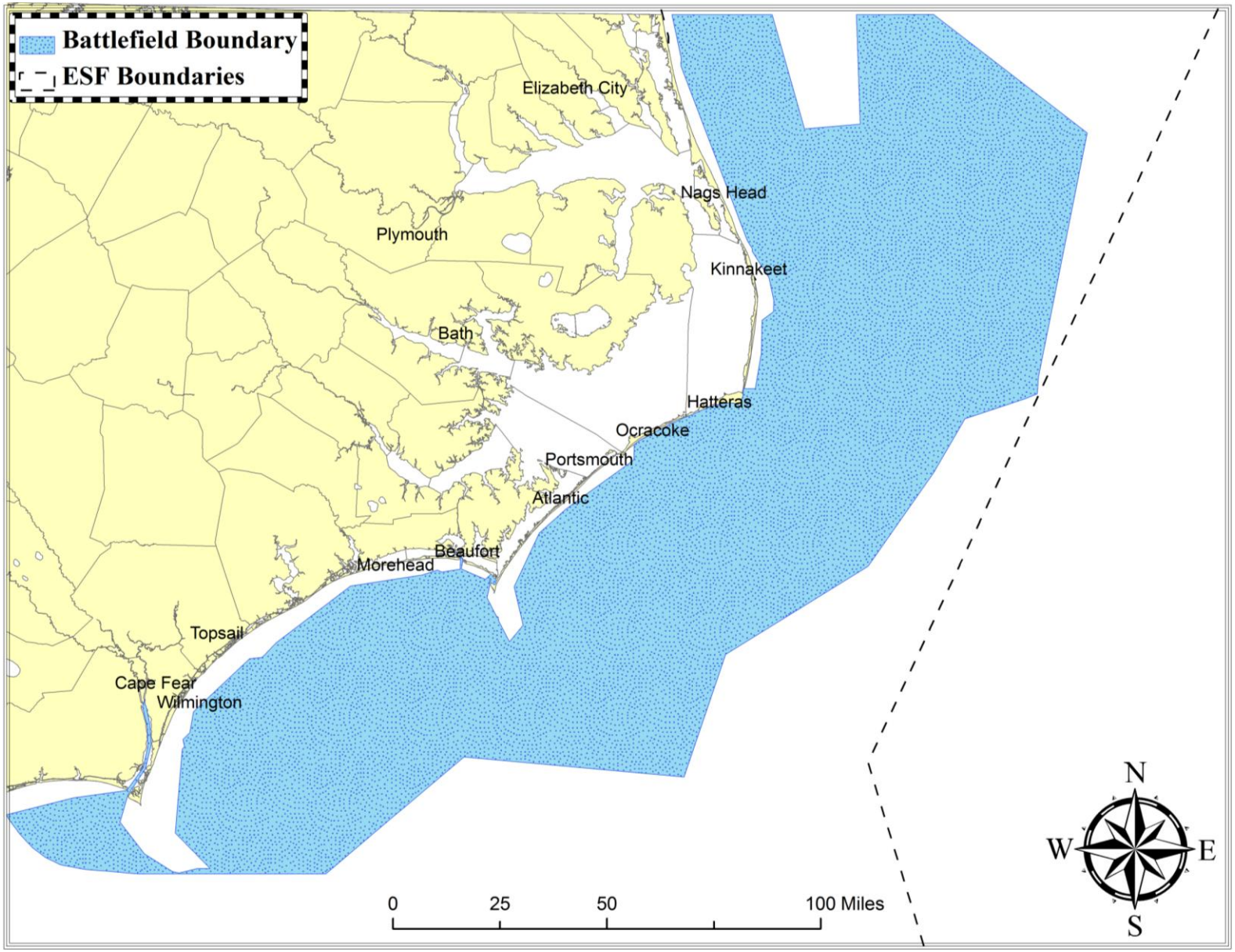

FIGURE 6.13. Map representing the extent of the battle within the waters of North Carolina.

CHAPTER 7: CONCLUSION

This study followed a generalist approach towards researching and defining a maritime battlefield in light of the tangible heritage the engagement left behind in the form of vessel casualties and the intangible heritage left behind as action reports, war diaries, and routing instructions. By maintaining a broad view of the battle and the events occurring during it, regional observations pertaining to vessels, nationalities, and U-boat commanders contributing to the engagement have been made. Similarly, geographical analyses pertaining to battle extents, battle centrality, and U-boat movements have been conducted to depict geographical trends inherent in the battlefield and to generate boundaries on the ocean where the battle took place. These analyses have provided a broader understanding of the Battle of the Atlantic as it transpired in the waters of North Carolina and have portrayed the human dynamics that impelled events occurring during the engagement.

By following the theories of generalist archaeological studies and battlefield archaeology in conjunction with some theories of geospatial analysis as presented in Chapter One, and expanding upon them, it has been possible to propose a model for defining boundaries of maritime engagements based upon archaeology and history. Chapter Two showed how historical, archaeological, and geographical components of this study were merged to answer this thesis' research questions. Chapters Three and Four presented historical events occurring along the east coasts of America and North Carolina throughout the war. These historical chapters identified key factors contributing to the battle and laid out many of the historical events originally believed to have occurred within North Carolina waters.

Chapter Five dissected these historical events and limited them to those actually occurring off North Carolina as determined by the state's northern and southern borders and the

eastern boundary of waters patrolled by the NANCF and ESF. This chapter also statistically examined battlefield events as well as nations and vessels affected by the conflict to provide a greater understanding of the multitude of factors influencing the battle and to provide substance for the battlefield's geographical analysis. These geographical analyses, contained in Chapter Six, revealed several geographical trends in the battle.

Observations

There are several major geographical trends revealed by mapping battle centralities, event densities, battle extents, merchant vessel routes, and U-boat activity during the war. The analysis of battle centrality corroborates historical documentation of the entire Battle of the Atlantic along the American coast as well as suggests regional differences particular to the geography of North Carolina. The centrality of the battle for most months and years of the engagement reveals that the main area of U-boat attacks and battle related events rested in the waters off Cape Hatteras and Ocracoke. This finding supports the ESF's observation that waters around Hatteras were the U-boats primary hunting grounds (Freeman 1987:21,27,50,94,166,174). On the opposite end of the spectrum, activity focused around Hatteras and Ocracoke suggests that the battle did not follow an overall southern shift on a regional level. This is likely because the U-boats were hesitant to leave productive hunting grounds to seek success in unfamiliar waters and because the geography around Hatteras allowed U-boats to remain hidden in deeper waters during the day and to raid shallower shipping lanes at night (Freeman 1987:45,166,248; Hickam Jr. 1989:11).

The density of battle events depicts much of the same information as the measures of battle centrality in that it depicts hotspots of activity occurring around Hatteras, Ocracoke, and Oregon Inlet. This information differs, however, by revealing the number of events occurring within a particular area of ocean, 36 square nautical miles, or the equivalent of the smallest

German Kriegsmarine grid square (Emmerich 2010). This information reveals where the heaviest battle activity occurred as well as the least amount, which helps depict why the center of battle activity lies where it does. The remaining analyses of battle extents, vessel routing, and U-boat activity must be addressed together since each affects the others during the span of the battle.

The overall extent of the battle for each month or year of the war was largely affected by movement of individual U-boats and where those U-boat crews were able to find targets. This means that during the first two months of the battle, when U-boat activity was concentrated along the navigational buoys off the North Carolina coast, the area of ocean the battle transpired in was quite small. In March and April 1942, when many U-boats entered North Carolina waters, attack locations and where the battle transpired was greatly expanded. The range of attack locations throughout most of North Carolina's waters brings to light the fact that many vessels attacked during these months were not following shipping routes, whether out of disobedience to routing orders, or the failure of port officers or the ESF in disseminating information about new shipping routes. Regardless of where blame lies, the widespread nature of attacks during these months reveals that many vessels may not have been following the shipping routes since the beginning of the war, but the limited number of U-boats in American waters during January and February 1942 could not exploit this behavioral factor along the North Carolina coast.

By the time the convoy system was initiated, and merchant vessels were drawn into convoys, most battle activity had already moved to the Caribbean and Gulf of Mexico, resulting in few attacks in North Carolina waters and a much smaller theater of U-boat operations for the remainder of the war. When these base elements and characteristics of the battle are mapped in

conjunction with all other geographical and historical elements, it is possible to portray the extent of the Battle of the Atlantic in the waters of North Carolina. Although this map answers the feasibility of mapping battle events transpiring over four years, as was the primary intent of this thesis, some limitations affected the study's outcome, and many more questions about the battle were generated that can hopefully be addressed through future scholarship.

Limitations and Avenues for Future Research

The largest limitation revolves around the scope of study for the thesis. Since it is far beyond the ability and practicality of this study to find and document locations and identities of all the vessels sunk within the study area during the battle, all known and speculated resting locations of war casualties are accepted at face value and believed to be accurate to an acceptable degree of error. Although this is a limitation to the accuracy of specific locations of vessels sunk in this engagement, it does serve as a baseline from which to measure the accuracy of historic events occurring during the battle. Through future archaeological surveys intended to discover and identify the remains of vessels discussed in this study, the accuracy of historic documents can be tested to help determine the accuracy of additional shipwreck locations.

An additional limitation to this study is the necessity to analyze only events contributing to the battle. Although there are many reports of Allied vessels attacking sound contacts, fishermen sighting U-boats, and airplanes attacking potential targets, only events that could be corroborated based upon the chain of events they incited were included. While this means that some definite attacks on U-boats have probably been overlooked since they did not produce results, the decision to leave some events with known geographical locations out of the study was made so that only events directly contributing to the battle were chosen for analysis. Again, while this may leave out some battle related events, it increases the likelihood that no

superfluous events having no bearing on the battle's outcome skewed the statistical and geographical analyses.

One final limitation that suggests avenues for future research is the lack of information from the German U-boat commanders. Although uboatarchive.net has translated war diaries for some of the *Paukenschlag* U-boats, translation of the remainder of the submarine war diaries would contribute greatly to understanding the battle. This information would help with the statistical analysis of the sizes and ages of vessels sunk by adding the variable of number of torpedoes fired at each merchant ship as well as the running depths of those torpedoes. It would also allow the paths of the U-boats to be tracked for each day they were in North Carolina waters and not just when a merchant vessel was attacked. This data can depict whether the linear nature of the U-boat travel depicted in the geographical analysis is correct or if U-boats carried out searches in different patterns.

These facts, as well as other statistical analyses of the battlefield and geographical trends in a particular region, will greatly benefit from similar generalist studies of the Battle of the Atlantic in other regions. This will allow the comparative analysis of sizes of vessels attacked, sizes of vessels sunk, nationalities most affected, extents of battle areas, and successful U-boat captains to be made to determine if behaviors of U-boat captains, merchant captains, and Allied forces differed across the globe. By undertaking these analyses, a broader understanding of the Battle of the Atlantic can be made so that the memory of the brave sailors from each nation affected by the war can live on far after remnants of their once proud vessels cease to exist.

Archaeological and Environmental Implications

Although this study has not undertaken fieldwork to survey known shipwrecks or to find additional undiscovered shipwrecks, the archaeological implications behind a GIS based

inventory of historic wrecking coordinates are many. Through the use of GIS analysis tools, areas of battle and wrecking density can be examined to determine areas likely to contain significant amounts of cultural deposits. The environmental importance of being able to determine these areas should not be understated. Since many vessels were sunk with volatile cargoes including fuels of all types, the potential for those substances, not burned in the attack, to have an enormous impact on marine life must be considered.

Similarly, the use of a GIS based study of historic coordinates and event locations of the battle shows that these historic coordinates have the potential to help identify shipwreck sites that have been tentatively identified or identified incorrectly through previous surveys. One of these wrecks, the *Papoose,* was incorrectly identified as a wreck lying south of Beaufort. This incorrect identification stuck with this wreck for years and the so-called *Papoose* site became one of the prime diving spots off Morehead City. Over the years, however, the identification of this site as well as others came under criticism by wreck divers who felt that the *Gentian* Survey conducted in 1943 may have misidentified shipwrecks and did not provide definitive proof for identification of others. In the case of the *Papoose,* historic documents revealed that the *Papoose* drifted for two days after being torpedoed and sank north of Hatteras (USCG 1944k:1; Barnette 2006:77-79). The *Gentian* Survey, however, concluded that it "is quite apparent that the rate of drift could not have carried the PAPOOSE in two days time to the positions north of Cape Hatteras mentioned in the Coast Guard reports," and determined a wreck two miles from the spot the *Papoose* was torpedoed was the *Papoose* (Woods Hole Oceanographic Institution et al. 1944:15).

Not believing this assumption, several divers hypothesized that the *Papoose* might rest north of Hatteras, and following the belief that "[o]nly the recovery of a definitive, identifying

artifact and further investigation will prove whether this hypothesis holds" (Hudy 2007) set about systematically vandalizing the cultural heritage of the North Carolina coast in the hopes of finding that "definitive identifying artifact." Finally, Barnette researched the serial number of a helm stand manufactured by MacTaggart Scott and Company of Edinburgh, Scotland, that was recovered from a wreck northeast of Hatteras by Gene Peterson in 1997 and discovered the stand was manufactured for the vessel *Silvanus*, the former name of the *Papoose* (Barnette 2006:81). This discovery allowed the correct identification of the *Papoose* to be made and placed the *Papoose's* final resting location in the same vicinity as historic documents and the GIS this study created show the vessel should rest.

This means that the careful analysis of historic documents, coupled with a GIS of locations revealed in these documents and archaeological measurements of defining elements of shipwrecks can entirely remove the supposed need to recover artifacts to identify shipwrecks. This is especially important when those artifacts simply end up in private trophy cases and slight the memory of the sailors who lost their lives throughout the war.

Conclusion

While the primary research objective of this thesis was to test the feasibility of mapping the geographical extent of a maritime battlefield based upon its tangible and intangible cultural heritage and to provide a model for defining the extents of similar battlefields, this research in no way suggests that this is the only model available for defining regional areas of naval engagements. Furthermore, this study does not imply that the only way to protect the cultural heritage of World War II is through creation of a 16,042.8 square mile national battlefield. This thesis simply reveals the major battle components within North Carolina's waters. The geographical extent of those battle elements shows how much of the state's seascape was

affected by the engagement offshore. It is the author's hope that this study will open up a dialogue that will test the validity of this model for defining maritime battlescapes and bring to light the necessity of protecting the cultural heritage of World War II for future study and future generations, and so the memory of the sailors plying the oceans during this battle for the benefit of their countries will survive.

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