“And So Ends this Day’s Work”: Industrial Perspectives on Early Nineteenth-century American Whaleships Wrecked in the Northwestern Hawaiian Islands

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DECLARATION OF CANDIDATE

I certify that this thesis does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any university; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text.

Signed,

Jason Thomas Raupp

February 1, 2015

DEDICATION

For Abraham Joseph McKinnon Raupp

ABSTRACT

The pelagic whale fishery was one of most important contributors to the development of the early American economy. Although oil extracted from whales taken along the New England coast was a valuable commodity in the colonial trade for centuries, it was the expansion of the fishery during the late eighteenth and early nineteenth centuries that resulted in unprecedented financial success for American whaling. During that time extensive hunting grounds discovered in the Pacific Ocean led to an ever increasing demand for sperm whale oil, which was considered the ideal lubricant and illuminant for the burgeoning industrial revolution. To meet demand the geographic focus of the majority of whaleships was shifted to the Pacific region in the early decades of the nineteenth century and trading centers were subsequently established at island groups like Hawaii to support their activities.

The ships employed in pelagic whaling in the early to mid-nineteenth century were workplaces which incorporated complex industrial processes that resulted from wider social, cultural, and industrial changes. Due in large part to technological innovations and systemic standardization by American whalers in the mid- to late eighteenth century, whaleships were organized as self-contained and fully integrated industrial platforms that incorporated both the equipment necessary to carry out whaling operations and the domestic spaces needed for officers and crews. Thus equipped, the geographic restrictions that previously limited their operational range were removed and the search for new hunting grounds led to voyages to ever more remote regions, greatly extended the duration of voyages, and resulted in an increase to the size of the vessels employed and changes to their rigs.

This dissertation explores the industrial nature of the pelagic whaling ships that operated in the Pacific Ocean in the early to mid-nineteenth century. It combines historical and archival research, the results of archaeological site inspections and recording, and comparative studies of museum collections to contextualize the industrial experience and the working environment that existed onboard these vessels. To understand the systems that operated on pelagic whaleships of this period, relevant data is analyzed using three themes adapted from industrial archaeological practice to explore the concepts of ‘maritime industrial workplace’, ‘maritime resource extraction’, and ‘maritime industrial seascapes’.

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The collections housed in a number libraries in Australia and the United States were consulted in the course of this research project and I would like to thank the skilled librarians and archivists for the welcoming atmosphere and pleasant experience. Among the main facilities visited were the National Library of Australia; the State Library of South Australia; the State Library of Victoria; the libraries of the Australian National University and its Pacific Manuscripts Bureau; the Vaughn Evans research library of the Australian National Maritime Museum; the Hamilton Library at the University of Hawaii; and the Providence Public Library (and the excellent 'Paul C. Nicholson Whaling Collection' of whaling logbooks and journals that are published online).

I would like to express my appreciation to the friendly and helpful staff at several archival repositories in New England. Information contained in many of the historic records held at the New Bedford Whaling Museum Research Library were instrumental to this research and thanks are extended to museum staff Michael Dyer, Stuart Franck, Greg Galer, and Mark Procknik for providing access, advice, and input. Special thanks are also extended to Research Library volunteer *extraordinaire* Jan Keeler, for the assistance she provided and the hospitality that she offered during my visit. The Whaling Collection Archives at the New Bedford Free Public Library proved to be another vital source of information; thanks to Special Collections Librarians Paul Cyr and Joan Barney for keeping the lights on for me on many late evenings and for being so accommodating. Another source of invaluable data was the Nantucket Historical Association Research Library; the generosity and assistance provided by staff members Ben Simmons, Marie "Ralph" Henke, and Elizabeth "Libby" Oldham is greatly appreciated. The staff of the Martha's Vineyard Museum also kindly provided access to their archives and collections and I would like to thank Nancy Cole, Bonnie Stacy, and Dana Street for their help. The G.W. Blunt Research Library at Mystic Seaport was another source of information that greatly enhanced this dissertation and I am indebted to its staff for their generosity and enthusiastic assistance. I would also like to thank the friendly staff at the Massachusetts Historical Society for providing access to their collections and offering advice on how to best locate hard to find materials pertaining to whaling.

In Hawaii, a number of archival institutions hold documents that include pertinent information about American whaling activities specific to the Pacific region and the staff at those visited were friendly and accommodating. The collections held at the State Archives were extremely useful for this research and Historical Records Branch Chief Luella H. Kurkjian and staff graciously helped me to easily navigate my way through them. The archival data housed in the Pacific Collection at the University of Hawaii's Hamilton Library also proved valuable to this research and I would like to thank Hawaii Collection Librarian Jodie Matos and Pacific Specialist Eleanor Klieber for their assistance. The staff at the Hawaiian Mission Houses Museum and Archives generously provided access to their archival

collections which also proved beneficial to this dissertation.

Several museums pertaining to historic whaling were visited in the course of this research and many of their collections offered opportunities for comparative studies. At the New Bedford Whaling Museum I am grateful to the staff who allowed me to thoroughly study the half-sized, fully-rigged model of the whaleship *Lagoda*, which provided perspective on the organization and use of whaling equipment onboard mid-nineteenth century vessels. Similarly, I gleaned invaluable perspective on the proportions of a working whaleship and its construction through visits to Mystic Seaport and the wooden whaleship *Charles W. Morgan*, built in 1841. Each of those visits coincided with the multi-year refit of the vessel and allowed me to document components of this vessel that are inaccessible under normal conditions. Shipyard staff were extremely friendly and took time out of their busy schedules to answer my many questions; thanks to senior shipwrights Quentin Snedicker and Roger Hambridge, as well as *Morgan* Historian Matthew Stackpole. I was also fortunate to participate in the 38th Voyage of the newly refit *Charles W. Morgan* in 2014, which provided me with a chance to cruise under full sail off the coast of Massachusetts and spend a night onboard the ship in the cramped confines of its fo'c'sle. This unforgettable experience offered a unique opportunity to gain first-hand perspective on how the many components of early to mid-nineteenth century ships operated and how the ship handled. I would like to thank all of the Mystic Seaport staff and contractors who worked tirelessly to make this cruise happen, as well as the 38th Voyager program directors for including me in this historic event.

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CHAPTER 1. Introduction

By the early 1800s British and American whaleships entered the Pacific Ocean and began exploring its vast expanse. In many areas they found immense numbers of sperm whales, which they quickly exploited. The discovery of new hunting grounds, and an understanding of the seasonal movements of different whale species, brought increasing numbers of ships that roamed throughout the region year round. Markets in the United Kingdom (UK) and Europe found the massive quantities of extracted whale oil the perfect fuel for the industrial revolution and used it to lubricate machines and illuminate factories. These uses allowed for increased productivity and in turn created greater demand for whale products throughout the first half of the nineteenth century. As a result, the whaling firms of New England and those of the British South Sea fishery soon sent the majority of their fleets on extended voyages to the remote and often uncharted and dangerous areas of the Pacific Ocean in the hopes of full cargo holds and quick returns. By the 1850s ships roved year-round between established grounds (Figure 1) that extended in a rough triangle from just north of Cape Horn, west to New Zealand and north to the Arctic (Rydell 1952:68).

This dissertation explores the industrial nature of the pelagic whaling ships that operated in the Pacific Ocean from the early to mid-nineteenth century. Unlike the vessels employed in other seaborne merchant activities of this period, whaleships were constructed and organized to be both floating production platforms and a home for the whalers. This study combines historical and archival research, the results of archaeological site inspections and recording, and comparative studies of museum collections to contextualize the industrial experience and working environment that existed onboard these vessels and interpret them as industrial workplaces.

The industrial system employed in nineteenth-century pelagic whaling involved a series of interrelated processes and organized labor. Many of these processes and their associated material culture were adapted from the whaling traditions of Europe that developed over centuries. The origins of commercial whaling can be traced to prehistoric times, when the value of the oil, meat and bone made stranded whales a rich prize (Sanger 1995:15). In many parts of the world, whaling from shore was an important subsistence activity and petroglyphs possibly as old as 6,000 years depict whales, boats, and whale hunting scenes have been identified in southeastern Korea, Norway, and in the White Sea region of Russia (Savelle and Kishigami 2013:3). The expansion of whaling to a commercial scale, however, is generally considered to be of European origin. The Basque people of the modern border region of France and Spain regularly took whales from open boats and by the fifteenth-century had pioneered long distance voyaging in pursuit of their prey (Nash 2003:8). Over the next three hundred years, whaling in the Arctic regions of the North Atlantic developed into an important business for many European countries.

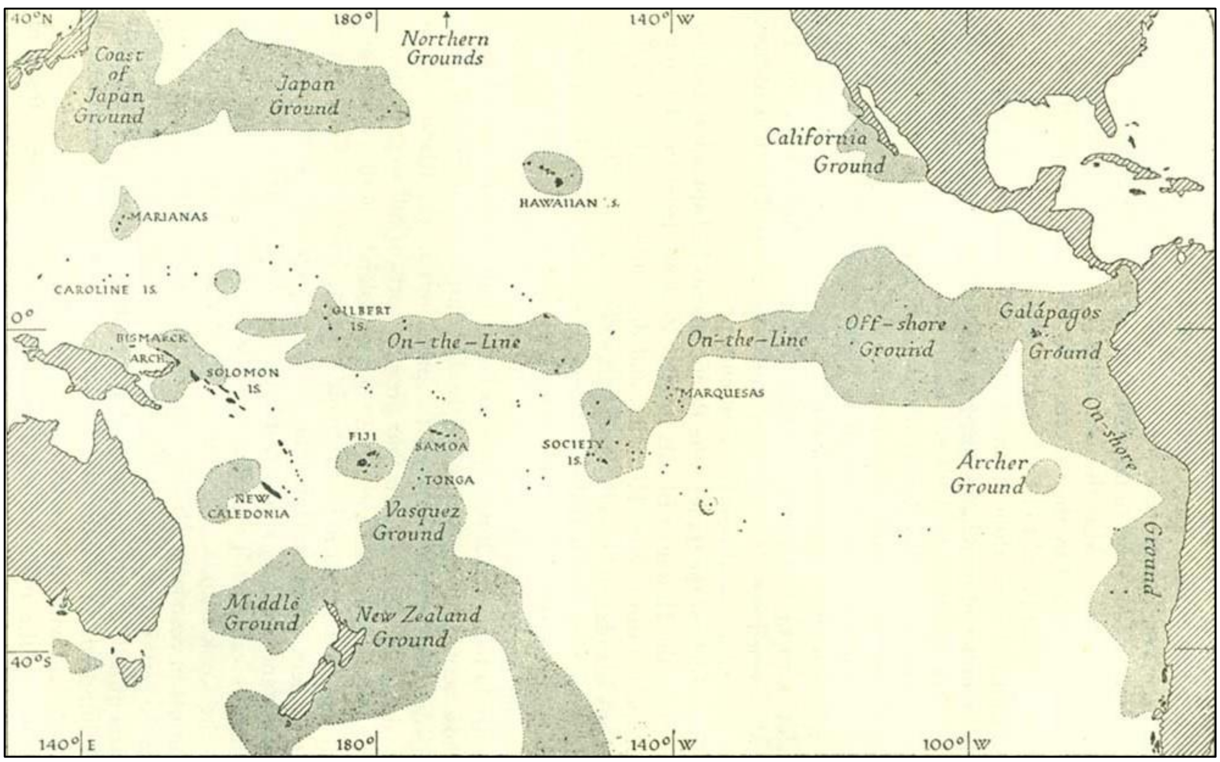

Figure 1. Nineteenth-century whaling grounds in the Pacific. From Naval Intelligence Division. 1945.

In 1610 the English sent their first expedition to the Arctic for the sole purpose of whale fishing (*North American Review* 1834:86). Operations were conducted via a method known as shore whaling, which utilized small whaleboats launched from the beach to intercept and capture whales that were then processed at shore stations (Gibbs 2010:4). The English initially focused their whaling activities around the arctic archipelago of Spitsbergen; however, after about thirty years whale populations began to decline so their field of operations moved westward to the Greenland Sea, Davis Strait, and Baffin Bay (Isachsen 1929:388). Although the English dominated the fishery in the early period, intense competition from other nations—most notably the Dutch—led to a lull in the English whaling enterprise during the last quarter of the seventeenth to the early eighteenth century (Chatterton 1925:52). Recognizing the value of the fishery, the English government established a bounty system to support it. Over time the subsidies paid to English whaleships equipped by English crews, leaving English ports and returning with whale products for English markets were raised to such an extent that it became impossible for foreign whaling nations to participate in England's domestic economy (Robotti 1962:5-6; Schokkenbroek 2008:36). These incentives resulted in greater private investment and ultimately re-established English dominance in the Arctic fishery by the beginning of the nineteenth century.

The organization of a colonial whaling enterprise was a priority of early English settlers to North America. The frequency of coastal whale stranding meant that colonists could easily undertake opportunistic whaling, which involved simply processing carcasses and storing whale products for shipment to markets back home and abroad. The profitability of these early activities and the knowledge that whales were found easily just offshore led to the establishment of shore whaling enterprises (Allen 1928:340). The success of shore whaling in North America soon brought an increased demand for whale products and by the early eighteenth century, offshore whaling methods were developed. Offshore whaling involved outfitting sailing vessels with small boats and sending them out in search of prey; when captured, whale carcasses were towed back to the mother ship, where the blubber was removed and stored for later processing on shore. This shift in methods allowed colonial whaling operations to thrive and by 1730 there was a regular trade in whale oil and whalebone to England, as well as to British ports in the West Indies. At this point whaling was the main industry of New England (Cherfas 1988:75).

Though the offshore whaling method was successful, limitations were realized quickly. The small cargo capacities of the sloops and schooners employed as mother ships restricted the number of whales that could be captured on a voyage. Furthermore, warm temperatures tended to spoil unprocessed blubber so whaling cruises could only be conducted as seasonal operations or in consistently cold climates. These restrictions, coupled with a shift to hunting sperm whales—which that produced higher quality oil—and the growing need to make longer voyages to more distant grounds, led to a revolutionary innovation: the transfer of the tryworks from the shore to the deck of the whaleship (Davis et al 1997:36). With the tryworks aboard, vessels could sail further and longer since, as rudimentary factory ships, they could process their catch and store the products on board (Kugler 1980:4). Though Basque and Dutch whalers working in the Arctic had experimented with onboard tryworks in the seventeenth and early eighteenth centuries (Barthelmess 2009:653-656), it was the American application of this technology that sparked a revolution in whaling and produced a multinational industry that was truly global in nature.

Whaling as a Standardized Industrial System

In the early nineteenth century the processes involved in whaling were part of an international operation that took on three forms (Little 1969; Chamberlin 1988; Gibbs 2010). The first of these was the long-used method of 'shore-based whaling', which utilized small boats to catch whales that were brought directly to pre-established stations for processing. Once complete the whale oil and other products were transported to European and American ports via annual cargo and supply vessels. Next was 'bay whaling', which involved ships used as both mobile processing plants as well as cargo transports. Equipped with processing equipment, these vessels hunted in remote bays frequented by migratory whales, but when they were ready to move on they stopped at local shore whaling settlements to pick up any oil ready for shipment. The third method was 'pelagic' or 'open sea whaling', which employed whaleships equipped with self-contained whale processing stations and storage capabilities that actively followed the global deep-sea migrations of the sperm whale (Gibbs 2010:4). While each of these methods is different in its range and scope and processing location, the basic industrial processes involved capturing whales, preparing the carcass, rendering blubber and storing oil for later transshipment.

Pelagic whaling practices changed little from the time of their establishment in the mid-eighteenth century until new technologies were introduced beginning in the mid-nineteenth century. Wooden sailing ships cruised known grounds looking for prey; when sighted, small whaleboats were lowered to pursue them and quickly maneuvered close enough to the target to attack. A harpoon attached to a long line was thrown by hand and stuck into the whale, which then dragged the boat and crew until it tired. At that point the whale was killed using a sharp lance and its carcass towed back to the waiting ship where it was processed (Whitehead 2003:14). Processing involved several stages, including cutting in, or removing the blubber and case oil; trying out, or rendering the blubber into oil; transferring oil into casks of varying sizes for storage and transport; and post-processing, which involved cleaning the work areas and preparing for the next round.

The ships used for pelagic whaling during this period were workplaces, which incorporated complex industrial processes that resulted from wider social, cultural and technological changes throughout the early to mid-nineteenth century. Unlike vessels employed in other seaborne trades, whaling ships were self-contained and fully integrated working platforms, as well as complex social systems. They contained both the equipment necessary to carry out whaling operations and the domestic spaces that became a meager home for officers and crews for up to five years. Equipped for long voyages, whaleships had no need to touch land for any other purpose than resupplying when fresh provisions were depleted or emptying holds for transshipment when an opportunity presented itself.

The success of their endeavors depended not only on standardized processes and technologies, but also the effective management of organized labor. While searching for prey, order was maintained through an established system of watches. While on watch crews were kept busy with the regular tasks associated with ship and gear maintenance, watches, and lookout duties. Officers of the watch supervised these activities and assisted the captain in making decisions about best plans of action. When whales were spotted, a flurry of activities erupted onboard as boats were lowered for pursuit and the ship was readied for operations. Unlike other fisheries that depended on getting fresh, frozen or salted fish to market in a relatively short amount of time, whalers signed on to voyages that lasted until the ship’s hold was full or the captain decided to return to port. To ensure ultimate productivity American whaleship owners relied on the 'lay' system, which paid each crew member a prearranged fractional share of the total net proceeds of a voyage (Hohman 1926:644).

Pelagic whaling ships of the nineteenth-century provided a foundation to several smaller industrial processes that operated in conjunction with one another for commercial success and survival. Further, these ships provided structure for a community of crew members who lived and worked together for extended periods of time. They relied on each other for the success of their catch, as well as the overall success of the cruise and their lay of the profits, but in many instances they also relied on each other for their lives. As the hunting grounds grew more distant and voyages became longer, standardization of industrial practices and techniques on board pelagic whalers became necessary for success. This standardization also manifested in changes to the overall design and layout of the whaling vessel and its component parts, so that the processes involved could be undertaken with greater efficiency. By the early nineteenth century, the basic pattern of many of these technological features would have been apparent to the common eye and would have distinguished ships as whalers, irrespective of the nationality of the vessel.

At times observers of the industry referred to whaleships of the early nineteenth-century as 'floating oil-factories' (Day 1966:132; Allen 1973:159; Weiss 1974:79). Yet by the very nature of the activities that they supported, the concept of factory is not appropriate. The term 'factory' is a contraction of the word 'manufactory' (Conlin Casella 2001:25) and is defined as "a building or group of buildings where goods are manufactured chiefly by machine" (Oxford Dictionary Online). When applied to whaleships, this term then implies that the onboard industrial activities involved secondary, manufacturing processes. In actuality pelagic whaling was an extractive industry and the operations that took place onboard ships were primary in nature. Much like in other extractive industries, early nineteenth-century whaleships were responsible for procuring raw materials; the processing that occurred onboard the vessels simply converted them into a form that allowed for maximum storage capacity and ease of transport. The products procured from sperm and other whale species included varying grades of oil, occasional ambergris, and to a lesser extent, bone and teeth; each of these materials required some degree of secondary processing and/or refinement before they were made commercially available.

With the exception of the ships' windless, which was primarily a component of its anchoring system that was adapted for use in whale processing, pelagic whaling was unmechanized during the period under investigation (Gordon and Malone 1994:228). The industrial processes employed onboard in the early nineteenth century changed little from the time of their introduction in the eighteenth century and targeted only specific parts of the whale. From the 1860s, however, the whaling industry experienced a series of technological advances that resulted in increased mechanization. Advances in harpoon gun technologies and the introduction of steam power to some vessels allowed for the hunting of whale species that were previously considered too fast for conventional whaling methods (Clapham and Baker 2002:1328). Such changes became a catalyst for the development of what would become known as the 'modern whaling' era and would ultimately lead to the development of the floating factory ships of the twentieth century (Tønnessen and Johnsen 1982).

As a combined tanker and factory, these large steel hulled ships were dramatically different from their wooden predecessors of the mid-nineteenth century; fully mechanized, they included all equipment necessary for efficiently processing entire whale carcasses into final products ready for commercial sale (Basberg 1998). They acted as mother ships for a small fleet of steam-powered whale catchers that explored surrounding seas in search of whales. Once spotted, the whale chasers used explosive rocket harpoons mounted on their bows to kill the whales and then tow the carcasses back to the factory ships for processing. Thus, the term factory is more fitting of the vessels employed in twentieth century pelagic whaling, as they included manufacturing capabilities. In fact, it might be said that mid-nineteenth-century whaleships are more closely akin to floating production platforms employed in modern offshore petroleum industries with their "mother ship" refineries onshore.

Maritime Industrial Archaeological Practice and Theory: Three Concepts Related to Pelagic Whaling

In order to understand the systems that operated onboard pelagic whaleships of this period, this research analyzed relevant data through the lens of industrial archaeological practice and theory using three concepts: ‘maritime industrial workplace’, ‘maritime resource extraction’ and ‘maritime industrial seascapes’. Industrial archaeology is an academic sub-discipline that has grown into a vibrant and progressive area of research and practice over the past five decades (Basberg 2004:22; Cossons 2005:ix). Although early industrial archaeological studies were concerned primarily with recording and preserving the technological and structural remains of the industrial revolution, as industrial archaeology matured more consideration was given to how social and cultural factors can be incorporated into its agenda.

The primary aims of more recent archaeological investigation into sites of past industrial activity include identifying not only the technical processes but also the human activities that took place, when and where on sites they occurred and how they affected and were affected by the technical process (Cranstone 2001; Badcock and Malaws 2004; English Heritage 2006). This type of inquiry has the potential to provide a unique perspective on the study of nineteenth-century pelagic whaling because it focuses on the ship as a platform, where the industrial process took place, on the whalers and their day-to-day lives onboard the vessel, and the setting, or seascape, in which this activity occurred. All too often past maritime archaeology studies have focused solely on particular aspects of ships such as construction techniques or the technology employed to operate them (Adams 2001; Flatman 2003); with the application of an industrial archaeological approach to the study of pelagic whaling, this research expands beyond the ship and examines pelagic whaling as an integrated system inclusive of the human experience.

This study is not the first to analyze archaeological sites associated with whaling from an industrial archaeological approach. A small number of academic researchers have attempted to view the remains of nineteenth- and twentieth-century shore whaling stations as industrial archaeological sites. Such studies include Adam Paterson’s Master’s thesis in which he investigated the technological development of shore-based tryworks at Sleaford Bay in South Australia (2006a; 2006b); Rhonda Steele (2005) undertook an analysis for her Master’s thesis of the industrial technologies used in New Zealand shore whaling; and Martin Gibbs’ research for his PhD thesis (Gibbs 1995) on Western Australian whaling as a process and part of a maritime industrial frontier. While each of these studies focuses on particular technological or social aspects of whaling, they lack the holistic approach proscribed by this study.

The most deliberate application of an industrial archaeological approach to whaling sites is the work of Björn Basberg on early twentieth century commercial whaling stations on the Antarctic Island of South Georgia (Basberg 2004). Basberg's *The Shore Whaling Stations at South Georgia* (2004) organized data into functional groups in an attempt to determine the scope of the industrial workplaces. The results were significant because they highlighted the potential of these well-preserved remains to inform archaeologists of the technical and social aspects of life at Antarctic stations, as well as the ecological impacts whaling had on the region.

Though the validity of the study of early nineteenth-century pelagic whaleships as industrial archaeological sites has been suggested by prominent industrial archaeologists in the recent past (see Gordon and Malone 1994:232), to date no such analysis has been undertaken. Perhaps the most closely related study was Basberg's (1998) examination of the development of twentieth-century whaling factory ships. His work only considers briefly eighteenth- and early to mid-nineteenth-century whaleships as predecessors and instead focuses on the technological developments of the latter part of the nineteenth century that produced the 'modern' whaling industry (1998:23). Basberg was particularly interested in the developmental phases and particular features of twentieth-century Antarctic factory ships that led to the establishment of a 'dominant design' (Abernathy and Utterback 1978; Basberg 1998:22). While his work presents an excellent and thorough analysis of industrial development and ship design for the era, it might have benefited from better consideration of how the emergence of pelagic whaling by the middle of the nineteenth century created the necessary conditions that allowed twentieth century whaling operators to arrive at such a design. Thus, he inadvertently highlights the need to research the evolution of earlier whaleships, their technology, and industrial relations in order to better understand the historical development of the pelagic whaling industry as a whole.

This research pushes the discussion forward from the work conducted by previous researchers on shore whaling and Basberg's work on the penultimate design of twentieth-century whaling factory ships. It seeks to investigate the development of early pelagic whaleships as maritime industrial workplaces and their evolution in design and technology through historical and archaeological inquiry by focusing on, and outlining, pelagic whaling as a maritime resource extraction industry. Further, it seeks to identify and discuss the maritime industrial seascape within which this maritime industry succeeded and failed, and to understand how that land- and seascape were shaped and were shaped by the industry and its actors. Thus a strong focus of this research is the historical documentation and material remains of whaleships wrecked in the early nineteenth century and how those remains relate to the available technologies of the time and the specific processes of hunting, capturing, processing, storing and transporting whale products. Each stage in the process is represented by a distinctive toolkit and set of procedures that developed along a trajectory to produce the fully integrated maritime industry of shipboard whaling conducted in the early nineteenth century, culminating in the extractive process occurring solely onboard the ship, away from shores.

Research Questions

This study aims to better understand the development and operation of industrial processes and technologies used in shipboard whaling in the Pacific region in the early nineteenth century. Through the historical and archaeological investigation of the material remains of American whaling ships wrecked in the Northwestern Hawaiian Islands, this research explores the industrial workplace of pelagic whaling by answering the following questions:

- Do thematic approaches derived from industrial archaeology practice and theory adequately apply to the remains of wrecked whaleships when explored as part of a maritime resource extractive industry? What new perspectives for maritime archaeological studies could be gained by doing this?
- What characterizes the maritime industrial workplace of the pelagic whaling trade in the early nineteenth century? How did this workplace change over time from the middle of the eighteenth century onwards?
- What was the significance of the Hawaiian archipelago to nineteenth-century American pelagic whaling operations in the Pacific Ocean? How did the

establishment of trading centers within the archipelago affect the industrial organization of the pelagic whaling system?

Methodology

This study integrates three sets of data to explore the industrial organization of pelagic whaleships in the early nineteenth century. These datasets include archaeological data recovered from the sites of two wrecked American whaleships; historical data derived from contemporary documents, primary sources, and other archival materials; and data from comparative studies of historic whaling vessels housed at maritime museums in New England. Each of these sources of data provides a unique perspective through the recognition of the material components of the fishery and the ways in which the various technologies were employed. It is the integration of these datasets, however, that help to illuminate many of the social factors that affected these highly successful industrial workplaces.

Archaeological Data

The archaeological data analyzed as part of this study includes the investigation of two American whaleships wrecked in the Northwestern Hawaiian Islands (NWHI). Situated in the northwestern portion of the Hawaiian Archipelago (Figure 2), the NWHI are a chain of small islands, atolls, and reefs that were relatively uncharted in the early nineteenth century. Due to the low, inconspicuous character of the geographic features in this region, it was historically referred to as a “graveyard of marine disaster” (Thrum 1915:133) and many of its dangers remained hidden until discovered by accident. In the early nineteenth century whalers began venturing into the region while en route to the newly discovered Japan Grounds, the lower portion of which is located at the top of the NWHI chain (Richards 1999:189). Over the first half of the nineteenth century, ten whaleships—six American, three British, and one of unknown provenance—are known to have wrecked there. Over the past decade, the remains of five of these wrecked vessels have been identified and archaeologically investigated. The scattered remains two of those ships—the Nantucket whaleship *Two Brothers* lost in 1823 and the New Bedford whaleship *Parker* wrecked in 1842—are incorporated into this study since they offer an opportunity to investigate industrial life onboard American vessels from the earliest period in the central Pacific to the peak of whaling activities in Hawaii.

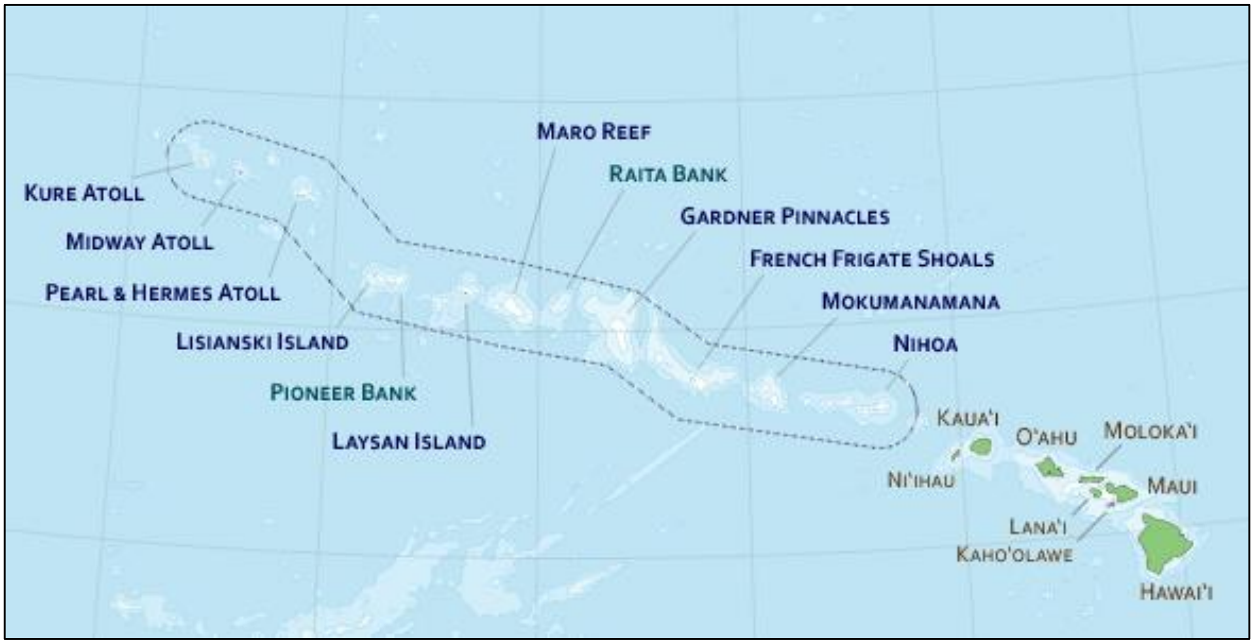

Figure 2. The Northwestern Hawaiian Islands run in an arc to the northwest of the main Hawaiian archipelago (image courtesy of Papahānaumokuākea Marine National Monument).

The NWHI and the wrecks located within them are protected through their designation as a marine conservation area named Papahānaumokuākea Marine National Monument (PMNM). PMNM boasts a rich maritime heritage encompassing hundreds of years of continuous seafaring beginning with Polynesian explorers, moving through the age of sail, passing through the turmoil of World War II, and continuing with present-day researchers who make new discoveries with each expedition to the NWHI (Papahānaumokuākea Marine National Monument 2011:3). The PMNM Maritime Heritage Program (MHP) is tasked with identifying, assessing, and managing all relevant maritime heritage resources within the Monument boundaries. This dissertation project is supported fully by the MHP and was conducted in conjunction with the goals of the program, with staff and volunteers involved with all aspects of the field research from initial archaeological survey to data analysis and post-processing.

The archaeological data was collected during numerous field projects conducted between 2002 and 2012. Due to the remote locations of these sites in open ocean environments, all operations were based from the National Oceanic and Atmospheric Administration (NOAA) Ship *Hi'ialakai*. Accessibility to the sites was limited by both the predetermined amount of time available for research at each shoal or atoll and by the weather and sea conditions encountered. Field operations were conducted from smaller, jet-propelled skiffs, which were launched from and recovered by the ship daily. Boating operations were supervised and conducted by licensed *Hi'ialakai* crew and safe operating conditions were at the discretion of the boat's coxswain. All diving was conducted under the auspices of the NOAA Diving Program (NDP) and supervised by the NDP divemaster assigned to the ship. Due to the shallow depths encountered at both of the sites, a combination of SCUBA and skin diving methods were utilized. The tropical environment in which these ships were deposited provided excellent visibility and generally favorable conditions for diving, although work in reef top areas of the sites often proved challenging due to heavy surge and swells.

The same tropical environments that produce prime diving conditions are also perfectly suited to wood boring organisms and bacteria that actively attack and quickly consume submerged wooden objects. As such, almost no wooden remains are present at either site. Instead, the wrecks are characterized by large scatters of exposed portions of metallic fittings used for securing the ship's structure and rigging; metallic or brick components of the shipboard industrial equipment; and glass and ceramic remains associated with the ship's crew. Although each of the sites contains areas where deposits of sand could conceal structural remains, archaeological research conducted within PMNM is non-intrusive, thus no excavation is planned.

Prior to any archaeological recording, the sites were visually surveyed to delineate boundaries and identify as many features as possible. Mud maps were created to help better understand the spatial distribution of the artifacts and to determine the best approach for mapping. Global Positioning Systems (GPS) data was recorded for each of the features and all identified artifacts were photographed. Since the remains of these ships are characterized by concentrations of artifacts scattered over very large areas, they were recorded using a combination of baseline offset and trilateration methods. It is important to note that despite the best efforts of researchers, the accuracy of some of the measurements were inevitably affected by catenary that results from the often rough conditions and long distances between many of the artifacts. Regardless, the results of archaeological recording at each of the sites produced accurate plans of the remains of these whaleships.

All site documentation was conducted *in situ*. Once the locations of artifacts or features were recorded spatially, they were sketched, and measured to document as many details as possible. Although no mechanical excavation was undertaken, light hand-fanning was necessary to distinguish diagnostic features and aided in identification. With the exception of a small number of artifacts recovered from each site for interpretive purposes, all artifacts remain on site.

The removal of artifacts from these sites was conducted under the guidelines of a pre-approved 'Conservation and Management Permit' issued by Monument administration, an Archaeological Resources Protection Act permit, and a Special Use permit issued by US Fish and Wildlife Service; these are reviewed by the State Historic Preservation Division/Department of Lands and Natural Resources.

Historical and Archival Data Utilized

The second set of data analyzed for this study derives from historical and archival materials. The unique social conditions under which the American whale fishery developed resulted in a dearth of business records, and those records that exist are found in many different repositories around regional New England. These records concern the daily operations of merchants, ship owners, ships chandlers, whaling agents and others involved in preparation, outfitting, and management of whaling operations. Furthermore, these same institutions house enormous libraries that pertain to the history of whaling and the development of the industry. Thus, this research focuses heavily on information contained within both primary and secondary source materials, pertaining to topics such as whaling technologies, the industrial processes of whaling operations, and domestic aspects of life at sea.

Primary sources included contemporary accounts of whaling voyages to the Pacific Ocean penned by officers and crewmembers, vessel logbooks, newspaper accounts, ship's logs and journals, archival illustrations (including maps, plans and sketches), personal and official correspondence, outfitting records, account books, accounts of wrecking events, court proceedings, and vessel construction plans and descriptions. Of particular interest are the journals and other “first-hand accounts” of American whalers. Typical of literature of the time period, these sources can all too often become quasi-fiction; thus, discussions of capturing whales are frequently romanticized to highlight the heroic deeds of the whalers fighting the largest creatures of the sea. Though some historians might regard such works as simply stories of embellishment, it is important to remember that most stories have some degree of authenticity. These narratives often include information about the vessels employed and methods for handling and maintaining them, techniques and technologies used in the fishery, the characters of sailors, as well as meteorological and geographical data. Thus, the firsthand accounts in these “salty” narratives often provide a great deal of information about the fishery.

Secondary sources also provide a wealth of information regarding the development of the American whale fishery, insight into the different Pacific whaling grounds and the challenges that whalers faced, as well as the various industrial processes and whaling technologies employed. Secondary sources include early histories of the coastal settlements of New England that offer discussions of the importance of whaling to their success; the books and articles published by economic historians who attempted to describe and understand the changes that occurred and how they affected the market; compilations of shipping data from records kept in New England whaling ports; and expositions on the methods and materials used to construct nineteenth-century whaleships.

Comparative Studies

The third dataset comes from comparative studies of historic whaling vessels housed in maritime museums in New England. Many of the artifacts inventoried during the archaeological research phase of this study were easily identified by their function aboard the ships; others proved more difficult. Discussions with curators and other experts at the New Bedford Whaling Museum, the Nantucket Historical Society, and Mystic Seaport provided useful information about these unidentified artifacts. Furthermore, the physical examination of the historic ships and models offered perspectives on the industrial and domestic layout, as well as the many technical components of typical nineteenth-century whaleships.

The most relevant and useful of the comparative data came from an examination of the half-sized model of the whaleship *Lagoda*. Housed in a specially constructed exhibit hall at the New Bedford Whaling Museum in Massachusetts, this model was constructed in 1915 as a memorial to the highly successful New Bedford whaling merchant Jonathon Bourne (Pease 1916:19; Olly 2004:145). This waterline-style model was built using construction details from Bourne's favorite vessel—the 340 ton whaling barque *Lagoda*—and was designed to represent a mid-nineteenth-century whaling barque mid-way through a voyage (Olly 2004:149). More than 40 companies and individuals were involved in building the model, including the last ageing craftsmen who worked on and built the wooden whaleships of the previous century (Olly 2004). Although it is rigged and fitted out to represent a later period than that of the *Two Brothers* and *Parker*, this model was helpful in identifying the types and functions of be recovered from the examination of *Charles W. Morgan,* the last floating wooden whaleship in the world. Berthed at Mystic Seaport in Connecticut, the vessel is a memorial to the great days of whaling, seamen, and ships (Leavitt 1973:84). Launched in 1841 at New Bedford, the 350 ton ship was named for its owner, the successful whaling merchant Charles Waln Morgan (Stackpole 1967:22). Actively used in the whale fishery for an astonishing 80 years, it is a testament to the endurance of the wooden whaleships of the time and is "as near to being an example of the typical whaler of the 1850's as ever was built" (Hegarty 1964:21). While it is a contemporary of the whaleship *Parker*, the *Morgan's* long career resulted in some of its original fittings being replaced when needed with newer technologies. An opportunity to sail onboard the ship during its 38th voyage in 2014, however, provided technical data, as well as an insightful ethno-archaeological experience that is reflected in the interpretation of the sites under study.

Significance

The value of this research lies in the compilation and synthesis of several different data sources and the application of previously unexplored lines of inquiry to better understand the nature of nineteenth-century shipboard whaling. No previous studies have combined the investigation of shipwrecks, historical and archival data and museum collections to explore whaling fully as a process and occupation. Thus this study brings together a large corpus of data to investigate and understand the nineteenth-century resource extraction industry of whaling, which could be compared to that of the modern day oil platforms.

The vessels used during this period were different from other contemporary ships employed for marine resource extractive purposes such as fishing, shell fishing or sealing. Because they were self-contained industrial sites, their remains constitute an archaeological site type that has the potential to provide insight into the *floating* version of the industrial process. Thus, a concentrated investigation of whaling shipwreck sites can significantly advance historic whaling research generally. By their nature whaleships were everyday working vessels, when identified, have often been passed over in favor of sites considered to be more "significant" such as exploration vessels, warships, or "treasure" ships. Until now little scholarly research has been conducted into the nineteenth-century whaling vessels that operated in the Pacific. Although the wrecks of several pelagic whaleships in the Pacific Region have been investigated archaeologically, few of them have been the focus of intensive academic study.

This study bridges the sub-disciplines of maritime and industrial archaeology. Pelagic whaleships were floating work platforms that functioned under an organized framework and utilized many tools specific to that trade. Therefore, the well-preserved remains of these vessels present an opportunity to gain insight into onboard industrial operations. Additionally, much of the maritime archaeological research that has taken place over the past fifty-plus years relies heavily on historical particularist approaches to wreck site investigations, focusing mainly on technological aspects of ships. While such studies resulted in a great deal of valuable information, too often they arrived at their conclusions by bypassing the human element that shaped those remains (Adams 2001; Flatman 2003; Hocker 2004; Dellino-Musgrave 2006). Thus, by applying an approach that is inclusive of social and cultural aspects, this research has the potential to reveal information about the daily life of the communities that existed onboard whaleships, as well as the ship as a technological feature.

Without a doubt whaleships fit into the category of ordinary working vessels. These ships and their crews were, however, also pioneers that pushed the oceanic frontier forward by exploring the largely uncharted Pacific Ocean. Whaleship captains and crews were responsible for recording critical reconnaissance information about the region and collaborating with government officials to provide valuable information ranging from geographic discoveries, to oceanographic data, to contact with native Pacific Island cultures. Thus, the in-depth study of the whaleships of the early nineteenth-century provides useful data about not only the fishery or the industrial processes involved in whaling; it can shed light on how they operated within the colonial process of exploration and expansion into territories previously uncharted by the West. This study also helps to further identify and distinguish that context in which whalers and whaleships interacted, bringing new insight into archaeological studies on the maritime cultural landscape and seascape (Ford 2011).

Chapter Outline

This dissertation is divided into eight chapters, the first of which is this introduction. Chapter two explores the scope and development of the industrial concepts 'maritime industrial workplace', 'maritime resource extraction' and 'maritime industrial seascape' as archaeological research themes, outlines previous archaeological investigations of whaling shipwreck sites, and provides a discussion of how the use of research themes for understanding maritime industries can be employed to better interpret the archaeology of nineteenth-century pelagic whaling shipwreck sites. Chapter three provides a general overview of the history of whaling from its beginnings as an opportunistic pursuit by coastal communities to the 'golden age' of commercial whaling in the early to mid-nineteenth century. A discussion of the development of Hawaii as an entrepôt for trade in the central Pacific is offered in chapter four. Chapter five presents the archaeology of American whaleships wrecked within the Northwestern Hawaiian Islands and an analysis and interpretation of their material remains. A discussion of the 'pre-cruise' and 'post-cruise' stages of a pelagic whaling cruise and historical and archaeological evidence of the processes is provided in chapter six. Chapter seven presents an historical and archaeological discussion of the many different aspects of the 'cruise operations' stage. And chapter eight restates the research questions, explores the interpretation of these sites as ‘maritime industries’, and provides a conclusion which situates the study within a broader theoretical and methodological context.

CHAPTER 2. The maritime industrial workplace, maritime resource extraction, and maritime industrial seascapes

This study examines the concepts ‘maritime resource extraction’, ‘the maritime industrial workplace’ and ‘industrial maritime seascape’ and how they can be applied to investigate early nineteenth-century pelagic whaling. The early nineteenth century was a dynamic period in which the standardization of technology and the organization of labor through defined roles resulted in efficient processes. These processes allowed for shipboard whale oil production to take place on an industrial scale in an otherwise uncertain and often uncharted seascape. The ships involved in early nineteenth-century pelagic whaling were microcosms of industrial life but, much like frontier mining sites of the American West, each of these vessels represented only a piece of the larger capitalistic pursuit of an industrial whole. This research seeks to understand the social, cultural and technical conditions that existed onboard the vessels employed in American pelagic whaling during the industry’s “golden age” (Hegarty 1964; Tompkins 1972:77; Davis et al 1988:570; Davis et al 1997:38) and how they operated within the broader seascape of the Pacific.

The adaptation of interpretive methods used by researchers whose focus is on industrial archaeological research to the study of pelagic whaleships provides a new perspective in the investigation of shipwrecks in maritime archaeology. Pelagic whaleships were essentially floating industrial sites of resource extraction. They also acted as work and living spaces for those who participated in the industry and functioned within a broader environmental context, which for areas and periods of time, were uncharted, unknown and dangerous. Some of these qualities fit other types of ships operating in the early nineteenth century. For example, ships used for mercantile activities and defense each comprised a work and living space and often operated in an unknown seascape, and fishing vessels even participated in resource extraction. The degree to which all these vessels encompassed an entire industrial process is, however, incomparable to pelagic whaleships. These whalers were different from other commercial vessels of this time period for a number of reasons and when viewed through an industrial archaeological lens, they can be understood as a complex system of interrelated industrial processes and lifeways.

This chapter considers previous archaeological investigations of wrecked whaleships; explores approaches used by industrial archaeologists to interpret sites associated with extractive industries; industrial workplaces and industrial landscapes, and investigates ways in which interpretive themes derived from industrial archaeological research might be applied to the study of early nineteenth-century pelagic whaleships.

Previous Archaeological Investigations of Whaleships

The investigation of wrecked whaleships provides insightful information about the types of vessels used and the different technologies employed for nautical whaling operations. Ranging from the sixteenth century to the late nineteenth century, the remains of ships associated with the industry have been identified in several areas of the world and exist in various states of preservation. The 'whaleship', or 'whaler' as it is commonly referred, is a type of ship that operated as a 'mother ship' by supporting small whale-hunting boats, was used for transporting blubber to shore for processing, and was used for storing oil. Many other vessel types were involved in the whaling process as it developed over the centuries; however, these are not the focus of this research. Nevertheless these other vessels are relevant to this study from a comparative standpoint and are included to illustrate the continuum of whaling and whaleships as a theme for maritime archaeological research over the past thirty-five years.

By far the most extensively investigated wreck of a whaling vessel is that of the sixteenth-century Basque galleon found in Red Bay, Labrador. This shipwreck site is located just offshore from the extensive remains of Basque shore whaling operations (Logan and Tuck 1990). Using documentary sources as a guide, Parks Canada archaeologists discovered one ship in 1978. Although over the course of the next six years two additional Basque whaleships and four whaleboats – known as chalupas – were found in the clear, cold waters of Red Bay (Stevens 1997:336; Grenier et al 2007), the first shipwreck received the most attention. The wreck is probably that of the whaling galleon *San Juan*, which sank in the autumn of 1565 with nearly 2,000 barrels of whale oil already stowed onboard (Barkham 1984:516). The remains of this vessel were studied extensively and over several field seasons were excavated systematically, mapped, dismantled, brought to the surface for precise recording, and then reburied on site (Grenier 1988:70; Grenier et al 2007). This project shed light on many aspects of sixteenth-century maritime activities, such as navigation (Grenier 1988; Grenier et al 2007), ship construction, fittings and rigging (Wadell 1985; Wadell 1986; Bradley 1993; Grenier et al 2007), and iron working (Light 1990, Light 1992; Grenier et al 2007), as well as whaling technologies used by the Basques in Labrador (Grenier 1988; Ross 1985; Grenier et al 2007) and life onboard their ships (Barkham 1981; Grenier et al 2007).

As with the Basque whalers that operated in Red Bay, the methods employed by the English and Dutch at Spitsbergen generally involved the use of a mother ship for capture and a shore based tryworks for processing blubber. Although the remains of shore whaling settlements have been identified and investigated in the arctic region (Hacquebord 1987), to date no ship remains have been located. To date no maritime archeological surveys of the waters surrounding Spitsbergen are known to have occurred.

Over the past forty years archaeologists have documented the wrecks of whaling ships in both the Indian and Pacific Oceans. Of the whaling-related wreck sites that have been identified, Australian archaeologists have been the most proactive in this area. The remains of a number of pelagic whaleships have been identified and studied along the coast of Western Australia (WA). The wrecks include those of the British whaler *Lively*, wrecked at Rowley Shoals in 1811 (Henderson 1983; Atkinson 1987; Nutley 1987; Stanbury 2015); the French whaling barque *Lancier*, wrecked off Stragglers Reef in 1839 (Kenderdine 1994); the American whalers *North America*, *Samuel Wright* and *North America*, all blown ashore at Bunbury between 1840 and 1843 (McCarthy 1982; Anderson and McAllister 2012; McAllister 2012); the American whaleship *Cervantes*, lost at Jurien Bay in 1844 (McAllister 2013); the Australian whaling barque *Lady Lyttleton*, wrecked near Albany in 1867 (Vosmer and Wright 1991); and the American whaler *Day Dawn*, lost near Perth in 1886 (McCarthy 1981; Kimpton and Henderson 1991). Each of these ship sites were recorded by staff of the Department of Maritime Archaeology at the Western Australian Museum and, in most cases, a small number of artifacts were collected and curated.

Although government mandate and management considerations provided the impetus for most of these investigations, academic research prompted the study of some wrecks. The wrecks of *Day Dawn* and *Lady Lyttleton* were the focus of a post-graduate maritime archaeological field course and resulted in detailed analyses of artifact assemblages (Erskine 1997a; Erskine 1997b), ship construction (Vosmer 1991); site deterioration (Thomson 1997); and cultural heritage management research (Moran 1997; Williams 1997). Recent investigations of the wrecks at Bunbury in the southwest of the state supplied the data for a master's thesis that proposed a typology for nineteenth-century whaleships (McAllister 2012).

Two other shipwrecks documented along the Australian coastline are thought to have been involved in pelagic or bay whaling at some point in the careers. These wrecks are the Hobart whalers *Litherland*, lost in Bass Strait in 1853 (Nash 1990), and the barque *Cheviot*, wrecked off of Wilson's Promontory (Victoria) in 1854 (Anderson 2004). Although both of these vessels were equipped for whaling (i.e. the remains of tryworks and other industrial tools are present), historical data indicates that neither was actively involved in the trade at the time of wrecking.

Although the largest concentration of pelagic whaleship wreck sites have been documented around Australia, a number of others have been investigated in scattered locations throughout the Pacific region. The wrecks of two whaleships were in identified in the Federated States of Micronesian (FSM) state of Kosrae. One of these—possibly the remains of the British whaler *Harriet* lost in 1843 (Ward 1960:525) —was recorded by the US National Park Service (Silva et al 1992). Due to its excellent state of preservation this shipwreck has the potential to offer interesting comparative information for the current study; however, the documentation of the site was management driven and therefore available details and interpretation are limited. The remains of three other whaleships were examined and preliminarily documented in the FSM. Located in Madolenihmw Harbor in Pohnpeii, these remains are thought to represent three of the four American whaleships attacked and sunk by the Confederate raider *Shenandoah* in 1865 (Finney and Graves 2002).

Perhaps the most relevant shipwrecks sites archaeologically investigated are the wrecks of three British pelagic whaleships lost in the Northwestern Hawaiian Islands (NWHI). Two of these, *Pearl* and *Hermes*, were lost on the same night in 1822 on the atoll which bears their name (Spoehr 1988:80). First identified by a NOAA marine debris removal team in 2004, these wrecks were subsequently documented by archaeological staff and volunteers from PMNM and NOAA (Van Tilburg 2005). Another British whaleship lost in the NWHI is *Gledstanes*, which was wrecked on the outer reef at Kure Atoll in 1837. The remains of this vessel were thoroughly documented in 2008 and are represented mainly by heavy iron ship fittings and equipment such as anchors and some whaling specific artifacts such as tryworks knees and a trypot (Gleason 2008).

Technically not shipwreck sites, the remains of three other pelagic whaleships in the Pacific region have been archaeologically investigated. Each of these was fitted out and employed as a pelagic whaleship early in its career, but was later reused for other purposes. Two of these—the former whaleships *Niantic*, built in Chatham, Connecticut in 1835, and *Candace*, built in 1818 in Boston, Massachusetts—were sold to interests in San Francisco, California and converted into storeships on the city's waterfront (Delgado 1980; Strother et al 2007). The extremely well-preserved lower hull sections of each of these vessels have been documented as the result of modern development activities (Delgado 2006; Strother et al 2007; Delgado 2009). The American whaleship *Othello* was another whaling vessel that was removed from service and used for a different purpose. Built in 1853, *Othello* sailed for a decade as whaler before being sold first to interests in Sydney, Australia and eventually to a shipyard in New Zealand to be scuttled at the outer end of a 'T-wharf'. The well-preserved remains of the ship's lower hull lie in situ at the former shipyard and were recently documented (Dodd 2013).

Whaleships and Maritime Archaeology

Due to both their nautical nature and their depositional environments, the investigation of ship remains typically falls under the purview of maritime archaeology. Defined as "the scientific study of the material remains of man and his activities on the sea" (Muckleroy 1978:4), maritime archaeology incorporates the principals and practices used to study terrestrial archaeology and applies them to sites that are often found in submerged environments. Thus, from a methodological standpoint, the sites investigated for this dissertation have been subjected to the same rigors of recording as any other type of shipwreck studied by maritime archaeologists.

Of course, in elementary form whalers are like other wooden sailing vessels of the period; solidly-built wooden hulls, sturdy masts and spars, extensive standing and running rigging, and expansive sail patterns all provided their basic features. But the difference between wrecked whaleships and other vessels lies in the interpretation of their function and purpose. Early nineteenth-century whaleships were often purpose-built, housed specific technological features that clearly distinguished them from other ships and they performed the function of catching and processing whales; thus, they present an opportunity to investigate a specific industrial process and workplace as opposed to another merchant vessel or warship.

Much like other sub-disciplines within archaeology, maritime archaeology has dealt with the growing pains associated with finding its place within the broader discipline. Developing out of historical particularist approaches to the remains of ships (Bass 1983), early maritime archaeological projects focused primarily on the potential for shipwrecks to expose data pertaining to patterns in ancient seafaring. In the 1960s expensive excavations of a few sites were undertaken in which wrecks were either recorded in minute detail on the seabed before each of their components was recovered for further analysis in laboratories on land or were recovered completely (Bass 1967; Crumlin-Pedersen and Olson 1978; Cederlund and Hocker 2006). Though such projects certainly provided a great deal of information about the physical remains of those particular vessels and established excellent methods for conducting underwater archaeological investigations, their significance to anthropological archaeology was generally neglected. By the 1980s anthropologically-minded maritime archaeologists began to realize the potential for shipwrecks to provide a greater range of information (Gould 1983). According to Gould (1997:380), “Anthropological approaches encourage maritime archaeologists to look analytically at their results not only in relation to the specific details of maritime history but also to broader, social-scientific conclusions about human behavior in relation to marine environments.”

Over the past thirty years calls for more consideration of theoretical perspectives within the sub-discipline have emanated from many parts of the world (e.g. Gould 1983; Gibbins 1990;

Potter Jr. 1990; Hosty and Stuart 1994; Gould 1997; Babits and Van Tilburg 1998; McCarthy 1998; Veth and McCarthy 1999; Blackman 2000; Staniforth 2000; Gibbins and Adams 2001; Gibbs 2006; Veth 2006; Gould 2011). In a journal article published at the turn of the twentieth century, Peter Veth and Michael McCarthy argued that a “vital component of any maritime archaeological reconstruction of the past must be clear and explicit statements of how specific nautical behaviors and belief systems can be reliably correlated with patterns in the material record” (1999:12). This statement highlights the perceived need for better informed interpretations for maritime archaeological data.

Since that time theoretical and methodological approaches have been incorporated by practitioners who have infused their interpretations of wrecked ships, coastal landscapes and other subjects covered by maritime archaeology with anthropological and archaeological theory. A synopsis of this can be found in Flatman’s “Cognitive Biographies, Cognitive Landscapes and Dirty Old Bits of Boat: Theory in Maritime Archaeology” (2003). This article provides an insightful discussion of not only the ways in which theory has been applied to different maritime archaeological projects and site types, but also offers several examples of how new approaches relating to shipboard societies might be explored. Some of the themes covered include gender, sexuality, class, social relations, hierarchy, labor, power, and discipline (Flatman 2003:145-150). One particularly relevant yet fleeting thought compares mining communities to shipboard communities:

> The work by Pfaffenberger (1998) on the châines operatoires of different mining communities are of similar relevance, since mining communities are also controlled environments, including predominantly male populations, potentially dangerous and often clearly-delineated living and working environments (Godoy 1984), strong social hierarchies, and a distinctive position in relation to wider communities (Flatman 2003:147).

The interpretation of shipwreck sites specifically as ‘maritime industrial workplaces’ has the potential to contribute a new approach to maritime archaeological research. As a research concept the industrial workplace incorporates the technical and social components of industrial sites in its analyses and attempts to provide the most complete picture possible through the use of documentary and archaeological sources. By looking at associations between sources of raw materials, methods of processing, transportation, and the social context of production, a holistic understanding of the relationship between the various components of sites can be gained (Palmer and Neaverson 1998:4-5). Before discussing some of ways in which archaeologists have approached industrial workplaces and how the concept may be applied to the remains of whaleships, it is important explain the development of industrial archaeology as an academic sub-discipline to understand ideological changes that have affected the ways in which practitioners have approached the remains of the industrial past.

Industrial Archaeology in the UK and US

The study of industrial archaeology is a phenomenon of the second half of the twentieth century (Palmer and Neaverson 1998:1) and developed concurrently in the UK and US. Born from a perceived need to preserve the remains of the industrial past, the development of industrial archaeology into an academic sub-discipline was slow. Practiced mostly by non-academic groups in the 1950s and 1960s, it remained largely an amateur pursuit until the establishment of the Society for Industrial Archaeology (SIA), founded in the US in 1971, and the Association of Industrial Archaeology (AIA), founded in the UK in 1973. These professional organizations brought together architects, engineers, ex-industrial workers, and historians, as well as other avocational industrial enthusiasts who were passionate about aspects of industrialization (Cranstone 2004:314; Martin 2009:289). With members that included such technical backgrounds, it is perhaps unsurprising that the preservation of built heritage and technological aspects of industrialization were central to their missions.

A sign of how quickly the concept of industrial archaeology was picked up is the number of books devoted to industrial heritage that were published in the 1960s and 1970s (Gwyn 2007:15). On both sides of the Atlantic, many of the texts produced followed a general pattern of defining the field of study, describing the techniques employed in gathering the data, and then categorizing industries based on raw materials or industrial products. Volumes on regional and national industrial heritage highlighted the extant physical remains of the industrial age and explored the complexity of the processes and technologies involved in production, but included little or no discussion of the organizational structure for the labor required or of the experiences of workers. Although the term 'archaeology' was often included in the titles of these publications, little concern was given to how the studies actually contributed to the discipline as a whole. The need for academic rigor within the sub-discipline was aptly noted by C.M. Clark when he stated that, "archaeology is no more than antiquarianism when there is no framework—whether behavioral, economic, or—on which to hang the evidence" (Clark 1987:170).

During the 1980s approaches to industrial archaeology in the US diverged from those in the UK. While the British tradition maintained its focus on manufacturing processes, in North America a strong tradition of social archaeology was applied to the investigation of eighteenth- and nineteenth-century society under the broad heading of historical archaeology (Nevell 2006:4-5). Although historical archaeology originated around the same time as industrial archaeology, it was more concerned with the analysis and theoretical examination of human behavior from a much wider variety of historical sites located primarily in colonized countries (Hall and Silliman 2006:1; Hay 2009:24). Developing from an extension of a general shift in the kinds of questions being asked by historical archaeologists, during this period many became dissatisfied with the processual approach espoused by Binford's 'new archaeology' (1967) and experimented with diverse ideas and theoretical points of view at many different sites (Orser, Jr. 2004:47). The proponents of this 'post-processual' approach were concerned with issues of meanings, symbols, cognition, power, and historical context, and how these could be studied through archaeology (Little 1994:13).

While historical archaeologists in North America were developing ways to study industrialization and issues associated with it, British archaeologists continued to use a thematic approach focused on industrial heritage (Orange 2008:85). Driven largely by cultural heritage management projects, industrial archaeological studies employed methodology that focused on the significance of structures and the understanding of technological development rather than social and cultural parameters (Johnson 1996:12; Patterson 2006:7). Thus, in the UK industrial archaeology maintained a focus on "the need to record and preserve standing structures threatened with demolition rather than an inherent desire to understand more about the historical period of monuments" (Palmer 1990:275; Patterson 2006:7). By the 1990s a major transformation in British archaeological theory, however, occurred through the inclusion of post-processual approaches. This development produced "questions of power and inequality, labor relations and class formation, and social aspects of resource exchange—exactly, in other words, the topics that provided central research themes for industrial archaeology" (Symonds and Casella 2006:146).

Around the turn of the twentieth century questions arose relating to whether British industrial archaeology should be seen as a thematic study focusing on industrialization or as a period discipline defined by the industrial revolution of the seventeenth century to early twentieth century. Furthermore, discussions arose pertaining to whether there was a difference between British industrial archaeology and post-medieval archaeology, and in turn whether there was much difference between those and North America's historical archaeology. Although debates ensued surrounding the scope of industrial, post-medieval and historical archaeologies, they failed to formally merge into a single sub-discipline for the academic study of the industrial past (Palmer 2005:11). This discourse, however, was not altogether unproductive since it successfully clarified the need for industrial archaeological research approaches to include broader themes in the interpretation of industrial sites.

Three Concepts: Maritime Industrial Workplace, Maritime Resource Extraction, and Maritime Industrial Seascapes

As with all anthropological and archaeological research, identifying key influences and thought processes that inform our methodological and theoretical viewpoint is critical to understanding interpretations of the past. Industrial archaeology as a sub-disciple plays a large role in influencing this research conducted on pelagic whaling. While other systems approaches, critical archaeology approaches, or specific landscape approaches could have been applied, this research draws on themes and concepts from industrial archaeology. Thus three concepts—the industrial workplace, resource extraction, and industrial seascapes—are discussed in relation to their manifestation in both industrial archaeological and maritime archaeological approaches.

The Maritime Industrial Workplace

The perceived need to consider the socio-cultural elements of industrial operations resulted in archaeological sites being conceptualized and studied as interrelated industrial workplaces. In the simplest of terms, a workplace is any location in which people conduct work, such as an office or factory (Oxford Dictionary Online). This description, however, fails to convey the fact that workplaces are actually multifaceted microcosms composed of many interrelated technical and social parts that require organization and order to successfully achieve goals. Obviously, the complexity of a workplace varies greatly and the factors affecting it range from employee numbers, to the technical difficulty of the work, to the level of sophistication of the technologies involved. Since the components of workplaces are particular to different industries, some archaeological studies aimed at understanding them have structured interpretations through the use of broad themes such as production (Riley 2005) and consumption and space (Mellor 2005) as a way of creating an umbrella under which all available data can be considered.

The desire to derive overarching concepts associated with issues related to industrialization and industrial society led to the proposal of a research framework for industrial archaeological sites, which included the workplace (Palmer 2005). Covering issues that have been addressed by industrial archaeologists over the past half century, this framework is structured as a list of nine broad research themes followed by supplementary questions that are intended to help investigations. The themes included in this framework are:

- *Continuity and Change*
- *Production and Consumption*
- *Understanding the Workplace*
- *Industrial Settlement Patterns*
- *Class, Status, and Identity*
- *Social Control, Paternalism, and Philanthropy*
- *Use of Scientific Analysis in Understanding Significance of Artefacts* [sic] *and Industrial Residues*
- *Historic Landscape Characterisation* [sic]
- *International Context of Industrialisation* [sic]

(Palmer 2005:16-17).

Of particular interest to this research is the theme entitled 'understanding the workplace,' which is accompanied by questions pertaining to the ways in which issues such as technological change and social control can be seen within the archaeological record. Although Palmer's intent was to create a general "framework of inference" for understanding the social, economic, and technological meanings of the physical remains of past industrialism at archaeological sites, she was quick to point out that, as with the initial attempt at any set of guiding principles, it must be seen as a 'work in progress' (2005:17).

Although Robert B. Gordon and Patrick M. Malone introduced the idea of a 'maritime workplace' in their highly-regarded volume *The Texture of Industry* (1994), they provided little direction for ways in which they might be approached archaeologically. The reference to this concept is found with the book section 'Industrial Workplaces,' which is organized around the concept of 'microgeography' or "the spatial and functional relations within workplaces" (Gordon and Malone 1994:6). The four chapters within this section provide an overview of the development of workplaces from those connected with unmechanized work in countryside settings to engine-driven urban factories. Included in this summary is a brief discussion of how shipboard processing of whale oil in the nineteenth century was an industrial experience. Initially describing whaleships as "maritime workplaces with their own on-board blubber processing capability that was truly industrial in scale" (Gordon and Malone 1994:231), the section concludes with a description of an experimental archaeology project conducted in the 1980s that attempted to recreate a tryworks and extract oil from a stranded whale (Franck 1986; Gordon and Malone 1994:231).

The fact that Gordon and Malone did not include a formula for investigating maritime workplaces is not surprising since doing so was not their intent. Instead, they simply identified shipboard whaling as one of a number of largely unmechanized, early American enterprises that might be studied archaeologically to learn more about the work processes involved (Gordon and Malone 1994:228). Their reference to a whaleship as a 'maritime workplace' did directly influence the approach taken by this study for investigating the remains of early nineteenth-century whaleships. Gordon and Malone's suggestion provides a starting point for understanding the structure of the 'maritime industrial workplaces' that existed onboard pelagic whaling ships in this period.

Related to the concept of a maritime workplace are the concepts of 'life aboard', 'shipboard communities' or 'shipboard society' which are discussed within the sub-discipline of maritime archaeology (Muckleroy 1978; Redknap 1997; Dellino-Musgrave 2006). While these concepts capture the social and cultural aspects of life at sea, the focus of these studies typically do not emphasize ships as workplaces or settings for industry. Further, very little research within maritime archaeology has focused on the community or society of a ship's crew; instead that work has been conducted largely by maritime historians (Creighton 1996; Norling 1996). As Flatman (2003:151) suggests much work needs to be undertaken in maritime archaeology to explore "[t]he nature of shipboard societies and their relationships to 'mainstream' society, utilizing class, race, and engendered perceptions of social interaction." Thus, this study considers the idea of the maritime industrial workplace through the remains of pelagic whaleships.

Maritime Resource Extraction

One approach to interpreting the remains of pelagic whaleships as industrial sites is to consider whaling as a marine extractive industry. Extractive industries have been the focus of archaeological study for decades and an increasing body of literature has offered methods for their investigation and interpretation (e.g. Hardesty 1988; Franzen 1992; Knapp et al 1998; Baxter 2002; McGowan 2003; Hardesty 2010; Mate 2010; Mate 2013). The term 'extractive industry' incorporates all activities associated with the primary extraction of raw materials and includes the mining of precious and non-precious metals, ore deposits, and fuel materials, as well as the quarrying of stone and forestry-related activities (Franzen 1992; Baxter 2002; McVarish 2008:287-323).

The archaeology of extractive industries, and in particular mining, has been an important part of industrial archaeological research. As with the other types of industrial sites, early efforts to understand the remains of mining employed a technologically-focused approach with a view to preservation. Studies generally focused on the techniques employed, and physical remains were used to interpret how raw materials were obtained, processed, and prepared for transportation to other sites where they were refined in some way or used as fuel. In the case of remote mining districts or company towns, various types of housing were provided in an attempt to offer an "improved standard of living" for workers (McVarish 2008:290); when included in early surveys these facilities were simply described structurally and functionally with little or no consideration for the conditions experienced by the people that occupied them. Over time, however, practitioners realized that technology cannot be separated from the people, their daily life and human abilities, their ideology and beliefs, and their capacity to negotiate complex social, economic and political relationships within the industrial context (Childs and Kilpatrick 1993; Knapp 1998:18). This revelation resulted in research agendas that are more considerate of industrial culture and which attempted to explain sites as places where people performed work rather than simply as the remnants of production.

Although no specific framework for the study of extractive industrial sites has been formalized, archaeologists interpret such sites using general socio-technical themes to explore the technology and overall experience of individuals working within the industry. Of these studies perhaps no better example exists than Donald Hardesty's research into the processes by which extractive industry shaped the nineteenth-century cultural landscapes of Nevada, California, and Idaho. The archaeological and historical data analyzed in Hardesty's study are related to various sites of hard rock gold and silver mining conducted in Nevada from the latter part of the nineteenth and early twentieth century and are presented under the general themes of technology and residential settlement (1988:12). Hailed as the seminal work on 'frontier' mining industries (Symonds and Cassella 2006:147), Hardesty's efforts to interpret frontier mining sites culminated in the publication of a monograph entitled *The Archaeology of Mining and Miners: A View from the Silver State* (1988). Intended to be used as a guide for documenting and understanding sites in historical mining districts, this volume provides a straightforward approach to documentary and archaeological records related to the industry (Hardesty 1988:ix).

Drawing on a maritime analogy to describe his approach, Hardesty characterizes the American mining frontier as "a network of islands colonized by miners", with each "island" representing a different source of raw materials (Hardesty 1988:ix, 1; Delgado 2006:52). He goes on to explain that unlike many of the mining sites that were recorded by industrial archaeologists and which include examples of surviving machinery, buildings, and landscape structures, the archaeological deposits found at many frontier sites are characterized simply by the remains of the miners themselves. Thus, he states that his study is guided by an 'industrial archaeology' that is defined as "the systematic problem-oriented study of the material remains of the workplace and the worker, in the context of the industrial revolution" (Teague 1987:200; Hardesty 1988:17).

There are many marine extractive industries that have been the subject of maritime archaeological investigations. Marine extraction is understood to be the removal of sea life for commercial purposes and includes investigations into pearling conducted by researchers at the Western Australia Maritime Museum, fishing (Carter and Kenchington 1985; Raupp 2004), trepang fishing (Macknight 1976; Wesley et al 2012), sealing (Henderson 1989; Anderson 2014), shellfishing (Shefi 2006; Botwick and McClane 2005), and turtling (Smith 2000). While these industries had similarities to whaling in that they were extracting natural products from the marine environment, none of them required the vessel to be an industrial platform nor did they require the length of voyage and intensity of production as did pelagic whaling.

Environmental Context: Maritime Industrial Seascapes

The study of landscapes is another approach that assisted in developing an understanding of the interrelationship between the lives of those employed in industrial mining activities, the technological aspects of the operations, and the environment. Mining sites were inextricably tied to the landscape and left unmistakable physical evidence of their existence. The use of landscapes within archaeological research provides not only a wide context within which to place sites and associated structures, but also offers a mechanism for analyzing the social structuring of the physical (Hodder 1987; Newman 2001:100). The concept of 'the industrial landscape' was first popularized in the early 1980s by British industrial archaeologist Barrie Trinder and since then its study has become an essential tool for industrial archaeologists (Trinder 1982). Over the past thirty years the number of surveys of industrial landscapes has increased and, although the scope of those studies varies widely, they commonly include elements such as buildings, machinery, pathways, and worker housing, as well as topographic features of the land and more recently phenomenological qualities (Quivik 2000:56; McVarish 2008:373). The application of a landscape approach to the study of extractive industries provides the ability to better understand the industry not only by its technology and workplaces as defined by areas of site-specific activities, but how these were one component in the strategy of a larger interconnected physical, social, and economic landscape.

The concepts of maritime cultural landscape (Westerdahl 1997; Ford 2011) and seascape (Cooney 2003; McKinnon et al 2014) have been employed by archaeologists for many years to investigate maritime activities on land and water. While the maritime cultural landscape concept is generally used to describe changing coastal zones and human interaction within the land/sea interface, seascapes provide perspective for seafarers and their interaction with the open ocean, far from land. When engaged in hunting activities, whaleships and their crews spent extensive periods at sea, and only made relatively brief contact with land when fresh provisions were needed. Thus, the environmental context for pelagic whaling is largely that of the open ocean and therefore the concept of the seascape is applicable.

Pelagic Whaleships through the Lens of Industrial Archaeology

To better understand the industrial nature of pelagic whaleships, the three aforementioned research themes borrowed from industrial archaeology were used and adapted to incorporate a maritime perspective. Much like Hardesty's (1988) approach to frontier mining sites, the use of broad themes allows for a large amount of historical and archaeological data to be synthesized, and offers a more complete picture of ships as technology, of industrial life onboard, and of ways in which the environment shaped and was shaped by the process. By adjusting the parameters to accommodate the confines of the ship and the hunting strategies employed by whaling captains, these themes become more focused on the seaborne elements of the early nineteenth-century pelagic whaling trade and on the wide-ranging nature of the whaling ships operating in the Pacific Ocean, which ultimately helps to define them as a maritime industry.

Before attempting to understand how early nineteenth-century pelagic whaleships functioned as maritime industrial workplaces within the maritime industrial seascapes of the Pacific it is necessary to examine how they operated as an industry of maritime resource extraction. Due to the nature of hunting whales in often unchartered, open ocean environments, the industrial success of a voyage also required a great deal of preplanning, decision making, and outfitting to ensure that the ships were well-managed and self-sustaining entities capable of spending long periods of time at sea. And at the end of a voyage there were also a number of activities related to post-processing such as accounting, the settlement of debts, and the basic preparation of the ship for its next voyage. Thus, for the purpose of this discussion the industrial system under which whaleships operated included three main stages: the pre-cruise stage, the cruise-operations stage, and the post-cruise stage (Figure 3).

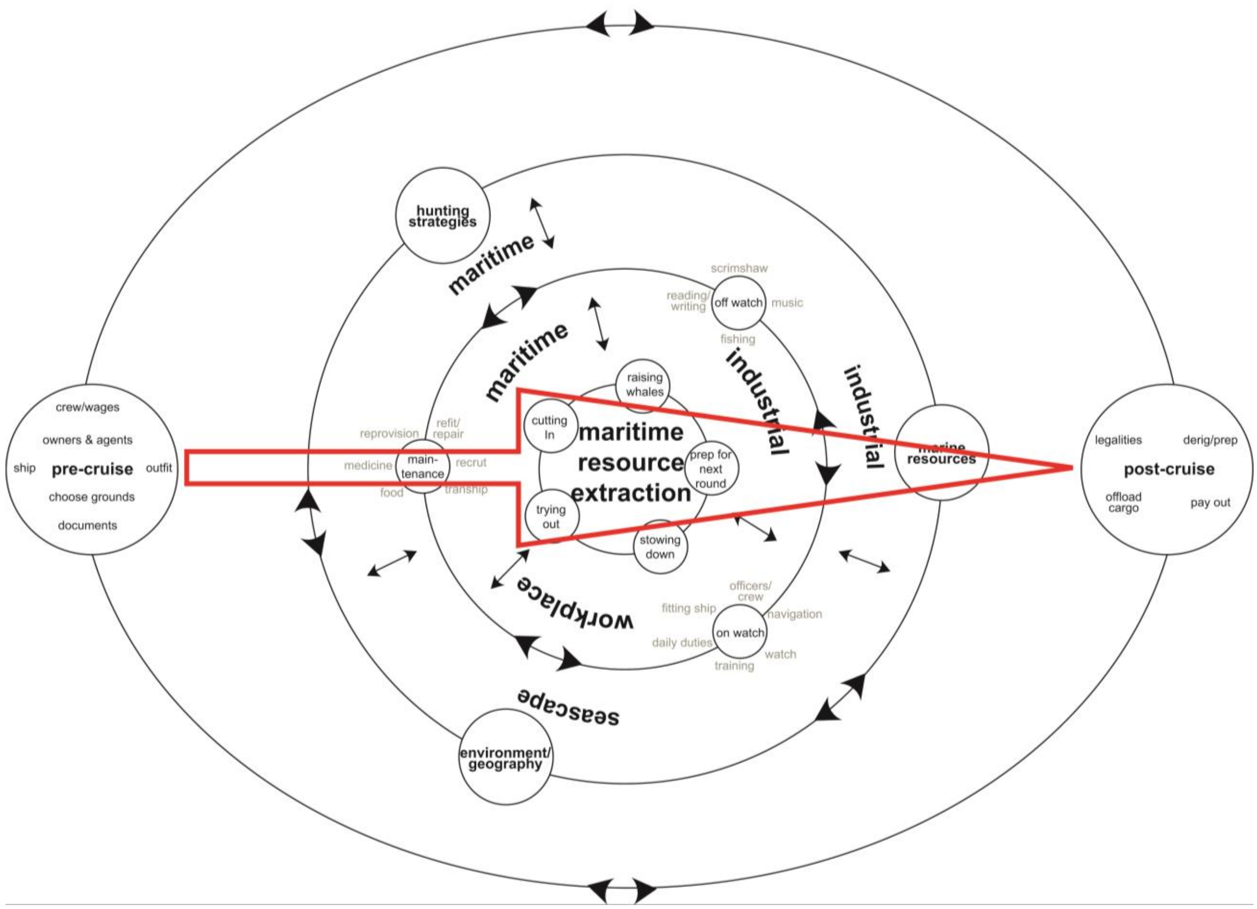

Figure 3. Presents the three stages of a whaling cruise and illustrates the complexity of the linear industrial whaling process.

As with frontier mining, pelagic whaling required a high degree of organization, effort, and coordination at all stages to succeed in extracting raw materials and transporting them to markets. At its center, shipboard whaling involved a series of complex and interconnected processes that were conducted by a crew who lived and worked within the close confines of a relatively small platform for several years at a time. The industrial technologies employed on these ships were specific to whaling and the ships themselves can be considered as one technological component. Early nineteenth-century whaleships were unlike other contemporary ships in that they were working platforms on which technological and social processes combined to allow for the extraction of raw materials from the marine environment. Much like the site complexes associated with primary resource extraction industries on land, in order to achieve commercial success they relied on sets of interrelated and standardized practices specific to the industry. Thus, analysis of a pelagic whaleship as a maritime resource extractive industry requires an understanding of the ship and how it provided the platform on which whaling operations took place, as well as the gear needed to carry out the specific processes involved in hunting and capturing sperm whales, processing blubber, storing whale oil, and transporting it (Figure 4).

Each step in the whaling process was represented by a distinctive toolkit and set of procedures that allowed whaleships to operate as highly successful mobile production platforms. In order to explore these processes, a comprehensive review of the historical documentation of the industry and of the material culture associated with whaleships during this period is presented in further chapters.

Building from Gordon and Malone's (1994) suggestion that pelagic whaleships were maritime workplaces, this study attempts to further distinguish them from other types of commercial ships of the period. As stated previously, most commercial vessels of the nineteenth century can be viewed as maritime workplaces since their functionality depended

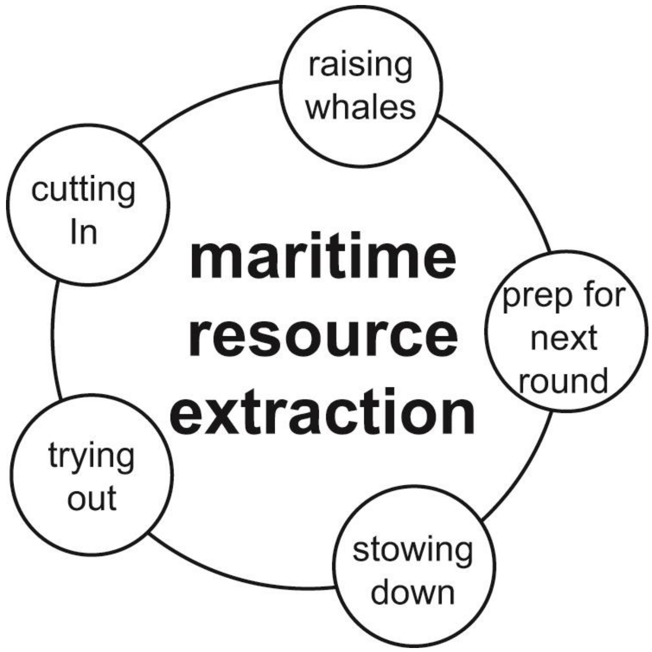

Figure 4. The five interrelated processes involved in 'American-style' pelagic whaling.

on the use of specific tools and the management of labor through defined roles. The fact that pelagic whaleships operated not only under those conditions, but also incorporated the equipment necessary to carry out resource extraction and processing, sets them apart as floating industrial sites. Thus, for the purposes of this study the wrecks of early nineteenth-century pelagic whaleships were analyzed and interpreted as 'maritime industrial workplaces' (Figure 5).

Hardesty (2010:109) indicates that when looking at settlement systems and the workplace at mining sites, the information "reflects the spatial arrangement of tools, operations, and social formations as well as the coordination of work within mining related socio-technical systems." This study seeks to better understand the ships as a socio-technical system and workplace. The individuals who operated and lived onboard early nineteenth-century whaleships provided the power for the industrial processes and co-existed as a community onboard a vessel. This community can provide a focal point for understanding the industrial operations and relations associated with pelagic whaling. Although these communities were socially and spatially remote for long periods of time, they were linked to broader social and cultural networks by virtue of their role in supplying raw materials to a regional and world system.

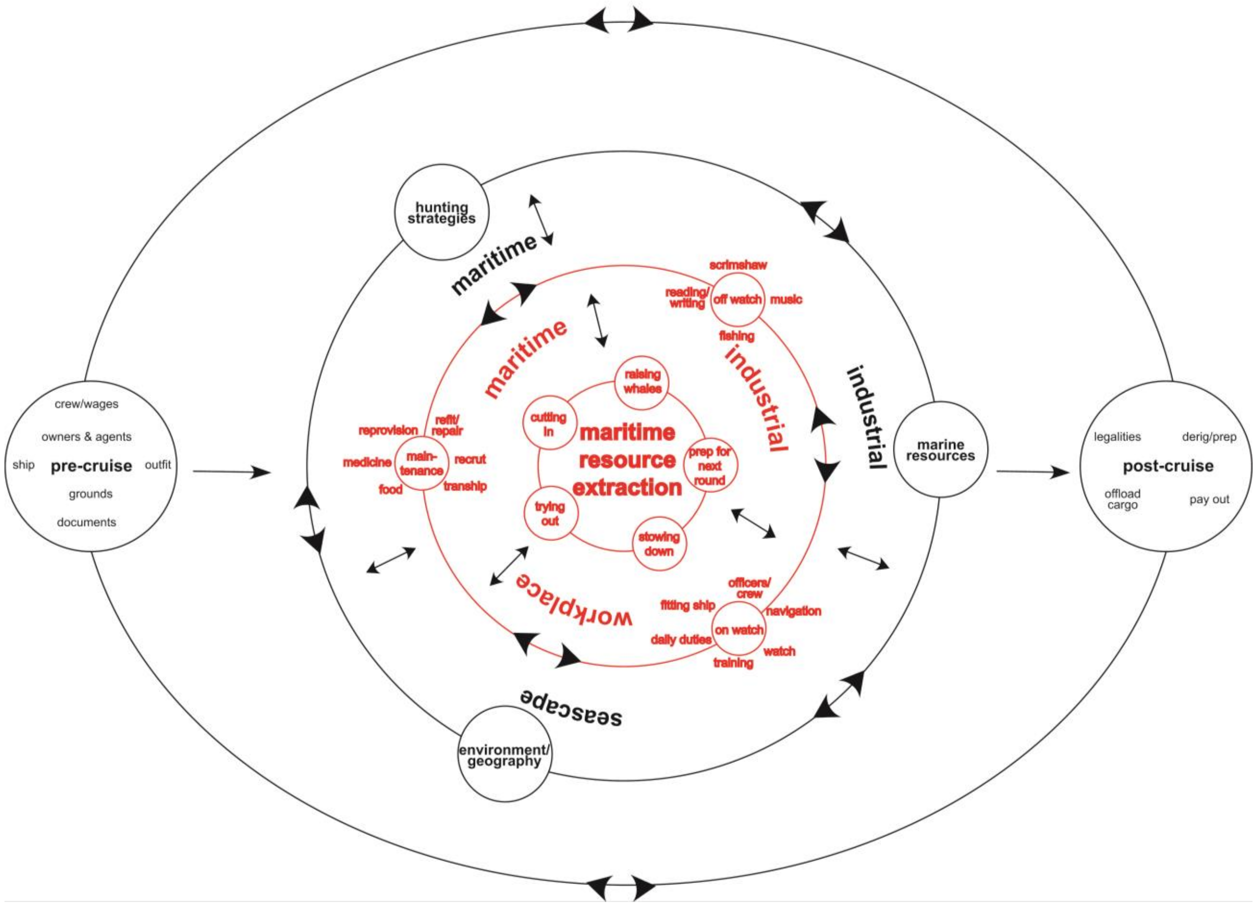

Figure 5. The maritime industrial workplace for American pelagic whaling.

Much like remote mining communities and workplaces, a maritime workplace represents “the domestic space of people who often were or are heterogeneous in character, of diverse origins, and drawn together by the need to work” (Knapp 1998:4). Order and efficiency was maintained onboard whaleships through a strictly defined hierarchy in the division of labor which consisted of officers, specialized craftsmen, and numerous general laborers. Whaleship crewmembers understood their position within the chain of command and were tasked with specific duties and responsibilities relative to it; however, this awareness does not discount the active participation which resulted in actions such as rising through the ranks, desertion, and even mutiny. Though in the early period of pelagic whaling crews were generally composed of young men eager make a career as a whaler, as the Pacific fishery developed, international market factors affected the composition of whaleship crews (Brundage 1948). Issues such as desertion and accidental death resulted in the need for replacing crew and many captains recruited from the native populations of the Pacific islands they visited for provisions. Thus, the communities that existed onboard these ships were not stagnant in their makeup but changed over time.

The hierarchy that provided the structure to the community onboard early nineteenth-century whaleships is also manifested physically. This structure is reflected not only in the physical arrangement of the various industrial operations and working spaces, but also in the accommodation offered. As with some merchant vessels of the time, personal space onboard whaleships was located at either end of the ship; average seamen were housed in sparse and cramped conditions in the front of the ship, known as the forecastle or fo'c'sle, while officers enjoyed better comforts in the more spacious after end of the ship. The physical separation and variable amount of space provided depending on hierarchy highlights the complexity of the seafaring experience between those that sailed on whaleships of this period.

The final research theme to be considered is that of the 'maritime industrial seascape' (Figure 6). Due to the mobile and fluid nature of the industry and the depositional environments of the wrecked whaleships examined in this study, this theme requires consideration of the maritime industrial seascape. For this study seascapes pertain primarily to the various hunting grounds visited throughout a voyage and the dangers and risks involved in reaching them.

Whaleship owners and agents did not simply send vessels out randomly to a given ocean for years on end in the hope of finding whales; instead they made calculated decisions about where the vessels should operate based on the collective knowledge of experienced captains. Whaling grounds were areas where whales were known to migrate, feed, mate, or calve and though they were often separated by long distances, several potential hunting grounds were accessible in different geographic regions (Finney 2010:46). Knowledge of these areas was invaluable and was generally passed between the fraternity of whaleship captains before being added to printed charts. Information about particular grounds included data pertaining to relative population densities of different whale species and their seasonal movements; potential hazards (both charted and uncharted) such as shallow shoals and reefs; seasonal weather patterns; and hydrographic information about currents and tides. Thus for seafarers, the seascape represented the knowledge of an area obtained by experience and by the comprehensive review of all information at hand, including published charts and sailing guides, as well as the oral testimony of peers.

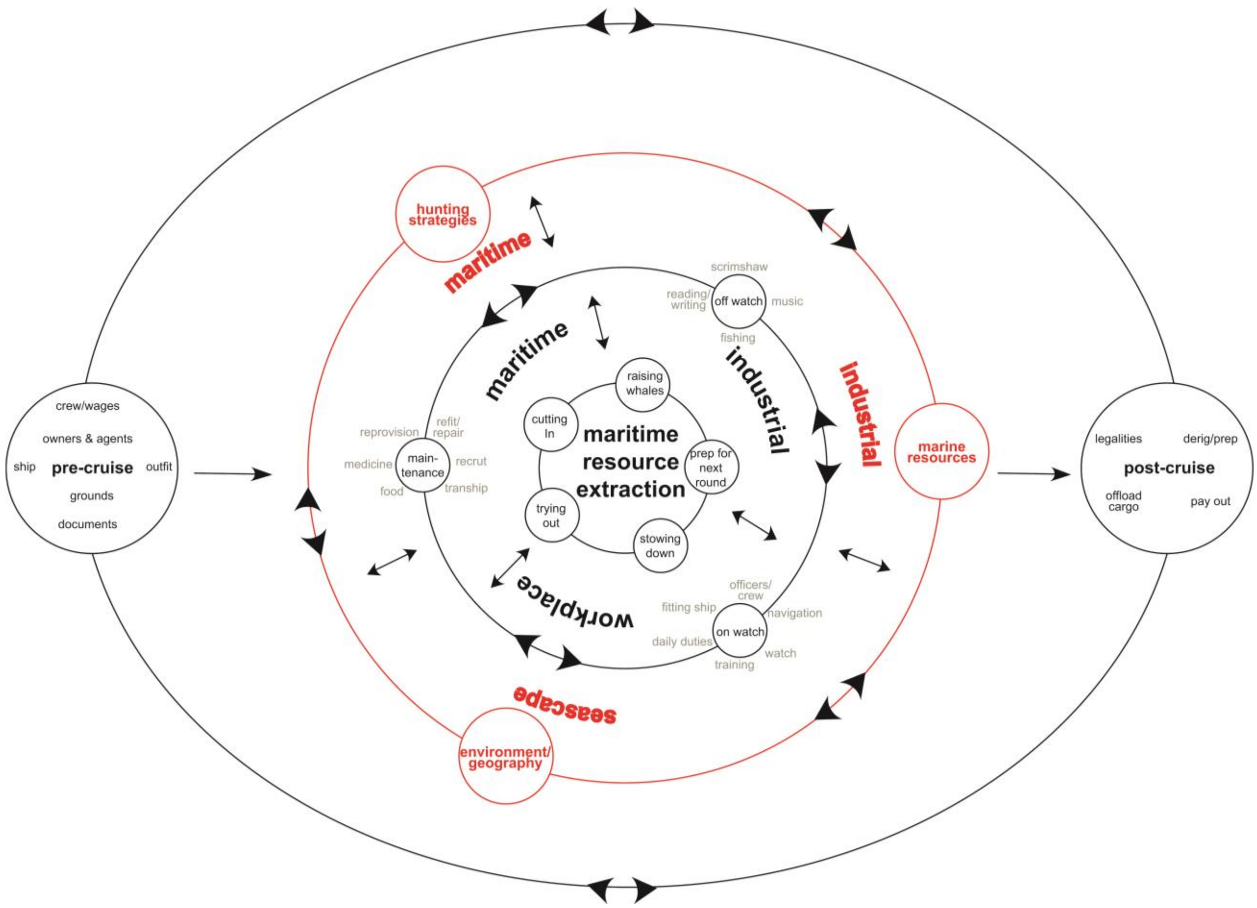

Figure 6. The maritime industrial seascape for American pelagic whaling.

Although the seascape pertains primarily to the hunting grounds in the Pacific, for this study it also incorporates the islands that were used by whalers for seeking refuge from storms or for reprovisioning. The locations of these places were generally identified either through exploratory voyages of whalers seeking new hunting areas or by ships that unsuspectingly encountered uncharted dangers. When sighted, captains recorded their locations and ascribed a name to them and, if a newly-sighted island appeared to offer potential for resupplying a ship with fresh water and food, it was reconnoitered to determine the availability of safe anchorages and whether safe approaches to them existed. Often these investigations produced positive information and over time many well-known provisioning ports were established throughout the Pacific. As with information about new hunting grounds, data relating to hazards or safe anchorages where provisions could be obtained was initially shared among whaling captains and eventually found its way onto printed maps of the region. The long-term effect of many of these early encounters can be seen on modern maps, which include many remote and still uninhabited geographic features that bear the names of whaleships, their captains, whaling ports, or ship owners.

Summary

This chapter examined the usefulness of analytical methods employed by industrial archaeologists and how they might be useful to the study pelagic whaleships wrecked in the Pacific Ocean. By undertaking a review of the ways in which such sites have been studied previously, it was determined that an approach that studied the industrial elements of the vessels and their crews produced interesting results that have yet to be considered. Investigations into frontier mining settlements in the American West had similar operational aspects to those of pelagic whaling. Aside from the obvious difference in the environmental factors that affected their operations, many organizational and functional parallels existed between the two industries. Therefore a number of themes that have been employed by archaeologists studying mining sites were adapted for use for this study.

CHAPTER 3. The Light that Shone the Brightest: The Rise and Prosperity of American Whaling

As whaling was an important component in the development of modern American society, the subject has long been a focus for historians and economists. From as early as 1820, authors have dedicated volumes to understanding the intricacies of the whale fishery. While all aspects of the trade are important, this study is concerned mainly with the interpretation of archaeological data, thus what is presented in this chapter is not intended to be a definitive history of whaling. Instead it is an overview of the activities of American whalers and places a specific emphasis on their activities in the Pacific Ocean during the "Golden Age of Whaling" (Tower 1907; Hegarty 1964; Tompkins 1972:77).

Origins of Commercial Whaling

In many parts of the world opportunistic and targeted whaling was practiced since prehistoric times, when the oil, meat and bone derived from stranded whales made them rich prizes (Sanger 1995:15). Often the result of severe weather, opportunistic strandings provided local inhabitants of nearby coastal regions with an unexpected windfall of food, fuel and even building materials (Credlund 1989:46). Datable archaeological evidence of early whaling includes harpoons fashioned from bone found in Paleolithic cave sites along western European shores (Whipple1979:43), as well as Neolithic rock art depicting whale hunting scenes from sites in Korea (Lee 1984), the White Sea region of Russia (Stoliar 2001; Lubanova 2007; Savelle and Kishigami 2013) and Scandinavia (Gjerde 2010). Subsistence whaling practiced by Arctic cultures, such as those of the northwest coasts of North America, has long provided an important source of energy (McCartney 1984:82). Though exactly how long people engaged in the targeted hunting of different cetacean species is unknown, the relationship between Indigenous cultures remains significant as seen through the incorporation of these animals into traditional belief systems that continue to this day.

Likewise, the exact origins of European whaling are uncertain. Archival evidence indicates that Scandinavian people in the Viking era (approximately 800 to 1066 A.D.) hunted whales along the shore and developed methods that would later spread to other European cultures (Schokkenbroek 2008:26). An early example of this diffusion comes from an account documented by King Alfred of England and passed on to him by a Flemish explorer named Ohthere. In the account he describes a ninth-century method of taking whales by trapping and harpooning them in the fjords and bays along the coast of northern Norway (Spence 1980:10; Lindquist 1993:24). Other reports dating from the ninth to the thirteenth centuries include those of whaling by the Normans, Icelanders, Germans, and Russians (Proulx 1986:9-13). Nevertheless, of all the European cultures known to have engaged in early whale fishing, it is the Basque people of the modern border region between France and Spain who are best known for whaling on a systematic, commercialized basis from the twelfth century onwards (Hohman 1926:19).

Basque Whaling

As in other parts of the world, it is probable that Basque whaling began with people simply taking advantage of whales that became stranded near coastal villages. If it was fresh enough, meat from these whales provided sustenance; the main product extracted was oil, which was used as fuel for heating and lighting (Ommaney 1971:71). Over time these products became important and fishers began actively pursuing whales in shallow waters just offshore. The Basques found whales to be relatively timid creatures, which made hunting them with hand-thrown harpoons possible (Scoresby, Jr. 1820:11; Proulx 1986:15; Grenier et al 2007). The skills developed for efficiently harvesting whales allowed for great success and soon the oil became an important trade commodity. Thus, the Basque commercial whaling industry was born. As more fishers became occupied in this pursuit, regional governments involved themselves in the operation; records and documents dating to the eleventh century provide the earliest evidence of active hunting through a report of government levies on whale takes (Hawes 1924:16; Dégros 1940:162; Proulx 1986:15).

To exploit the offshore marine resources of the Bay of Biscay, methods and technologies for capturing whales were standardized. Among the most essential of these were vessels that could withstand the challenges of the hunt. In order to construct their whaleboats, Basques took advantage of the timber resources and high-quality iron ore that were found in the region. Since the species targeted, the Northern right whale (*Eubalaena glacialis*), was migratory (Kenney et al. 2001), the shipbuilders did not construct boats solely for the chase; instead they crafted sturdy boats that could be employed for fishing as well as seasonal whaling. This tradition of building multi-purpose vessels continued, regardless of size. And, as the quality of the ships they constructed became well-known to other European nations, the Basque people became famous for their iron-working and shipbuilding skills (Grenier 1988:69; de Zulueta 2000:261-261; Grenier et al 2007).

The methods and technologies developed for hunting and capture during the early period of Basque whaling are significant, as they became the basis for those employed by other European and American whaling interests over the next three hundred years. The Basques used stone towers as seasonal lookouts for whales, and once spotted, signal fires were lit and drums alerted waiting crews of up to ten oarsmen, a harpooner and boatsteerer, who launched their boats from the shore and chased the whale until a harpoon could be deployed (Whipple 1979:44). Once a wounded whale became too tired it was given a final blow with a lance and its floating dead body was towed to shore for processing (Appleby 2008:24). The main products of the whale hunt were oil extracted from blubber and baleen plates from the mouths. Whale oil was used to make other products such as "soap, protective coatings for ships, fabric treatments, and pharmaceutical mixes" (Grenier 1988:69). Baleen, also known as whalebone, with its strength and flexibility, was highly sought after for many different uses such as corset stays, petticoat hoops, and buggy whips (Whipple 1980:47; Dolin 2007:120).

The profitability of Basque whaling operations depended not only on their ability to catch and process whales, but also on their success with getting the products to markets and negotiating good prices (Hohman 1928:19). Eventually their hunting prowess, combined with climatic changes in the bay, led to a decrease in the number of whales frequenting the near shore waters (Proulx 1986:18). Thus, the ever increasing demand in northern Europe for whale products led Basque whalers to venture farther and farther from the Bay of Biscay in search of whales, and by the fifteenth century they pioneered long distance voyaging in pursuit of their prey (Nash 2003:8). These voyages eventually led them to the coast of North America, where along the shores of Labrador in present-day Canada they found rich stocks of both fish and whales. This region soon became an important location for both the whale and cod industries, as fisheries on the eastern side of the North Atlantic already exhibited noticeable depletion. Though the exact date for the first Basque whaleships entering the Labrador region remains uncertain, archaeological evidence indicates that by the mid-sixteenth century industrial settlements for processing whales and fish were established around Red Bay (Logan and Tuck 1990).

By the mid-fifteenth century Basque whaling operations developed from a simple shore-based activity to one that included the use of large sailing vessels carrying small boats onboard with which to pursue whales in the open ocean. The larger vessels were not purpose-built for whaling; instead they were adaptations of existing ones that could be used for whaling or fishing operations (Proulx 2007:43). When employed in the whale fishery these ships (Figure 7) served a dual purpose. First, they acted as mother ships that explored the area, launching the boats when whales were sighted and transporting unprocessed blubber back to shore for rendering. Second, they operated as floating warehouses, storing oil until it was ready to be shipped back to Europe at the end of the season.

The methods employed at Red Bay were essentially the same as those described above; thus if whales were sighted near the coastline they continued to be taken by boats launched from shore. But if whales were encountered offshore the small whale-chasing boats, known as *chalupas*, were launched from the mother ship as close to the prey as possible. Chalupas were sturdy, double-ended and built for speed, but their lack of reinforcement at the ends meant they were not intended to be towed by whales. Instead, it is more likely that harpoon lines would have been equipped with a wooden float known as a *drogue*, which slowed a whale's attempts to escape (Grenier 1988:79). Once dead, whale carcasses were either flensed at sea and the blubber stored on the ship for processing on shore, or if close enough to shore, the entire carcass was towed in for flensing and processing. Regardless of when and where the blubber was removed, it was processed into oil onshore at established tryworks stations located near deep water access so that carcasses could be brought in as close as possible (Logan and Tuck 1990:68). The tryworks were "ovens or furnaces where heavy copper cauldrons were apparently kept boiling day and night" when operations were underway; archaeological evidence from Labrador shows that they were covered by wooden structures with red roof tiles and that there were other structures nearby associated with this process (Barkham1984:516). When the oil was rendered it was transferred to wooden casks and then stowed carefully in tiers onboard a warehouse ship. This operation was likely carried out as soon the barrels were filled, since the ship's hold provided the best possible protection from storms or other hazards (Proulx 2007:74). Once the appropriate number of casks was obtained the ship was prepared for the return journey, where the oil was transshipped and then sold at markets in Spain, France, and England (Proulx 2007:74-78).

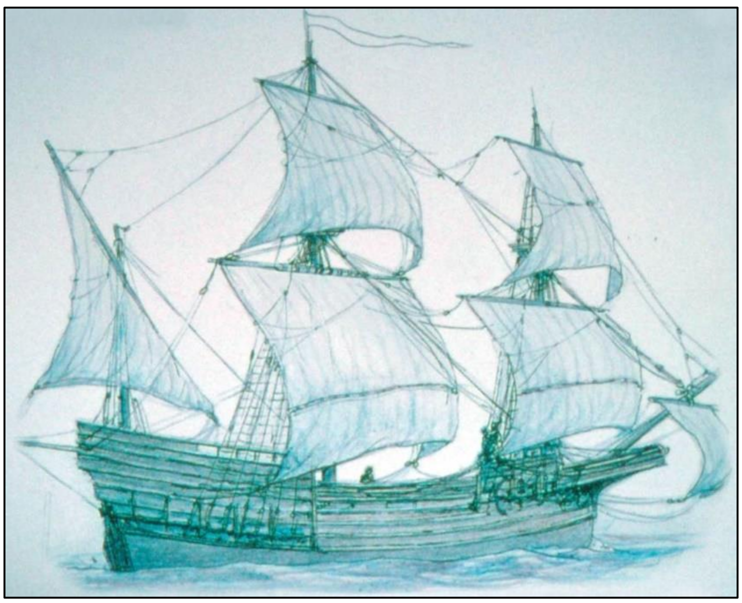

Figure 7. Reconstruction of a sixteenth-century Basque whaling vessel. From: http://www.mnh.si.edu/arctic/features/gateways/results.html.

The abundance of prey in the waters surrounding Labrador provided Basque whalers with great success. Archaeological and historical evidence pertaining to the region around the Strait of Belle Isle, known to them as Terranova, indicate that by the middle of the sixteenth century at least a dozen ports were in operation (Grenier 1988:69; Grenier et al 2007). Over the next fifty years the Basque business in Labrador developed into one of the world's most important whale fisheries (Ross 1985:1). Evidence suggests, however, that by the end of the sixteenth century it was waning due to the increasing scarcity of whale populations near shore (Aguilar 1986:196). Trouble finding prey compelled Basque whalers to explore the arctic region and eventually they encountered the coasts of Newfoundland, Greenland, and Iceland. Soon they united their energies with Icelanders interested in the prospect of new commerce and the business continued to grow (Scoresby, Jr. 1820:17). In his now famous account of the history of the northern fisheries, Arctic whaling captain William Scoresby, Jr. described the operations at in the early nineteenth century as being "…on so extensive a scale, that, towards the end of the sixteenth century, the number of vessels annually employed by the united nations, amounted to a fleet of fifty to sixty sail" (1820:18). And while all of this activity brought Basque whalers financial success and certainly added to the expanding market for whale products, it also attracted the attention of other European nations interested in establishing their own arctic whale fisheries.

Spitsbergen, the Dutch, and the English Northern Fishery

By the 1500s the search for the fabled Northwest Passage led English mariners into the unexplored seas to the north, where they found new lands with large stocks of whales in the surrounding seas and bays (Watson 2003:9). The most significant of these were the islands of Spitsbergen, part of the Svalbard archipelago located in the Arctic Sea (Figure 8). Due to the immense marine resources that existed around the coast, the issue of "discovery" and ownership of Spitsbergen became heavily contested between England and Holland. While the former claimed that Sir Hugh Willoughby's and Stephen Burrows' sightings of land in the general vicinity in the 1550s gave them rights to it, most observers agreed that it was the Dutch explorer William Barentz who found it, as he had not only gone ashore but named many of the islands (Laing 1825:85-86). And though neither nation accepted the other's claim, both England and Holland noted the success that the Basque experienced in Labrador and by the late sixteenth century both were keen to exploit Spitsbergen's whale populations to develop their own national whaling industries.

Figure 8. The islands of Spitsbergen in the Svalbard archipelago. From Scoresby, Jr., W. 1820.

Due to the effects of marked population growth in Europe around 1600, the prices derived from whale products increased exponentially (Schokkenbroek 2008:26). Whale oil was particularly sought after by European nations not only for its illuminating properties, but also for its use as a lubricant and wool cleanser in the textile industries (Francis 1991:55). Realizing the economic potential for the whale fishery, several European nations, including England and Holland, soon organized whaling ventures. Though areas rich in whales were known to exist throughout the North Atlantic, the abundance of whales around the islands of Svalbard led most of these countries to establish stations there in the early decades of the seventeenth century. Archaeological materials indicate that these islands could have been visited or even inhabited as early as the third millennium B.C. (Chorchorowski 1991:395), but it was not until

European whaling activities of the seventeenth and eighteenth centuries that serious exploitation of this region occurred.

The two countries that became most involved in the early arctic fishery were England and Holland. The English fishery began with attempts by the Muscovy Company, which was granted an early monopoly on the fishery by the English government. In the latter part of the sixteenth century they sent ships on unsuccessful voyages to the Bay of St. Lawrence and around Iceland (Jenkins 1921:75). It was not until the early seventeenth century, however, that whaling commenced around Spitsbergen (Jackson 1978:5-7). In 1610 the English sent their first expedition to the region for the sole purpose of whale fishing (*North American Review* 1834:84) and the Dutch began whaling operations there in 1612 (Braat 1984:473). From the start, these two countries came into conflict; their mounting commercial and naval rivalry also translated into competition for dominance in the fishery (Whipple 1979:46). The problems between the countries led to the establishment of the *Noordsche Compagnie* in 1614, an association of independent enterprises that operated collectively under a charter from the Dutch government to organize and regulate whaling interests, as well as to provide protection through the use of armed ships (Hacquebord 1987:20).

In the early years of bay whaling in Svalbard the participating nations contended for access to the best ports and whaling grounds and "soon it became an issue of international law —or the lack of such" (Arlov 1993:81). As the territorial disputes continued, it became necessary to divide the coasts and bays of Spitsbergen among the states that were engaged in whaling efforts. Although each of the countries who had previously engaged in whaling was offered sections of the island's coastline, the dominant English and Dutch interests were assigned the best areas (Leslie et al 1850:348-349).

The Basques also set their sights on Spitsbergen as a means of propping up their now failing North American fishery. Conflicts with their competition in the archipelago, combined with the effects of crippling and seemingly unending wars with Spain and France, ultimately collapsed their whaling operations (Proulx 1986:23). While Basque whalers did continue to take their prey in the open sea, Spanish depredations in their home ports kept them from processing their catches, which annihilated their fishery by 1636. Thus, to carry on their whaling talents

Basque sailors found it necessary to contract their services as captains and harpooners on foreign vessels (Noel 1809:692). Other nations engaged in the fishery were only too happy to employ Basques, for by doing so their inexperienced crews could acquire knowledge of the methods employed in the fishery directly from the Basque whalers who perfected them in arctic seas along the North American coast. Unfortunately, as soon as these nations mastered the art of whaling, they refused to employ their "teachers" and even went as far as banning them from northern waters and threatening to sink Basque ships that ventured into the region (Whipple 1979:46).

Initial operations were conducted via a method that became widely known as shore whaling. Essentially, the same method that was employed by the Basque whalers for centuries, shore whaling utilized small whaleboats launched from shore to intercept whales that were then processed on shore at rudimentary tryworks (Gibbs 2010:4). The boiled blubber produced "nearly its own weight of a thick viscid oil" referred to as 'train oil', a name which probably derives from the Dutch word *traan* meaning tear (Jenkins 1921:39). These methods proved successful and the species that became the basis for this fishery was the Greenland right whale (*Balaena mysticetus*), also known as the bowhead. This focus resulted from immense quantities of bowhead found in the region and because taking other species proved to be quite dangerous with the existing technology (Appleby 2008:25).

> When the fishery commenced, they were so tame that they were found floating in all the gulfs and bays of Spitzbergen [sic], fearless of harm, and were taken by the hundreds, and without an effort. In a few years, however, this dreadful destruction drove them to the more remote bays, from whence they were soon driven into the open sea, far away from land (*The Dublin Penny Journal* 1836:347).

Thus, the rapid rate at which the right whales were harvested made it necessary for ships to hunt offshore in order to meet their quotas. This practice brought with it changes in the method of bringing blubber to shore for processing; the increased distance from shore saw the use of another Basque method known as 'bay whaling.' This technique involved cutting the whale's blubber into small pieces that were then stored in casks on the deck or in the hold of the ship. Once full, the ship returned to shore where the blubber was processed at stations that were used year after year. In time, the pressure of bay whaling on whale populations pushed them even farther offshore and gave way to open sea whaling. Operated in the same way as bay whaling, open sea whaling required longer voyages farther out to sea and was far riskier due to dangerous arctic sea conditions and the chance of plunder by ships of other countries—especially England (*North American Review* 1834:87).

Regardless of the fact that the English supposedly received the best part of the island in the earlier land division, by the early 1620s there was a noticeable decline in its involvement in the fishery. Among the main factors contributing to this decline was profitability, which was greatly affected by the massive increase in oil imports. This influx resulted in low priced oil in the English market and in turn led to less investment by ship owners (Proulx 1986:30). Another major problem faced by the Muscovy Company was poor internal management of the fishery; crew structure, wages, ship maintenance, and outfitting costs were all issues that greatly affected operations during this time (Proulx 1986:30). The shift from shore whaling to bay whaling to open sea whaling was another factor that led to the decline of the English fishery. The ever-expanding number of Dutch ships had a direct effect on the whale population throughout the region, which was in turn reflected in diminishing English productivity (Jackson 1978:25-26). Ultimately, though efforts were made to infuse the English fishery the problems that plagued it proved too great, and from the end of the first quarter of the seventeenth century it languished.

In the meantime, Amsterdam became a major European market for oil and, as such, the Dutch pursued their whale fishery with such vigor that they soon dominated (Scoresby, Jr. 1820:41; Israel 1990). Unlike the English, the Dutch invested immense capital in their whale fisheries, which soon became the source of national wealth. They also established the large settlement of Smeerenberg at the north-west corner of Spitsbergen to serve as a blubber processing station, and supply outlet for their ships (Hyde 1874:127). The establishment of this outpost proved to be a lucrative investment, and by the heyday of the settlement, up to two hundred ships visited it during the season (Spence 1980:32). Thus, the development of this infrastructure, the quality and experience of the Dutch sailors, the economic organization of their business, and the low cost of their ships (Braat 1984:476) were all factors that led to their virtual control of the northern fishery for much of the early to mid-seventeenth century.

After thirty years of intensive whaling at Spitsbergen the populations had reduced drastically and it was necessary to move the field of operations westward to the Greenland Sea, Davis Strait, and Baffin Bay (Isachsen 1929:388). As the ships cruised farther away from Spitsbergen, stopping at Smeerenberg became unnecessary and the settlement languished. The fact that most whaling was by that point carried out in the open sea meant that it became impossible to control; thus the number of 'interlopers,' or non-company owned ships, involved in the industry grew at an incredible rate (Hacquebord 1987:143).

As a result of the interloper problem, the monopoly granted to the *Noordsche Compagnie* was removed in 1642 (Tower 1907:17). At the same time, changes in the arctic climate saw the return of large numbers of whales around the Spitsbergen coast and the fishery shifted its focus back there. Eminent arctic archaeologist and whaling historian Louwrens Hacquebord described the large numbers of whalers flocking the region during this period as having taken "the character of a gold rush, mainly concentrated on the Spitsbergen hunting grounds" (1984:144). For many years Dutch whaling continued to flourish, with an increasing number of ships visiting the grounds; between the years 1660 and 1670 the fleet comprised at least four hundred ships annually (Scoresby, Jr. 1820:56).

The inevitable consequence of the relentless hunting was a decline in the number of whales on the coast, which pushed the dwindling population amongst the ice floes. The dangers encountered in these areas resulted in unsuccessful voyages, the loss of many vessels, and eventually to the decline of the Spitsbergen fishery (Tower 1907:17). These risks in turn led to the search for new grounds. In 1719 Dutch whaleships first sailed into the Davis Strait and established a fishery that would remain active for the next two hundred years (Clark 1884:194). Though this new fishery helped Dutch whaling to prosper for the next decade, the effects of uncontrollable. External factors, such as constant war with other European nations, took their toll. Slowly the number of ships in the fleet decreased and by the last quarter of the eighteenth century Dutch superiority in the fishery waned (Tower 1907:17-18).

English whaling did not cease altogether during the seventeenth century, though its involvement was miniscule in comparison to the Dutch. In time, however, the sad condition of the fishery drew the attention of the British Government. Officials not only realized its potential economic significance, but also "saw its importance as a nursery for hardy seamen, as offering employment for a great number of ships, while the requisite equipments [sic] would require the co-operation of a number of artisans, tradesmen, and laborers" (Scoresby, Jr. 1820:57). Thus, in an effort to help rebuild English whaling at this time, Parliament deemed it necessary to pass an act to stimulate the industry (Tower 1907:15). This initiative took the form of heavy duties on all whale products imported into Britain by foreign ships—including the English colonies. On the other hand English-built whaleships equipped by mostly English crews that left from, or were returning to, English ports were exempt (Schokkenbroek 2008:36). Though these conditions did attract some interest from private firms between 1672 and 1697 (Scoresby, Jr. 1820:58), on the whole they failed to revive the trade and no serious attempt at whaling was made for the next quarter of a century (Jackson 1978:39).

By the 1720s English demand for whale oil grew due to its increasing use as a lubricant, wool cleanser, and street illumination. Thus the discovery of the rich Davis Strait whaling ground rekindled interest in the arctic fishery (Francis 1991:55). In 1725, the South Sea Company began investing heavily in the implementation of a seasonal fishery in this area, but lack of success resulted in financial losses and led them to abandon it in 1732 (Leslie 1850:351-352). Petitions from this company to the government to subsidize their speculation in the fishery, however, came to fruition; in that same year a bounty of "20 shillings per ton on the burden or tonnage of all British whale-fishing ships of two hundred tons and upwards" was implemented (Scoresby, Jr. 1820:72). The bounty had some positive effects and slowly encouraged more ships to outfit whaling voyages, but it was not until it was doubled that the industry really began to revive (Proulx 1986:32). *The Bounty Act of 1749* immediately resulted in greater investment in the fishery and induced many seaport towns to outfit vessels for whaling (Jenkins 1921:185). Soon, northern English ports, such as Hull and Whitby, as well as others in Scotland, including Aberdeen and Dundee, became involved and their importance to the northern whale fishery grew quickly in the following decades. The 1749 increase in the bounty can be seen as both reviving British whaling and giving birth to the Scottish fishery

(Watson 2003:12), and ultimately, for providing the impetus for British dominance in the Arctic by the beginning of the nineteenth century.

The New England Fishery to 1750

American whaling history began with the establishment of the New England colonies (Walton 1915:13). At the same time European nations were competing for the prime hunting areas around Spitsbergen, English colonists were settling the 'New World.' And with these new colonies came the prospect of exploiting natural resources in the region. Reports from the ships that initially explored the region mentioned immense quantities of whales and that abundant stocks of fish could easily be found in its bays and near shore waters. Thus, fisheries were considered by the English as one of the main commercial enterprises to be undertaken. An example of the perceived importance of these activities was seen when Captain John Smith set out for the colonies in 1614, he carried a crown permit to fish for whales (Ashley 1926:28). His return to London only six months later with a cargo of dried fish, furs, and whale oil confirmed the potential for wealth to be obtained from these untapped seas (Dow 1925:5-6).

The colonists were not the first to realize the value of taking whales along this coast; Native Americans of the region considered whales a source of sustenance and had a long tradition of utilizing stranded whales. Though they did not actively engage in hunting whales, coastal Native Americans might attack whales that were "sick or injured … and in shallow waters, or those that that had become trapped by the tide inside a narrow inlet" (Whipple 1979:47). When they did hunt, they used dugout canoes to pursue their prey and harpooned them with stone-tipped, wooden spears equipped with wooden drogues to slow them down (Bailey 1953:83). The settlers observed these whaling practices and noted that the flukes and fins were the only parts taken and that carcasses were left for the birds. As the colonists were only interested in the blubber from which they could obtain the much sought after oil, this situation proved to be perfect. In an effort to maintain good relations with their Indigenous neighbors, they proposed a situation that would be beneficial to all – when whales were found or taken, each group offered the discarded pieces to the other (Bailey 1953:83). To increase the effectiveness of Native American whale hunts, colonists at Southampton, New York, gave them ‘harping irons’ or metal tipped harpoons (Palmer 1959:3).

The frequency of coastal whale stranding meant that settlers could easily undertake *drift whaling*, which involved simply processing carcasses of whales that died of natural causes and drifted ashore, and then storing whale products for shipment to markets abroad (Fairburn 1945:977). Such opportunistic whaling was initially seen as a financial windfall; however, issues of ownership and disposal of drift whales appear to have attracted much attention in both the Plymouth and Massachusetts Bay Colonies (Tower 1907:20). The governments of each colony, as well as those on Long Island, decreed that whales could not be the exclusive property of the person or persons finding them. Instead they belonged to the public and thus the township where the drift whale came ashore was entitled to an equal share of the oil and products salvaged (Fairburn 1945:977). The profitability of these early activities and the knowledge that whales were easily found just offshore soon led to the establishment of shore whaling enterprises (Allen 1928:340).

As drift whaling was opportunistic, obviously the type of whale that washed up was of no concern to the colonists or Native Americans. Once whales were actively sought by the shore fisheries, two main species were targeted; these included the right whale, which frequented the New England coast from October to the beginning of June, and the humpback (*Megaptera novaeangliae*), present in the summer and fall (Ashley 1926:30). Of these, the North Atlantic right whale was the main object of the hunt because they produced large quantities of oil and whalebone (Reeves and Mitchell 1986:201). It appears that the term ‘right’ was given to them simply because they were the right kind to take due to their natural tendency to float after being killed (Allen 1916:171; Braginton-Smith and Oliver 2008:19).

The exact location of the first shore whaling activities on the New England coast is contested. While some authors have attempted to identify a particular time and place, it is likely that the first whales were taken by colonists who had some understanding of, and possibly participated in, English or Dutch whaling in the Arctic prior to their arrival in the New World. The earliest documented organized whaling operations come from Long Island, where by the late 1640s “whaling companies were formed, neighborhood lookout stations were posted, and small craft put out from shore on cruises that lasted one or two weeks, making shore each night" (Starbuck 1878:10; Ashley 1926:29-30). With the success of these endeavors, shore whaling spread along the coast and both the number of boats engaged in the business and the number of whales towed ashore increased (Dolin 2007:47).

The main method employed in early shore whaling was a technique that came to be called *inshore whaling* and involved cooperative efforts only slightly different from those developed by Basques whalers (Davis et al 1997:43). As mentioned previously, lookouts were stationed along the coast for the purpose of scanning the ocean for spouting whales. These structures consisted of tall spars fitted with wooden pegs for climbing, topped with elevated seats, and covered with thatched roof shelters that were open to the sea (Forman 1966:31). When whales were spotted, the lookout alerted the whalers, who rowed out in whaleboats with a complement of six crewmembers (Dolin 2007:49)—many of whom were Native Americans paid for their skills as harpooners. The boats developed for shore whaling were constructed of native cedar and described as "light, graceful and easy to manage, [and] were exceptionally strong" (Bailey 1953:83). A whale would be struck with a harpoon attached to a line and allowed to run; when too exhausted to run any longer, it was then killed by a blow from a lance. Once dead, the whale was towed to shore and, with the assistance of a capstan-like machine called a 'crab', the blubber was removed, and either boiled in metal pots close to the beach or taken to one of a number of more distant try-houses for rendering (Hawes 1924:73). Such try-houses were semi-permanent facilities that offered better conditions where rendering could be done in a more orderly fashion (Wiess 1974:79).

Shore whaling proved profitable and soon it became one of the economic mainstays of the communities of Long Island and the New England coast (Francis 1991:45). The proceeds from these activities did not go unnoticed by colonial authorities, who sought to regulate the new businesses by levying duties. For example, in 1684 an act was passed that "layed [sic] a duty of 10 percent on all oil and bone exported from New York ports to any outside ports except directly England or to the West Indies" (Starbuck 1878:15; Tower 1907:23). In spite of these and other controls, shore whaling continued to grow and communities along the New York and Massachusetts coasts profited. Slowly the increased number of whales being taken led to a noticeable depletion of the right whale stocks by the beginning of the eighteenth century

(Braginton-Smith and Oliver 2008:75).

Eventually the success of shore whaling on the mainland led the inhabitants of the small offshore island of Nantucket to begin whaling. Nantucket was settled around 1650 by a group of Quakers who fled persecution on the mainland (Figure 9). “The character of the island and its situation far out in the ocean, its poor soil and the number of whales along its shores, all proved inducement to the Nantucketers to the follow the sea as a calling” (Walton 1915:19). Though whales could easily be found along their shores, for some time the islanders only took advantage of drift whales that washed up—many of which were previously harpooned by their neighbors on the mainland (Ashley 1926:30). In time they attempted to kill whales that ventured into the bays and harbors, and quickly realized the economic potential of a well-organized whale fishery. To instruct them in the best methods for taking whales and extracting oil, the Nantucketers enlisted the help of a Cape Cod whaler named to Ichabod Paddock. Paddock moved his family to the island and quickly took up his new role by dividing the island’s southern coastline into four sections and establishing lookouts operated by crews of six people. Whaling became a community affair as all shared in the expense, the work, and the products and profits (Fairburn 1945:981). Nantucket’s Indigenous inhabitants also played a key role in early shore whaling by selling prime coastal land where whaling stations were established and by providing a source of much-needed, skilled labor (Dolin 2007:69). Thus, due to the diligence of the islanders and the cooperative nature of the fishery, Nantucket achieved such success that by the turn of the eighteenth century it became the leading whaling port in the colonies (Proulx 1986:60).

Over time the numbers of whales frequenting the coasts of New England dwindled. Realizing that large stocks of whales could be found offshore, the whalers extended their operations further out to sea. Thus, by the end of the seventeenth century *boat whaling* had begun in New England. Boat whaling did away with the need for lookouts by sending boats out to actively hunt whales in near shore waters. It involved whalers outfitting small boats with provisions to last a few weeks and cruising in search of their prey. When a whale was taken, it was towed to the nearest shore, cut up and the blubber packed into barrels and taken back to the homeport to be processed while the whalers resupplied and returned to the hunt (Davis et al 1997:35). By the early 1700s Nantucketers were taking their sloops on voyages of 40 to 50 miles (64 to 80 km) out to sea, well beyond the shoals and sight of land (Stackpole 1953:24).

Figure 9. Map of Nantucket Island drawn by William Coffin. From Macy, O. 1835.

Perhaps the most significant of these early boat whaling voyages was that of Christopher Hussey around the year 1712. Although some authors have disputed the exact date and accuracy of this event, it represents the first known instance of a spermaceti whale being actively taken at sea. According to the first historian of Nantucket, Obed Macy (1835:36), Captain Hussey was "hunting Right [sic] whales when a strong northerly wind blew him some distance offshore, where he fell in with a school of that species of whales [i.e. sperm whales], and killed one and brought home." The sperm whale was not unknown to the people of New England; carcasses had been previously found stranded along their beaches (Figure 10). As such, they were aware that the oil from this species was of superior quality and that their heads contained a reservoir of a waxy substance known as spermaceti. The reason that whalers had not actively pursued them was simply that there were plenty of right whales close to shore

(Spence 1980:43). Commercial value of sperm oil, however, was undisputed, for it was “the best lighting fluid yet discovered” (Stackpole 1953:28). Thus, the significance of Hussey’s voyage was that it proved these whales could be taken in open water and marked the advent of *offshore whaling* or *pelagic whaling*.

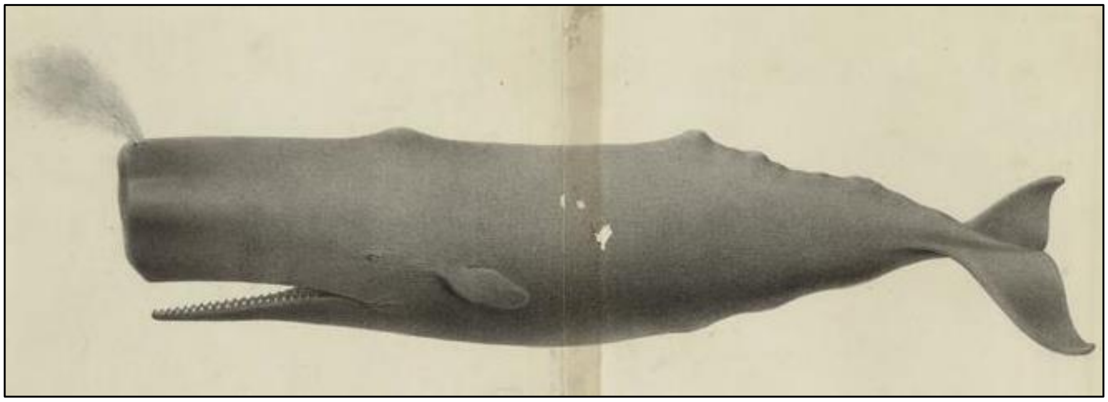

Figure 10. Illustration of a sperm whale (Physeter macrocephalus). From Scammon, C.M. 1874.

Offshore whaling required the replacement of the small boats used in the inshore and near shore fisheries with much larger vessels, such as sloops, schooners, and brigs. When sloops were used, whales continued to be directly hunted from them; however, the larger schooners and brigs were operated by crews of up to thirteen who attacked whales from two whaleboats, which were carried onboard (Davis et al 1997:35). The larger size of the vessels was necessary to hunt the much bigger sperm whale because, “as Yankee whalers quickly discovered, sperm whales were not only a richer prize than the right whale but an even more fascinating and fearsome quarry” (Whipple 1979:50).

Though sperm whales inhabit all of the world’s oceans, Nantucket whalers first found them in the warm waters of the Gulf Stream that passed just offshore of their island home. Their size, their unusually large head, and their behaviors enabled them to be easily distinguished from other whale species. Feeding mainly on squid that live in the ocean’s depths, they often make prolonged dives to feed. They also have a strong schooling instinct, forming schools of females and young males, with older adult males being solitary (Gosho et al 1984:54). The carcasses of sperm whales yielded several products including sperm oil, which burned with a very bright, odorless flame (Spence 1980:47); spermaceti, a waxy substance that was found inside their heads and used to produce the finest of all candles, as well as a lubricant for very delicate instruments; the fine-grained ivory teeth which were put to many uses; and the treasured ambergris, a byproduct of an infection in the whale's intestine that was used as a fixative for high-priced perfumes and thus, was literally worth its weight in gold (Sanderson 1956:211-212).

Due to higher prices paid for sperm whale products and the decreasing numbers of whales along the coast, the deep-sea fishery soon eclipsed shore and boat whaling. Though Nantucket shore whalers carried on as late as 1760, the fishery is said to have reached its peak around 1726 (Macy 1835:46; Tower 1907:27). The profits that Hussey realized from his legendary voyage quickly led Nantucketers to outfit trips into the wider ocean—referred to as "ye deep"—to distinguish it from shore whaling (Macy 1835:36; Dolin 2007:90). At first they fitted out sloops of about thirty tons for cruises of up to six weeks, during which time the blubber obtained from whales was stored in barrels and then brought back to shore for processing at established tryworks (Macy 1835:46; Tower 1907:27). The success of these activities can be seen in the growth of the industry and the number of vessels employed over the first decades of the eighteenth century. In 1715 the Nantucket whaling community engaged six sloops in this new deep-sea fishery and that number grew to twenty-five vessels ranging from thirty to fifty tons by 1730 (Tower 1907:27).

The scope of the offshore whaling voyages quickly expanded. Bound only by the cargo capacity of their vessels and the amount of provisions aboard, whalers from the various New England ports cruised both north and south in search of their prey.

> The practice was for the whalers to fit out during winter, then go south in the spring—first to the Carolina coast, thence via the Bahamas either into the Gulf of Mexico and the Caribbean or down the outside of the West Indies, then east to the Azores, from there to the Cape Verdes and the west coast of Africa… the fleet returned to Nantucket in July, refitted, and then sailed again for the Grand Banks and Davis Strait to the north (Sanderson 1956:212-213).

Though sperm oil was in higher demand, American whalers did not discriminate when they encountered whales of any sort; instead they simply kept the blubber of the different species separate. Other towns in the region, such as Salem (Massachusetts) and New London (Connecticut) also outfitted vessels for offshore whaling and enjoyed some success in the fishery (Robotti 1962; Decker 1974). But it was Nantucket that took the early lead and would become the center for American whaling until the early nineteenth century (Ellis 1991:143).

The colonial market for whale oil was based in Boston, where merchants controlled the shipping of products to foreign markets. The success of offshore whaling and the production of such large quantities of oil soon glutted the colonial market and forced prices down. Though the principal port for the New England trade was London, Amsterdam and other European ports claimed a share of the oil shipped through Boston (Dow 1925:24). Realizing that colonial oil was in constant demand on the other side of the Atlantic, due to issues with the Spitsbergen fisheries, the Nantucket whalers decided that a direct contract with foreign markets would be more beneficial. Though there is evidence of a shipment from Nantucket to the London market as early as 1720, it was not until the middle of the eighteenth century that a direct trade was established in which whale oil was delivered and articles required for the whaling business, such as iron, hardware, hemp, sail cloth and many other goods, were brought back to the colony (Dow 1925:24-26). By setting up this trade, the Nantucketers bypassed the fees that they had paid previously to Boston merchants on both ends. Thus the island's whalers not only "dominated the actual capture of the whales but soon learned to control the commercial aspects of the industry as well" (Whipple 1979:54).

In the first half of the eighteenth century several improvements were made to the methods and technologies employed in offshore whaling. These advances included the practice of fastening the boat to the whale by means of a line attached to the harpoon; the evolution of the versatile whaleboats used to chase their prey; better methods for stripping blubber from the carcasses; and the development of better quality whaling craft and gear, such as harpoons, lances, whale-lines and cutting-spades (Hohman 1928:27-28). By this time the larger vessels were used as mother ships and floating warehouses; as such, they not only increased in size and tonnage, but also underwent gradual changes in rig (Hohman 1928:27-28). While all of these changes increased the range and certainly the productivity of the fishery, progress in the industry was still restricted. Limitations included the small size and relatively small cargo capacity of the sloops and schooners employed as mother ships, and the need for low temperatures to preserve the raw materials, which limited them to seasonal operations. These restrictions, coupled with the growing need to make longer voyages to more distant grounds, led to a revolutionary innovation: the transfer of the tryworks from the shore to the deck of the whaleship (Davis et al 1997:36).

The installation of tryworks on the decks of whaling vessels marked a turning point in the industry. The ability to process whales wherever they were taken had major advantages over offshore methods. First, it lengthened voyages, which allowed for an increased number of whales to be taken and in turn greater profits. Second, it allowed whalers to move out of the northern hunting grounds to pursue sperm whales in the warmer waters that they preferred. Several subsidiary effects of the application of shipboard tryworks included increases in the size of the vessels employed in order to provide greater oil storage capacity and increased seaworthiness; a subsequent change in the rig of the vessels; changes to their outfitting; and changes to labor requirements for pelagic whaling, including increased numbers of crew, clearly defined roles, and the institution of a wage system (all of which are considered in greater detail in later chapters).

The addition of the shipboard tryworks coincided with another major industrial innovation at the time. Though onboard tryworks resulted in access to an unprecedented supply of sperm whales, it was the development of a method for separating the spermaceti that greatly increased their value (Bockstoce 1984:529). The originator of this procedure cannot be identified with certainty, but it is apparent that the person who introduced it had some knowledge of the process of tallow candle manufacture (Kugler 1980:5). Spermaceti is contained in a void in the sperm whale's head, called the 'case.' When exposed to air, it becomes a waxy substance that can be used to make high quality candles (Stackpole 1953:28). The process involved several steps. First, the 'junk' (the unprocessed matter), was heated in a large copper vat to remove impurities; then it was allowed to congeal before being bagged in woolen sacks; finally it was squeezed using a screw press (Ellis 1991:144). The oil obtained was of extremely high quality and was recognized as a far better illuminant than that of right or humpback whales; “thereafter the two kinds of oil—sperm and whale—would be distinguished in the marketplace, each sold as a separate commodity and priced accordingly” (Kugler 1980:5).

Together these two technological innovations had a phenomenal effect on the market for whale products and the expansion of the fishery. The addition of processing blubber into oil greatly extended the lengths of the cruises; as such, it required the creation of a system that allowed these vessels the freedom to roam the seas until their holds were full. From the types and sizes of vessels chosen and their outfitting prior to departure, to the taking of whales and stowage of oil, to the payment of wages upon return to their home port, all aspects of the trade would be affected under this new system (the methods employed in pelagic whaling are discussed in greater detail in later chapters). Because it was the whalers of New England who developed the system, it is referred to as “American-style whaling” (Davis et al 1997:37). The introduction of this new system led to the ability to maintain cruises for years at a time, which in turn allowed American whalers to explore far beyond known grounds, and the resulting financial gains had a profound influence on their world.

From Revolutionary Technology to the Revolutionary War

By the middle of the eighteenth century, urban development led to a great social transformation in cities across the world—the lighting of streets (Dolin 2007:121). On both sides of the Atlantic “the white flames of whale-oil lamps were lighting up thousands of homes, churches, factories and shops” and oil was used for the lubrication of machines, for finishing leather goods and woolen clothes, and in making soft soap, varnishes and paints (Hawes 1924:81). As a result, whale products were by this time one of the principal exports of the Massachusetts colony to England (Dow 1925:26). While whaleships continued to take whatever species they encountered, the ever-increasing prices paid for sperm oil meant that it became the main target. Whaling historian Richard Kugler highlighted the role of New Englanders in developing this fishery by pointing out that “sperm whaling quickly became an American preserve, exclusively so up to the time of the Revolution and largely so thereafter” (1980:6).

Early American whaling historian Alexander Starbuck explained the importance of the period from 1750 to 1784 by stating that it was "the most eventful era that the whale fishery ever passed through" (1878:36). During this time the character of the American deep sea whaler emerged; they quickly became experienced mariners with a growing knowledge of the hazards of both whaling practices and the industry's financial success (Stackpole 1953:47). As more ports along the New England coast outfitted vessels for extended whaling cruises, the boundaries for hunting grounds were pushed ever farther offshore. In addition to the dangers of this new style of whaling, English foreign affairs meant that American whalers faced the constant threat of attack by Spanish and French privateers and pirates who roamed the Atlantic at this time (Starbuck 1878:56; Tower 1907:33).

The influx of colonial oil into the markets of London and other European ports at this time was welcomed enthusiastically due to the almost complete failure of British arctic whaling. The end of the French and Indian War in 1763 saw France concede all claims to Canadian lands to England; as a result New England whalers were allowed to move into the arctic (Ellis 1991:145). Around the same time, the British sought new sources of revenue and established a bounty system that favored English ships and their national fishery. The bounty system was extremely restrictive to the colonists and by 1765 more discriminatory legislation put the colonial fisheries at a severe disadvantage by prohibiting their vessels from taking products to any non-English markets and by limiting the waters in which they could operate (Ashley 1926:32). Though these acts were seen as unjust, there was little action to be taken aside from petitioning Parliament, which was done by both New England merchants and the London firms involved in the colonial oil trade (Dow 1925:26). Ultimately these sanctions were only partially successful; while they did drive some New England whalers from the arctic grounds, it did not impede the growth of the colonial industry. Instead, the American whaling fleet turned their attention to the south (Francis 1991:61).

Whaling voyages by this time extended in length from weeks or months away from home to sometimes up to a year and "in 1767 fifty New England whalers were reported as engaged in experimental cruises in far southern waters" (Fairburn 1945:985). A major scientific discovery during this early period of exploration was the Gulf Stream. Nantucket whalers were the first to gain knowledge of this powerful north and eastward flowing current and one of them eventually passed this information on to Benjamin Franklin, who published the first chart (Figure 11) showing its path in 1786 (Whipple 1979:54). The Gulf Stream abounded with sperm whale food and, by hunting along its edges, rich new grounds were identified, ranging from Hatteras (off the coast of modern-day North Carolina) to the Banks of Newfoundland, east across the Atlantic Ocean and south to the coast of Africa (Fairburn 1945:984-985).

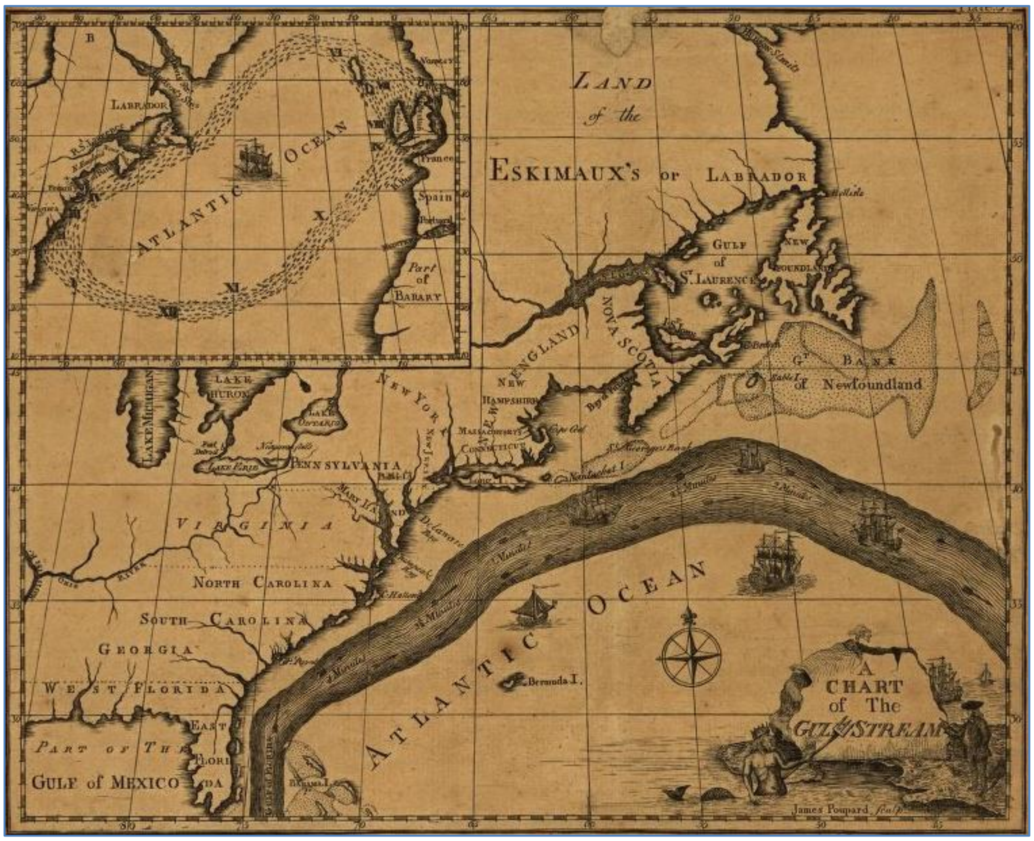

Figure 11. Benjamin Franklin’s map of the Gulf Stream’s. From Franklin, B. 1786.

Also encouraged by reports of merchants engaged in the West Indies trade, whalers ventured farther south where they found their prey in abundance around the Bahamas and in the Caribbean. Exploration of the Atlantic region continued and by the mid-1770s American whalers were hunting off the coast of West Africa, around the Azores, and off the coast of Brazil (Tower 1907; Robotti 1962). The hunting grounds identified along the South American coast, such as those off Brazil, as well as around the Falklands and other South Atlantic islands, would prove to be important for both the American and the revived British fleets. Whaling in this region was not introduced by American or British whalers; instead it was the accounts of Portuguese explorers describing the presence of whales in shallow waters off the Brazilian coast that initiated a limited shore based fishery by the seventeenth century (Alden 1964:270). Basque sailors introduced shore whaling techniques to the region and by the mid-eighteenth century, shore processing factories were established along many parts of the coast. The involvement of American, British, and French offshore whaling interests in the region, however, greatly reduced the number of whales along the coast and resulted in the decline of the shore fishery off Brazil (Richards 1994:6). Of all the new whaling grounds identified in the exploratory period prior to the American Revolution, perhaps none would prove to be as important as the Brazil Banks over the next decades.

The American Revolution 1775-1783

Despite the aforementioned British intrusion, the lead up to the American Revolution saw the whale fishery of New England enjoy healthy progress and profit. Evidence of this success can be measured by the fact that in the year 1775 the Quakers of Nantucket and New Bedford had around 300 vessels engaged in the fishery (Bockstoce 1984:529). Fifty to sixty vessels were also fitted out from other New England ports seeking to gain a foothold. These included Wellfleet, Martha's Vineyard, Barnstable, Falmouth, Swansey and Boston in Massachusetts; Newport, Providence, Warren and Tiverton in Rhode Island; and New London, Connecticut; and Sag Harbour on Long Island, New York (Dow 1925:40).

As most whaling historians have stated, the American Revolution nearly destroyed the colonial industry. In his extensively researched manuscript, *The Whale Oil Trade 1750-1775*, Richard Kugler (1980) noted that the war not only shut down the industry, but "marked the end of a period of radical change," as the quarter century leading up to it was "a time of expansion, of innovations in technology and management, and of rivalries and problems not completely resolved before the conflict closed down the fishery" (Kugler 1980:23).

The threat of conflict between the colonies and the British government was ever-present in the early to mid-1770s. Dissatisfaction was felt throughout the colonies over what was seen as undue taxation and control. Sources of discontent included not only the duties that were imposed on the whaling fleet that fished in the Arctic, but others that restricted colonial commerce. Ultimately, “trade relations and commercial chaos” escalated to the point of violence in April 1775 at the Battles of Lexington and Concord (Jackson 1978:66). The unrest of this time proved devastating to New England’s fisheries, because “the first steps taken by England to repress the colonies was directed at the fishing interests” (Tower 1907:37).

Of all of the New England ports, none was as successful at sperm whaling as Nantucket. This success can be attributed to several factors, including the location of the island off the coast of the mainland, which positioned them closer to the hunting grounds; the good business sense and determination of the Quaker whalers; and the system of community investment in voyages. All of these combined to create an island economy that became heavily dependent on the sea and, in particular on the whaling trade. As such, Nantucketers did their best to remain neutral before and during the war, however, these actions proved damaging and resulted in the prospect of attack from both sides (Spence 1980:57). Not only were the British actively engaged in crushing the colonial whale fishery, but early in the conflict, American colonial leaders obtained reports that supplies were being transshipped to the British via Nantucket, and therefore sanctions were laid against the islanders (Taylor 1977:583).

In all colonial business ventures, the war had a devastating financial effect. For whaling, both revenue and almost the entire colonial fleet were destroyed. Nantucket was particularly hard hit: of the 152 vessels at the outbreak of the war, 124 were captured by the British and fifteen others were wrecked (Fairburn 1945:990). Those employed in many other branches of the industry were also affected; rope-makers, coopers, blacksmiths, carpenters, and shipwrights all saw their businesses diminish (Macy 1835:68). Thus, in communities that shared ownership of vessels and voyages, the war presented twice the problems. If the vessels were not able to engage in the fishery, then no money could be made; and if the vessels already at sea were captured, then their investment was lost. Further, since British ports were closed to American vessels, what oil the Nantucket merchants had was not able to be traded directly and thus that revenue was lost as well.

As a general policy throughout the war, British privateers and naval ships aggressively pursued merchant vessels and interrupted commerce in an effort to starve the colonies into submission. And since much of the revenue of the colonies came from the proceeds of whaling, the British were determined to crush it. Still struggling to establish a profitable southern whaling industry of its own, however, the British took full advantage of the situation and captured American whalers. When whaleships were taken, the vessels were either burned and sunk or taken as prizes, and the crews were generally given the choice of imprisonment, being forced to join the British Navy and fight against their colony or being impressed to serve on British whaleships. Many American whalers opted for the latter and in doing so began a transfer of knowledge of the methods they had developed. Though the government's efforts to stimulate Great Britain's whale fishery through the bounty system was not as successful as they had hoped, the Revolutionary War and ensuing conditions in America produced a British whaling business operated by New England seamen (Fairburn 1945:1008).

The constant harassment at sea, mistrust on the home front, and the loss of vessels by capture and forced donation to the war effort, led New England whalers to cease operations for several years (Francis 1991:63). As the war dragged on, the situation in Nantucket became desperate. With no other way of obtaining the revenue needed to get supplies for the island's inhabitants, Nantucket whalers petitioned both sides of the conflict for consent to undertake limited whaling operations unmolested by naval or privateering actions (Spence 1980:57). In 1781 British authorities issued twenty-four permits that allowed named Nantucket vessels to undertake whaling without fear of capture. Over the following two years 35 out of a total of 41 voyages ended in success, with the others being captured or burned for defiance of their papers (Hawes 1924:86). In 1783 the American Congress finally granted similar permits to 35 vessels, but this did little good, as by this time the war was coming to a close (Jenkins 1921:231). While these permits did help to sustain Nantucket during the final years of the war, the industry was in ruins by its end.

Post-Revolution Depression 1783-1815

While the Treaty of Paris brought an end to the American Revolution in 1783, it also brought hard times to the North American economy (Woodward Jr. 1968:142). Determined to rebuild their industry and return to prosperity, whaling merchants in the ports of Nantucket and New Bedford quickly started rounding up and repairing decaying hulks, as well as building new ships (*North American Review* 1834:101). And as soon as they could continue their trade safely, whalers outfitted voyages from these ports. Owing to the lapse in hunting during the war, the whales proved to be easy prey (Tower 1907:40) and soon other New England ports followed suit. Although whale products commanded good prices for a time, this boom was short lived.

To protect British whaling interests, Parliament effectively closed the London market for American oil by imposing an £18 per ton duty in 1784. This action crippled American efforts to revive the industry by taking almost all profit out of the equation (Whipple 1979:57). In an effort to aid the industry, the Massachusetts Legislature attempted to stimulate recovery by offering a bounty on whale products returned by vessels owned and operated by state residents. This attempt proved ineffective, however, because the demand for whale products had declined (Starbuck 1878:78-79; Davis et al 1997:37). The lack of available whale oil during the war had led to the necessary substitution and acceptance of lower-quality tallow candles, which meant that the oil resulting from the bounty could not be absorbed by the young American market and over-production led to low prices (Jenkins 1921:231).

Around this time the British government's aspiration to make their whale fisheries completely self-sufficient led to a shift in focus from the northern to the southern fishery, with support for the trade coming from the highest levels (Chatwin 1996:25). Thus, spurred on by the protective tariffs and very generous subsidies from the British government, London whaling merchants further expanded their operations into the South Atlantic (Richards 1994:19). The Southern Whale Fishery—so called to distinguish it from the Northern (arctic) Whale Fishery (Spence 1980:57)—proved successful largely due to both the knowledge of American whalers impressed into service during the war and the enticing of many of those same whalers into continuing to work for the British thereafter. The skills of Nantucketers in particular were held in high regard and were in great demand, so much so that some firms, "made a general practice of having expert Nantucket whalemen [sic] on every ship that they sent to sea" (Fairburn 1945:989).

During this time the British also mounted a campaign to encourage Nantucketers to move their operations and to join Great Britain's newly resurgent whaling industry (Whipple 1979:57). Due to the stagnant conditions of the fishery in America, some Nantucket whalers migrated with their families to a new British settlement in Nova Scotia and others looked directly to the UK. Of particular note among these expatriates was William Rotch, Jr., a shrewd Nantucket whaling merchant who represented a group interested in settling in England. Rotch approached the British Government about establishing a whaling colony there on the condition that his group was reimbursed for all of their expenses and that they be allowed to collect the bounty that the British whaleships received. When the British Government refused to grant these demands, Rotch, knowing that the French had long been interested in Nantucket oil, then petitioned Louis XVI's government with a similar deal (Bockstoce 1984:529). Interested in reviving French whaling to compete with the British in the industry, the French quickly agreed and provided handsome bounties. In 1784 Rotch and a small group of families established a whaling colony at Dunkirk (Richards 1994:29).

A direct result of the establishment of Dunkirk was the gradual return of Nantucket as the leading whaling port in America (Stackpole 1953:134). The opening of the French market to American whalers in 1789 infused the Nantucket industry with new life (Tower 1907:43). Ships sailing from Dunkirk soon competed with British ships on the Brazil Banks and in the South Atlantic grounds. Dominated by Rotch-owned vessels, the Dunkirk fleet expanded from six ships in 1786 to 26 in 1792, and whalers from New England continued to send their products to French ports (Dolin 2006:179). It also was during this dynamic period that the French Revolution began and, as a result, war was ultimately declared on the UK in early 1793. At the outbreak of this conflict the safety of American inhabitants in the Dunkirk colony came into question and they opted for safety by going home. Among those who left was William Rotch, who settled in New Bedford—partly because he realized its potential as a mainland whaling center and partly because he found himself unwelcome among Nantucketers, who considered him a deserter (Ashley 1926:32). This choice would prove very wise, as in a relatively short time New Bedford eclipsed Nantucket and took the reins as the premier American whaling port.

During this period the British Empire sought to make up for its loss of the American colonies and outfitted ships for voyages of exploration into little known regions. As far as British whaling industries were concerned the most important of these expeditions were those of the famed Royal Navy navigator Captain James Cook. Not only did Cook make important "discoveries" of new lands, he also made observations regarding the natural world on three major voyages of exploration from 1768–1779. Cook's identification of new territories such as Australia, New Zealand, Tahiti, and the Hawaiian Archipelago proved to be very lucrative for the British in the coming decades and had a profound impact on the development and operations of both the British and American whale fisheries (Freeman 1951:74-81).

In the meantime, an increasing demand for oil had a disastrous consequence on whale populations in the known hunting grounds. By the late 1780s both American and British whaleships hunting in the South Atlantic found that the decline in whale populations meant that longer voyages throughout the region were necessary to obtain cargos (Whipple 1979:57). Knowing that merchantmen and sealers had already undertaken voyages into the Pacific Ocean and reported an abundance of whales there, the idea of making the dangerous passage around the tip of South America soon became a reality. In January 1789 the whaleship *Emilia*, owned by the London whaling firm Enderby and Sons, rounded Cape Horn and found numerous whales off the southwestern coast of Chile (Spence 1980:63). Captain James Shields, a Nantucketer, wasted no time in chasing them and soon first mate Archelus Hammond, also of Nantucket, harpooned and killed the first known sperm whale to be taken in the Pacific (Sanford 1871; Stackpole 1953:145). More whales were quickly taken and, once full, the ship returned to London, where news of a rich sperm whaling ground spread like wildfire. Immediately *Emilia* and nine other London whalers were dispatched for the Pacific (Stackpole 1972:129; Richards 1994:26).

By 1791, reports of the successful voyage around Cape Horn reached New England and vessels from Nantucket first went into the Pacific (Macy 1835:141). Nantucket, however, was not the only port outfitting vessels bound for the new grounds. The New Bedford whaler *Beaver* claimed the title of first American whaleship to round the Horn; between the years 1791–1793 its captain noted that, of 40 whaleships sighted during that time, 10 hailed from New England (Dolin 2006:182). At first the whalers only needed to stick to the southern coast of Chile to quickly find their prey and soon this area became known as the 'On-Shore' ground. The abundance of sperm whales found there meant that vessels could "fill to capacity and be back in port within two years, a phenomenally short amount of time when compared with the average four-year voyage a generation later" (Rydell 1952:62). As more and more ships came, however, they soon found it necessary to extend the scope of operations and by the end of the century whaleships cruised the entire western coast of South America (Hohman 1928:37).

Though the outlook seemed good for American whalers, the outbreak of the French Revolution created difficulties by destroying the burgeoning oil market. The captains of the whaleships in the Pacific had no way of knowing that the bottom had dropped out of the market. Thus, they continued whaling at a feverish pace and the over-supply of whale products meant that prices dropped still further (Rydell 1952:62). The glut in the whale market in turn created hostilities between the United States and France and by 1798 the prospect of war between the two nations led French privateers to prey upon American commerce (Jenkins 1921:232). The whaling industry suffered heavily during this "quasi-war" with France (Stackpole 1972:285); not only were several vessels captured, but many merchants refused to send their ships out due to both the threat of loss and the increased cost of insurance (Tower 1907:43). The political and military chaos in Europe placed all merchant vessels in a precarious position, as British privateers also roamed the seas for the next decade raiding commercial vessels and impressing sailors into service (Hohman 1928:37).

As a result of these and other privations, diplomatic relations between the US and Britain gradually worsened over the first decade of the nineteenth century. In response to French and British harassment, President Thomas Jefferson signed the *Embargo Act of 1807* and closed US trade with foreign countries. Though well intentioned, the economic problems it created proved to be "more damaging to US commerce than the attacks of the belligerents had ever been" (Woodward Jr. 1968:143). As the Act resulted in little if any impacts on either the French or British economies, it was soon repealed and replaced with the equally ineffective *Non-intercourse Act of 1809*, which opened trade to all countries of the world excluding France, Britain and their dependencies (Coles 1965:11). Over the next three years, relations between the US and Britain further deteriorated and ultimately war was declared.

As with the American Revolution, the War of 1812 had a devastating influence on the American whale fishery. Ostensibly fought to defend the rights of American commerce on the high seas (Woodward Jr. 1968:143), the war drastically impacted whaling through the activities of the Royal Navy and by cutting off access to markets. Believing that a peaceful resolution to the causes of contention between the two countries would be found, many New England whaleship owners fitted out ships prior to 1812. Thus, when war was declared many vessels hunting in both the Atlantic and the Pacific deemed it prudent to turn the bows homeward in the hope of avoiding interception by the enemy (Clark 1884:141). Ships that were captured were burned and their crews impressed into British service, and again it was Nantucket that suffered the most; “in 1812 the inhabitants of the island owned and operated one hundred and sixteen whaling vessels: in 1815 only twenty-three strained and battered craft remained” (Hohman 1928:39).

Still needing to supply the market in London with oil, British whaling during this time continued fitting out trips to the Pacific. In an effort to ensure dominance by eliminating competition, the ships of the South Sea fleet were armed, “so that each one constituted, in itself, a letter of marque as well as a whaleship” (Stackpole 1953:262). It did not take long for the US Government to realize the defenseless condition of American commerce in the Pacific, and to guard those interests they dispatched the two-gun frigate USS *Essex*. Under the command of David Porter, the warship not only protected American merchant activities, but also effectively destroyed the British whale fishery in the Pacific (Clark 1884:143). Porter’s general strategy involved the element of surprise; a common ruse involved flying a false Union Jack when approaching enemy vessels, then running up the stars and stripes and easily seizing the lightly armed and completely surprised whaleships (Norton 2013:7). And, being far from home and ports that could be guaranteed to remain neutral, he did not sink the ships he captured—instead he claimed them as prizes and used them to build up a small fleet of support vessels (Thurn 1915:314). Replacing the loss of these ships was not only expensive and difficult (Chatwin 1996:27), it was also considered to be too risky, with the presence of an effective US Naval force in the Pacific. Though USS *Essex* was captured by the British off the coast of Peru in 1814, Porter and his crew succeeded in taking 12 of the 20 or so British whaling ships operating in the Pacific (Jones 1981:22). Thus, the Americans not only achieved their naval objectives, but also greatly helped to turn the tide of superiority in the Pacific sperm whaling industry.

The Pacific Ocean and the "Golden Era of American Whaling" 1815-1860

By the time the Treaty of Ghent officially brought an indecisive end to the war in December 1814 (Coles 1965:237), the New England whale fishery was effectively in ruins. As soon as news of the Treaty's signing reached the US, however, whaling firms began fitting out vessels for voyages. Nantucket and New Bedford whaling merchants gambled on the idea that the demand for oil would bring good prices. They wasted no time in outfitting whatever vessels they could find and sending them to the Pacific, where from pre-war experience they knew they could expect big returns in the shortest amount of time. And as it turned out, their gamble paid off handsomely (Rydell 1952:64).

William Fairburn (1945:1001) points out that American whaling "dragged" in 1816–1817 because it took time for the ships that had sailed for the Pacific in 1815 to return. This time was not wasted, however, as new vessels were built, supplies secured, and the return of the ships that hunted the closer Atlantic grounds kept them active. As soon as the first of the post-war whaleships entered their homeport, the wharves were again stacked with greasy casks and the industry entered a period of unmatched prosperity (Ellis 1991:159). Through the resilience of the industry and the productivity of the Quakers, the US quickly took the lead over other nations engaged in Pacific whaling. Thus began the era that American whaling historians have deemed the "Golden Era of Whaling" (Tower 1907), or its "Golden Age" (Davis et al 1988; Davis et al 1997).

As the numbers of ships hunting in the Pacific increased, an ever expanding knowledge of its havens and hazards developed. Though it is true that European explorers such as Cook had canvassed parts of the Pacific long before American sealers, traders and whalers, none accomplished as much for understanding its geography and oceanography as whalers (Fischer 2002:95). Throughout the Pacific Ocean are thousands of islands, reefs, and shoals that were first sighted and named by whalers; when an island or group of islands was encountered and found to have friendly inhabitants offering fresh food and clean water, their locations were noted in the logbooks and journals and eventually made it onto nautical charts (Reynolds 1828:31; Bogs 1938:185). Where possible information pertaining to sea conditions, was noted, since such data could later help to determine the best approach to an island and warn of navigational hazards. The best efforts were also made to obtain precise locations of the dangers they encountered, such as partially submerged reefs and shallow shoals, so that others could avoid the potential for shipwreck. Many of the islands and atolls still maintain these names, some after the ship and some after the master that first encountered them (Leff 1940:5). Thus, the names of Howland and Starbuck islands, Pearl and Hermes Atoll, Maro Reef and Gardner Pinnacle, are among many that are testament to the American whalers' impacts on the geography of the Pacific (Figure 12).

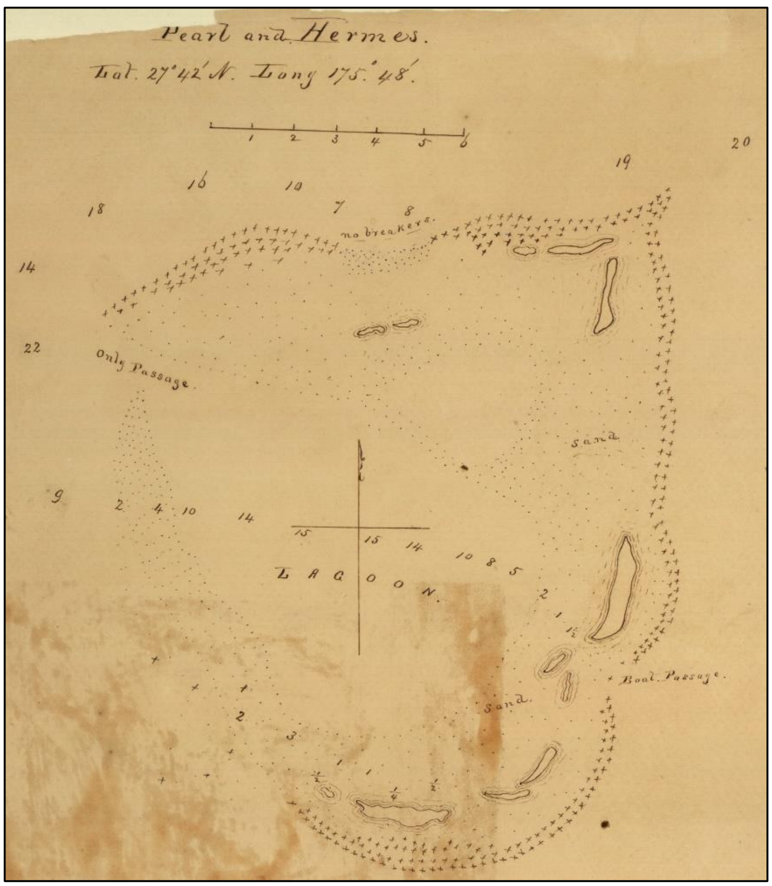

Figure 12. Captain N.C. Brooks' 1859 map of Pearl and Hermes Atoll, which takes its name from two British whaleships wrecked there in on the same night in 1822 (Courtesy of the Hawai'i State Archives [File number G4382 L37 1859 B7]).

In the decades of the early to mid-nineteenth century, the number of ships engaged in American whaling grew exponentially. From the few ships sent out at the end of the War of 1812, the number of vessels grew to 400 by the 1830s, and to over 700 hundred by the late 1840s (Rydell 1952:67). This expansion in turn resulted in the rapid exploration of the Pacific region, as the ships searched for both new hunting grounds and for islands where wood and water could be obtained easily (Thomson 1914:12). In their exhaustive analysis of the economic history of American whaling, Davis et al. (1997:38) determined that in addition to the increased number of whaleships and whalers employed in the Pacific region, the industry's growth during this period had three other major dimensions: the size and rigs of the ships employed, the number of ports that sent out whaling vessels, and the more and ever-distant grounds that they hunted. Each of these interrelated factors contributed not only to the success of American whaling in this period, but also to the impacts it had on the Pacific region.

The post-war revitalization of American whaling signaled the need for larger ships. The three main factors affecting the choice and layout of vessels employed at this time included the length of voyages brought on by the focus on ever-distant grounds; the need for self-sufficiency due to the distance from safe harbors for re-provisioning; and the potential for higher financial returns on the increased size of cargos due to imagined unlimited stocks of whales. Thus, as the industry grew, reliance on the small sloops, schooners and brigs used in the eighteenth century gave way to much larger and stauncher vessels (Davis et al 1997:38). Though in the early years of the 1820s, brigs up to two hundred tons were still being employed, they were soon replaced by ships and barks of greater tonnage. In fact, from then until the 1850s the tonnage of whaleships increased fivefold (Fairburn 1945:1627), and at its peak accounted for almost seven percent of all registered merchant shipping tonnage in the US (Chatwin 1996:6). Over the course of the "Golden Age," the tonnage of vessels increased to an average of around 400 tons.

Not all vessels were newly constructed. Many whaling merchants sought only to achieve the highest return on a voyage and rushed to get as many vessels to sea as possible; so older vessels used in other industries were commonly purchased and refitted for whaling. The most important deciding factor for whaleships in this period was cargo capacity. As their purpose was simply to fill their holds with oil, they had no need to achieve the speed of the clippers. Instead, bluff bowed and tub-like vessels were generally preferred as they provided stable working platforms (Figure 13).

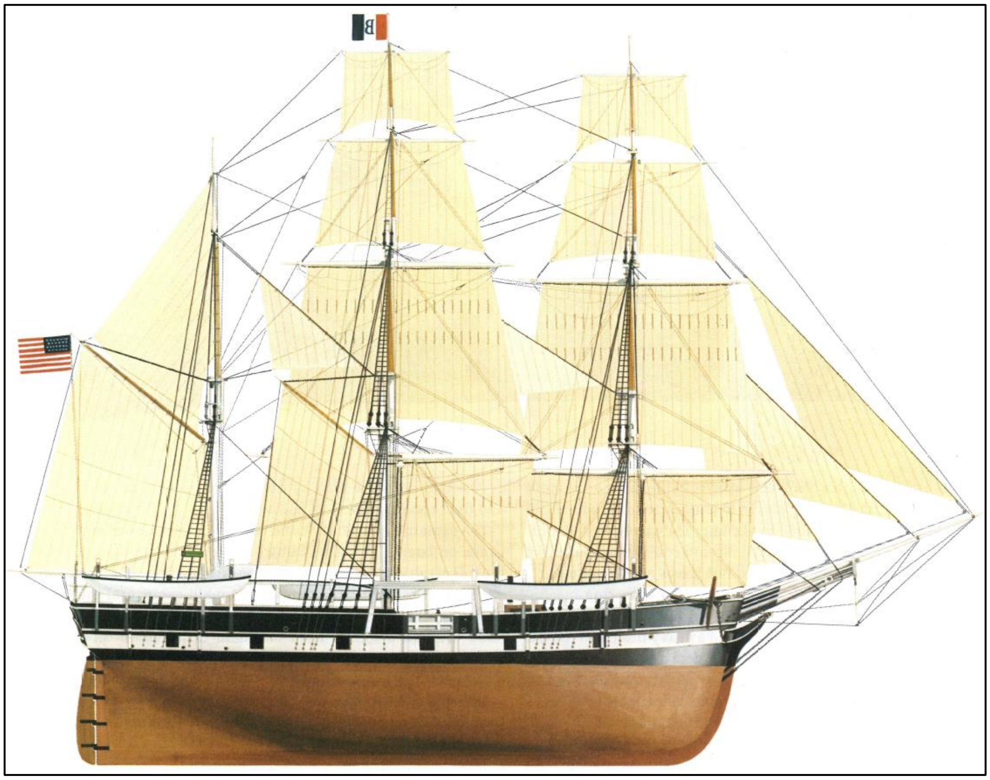

Figure 13. Built in 1826 and sold to a New Bedford whaling operation in 1841, the 371-ton *Lagoda* was employ in the trade for nearly five decades and included desirable hull features such as a tub-shape and bluff bow. From Whipple, A.B.C. 1979.

The whaling firms knew that regardless of whether old or new, their vessels would likely return from the hunt filthy and scarred from encounters with whales, reefs and shoals – despite the best efforts of the captains to keep them clean. Historian A. Hyatt Verrill (1916:56) states,

> As long as the ship held together and was able to weather the seas and gales, as long as it would carry its cargo of oil and bone, as long as the patched and dingy sails would serve to catch the winds and carry the whalers hither and thither, the whalemen were satisfied, and some of the old hulks, which were used for whaling, would appear fit only for the scrap pile to a merchant sailor.

Thus, the often dingy appearance of their smoke-blackened sails, the large brick tryworks on their decks, the cutting-tackle in their rigging, and the multiple boats hanging conspicuously from wooden davits, made the typical whaler of this period unmistakable (Hohman 1928:40).

The increase in vessel size needed for extended voyaging eventually had a direct consequence on Nantucket's significance to the industry. Since the early 1700s Nantucket was the dominant whaling port in New England, and its post-war success had a stimulating effect on the region (Tower 1907:49). The tradition of young Nantucket whalers rising through the shipboard ranks with the goal of becoming captains meant that they were extremely skilled in all aspects of whaling operations, and that a sense of pride in their profession and duty was ingrained. Despite all of their knowledge of the business, skills as seafarers, or sheer determination to constantly rebuild, however, the physical limitations of their harbor ultimately became too great. As the size of the ships grew larger, the shifting sands of the harbor bar at the entrance to Nantucket Sound became too dangerous and its shallowness greatly restricted passage of ships with full cargos. In 1839 a steam-powered, floating dock was built to assist ships in passing, but it was too late; "Nantucket had reached its peak as a whaling port in 1833 and by 1869 the last whaler crossed the bar" (Ashley 1926:33).

In the meantime, the success enjoyed by the early post-war voyages sent out from Nantucket and New Bedford led many expatriate whalers return to the US to take up the trade (Spence 1980:83). Merchants in many New England ports quickly realized the economic potential of the industry and soon harbor towns in Connecticut, Rhode Island, New York, and other parts of Massachusetts, were engaged in whaling. The rate at which New England ports joined in the rush to the Pacific can be seen as an indicator of the promise of whaling at this time; in 1820 there were 16 such towns, by 1835 there were 32, and by 1841, 38 New England coastal towns were fitting out whaling ships mostly bound for the Pacific (Davis et al 1997:41).

Of all of the New England ports, none achieved as much success as New Bedford. First established in 1765 by successful whaleship owner and Quaker Joseph Rotch (Hegarty 1960:9), the port developed slowly and quietly until it eclipsed Nantucket to become the nation's whaling capital. Though Nantucket's location farther out to sea and closer to the Gulf Stream and Atlantic grounds was advantageous in the eighteenth century, the opening of the Pacific brought with it strategic changes. Located inshore of Nantucket on the Massachusetts coast, New Bedford offered not only a spacious deep water harbor, but it eventually provided direct access to a railroad network that connected the major cities of the US. Adding to the better physical location was the dogged determinism of the Quaker ship owners—described as "tight-fisted, cruel, ruthless a set of exploiters as can be found in American history" (Morrison 1921:315). These 'oil barons' quickly established refineries, cooper's shops, tool shops, and many other subsidiary industries to become the leaders in both whaling craft production and the nation's fifth largest port for shipping (Morrison 1921:315; Fairburn 1945:1002-1003). By the 1850s New Bedford's importance to whaling grew to the extent that it became "home to the largest proportion of the fleet, with about one-half of all American whalers listing it as their home port" (Davis et al 1997:41).

Both the greater number and size of the ships and the ambitions of whaling interests in towns throughout southern New England led to the constant search for rich, new whaling grounds. The high demand for sperm oil and spermaceti, coupled with the supposition that Pacific sperm whale populations were limitless created a rush to the region. Even as the century progressed and other illuminants were substituted, the considerably viscous quality of sperm oil saw its main use shift to the lubrication of light, rapidly moving machines (Davis et al 1987:5). Therefore the demand for sperm whale products during the golden age meant that profits from voyages could be unbelievably high. Despite the potential dangers in reaching them, the richer the grounds, the easier the hunting, and the more quickly holds could be filled. These factors in turn yielded even higher returns, as the cost of outfitting was reduced by the shorter voyages.

The increasing number of ships operating in the region soon diminished the stocks of whales on the 'On-Shore' grounds along the coasts of Chile and Peru. And while expansion beyond those waters simply followed the century-old pattern of exploiting one ground and then moving on to another, as historian Richard Kugler points out, "the rapidity with which the American fleet moved elsewhere is surprising" (Kugler 1971:24). Unlike previous Europeans who explored the waters of the Pacific, Yankee skippers were "realists and practical businessmen; their quest was not for glory but for money and 'the wherewithal to make the wheels go round' and trade profitable" (Fairburn 1945:512).

The first of the new hunting areas to be located was the 'Off-Shore' grounds. In 1818 the Nantucket whaleship *Globe* sailed out from the 'On-Shore' grounds and found this new area, located south of the Equator between 105˚ and 125˚ west, to be rich in sperm whales (Bockstoce 1984:531). This discovery was followed quickly by the location of the 'Japan Grounds' in 1820 by the whaleships *Maro* of Nantucket and *Syren* of London, which proved to be a "great resort for sperm whales in the summer months, which stretched from Midway Island west to the Bonins" (Kugler 1971:24). In the same year the rich 'On-the-Line' grounds along the equator and among the Gilbert Islands were opened; these were soon followed by the 'Middle Ground' in the waters between New Zealand and Australia and the 'Vasquez Grounds' to the north of New Zealand towards Tonga (Ward 1960:44). The 1820s also saw the rise of 'country whaling,' in which ships cruised among the reefs and islands of the central Pacific (Rydell 1952:67).

During this time American whalers also operated in minor grounds throughout the Pacific such as those around Micronesia. They also hunted in the Indian Ocean, among the islands of Indonesia and the Philippines, though none of these were ever as important to the sperm whale fishery as the major Pacific grounds mentioned above (Johnson 1995:49). Of all the whaling grounds explored and exploited in the first half of the nineteenth century, probably the most productive were the Japan Grounds (Richards 2002:31). By the 1830s two patterns for cruises were established: depending on the season, they either sailed for the Pacific via the Cape of Good Hope, across the Indian Ocean to Timor, then north between the various island chains; or they entered by way of Cape Horn to the Off-Shore ground, then to on to Hawaii and ultimately Japan (Kugler 1971:24).

The increase in the numbers of ships hunting the Japan Grounds eventually brought more discoveries in the North Pacific, including the grounds toward Alaska and the Aleutians, which were identified around 1835 (Johnson 1995:48). The main species of whale found in the northern Pacific grounds was the northern right (Richards 2002:31). The location of grounds in the Arctic, such as the North West Coast and the Kodiak, was significant and by the early 1840s sperm whale populations were noticeably declining (Bockstoce 1984:531). Davis et al. explain the slow decline in sperm whales (1987:5),

> The quantity of sperm oil that the fleet brought home increased rapidly from 1820 until the later 1830s. Then growth ceased, although output remained fairly constant until the middle of the next decade. By the late 1840s, however, the catch began to decline. The fall continued, although with some significant pauses, until the end of the century.

Declining sperm whale populations resulted in the need for longer and longer voyages in order to obtain a profitable cargo. Extended cruises in turn increased the costs of outfitting and labor, as well as bringing a greater risk of disaster. The combination of these factors, the need for affordable lighting fuel, and the immense whale populations on the Arctic grounds soon led more vessels to hunt and explore this region. Thus a pattern developed whereby sperm oil was the object of the hunt while ships cruised in the south and central Pacific, but when they entered the northern waters their attention shifted to right whales and eventually to the fast swimming bowheads. For some time this pattern provided the markets with both types of oil and the industry maintained a healthy return on voyages.

Another market factor that drew ships into northern waters with greater frequency was the increasing demand for the baleen of right, bowhead and humpback whales. Generally referred to as 'whalebone', baleen plates are located in the back of a whale's mouth (Lawrence and Staniforth 1998:5) and were a highly valued industrial commodity,

> Because it could be cut into long strips or indeed any shape that the baleen plate would allow, without sacrificing its strength or springy flexibility, and could also be moulded [sic] by steam to hold a new shape, it was used in a number of items where resilience was required, among them umbrella spokes, buggy whips, hat brim stiffeners, brush bristles, and corset stays (Bockstoce 1984:531).

As a result, the demand for whalebone skyrocketed and whaling merchants began to realize higher prices for cargos of whalebone and whale oil than for sperm oil. An industrial boom occurred with the opening of the Kamchatka and Sea of Okhotsk grounds in 1846–1847. By the early 1850s the Arctic bowfin whale fishery was underway and by the 1860s almost the entire

Pacific fleet cruised the area (Jenkins 1921:236). Success in the arctic fishery meant hunting amongst ice floes, an activity which came with increased risks; as a result measures such as reinforcing vessels' hulls by placing additional strengthening members in their bows and adding extra layers of planking to avoid puncture by ice were necessary. It only took a little over half a century for whalers to deplete the sperm whale populations of the Pacific and to penetrate the Arctic, which in the coming decades became the most important of all the whaling regions (Tower 1907:59-60).

The Decline of American Whaling

The apogee of American whaling occurred from 1852 to 1858 and the industry maintained its profitability by focusing on the Arctic grounds (Hohman 1928; Fairburn 1945:1038-1039). By the end of the decade, however, several factors began to take a toll on operations, which led to the rapid decline in tonnage of the whaling fleet throughout the 1860s (Table 1). Some of the reasons for this decline were directly attributable to the practices of the whaling firms; these included over-exploitation of whale populations, increased costs of outfitting and less profitable returns on whaling ventures, necessarily longer voyages of the ships, and greater difficulty in obtaining competent crews (Fairburn 1945:1039). In addition, there were a number of uncontrollable factors external to the industry that also had devastating effects.

Table 1. Table illustrating the decline in total tonnage of the American whale fleet for selected years from 1859 to 1867. From Fairburn, W.A. 1945.

Year	Registered Tonnage	Percentage Decline from Average Tonnage 1852-1858
1859	185,728	3
1860	166,841	13
1861	145,734	24
1862	117,714	39
1863	99,228	48
1864	95,145	50
1865	84,233	56
1867	52,384	73

The first of these external factors was the mid-nineteenth-century California gold rush. The discovery of gold at Sutter's Mill in 1848 and the "get rich quick" stories that followed led many people to leave the east coast of the US for the west. The main port of call for these would-be miners was San Francisco, which by this time was also a resupply and transshipment point for whalers. As news of the gold rush spread among the whalers, many saw it as an opportunity to give up the hard life at sea and soon deserted their ships. As the price of passage to the west increased, those familiar with the sea knew that they could obtain a free trip out by signing on to a Pacific whaling voyage and then deserting the ship when it arrived in San Francisco. This practice became so prevalent that sometimes whole crews, often including the captains, deserted en masse (Robotti 1962:196).

The negative impacts of the gold rush not only affected the industry by luring away experienced whalers, it also reduced the number of vessels employed in the industry, due to both their reconfiguration for use as passenger vessels and to the abandonment of large numbers of them along the northern California coast, which in turn greatly reduced the numbers of New England ports fitting out voyages. By the late 1850s only New Bedford and its neighboring towns, such as Mattapoisett, Fairhaven and Dartmouth, maintained an increase in vessel numbers and industrial investment (Hawes 1924:196).

Another turning point was the US Civil War (Kugler 1971:26). As with the Revolutionary War and the War of 1812, the Civil War (1861-1865) had a crippling effect on American whaling (Dolin 2006:309) through economic sanctions, a lack of demand for oil due to decreased capital, and the destruction of the fleet. While the right to own slaves can be considered a main issue that led to the war between the Union and the Confederate States of America (CSA), there were many other economic and political differences between the states that led to its outbreak. As such, the impacts of the war on commerce and trade were a by-product of these larger national issues. Of the wartime actions that affected the output of whaling during this time, perhaps the two most significant were those that contributed to the size of the fleet.

The first of these factors was the CSA's strategy of disrupting commerce through attacks on whaleships. This tactic was executed by the Confederate raiders CSS *Alabama* operating in the Atlantic Ocean and the CSS *Shenandoah* operating in the Pacific; together their actions resulted in the loss of 80 whaleships, several of which were attacked after the war ended officially (Starbuck 1878:103; Kugler 1971:26). The other major military strategy that affected the whaling fleet was the Union's attempt to blockade the harbors to the southern ports of Charleston, South Carolina and Savanna, Georgia. Known as the 'Stone Fleets', US Naval officials purchased some 40 whaleships from various New England ports, filled their cargo holds with stone, sailed them south, and sunk them in strategic positions to "prevent the entrance of blockade runners and the ingress and escape of privateers" (Starbuck 1878:101). Problems encountered with positioning the vessels during their scuttling were compounded by tropical storms and the "the ceaseless flow of the sea," which quickly created channels between the ships, thus making this submerged wall largely ineffective (Songini 2007:140).

Though after the war the prices for whalebone rose dramatically, the return was not sufficient for most firms to justify outfitting a large number of ships (Heffer 2002:53). As both the grounds and the types of whales hunted had changed, the need for newer technologies became apparent when considering the cost of replacing vessels lost during the war. Thus, over the next few decades the number of sailing ships hunting whales dwindled and steam-powered vessels were brought into service. Overall, the Civil War is estimated to have reduced the number of ships in the whaling industry by 60 percent between 1860 and 1866 (Morgan 1948:143; Vance 2002:41).

The final and most portentous factor contributing to the eventual demise of American whaling was the introduction of alternatives to whale oil. As the supplies of whale oil decreased and became little more than lubrication for the industrial revolution, the average American household turned to burning tallow candles and lard as illuminants. By the late 1820s products such as a coal-gas by-product called benzene, 'rosin oil' or 'burning fluid' made from pitch pine, and a turpentine distillate known as 'camphene' had all been tested as possible alternatives to whale oil (Beaton 1955:30). Though these fuels were consumed to some extent, they were also highly volatile, smelly, and smoky, which generally precluded their everyday use; however, this situation soon changed with the discovery of petroleum in 1859.

First discovered in the US in Titusville, Pennsylvania, the value of petroleum as a substitute for whale oil was realized quickly (Daum 1959:21). In the years prior to its discovery, experiments with obtaining oil from coal in England were successful, but it was a distillation process for manufacturing kerosene patented by A.P. Gesner that brought about a revolution in lighting and lubrication (Gesner 1861). As the refining processes for kerosene improved, the "disagreeable and dangerous qualities were no longer a handicap" and it quickly began to rival other oils (Tower 1907:77). Seemingly overnight the groundwork for mass consumption of petroleum oils was laid and by the fall of 1859 at least 33 'coal-oil' refineries were actively engaged in the manufacture of hydrocarbon illuminating oils (Beaton 1955:28). The by-products of the refining processes were also found to be excellent lubricants, which further added to the versatility of petroleum. Ease of extraction, simplicity of refining, ever-increasing discoveries of deposits around the county, and the growth in its use as machinery fuel are among the factors that allowed the industry to quickly dominate.

The development of the petroleum industry had devastating consequences on American whaling. As it coincided with the Civil War, by the mid-1860s the more expensive whale oils had largely been abandoned for the cheaper petroleum products. As petroleum use grew, even the whaling merchants of New Bedford realized that it would be the end of their industry and therefore invested in the construction of a petroleum refinery (Ellis 1991:166). Thereafter, demand for baleen kept the whaling industry afloat and the ever-diminishing fleet concentrated their hunting efforts on the Pacific Arctic (Kugler 1971:26). The focus on the Arctic region and on its fast-swimming bowhead populations meant that use of steam-powered vessels and bow-mounted harpoon guns became the rule. Thus, by the last quarter of the nineteenth-century the sperm whale fishery, and indeed the old way of whaling, was all but gone. As one author argues, "whale oil had become an anachronism… the age of petroleum had begun" (Ellis 1991:166).

Summary

The evolution of American whaling from its European origins led to organizational and technological adaptations in the second half of the eighteenth century that enabled it to become a highly successful, global enterprise. Despite poor diplomatic relations with the UK in the late eighteenth and early nineteenth centuries, which hampered its operations, the

American whale fishery flourished when the fleet began to hunt throughout the expanse of the Pacific. American whalers found great success on Pacific whaling grounds, which resulted in rapid expansion of the fleet and in US prominence in the region from roughly 1820 to 1870. A number of factors, mainly uncontrollable however, led to industrial decline and in the decades that followed the golden age American whaling became obsolete.

CHAPTER 4. Hawai'i: Entrepôt for Pacific Whaling 1819–1870

The boom that occurred in whaling after the War of 1812 had a profound impact on the trajectories of the American whale fishery. The opening of rich hunting grounds, coupled with the establishment of regular trade in the Pacific Ocean at the end of the eighteenth century, not only increased geographic and economic expansion, but also resulted in a fundamental change in the way that American whaling agents operated. In an effort to maximize the efficiency of their whaleships, the practice of resupplying vessels at established locations and transshipping oil cargoes was increasingly used. This change in business strategy had a dramatic effect on the success of the American fishery transforming the sleepy harbors in the main Hawaiian Islands into bustling centers of trade and activity. This chapter explores the colonization of the Hawaiian archipelago and its development as an entrepôt for Pacific traders and whalers, describes the dangers encountered by ships transiting between Hawaii and the hunting grounds of the central and northern Pacific, and introduces the wrecks of whaleships that are known to have occurred in the Northwestern Hawaiian Islands.

Colonization and European Trade

The Hawaiian archipelago, located in the central North Pacific Ocean (Figure 14), comprises a grouping of larger islands, commonly referred to as the 'main Hawaiian Islands' at its southern end, and a chain of islands, atolls and shoals known as the Northwestern Hawaiian Islands, which extend to the northwest (Papahānaumokuākea Marine National Monument 2011:1). The geographical location of the islands provides a tropical climate that offers abundant fresh water sources and a highly productive agricultural environment; it is these characteristics that have attracted people to the islands for nearly two thousand years.

Polynesian voyagers are considered the first people to inhabit the Hawaiian Islands. They arrived in the latter phase of a two-pronged Pacific colonization movement that archaeologists and linguists generally agree began approximately 3500 years ago (Bellwood 1979:282; Russell 2009:63). Though the exact arrival date is debatable, at some point between 0 and 500 B.P. seagoing canoes from the South Pacific encountered the uninhabited islands of

Hawaii (Finney 1994; Van Tilburg 2002a:248). This contact resulted in a “long period of two-way communication” (Van Tilburg 2002a:248) between the two distant areas of the Pacific and contributed to the development of complex cultural traits which were manifested socially, linguistically, and technologically.

The appearance of Europeans approximately five hundred years ago marked the start of the great age of European exploration in the Pacific (Daws 1968:*xi*). Beginning with sixteenth-century Spanish navigators searching for an alternate route to trade with the East Indies, European exploration and contact had dramatic effects on the economic and cultural development of the Pacific islands. Thus, the Hawaiian Islands escaped Spain’s attention and remained isolated and unknown to Europeans for over two hundred and fifty years (Gschaedler 1948:302; Daws 1968:*xi*).

Spanish success in establishing a reliable trade route across the vast Pacific spurred other European countries to explore in the hope of expanding their colonial networks. Seventeenth- and eighteenth-century expeditions undertaken by Dutch, French and British navigators resulted in significant geographic and scientific discoveries throughout the region. It was during the course of one such expedition that the Hawaiian Islands were first documented. On his third round-the-world voyage for the Royal Society of London, Cook sighted them in January 1778 (Coulter 1964:256). In honor of the first Lord of the British Admiralty—and an important backer of the expedition—Cook called the group the Sandwich Islands and that name was commonly used until the 1840s (Manchester, Jr. 1951:80; Clement 1980:55). Bound by his orders from the British Admiralty, only brief landings were made to secure provisions at the islands of Ni’ihau and Kaua’i. Soon thereafter Cook headed for the northwest coast of North America for mapping operations, and once these were completed he returned to Hawaii to explore the main group of islands (Manchester, Jr. 1951:80). Though no problems with Native Hawaiians were experienced in the subsequent months, just prior to their departure for England in February 1779 Cook was killed in a dispute with some of the chiefs at Kealakekua Bay (Gilbert 1926).

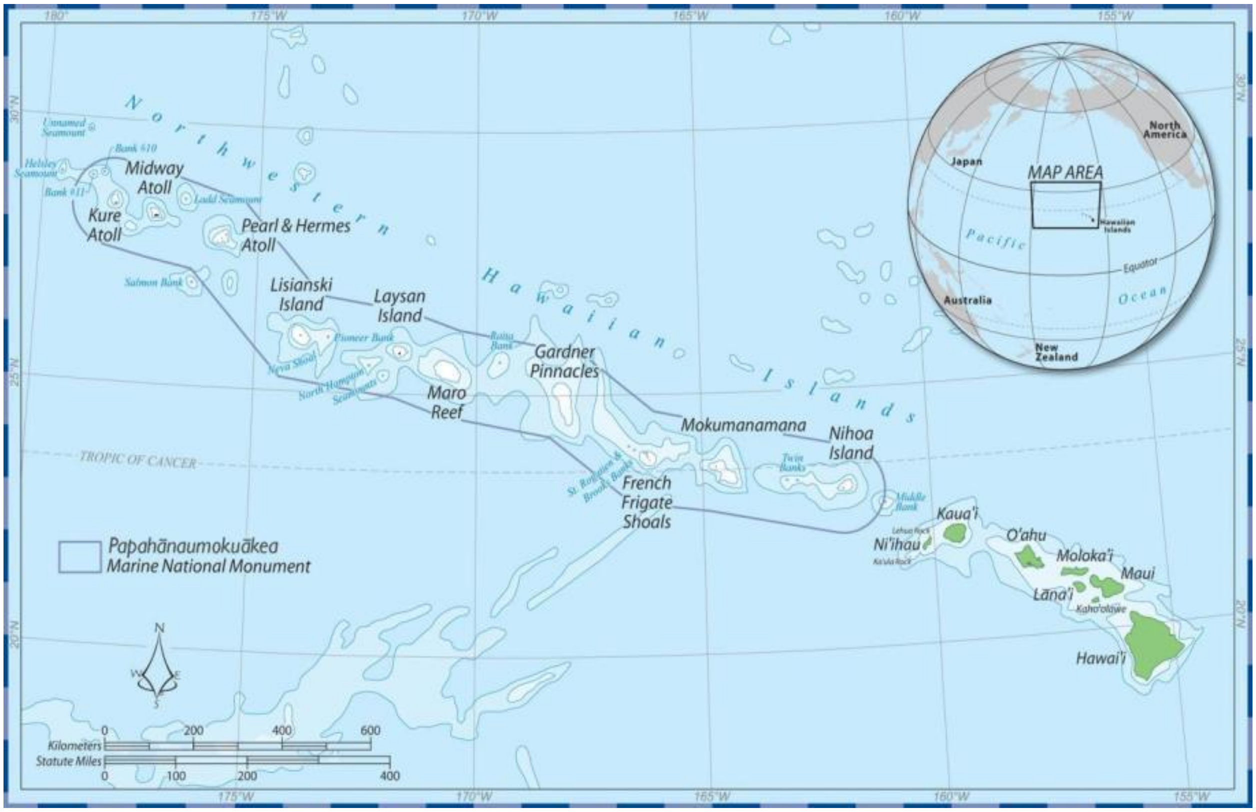

Figure 14. The Hawaiian archipelago in the central North Pacific Ocean (image courtesy of Papahānaumokuākea Marine National Monument).

In the years following the return of Cook's ships to England, accounts of the expedition were published which contained detailed information about new geographical discoveries, as well as remarks pertaining to the commercial potential for establishing a trade in sea otter skins (Dodge 1976:55). First introduced to the sea otter through trade with Russians, the Chinese prized the fine, soft, thick fur of the creatures (Dodge 1965:58). Acting on the assertions made by the Cook expedition chroniclers, entrepreneurial merchants, first from the UK and then the US, began to speculate on newly opened markets in Asia by 1785. They sent cargos of the highly desirable sea otter furs, as well as prized ginseng root, to China to be traded for equally valuable cargos of tea, nankeens, chinaware, silks, and drugs (Rydell 1952:23). Those early voyages proved successful and did more than just generate great profits for their investors—they also laid the foundations for what would become known as the China trade.

Though the British took the lead in the first few years of the China trade (Hezel 1983:133), pioneer Yankee traders were soon exchanging goods with native hunters of the northwest coast of America and outpacing their competition. Though this practice was considered extremely dangerous at the time, the risks were abundantly rewarded with large cargos of inexpensive furs for which they exchanged goods such as “guns, ammunition, hardware, textiles, beads, and baubles” (Howe 1984:171; Miller 1988:8-9). The trade was given a major boon with the spread of news of an abundance of fur seals along the northwest coast of America.

By the late 1780s American fur sealers developed a pattern for their voyages (Figure 15) to best deal with seasonal sea conditions; they sailed from Canton (Guangzhou), China, to the northwest coast to hunt or trade for sea otter and fur seal skins, then replenished their supplies in Hawaii over the winter while avoiding dangerous storms, and then returned to Canton to sell the furs for a small fortune (Fischer 2002:95). The addition of seal skins to the cargos destined for the China trade caused dramatic increases in profit margins for the Americans. Though European traders soon attempted to replicate this success, the persistent conflicts of the Napoleonic period depleted their capital and allowed the merchant adventurers of the US to ply the trade almost without competition (Kuykendall 1931:369).

By the early 1790s the British monopolies in the Pacific were also engaged in the trade; the East India Company sold furs at the markets in Canton, while the South Sea Company provided them to the London market (Smith 2002:4). Though the fur seal trade remained profitable for the next twenty years, fierce competition between these two, compounded by almost constant warfare in Europe, ultimately resulted in English disappearance from it altogether (Howay 1932:7). Thus, American interests, mainly from Boston, dominated the trade in the first decade of the nineteenth century and, despite fluctuations in prices resulting from over supply and unpredictable international markets, they profited handsomely from it (Rydell 1952:28). Growth of this industry was, however, always to be limited by seal populations and “the high prices obtained in the early years led to intensive exploitation and rapid depletion of known colonies” (Smith 2002:4).

Figure 15. Early nineteenth century map of the Pacific Ocean by Henry Schenk Tanner; delineating the North Pacific Fur Trade route (image courtesy of Library of Congress Geography and Map Division [G9230 18-- .T2 TIL]).

Throughout its early development, the Hawaiian Islands proved to be an important component of the China Trade. The long passages between Canton and the northwest coast of America depleted provisions and the time required on the return meant that crews suffered through violent winter storms in the North Pacific. A solution to both of these issues was soon found when traders realized that Hawaii was ideally equipped to operate as a provisioning point for ships bound for China and as a place to winter before returning to the northwest coast (Dodge 1976:17). The first American to make contact with the Hawaiian Islands was Captain Robert Gray, whose Boston trading vessel *Columbia* stopped there in 1789 in the course of his circumnavigation of the world (Tate 1980:1). Gray's reports of a tropical environment, safe harbors, and agreeable inhabitants soon resulted in the islands becoming a requisite stopover for most American traders.

When American traders first arrived, the Native Hawaiians were "happy to provide whatever and whomever they could exchange for nails, hoop-iron (for adzes) and cloth"

(Fischer 2002:95). In exchange for such goods the ships could obtain fresh water, fruits and vegetables, hogs, and salt, as well as useful goods, such as rope made from native fibers. Other attractions included native crafts and souvenirs that sailors took home to their families, alcohol, and women with whom to spend the night (Dodge 1976:57-58). The incredible seafaring skills and fitness of Hawaiians was quickly recognized and soon they were being recruited to fill the positions of crew that were lost or had deserted (Kuykendall 1934:369). Realizing the potential for obtaining greater power, by the 1790s the chiefs also wanted "gunpowder, muskets, small cannon, and ships' boats," which they used against their intra- and inter-island rivals (Fischer 2002:95). Regardless of the exchanges and provisioning, it appears that the opportunity to easily break up the rough voyages in such a warm, tropical location was worth any price, as the Hawaii islands were considered the "summer isles of Eden"(Howay 1932:10).

The lucrative fur trade began to decline by the end of the first decade of the nineteenth century due to the over-exploitation of resources and financial crises (Smith 2002:4). As such, the strategy of the traders changed and the stopovers in Hawaii were all but discontinued. Instead, the ships spent the entire year moving between Indian villages on the northwest coast trying to obtain suitable cargos (Howay 1932:10). But just as the fur trade was declining the China Trade was given another boon through the introduction of sandalwood.

Europeans and Americans first discovered that sandalwood grew in the Hawaiian Islands around 1790. Capitalizing on the knowledge that the Chinese had a long history of using Asian sandalwood as incense and in the making of delicate furniture pieces (Tate 1980:1-2), a few American vessels began shipping it as a commodity to the Canton market. Although these early voyages were successful, they were discontinued after 1795 while King Kamehameha I engaged in the conquest of the various islands in order to consolidate power in Hawaii under a single monarchy (Rydell 1955:38). Once completed, trade in the islands was re-initiated and in 1804 Hawaiian sandalwood was again shipped to China (Dodge 1976:61). Though considered inferior in quality to Asian varieties of sandalwood, centuries of careless exploitation had exhausted those supplies and in turn created a need for an alternative source (Oliver 1989:161). Thus, when sandalwood from Hawaii and other parts of the Pacific—such as Fiji and the Marquesas—was introduced it quickly became prized (Ralston 1978:13). By 1810 its use in topping up the cargo hold of a ship low on skins became standardized and it was an important element of the China Trade (Dodge 1976:61).

Hawaiians and other Polynesians also valued the qualities of sandalwood and mixed it with coconut oil to be used as an aromatic body rub (Gibson and Whitehead 1993:159). Kamehameha I, however, understood its value as a commodity to be sold to the Chinese and soon Hawaiians were combing the archipelago for sandalwood (Manchester, Jr. 1951:83). Seeing the scented wood as the key to developing an empire and establishing a Hawaiian navy, from 1815 the king and his son, Liholiho (Kamehameha II), traded large quantities of the wood (Dodge 1976:61). By 1823 the Hawaiian sandalwood boom was over. As with other commodities that were sold as part of the China Trade, over-exploitation not only depleted the resources, it also resulted in an over-supply to the Canton market. This glut drove prices down and the Hawaiian suppliers never recovered (Ralston 1978:14). After that point a small amount of the fragrant wood continued to be shipped from the islands until 1835, when the resource was nearly exhausted and the trade was abandoned altogether (Freeman 1951:346). Though it would seem that the loss of this trade should have resulted in the decline of the now-dependent economy of the Hawaiian Islands, the discovery of new whaling grounds supplemented the China Trade and brought with it an era of development that forever changed the islands.

Pacific Whaling and the Japan Grounds

The sandalwood era was brief and hectic, but it had long-term significance in the Hawaiian Islands (Bradley 1943:278). Prior to its development as a commodity, the islands served merely as a stopover point for vessels in transit; however, the increase in the number of ships resupplying or picking up cargos in the early decades of the nineteenth century resulted in increased importance of Hawaiian ports to trade. As a consequence, Honolulu slowly developed into the “center from which radiated the trade routes to the eastern and central Pacific” (Bradley 1943:278). Its significance was further underscored when it became the monarchy’s chosen hub and Kamehameha I took up residence in Waikiki in 1804 (Tate 1980:2).

Since the Kingdom of Hawaii had the only suitable ports within a four thousand mile radius (Day 1967:169), American and British mercantile interests forged strong alliances with Hawaiian royalty and were soon allowed to establish agencies in Honolulu (Igler 2004:709). In the early period the shipping agents assigned to these houses performed a dual role; they "supervised the purchase of sandalwood and its shipment to Canton" and "were charged with the disposal, either in the Hawaiian Islands or along the American coast, of the cargoes of American manufactures sent to the Pacific by their employers" (Bradley 1943:278). In order to provide the residents of the islands and visiting crews with easy access to increasingly desired goods, a few small retail stores were set up at Honolulu. As more merchant vessels visited, the harbor developed into an veritable entrepôt for European merchandise in the Pacific where consumers could find "a variety of manufactured goods equal to that which could have been found on the shelves of a small-town merchant in New England" (Bradley 1943:278-279).

The extension of whaling into the western Pacific added a new element to the maritime commerce, which radiated from Hawaiian ports (Bradley 1942:79). During much of the first two decades of the nineteenth-century, British whaleships roamed throughout the South and Mid-Pacific discovering new grounds, while American vessels hugged the western coast of South America (Hezel 1994:133). After the War of 1812, however, it was American whalers who were responsible for expansion into the far reaches of the Pacific, and the rapidity with which they did so is surprising (Kugler 1971:24). Always looking for new grounds to quickly fill their holds, American whalers pointed the bows of their ships to the unexplored north. It was during this exploratory phase that they first touched at the Hawaiian Islands; in 1819 the New Bedford whaler *Balaena* sailed into Kealakekua Bay on the island of Hawaii and became the first to harpoon a whale there (Dorsett 1954:42-43). Though whaling in waters directly off the Hawaiian chain would never be very productive, this event was nonetheless significant because it signaled the beginning of a 'gold rush' of sorts that would soon see Hawaiian ports take a prominent place in the commerce of pelagic whaling.

In 1819 both American and British whaleships first called at Honolulu, which was then nothing more than a cluster of grass huts and a few previously-established storefronts (Allen 1973:181). While in port, the captain of a Massachusetts merchant ship reported having seen "great numbers of whales off the mysterious and forbidden Japanese Islands" (Fairburn

1945:512) and the whaleships that received this news immediately raced in that direction. Of the five that sailed, it was *Maro* of Nantucket and *Syren* of London that were first to take whales and in doing so are credited with opening the 'Japan Ground' in 1820 (Mrantz 1976:4; Gibbs 1977:59). This expansive sperm whale haunt is recognized as being among the most productive ever identified, though its boundaries were somewhat ambiguous. Pacific whaling historian Rhys Richards' research into the subject determined that there were actually three 'fisheries', or grounds and, although whalers used several names to identify the area, the biggest sector of what was referred to as the Japan Grounds stretched from top of the Northwestern Hawaiian chain towards Japan (Richards 1999:89).

Because Japanese ports were closed to foreigners, this discovery proved to be a major catalyst in the development of Hawaiian Island ports as the principal provisioning points for whaleships working in the region (Kuykendall 1934:381). News of the productivity of the Japan Grounds spread like fire and the number of ships calling into Hawaii grew exponentially. In 1820 only five ships cruised on the grounds, but within three years 60 called at Honolulu while en route (Mrantz 1976:9) and by 1829 that number nearly tripled (Daws 1968:169). Though the Japan Grounds were the main focus of the early years, new grounds opened in the North Pacific around 1835, followed by more in the Sea of Okhotsk in 1847, and finally those in the Bering Sea and Arctic Ocean just before 1850 (Johnson 1995:48). Each of these discoveries resulted in a better understanding of the seasonal movements of whales, which had a major impact on hunting strategies. These changes in turn contributed to the importance of the northern, rather than the southern, Pacific as the central focus of American whaling and made Hawaii an industrial crossroads (Johnson 1995:48).

Knowledge of sperm whale migration in the Pacific and the predictably unpleasant weather experienced during some parts of the year resulted in a reliable pattern for whalers and merchants alike. During the summer, ships hunted the fertile grounds in the North Pacific; then, as the water cooled and the sperm whales moved closer to the Equator and South Pacific, the ships followed. Because a season of whaling exhausted the supplies of fresh water and provisions that were kept onboard, whaleships could easily visit Hawaiian ports to replenish while transiting in either direction. Thus, each spring and fall, many ships called in for two to three month-long layovers (Kuykendall 1934:381). Whaling captains realized that these stops provided not only the opportunity to resupply and refit vessels, but also offered shelter from foul weather and gave the sailors a much welcomed break (Freidel 1943:381).

The adoption of this seasonal pattern by sperm whalers affected the development of the Hawaiian Islands. As the grounds were extended farther and the whale populations were reduced, the duration of the voyages became longer. Along with the length of voyages came other needs, such as secure ports equipped with dependable sources of fresh provisions and merchandise for replenishing ship's stores; facilities for repairing and refitting ships damaged while on the grounds; and recreation for the crew. In order to provide these necessities each ship was required to pay a tax and dues to the local harbormaster. Thus the visits from the whalers provided revenues that helped to develop port infrastructure (Gibbs 1977:60).

From the earliest visits of whaleships it was clear that Hawaii was to become an integral component of Pacific whaling and American commerce in general. Acting on this presumption, in 1820 US president James Monroe stationed a commercial agent there to protect the interests of American merchants and seafarers engaged in the commerce of the North Pacific (Bradley 1943:279). The British government also appointed a consul to the Sandwich, Society and Friendly Islands, who arrived in Honolulu five years later and was tasked with keeping detailed records of general trade and commerce (Macallan 2000:90). US presence in the islands strengthened American relations with the monarchy and exacerbated the difficulties experienced by the British southern whale fishery, which in the short term led to the abandonment of its bounty system and eventually to its withdrawal altogether. The dominance of the US in Hawaii is easily visible in the numbers of shipping arrivals at Honolulu between 1824 and 1843 (Table 2); of approximately 1700 whaling ships anchoring during that period, roughly 1400 were American—on average about 85 annually—while slightly more than 300 were British (Kuykendall 1930:49; Tate 1980:3). The prevalence of American whaleships of course meant that American merchant houses and shipping agencies established during the period of the China Trade were provided with great opportunities through the standardization of their visits.

Table 2. "Comparative Table for Twenty Years of the Annual Arrivals of Whaling and Merchant Vessels at the Port of Honolulu, S.I., formed from a Register kept by Mr. S. Reynolds, Merchant of Honolulu." Simmond's Colonial Magazine 5(19):254.

Whaleships visiting Honolulu	1824	1825	1826	1827	1828	1829	1830	1831	1832	1833	1834	1835	1836	1837	1838	1839	1840	1841	1842	1843	**Total**
American	69	22	91	64	84	83	75	60	101	89	93	63	57	50	62	58	41	53	53	109	**1377**
British	18	14	16	18	28	26	19	21	17	18	18	13	16	17	11	2	4	6	14	7	**303**

Whaling agents in New England also recognized that the standardization of seasonal visits and the protection of American commerce in Hawaii could greatly benefit the industry. Realizing the potential to capitalize on the fruits of the preceding season's labor, the habit of transshipping cargos of oil soon became commonplace. As older whaling grounds were depleted the need to venture ever farther into the Pacific, Indian, and Arctic Oceans grew. The cruises were lengthened even more by the habit of ships returning to their home ports in New England to unload their cargos, which in turn resulted in time and money being lost. Thus, by the early 1830s, agents were establishing warehouses in foreign ports as transshipment and resupply points (Davis and Gallman 1994:60-61). In an article about whaling in the North Pacific, historian John Bockstoce (1984:531) summarized the benefits of transshipping by stating,

> This practice, which helped to cushion the financial distress should the whaleship be lost, also served to lessen the whaleship's function as a freighter to carry the ship's oil. If a ship were carrying the oil from an entire voyage, the captain might well have had to modify his tactics as the cargo accumulated, balancing the desire to preserve a valuable cargo with the need to take risks in search of whales. The practice of transshipping his cargo two or three time a year therefore allowed the master to maintain a more aggressive search for whales in waters that were often poorly charted or known to be dangerous.

The system of transshipping cargos was quite successful and proved to be one of the most important developments in nineteenth-century American whaling. Clipper ships that arrived in the islands with goods to be sold in the merchant houses of Honolulu and Lahaina were soon returning to the mainland with oil and bone, while the whalers returned to their hunting (Hogue 1947:7). Voyages to the North Pacific and Arctic grounds soon averaged four years in length, though some lasted up to six. Whaleships themselves also participated in transshipment; if at the end of a cruise their holds were not full, the cargos were augmented with oil or bone from other vessels. Thus, this innovative practice resulted in a "much more efficient allocation of the industry's capital stock" and by the early 1840s almost every agent had adopted the process (Davis and Gallman 1994:60-61).

Throughout the first half of the nineteenth century several ports in sheltered areas around the Hawaiian Islands developed to provide for visiting whaleships. Fresh water sources and stocks of firewood were abundant and the climate proved perfect for agriculture and raising livestock. Communities prepared for the visits accordingly; farmers heavily planted the mountain slopes, ranchers fattened cattle and pigs, and wood was collected and stored. Aside from water and wood, visiting whalers could find freshly slaughtered meat; sugar, molasses, and coffee; vegetables such as potatoes, pumpkins, onions, breadfruit, taro, and cabbages; and fruits which helped to stave off scurvy, such as oranges, pineapples, melons, coconuts, and bananas (Allen 1975:182). For whaleship crews who had spent many months living on "salt-horse and hardtack", these fresh provisions were a welcome supplement to their diet (Day 1967:134).

A by-product of these seasonal visits was the introduction of Native Hawaiian sailors as a source of labor for whaleships. Often, when the ships called at Hawaiian ports they were missing crew members who had either deserted in other ports or had not survived the previous season. Whaling masters quickly took note of the fact that Indigenous peoples of the islands were instinctive sailors with superb boat skills and were "friendly, even-tempered, and generous"—all of which were characteristics that made them desirable additions to the crew of a whaleship (Allen 1975:183). The attractions of voyaging the world's oceans were enough to encourage many young Hawaiians to sign on to whaling cruises where they worked alongside international crews and experienced the world outside of their islands (Day 1967:134). Called *kanakas* from the Hawaiian word for 'person,' Hawaiians were expert crew members and soon became highly sought after for their skills—so much so that over time "New England whalers found it more lucrative to leave the US with a skeleton crew and sign on 'kanaks' on their arrival in Honolulu" (Fischer 2002:101). Furthermore, their abilities were such that they quickly gained a reputation as being among the finest whalers and harpooners in the fleet and by the 1830s as many as 3,000 native Hawaiian seafarers were crewing American and European vessels (Fischer 2002:101).

While minor ports such as Waimea and Koloa on the island of Kaua'i or Hilo on Hawai'i Island were convenient for obtaining fresh produce, recruiting local sailors, or simply for taking shelter (Gibbs 1977:60), it was Honolulu on the island of Oahu and Lahaina on Maui that became the major ports in the archipelago. Although the port fees were much lower and prices of provisions reasonable, the anchorage at Lahaina offered poor protection from the seasonal gales (Freidel 1943:381). As such, Honolulu dominated as the premier port throughout much of the whaling boom period (1820-1860). Offering a well-protected harbor, many shops, and ship repair facilities considered superior to any other in the North Pacific (Bradley 1942:217), Honolulu attracted the whaling fleets of the US, UK, and many other nations (Gibbs 1977:60). In a relatively short time the impacts of the whaler's retreats, however, took their toll; the waterfront lost much of its beauty and grew to look like "the seedier parts of ports back home, with boarding houses, gambling parlors, poolrooms, and grogshops in ample supply" (Dolin 2006:247).

By the middle of the century the ports of Honolulu and Lahaina were hosting hundreds of whaleships annually, peaking in 1846 when the number of arrivals reached 596 (Mrantz 1976:9; Dolin 2006:246). Without a doubt, the phenomenal growth experienced throughout the Hawaiian Islands in the early to mid-nineteenth century was due in large part to the seasonal visits by the whaling fleets. Hawaii's development as an entrepôt resulted from a combination of factors including the discovery of new hunting grounds, the investment of capital by merchants, the standardization of seasonal stopovers, changes in the business structure, and the way in which whaling agents capitalized on voyage profits. And while none of these can be seen as the single most important element, one thing was certain—it all depended not only on the success of the whaling crews while on the grounds, but also on their ability to access them safely.

Northwestern Hawaiian Islands: Dangerous Route to the North

The natural wealth of the Japan Grounds, in conjunction with others in the central and South Pacific, was enough to supply the whale fleets with sperm oil cargoes for nearly two decades. Eventually, however, those resources were overexploited and the returns diminished, causing changes to the patterns of seasonal hunting. Instead of solely concentrating their efforts on the Japan Grounds, whalers passed through the area taking what sperm whales they could find before expanding their geographic scope to the north in search of the next boom. By that time the numbers of British ships fishing in the North Pacific had all but disappeared and the American fleet took a dominant role (Rydell 1952:65). Understanding that the waters to the north were generally too cold for sperm whales, they altered their strategy to search for right whales as well.

These exploratory voyages quickly paid off; between 1830 and 1850 the whalers were rewarded with consecutive discoveries of several fertile right whale grounds all across the Arctic region (Kugler 1971:24), as well as bowhead grounds in the Bering Sea in 1848 (Bockstoce 2006:54). Coincidentally, during this period prices for sperm oil dropped and the demand for right whale oil and whalebone increased considerably (Bockstoce 1984:531). The new grounds soon became the main focus of most of the American fleet's activities and remained so until the decline of the whaling industry around 1870. Throughout this period Hawaii remained an important port of call for the whalers, but by the late 1850s San Francisco slowly gained prominence until it took the place as the dominant Pacific port for Arctic whaling (Spears 1910:415).

Although much of the North Pacific was not explored officially or mapped until the middle of the nineteenth century, the lure of filling cargo holds with oil and turning quick profits brought whalers in droves. In doing so, the captains of these vessels greatly increased their chances of damage or loss through encounters with the many shallow reefs and tiny atolls that rise up quickly of out of the region's generally deep water. Often, such dangerous oceanic features were completely uncharted and when encountered at night or in conjunction with a storm, the results were catastrophic. Ship's captains did their best to fix the positions of each hazard when they stumbled upon them, but often the reported positions were only relative and therefore of little help (Thrum 1915:134). Even when the positions were accurate, charts were seldom published during this period. Thus, the more prudent ships operating in the region maintained a constant and vigilant watch from their mastheads to alert the helmsman of any danger sighted on the horizon (Friis 1967:262).

Though many of the potentially dangerous shoals and reefs that formed around Pacific islands and atolls were visible from a distance, others developed around remote seamounts, which made early detection nearly impossible. In many cases isolated reefs sprang up out of deep, open-ocean environments; but once their presence was charted, ships set courses to bypass them. In other cases, however, such features were not isolated and instead formed links in a chain that stretched over vast distances. These formations resulted in an increased chance of shipwreck, as vessels trying to avoid one reef often unwittingly encountered the next in the chain. The increase in maritime traffic in the Pacific in the early to mid-nineteenth century saw seemingly innocuous semi-submerged archipelagos transform into veritable ship traps. Throughout the nineteenth century many merchant vessels and whaleships came to grief on islands, reefs and shoals previously unknown to Europeans, which in turn received their western names from the encounters (Van Tilburg and Kikiloi 2007:57).

Of the many remote formations that dot the Pacific, the area referred to as the Northwestern Hawaiian Islands (NWHI) are particularly relevant to nineteenth-century whaling. Located to the north of the main Hawaiian Islands, the NWHI runs in a northwesterly arc for approximately 2,000 km (1,243 miles) and encompasses a series of low islands, atolls, and barely submerged reefs (McDowell Ward 2010:6). For the most part the entire archipelago is characterized by deep water with intermittent areas of small, shallow reef banks. Aside from the more substantial southern islands of Nihoa and Mokumanamana (Necker), which are known to have been occupied for hundreds of years but abandoned by the time of western contact (Ward 2010:11), few of the other islands within the chain were capable of sustaining human habitation for a lengthy period. And, while it is highly likely that voyagers and fishers had long utilized the region for marine resource extraction, by the time Europeans arrived it is believed that the NWHI were not universally known to Native Hawaiians (Papahānaumokuākea

Marine National Monument 2011:19).

Western contact with the archipelago probably first occurred with the voyages of the French navigator Jean-François de Galaup de la Pérouse (Sharp 1960:151). A contemporary of Cook, La Pérouse's 1786–1789 expedition was responsible for first sighting and surveying the island of Mokumanamana, which he called Necker Island in honor of the French minister of finance under Louis XVI (Gibbs 1977:175). He is also credited with identifying French Frigate Shoals, so called for the type of ships under his command, as well as the fifty-foot tall rock named La Perouse Pinnacle (Sharp 1960:151; Dodge 1971:36; Van Tilburg and Kikiloi 2007:57).

Soon after La Pérouse passed through the region, China trade vessels entered the southernmost part of the NWHI chain after provisioning and wintering at Kaua'i. In 1788 Captain James Colnett of *Prince of Wales* first sighted the island of Nihoa, which he named Bird Island. Colnett's vessel was later captured by the Spanish off the west coast of America; his detainment kept him from claiming "discovery" of the island and ultimately drove him insane (Vancouver 1798:81-85; Rauzon 2001:8). Instead, one of Colnett's contemporaries, Captain William Douglas of the English trading vessel *Iphegenia*, sighted Nihoa in 1789 and was for many years given credit for having first located it (Meares 1791:28; Thrum 1915:135; Clapp et al 1977:15; Rauzon 2001:8-9). During the remaining years of the eighteenth century a few other China trade vessels passed near Nihoa while en route to the northwest coast of America, however, none are known to have landed (Buck 1953:46; Clapp et al 1977:15).

The next recorded European visit to the NWHI took place in 1805 with the Russian exploratory voyage under the command of Imperial Russian Navy officer Urey Lisianski. While surveying in the region, the Lisianski expedition ship *Neva* ran aground on a large, previously unrecorded shoal; after some effort, the ship was extracted from the reef and further exploration led to the identification of an island nearby. To mark the "discoveries," the island was given the name of the expedition leader and the reef was named Neva Shoal after the ship (Sharp 1960:189; Clapp and Wirtz 1975:21; Gibbs 1977:175). From that time, few voyages by westerners to the NWHI occurred until the advent of whaling on the Japan Grounds (Clapp et al. 1977:15).

While there is some speculation about the date of the first passage by a merchant vessel through the Japan Grounds (Richards 1999), without a doubt it was the initial visit there by American and British whalers in 1820 that sparked the explosion in the numbers of ships entering the North Pacific and Arctic regions over the next fifty years. The stopovers in Hawaiian ports brought whaleships into contact with the NWHI; whether sailing for the Japan Grounds, which stretched from Midway Atoll west to the Bonin Islands (Kugler 1971:24), or to those in the Arctic, the physical position of the NWHI became an obstacle to the success of the ships that dared to enter it.

In a very short time the uncharted physical hazards of the NWHI were exposed to the early whaling skippers that entered the region. Some of the vessels that encountered reef banks and shoals were fortunate enough to have detected them from a distance and to lay down their location on a chart. For instance, while on his second voyage to the Japan Grounds from the Sandwich Islands in 1820, Captain Joseph Allen of the whaleship *Maro* successfully identified and marked two such features: Maro Reef, a particularly treacherous location marked only by breakers (Robotti 1955:24; Van Tilburg 2002b:38), and Gardiner Pinnacles, which he described as "a new island or rock not laid down on any chart… 150 feet high and about one mile in circumference… it has two detached humps" (Stackpole 1953:269; Clapp 1972:2). Other early vessels were not as lucky and instead spotted uncharted reefs too late, which resulted in their wrecking and their crews being stranded for lengthy periods. Such was the case for the British whaleships *Pearl* and *Hermes*, both of which were lost in 1822 on the extensive reef that now bears their name (Sharp 1960:200; Amerson et al 1974:26). These examples illustrate two facts: first that the NWHI contained many dangerous areas that were capable of destroying unsuspecting vessels; and second, that cautious navigation could result in safe passage through the region.

As knowledge of the particularly dangerous areas of the archipelago was gained, it was disseminated amongst the whaling fraternity who fished the Japan Grounds. This knowledge transfer proved extremely useful; in the early to mid-nineteenth century, whaleships made thousands of successful passages though the region by charting courses that avoided the hazards. That is not to say that accidents did not still occur. Winter storms, poor judgment, and other circumstances led to occasional losses in the NWHI throughout the nineteenth century, which in turn contributed to its lasting reputation as being almost impossibly dangerous. An example of this public sentiment is found in a 1915 popular publication that listed the maritime casualties in the archipelago. Reverend J.M. Lydgate (1915:133) describes the general feeling for the area,

> The islands and reefs to the northwest of Hawaii have been a veritable graveyard of marine disaster. The two sufficient reasons for this have been, first, the low, inconsistent character of the islands, and, second, the faulty or insufficient location of them on the marine charts. The menace of an iceberg is the fact that it lies seven-eighths under water, and you strike some submerged, protruding spur of it before you dream of danger. In a much more disastrous way the same thing is true of many of these islands.

Regardless of this reputation, the potential for quick returns and profit far outweighed the risks of passing thorough the NWHI and by the late 1820s over a hundred whaleships were successfully fishing on the Japan Grounds each year. For the most part the risks were significantly lessened through industrial strategies, such as the establishment of fishing patterns that seasonally shifted between the North and South Pacific. Using knowledge of whale migration as a guide, ships were able to make the most of the North Pacific whaling season and then safely withdraw before the arrival of the dangerous winter weather. In some cases, however, whaleships remained on the grounds too late in the season or were simply caught off guard by inclement weather or miscalculations in navigation—11 whaleships are reported to have encountered the reefs of the NWHI between 1822 and 1867. Of these 11, only one was fortunate enough to have been refloated and saved, while the other 10 became total losses.

Whaleships Wrecked in the Northwestern Hawaiian Islands

Throughout the early decades of the nineteenth century, whaling in the North Pacific took several US and British casualties. Contemporary newspapers and journals published accounts of shipwrecks that occurred all over the world and they were often circulated widely. The following descriptions of the ten whaleships that wrecked on the reefs of the NWHI are drawn from these available sources and present a basic overview of the circumstances that led to their sinking and the rescues of their crews. More detailed information pertaining to the construction, crews, wrecking events, and post-wrecking activities of the American ships are the focus of the archaeological research for this study and are included in later chapters.

***Pearl* and *Hermes* (1822)**

The first occurrence of a shipwreck in the NWHI actually claimed two vessels, *Pearl* and *Hermes*, and resulted in the reef on which it occurred being endowed with their name. On April 4, 1822 the two British whaleships departed Honolulu together and set a course for the newly noted Japan Grounds (*Hawaiian Gazette* 16 September 1868). Sailing on the night of April 24 and unaware of the dangers that might be encountered in the unexplored region, both ships ran aground and were wrecked on a previously uncharted reef approximately 1,000 miles (1,609 km) to the northwest of Honolulu (Spoehr 1988:80). Accounts state that *Pearl* was the first to hit the reef; seeing its mast light and noting distress, *Hermes* attempted to look after its consort but unfortunately met a similar fate (*The Friend* 1876:86; Galtsoff 1931:49; Van Tilburg 2002b:21). The two wrecked approximately 10 miles (16 km) from each other and were unable to be extricated; *Pearl* apparently became wedged after running head on into the reef, while *Hermes* was likely pushed broadside onto the reef (Morrell 1832:217).

No lives were lost from either of the ships and after the storm abated the survivors set up camp and salvaged as much of the provisions and materials from the wrecks as possible. Realizing that the likelihood of rescue by another ship was slim, they developed a plan to construct a small schooner from the wreckage of the two ships (Amerson et al 1974:26; Van Tilburg 2002b:21). Just as the castaways prepared to launch the schooner, which they named *Drift*, the British whaler *Thames* came to their rescue and removed all but twelve of the crew, who elected to stay (Galtsoff 1931:50). Together these men sailed the newly built schooner on a successful, but long ten-week voyage back to Honolulu (Amerson et al 1974:26; Spoehr 1988:80). After recuperating in the islands most of the crew of *Pearl* and *Hermes* made their way back to England as crew onboard other whalers or merchant ships. Two of the *Hermes* crew, however, decided to remain at Hawaii where they established a highly successful ship repair business that catered to whaleships (Taylor 1952).

Two Brothers (1823)

After departing the home port of Nantucket and experiencing little luck on the southern and central Pacific whale grounds, *Two Brothers*, together with another Nantucket ship, *Martha*, sailed on a course toward the Japan Grounds (Heffernan 1980:149). Unwittingly they entered the North Pacific in the wrong season.On February 11, 1823 they experienced a tremendous gale and the two ships became separated. Though miles from one another, each ship quickly encountered breakers and made contact with a reef. Fortunately for both, *Martha* only lightly grounded and safely got off again with little damage (Ward 1960:327–333).

Two Brothers was not as lucky; the force with which it struck the reef smashed the ship and resulted in a total loss (Philbrick 2000:209). Almost immediately the crew launched the two surviving whale boats and abandoned ship. Though they were soon separated, both drifted through the night before they were rescued and taken aboard *Martha* the following day (Macy 1835:250). Soon thereafter *Martha* successfully arrived in Honolulu with the crews of both ships. Though the captains of both whaleships were certain that the reef they struck was unknown, eventually it was determined that their positioning was inaccurate and that the ships had in fact encountered previously charted French Frigate Shoals (Heffernan 1980:149).

Gledstanes (1837)

While cruising in what he thought to be open ocean, the captain of the London-based ship *Gledstanes* sighted a distant island that was “not layed down on any chart.” (*Hawaiian Spectator* 1838:336). Though a strong current was running, he allowed the vessel to drift under reduced sail, thinking it would bypass the island. At around midnight on June 9, 1837, however, the man on watch called out that the reef was under the vessel and soon it was surrounded by breakers (*Sandwich Island Gazette* 11 November 1837). *Gledstanes* struck on the northern side of a reef that was later determined to be part of Kure Atoll, and within a few days in the heavy surf it was a total loss (*Sandwich Island Gazette* 11 November 1837; *Pacific Commercial Advertiser* 29 January 1838; Casserley 1998:60).

Though one intoxicated crewmember died after jumping overboard into the surf, the Captain and rest of the crew were able to launch three whaleboats and eventually madelandfall on a previously sighted island on the far side of the atoll (*Hawaiian Spectator* 1838:336; *Pacific Commercial Advertiser* 29 January 1838). After establishing a makeshift camp on the island, the crew picked up pieces of wreckage with the intention of constructing a vessel. Using shipbuilding tools crafted from salvaged whale spades and lances on a makeshift forge, the crew completed a small vessel named *Deliverance* within three months of their wrecking (*Sandwich Island Gazette* 11 November 1837; Woodward 1972:4). The captain and a small crew then sailed it to the Sandwich Islands while the rest of the crew remained on the island for several more months before being rescued in a vessel sent by the H.B.M. Consul in Honolulu (*Pacific Commercial Advertiser* 29 January 1838; Read 1912:7; Woodward 1972:4; Casserley 1998:60).

Parker (1842)

Upon its return from unspecified grounds to the northwest, the American whale ship *Parker* of New Bedford, Massachusetts battled heavy winds and seas in the vicinity of Ocean Island (now named Green Island) at Kure Atoll, where it struck the reef on September 24, 1842. The storm continued to build and the heavy surf smashed the ship, causing the captain to give the order to abandon ship (Van Tilburg 2002b:4). Before doing so the ship's masts were cut away to be used as a raft to cross the reef into the lagoon. Four members of the ship's crew were lost while trying to escape and the ship broke up so quickly that it was no longer visible after the storm (Woodward 1972:4). The other 22 crew fought the seas incessantly for eight days and seven nights before they succeeded in reaching Ocean Island (*Temperance Advocate and Seamen's Friend* 27 June 1843).

Unfortunately, Ocean Island had no fresh water and only a few provisions were salvageable from those that washed ashore. The crew survived by hunting birds and seals, which they cooked on utensils manufactured from pieces of copper that floated ashore with bits of wreckage (*Boston Semi-weekly Advertiser* 8 November 1843; Rauzon 2001:176). The survivors spent nearly seven months on Kure Atoll until the captain and three others were picked up on April 16, 1843 by the passing trading ship *James Stewart*. The rest of the crew remained on the island until May 2, when they were rescued by the whaleship *Nassau* (*Whalemen's Shipping List* 7 November 1843; Van Tilburg 2006:6).

Holder Borden (1844)

On November 6, 1842 the relatively new vessel *Holder Borden* departed Fall River, Massachusetts on its first whaling voyage (*Daily Mercury* 21 March 1845). After seventeen months of relatively successful hunting in the South Atlantic and South Pacific, *Holder Borden* stopped at Honolulu to refit and recruit. Seven days after leaving, the ship was cruising to the northwest when the winds began to strengthen and forced the crew to reduce sails (*The Friend* 9 October 1844). By the early morning hours of April 12, 1844, gales developed, which drove the ship onto a sandbank and shortly thereafter it swung around and hit a coral reef from which it could not be extricated (Dupont 1954:357; Clapp & Wirtz 1975:22). At daylight they found that they were wrecked upon an enormous shoal, approximately four miles (6.5 km) from a small sand island (Chandler and Phillips 1848:194). After attempting unsuccessfully to free the vessel, the crew salvaged provisions, cut away the masts to keep the vessel from falling over, launched the boats, and rowed for the island (DuPont 1954:358).

Though they wrecked on Neva Shoal and were camped on Lisianski Island, the location was not on the ship's charts. Deeming it to be previously undiscovered, it was called Pell's Island after the *Holder Borden*'s captain (*The Friend* 9 October 1844). Fresh water and rations were quickly salvaged from the wreck and seals, turtles and seabirds sustained the crew while they were stranded (Clapp & Wirtz 1975:22; Casserley 1998:16). With provisions secured, the captain kept the crew busy by salvaging everything possible, including anchors, cables, sails, provisions, and clothing, as well as 1400 of the 1800 barrels of oil that were onboard (*The Friend* 9 October 1844). A plan was soon hatched to build a small schooner from the wreckage. To do so they constructed tools from the ship's fittings in a forge built using tryworks bricks and fired by coal intended for the tryworks. They crafted saws from barrel hoop iron and made a box for steaming planks out of a trypot (Dupont 1954:362-363). In a few months the completed vessel was painted, sheathed, copper-fastened and named *Hope* (*The Polynesian* 12 October 1844). Soon thereafter Captain Pell and 24 of the crew sailed it to Maui, where the schooner was sold. After purchasing a larger vessel, the brig *Delaware*, the captain returned to rescue the remaining crew and all of the salvaged goods that had survived (*The Polynesian* 12 October 1844; *Whalemen's Shipping List* 15 July 1845).

Konohassett (1846)

Only two years after *Holder Borden* was lost, the American ship *Konohassett* became the next whaler to wreck in the NWHI. As with *Holder Borden*, the former merchant vessel *Konohassett* left its home port of Sag Harbor, New York on December 6, 1845 bound for the Pacific and its first whaling voyage. Taking no whales on the outbound leg of the trip, the ship stopped at Lahaina to recruit before sailing to the northwest for unspecified grounds (*The Friend Magazine* 1846:124). Apparently also unaware of the existence of Neva Shoal, *Konohassett* was cruising under full sail in the early morning of May 24, 1846 when it struck the reef approximately 17 miles (27 km) south-east of where *Holder Borden* wrecked only two years earlier (Adams 1918:337; Clapp & Wirtz 1975:22). The impact of increasing swells quickly resulted in the ship being bilged, and the crew was forced to leave the wreck. The next morning they returned to the ship and from that vantage point sighted the island; realizing the ship was a total loss, they proceeded to shore where they found the remains of the *Holder Borden* survivor camp (Clapp & Wirtz 1975:22).

Understanding that their only chance of survival was through self-rescue, Captain Worth determined that they needed to construct a vessel. For four days the crew salvaged provisions and any useful materials and tools from the wreck. On May 28 construction began and after only 18 days the "fast-sailing sloop," which they named *Konohassett Jr.*, was complete (*The Friend Magazine* 1846:124). Though some difficulty was experienced in keeping it watertight, the sloop carried the captain and six crewmembers to the port of Honolulu where they arrived on July 31, 1846 (*The Friend Magazine* 1846:124; Finckenor 1975:44). The American Consul in Honolulu dispatched the Hawaiian schooner *Halileo* on August 4, 1846 to 'Pell's Island' to rescue the remaining crew and returned to Honolulu on September 14, 1846 (Ward 1960:63–67; Clapp & Wirtz 1975:23).

South Seaman (1859)

Thirteen years passed before the next whaleship became a casualty of the NWHI. The clipper-style ship *South Seaman* of Fairhaven, Massachusetts departed Honolulu on March 6, 1859 for a whaling cruise to northern grounds and then to the Sea of Okhotsk (*The Daily National* 2 May 1859; *Atlas & Daily Bee* 17 May 1859; *Saturday Press* 28 April 1883). Though the location of French Frigate Shoals was well known and charted by this time, an error in navigation led the ship's captain to "suppose himself to be full forty miles [sic] to the westward" (*Atlas & Daily Bee* 17 May 1859). While sailing in a stiff wind in the early morning hours of March 13, 1859, the masthead lookout spotted breakers and almost immediately the ship struck a coral reef at French Frigate Shoals with such force as to break the main royal mast on impact (Pratt 1859). The ship then pounded heavily on the bottom until it was forced on top of the reef; there it rested on its side, the bottom having completely smashed and the breakers making a clean sweep through it (*Atlas & Daily Bee* 17 May 1859). At daylight the order was given to abandon ship, but before taking to the whaleboats, the crew saved nautical instruments, charts, provisions, and materials to use for shelter (Pratt 1859; Walker 1909:16).

All hands onboard were saved but when the boats cleared the breakers there was no land in sight; the decision was made to sail for the Ladrone Islands (Guam), which, although farther away than Honolulu, were in the track of the "trade winds" (Pratt 1859; *Boston Daily Journal* 14 May 1859; Lydgate 1915:136). After only two hours at sea, the schooner *Kamehameha IV* – fortunately sealing and guano hunting in the area – spotted the whaleboats and rescued them. Due to limited space onboard, some of the crew was left on a nearby island, while the captain and others were transported to Honolulu (Pratt 1859; *Atlas & Daily Bee* 17 May 1859; Amerson, Jr. 1971:39). The wreck and stores were sold at auction to the owners of *Kamehameha IV*, which soon returned to collect the remaining survivors and salvage *South Seaman* (*Pacific Commercial Advertiser* 30 March 1859; *Pacific Commercial Advertiser* 30 March 1859 27 April 1867; Van Tilburg 2002b:42).

Daniel Wood (1867)

The American barque *Daniel Wood* was the last whaleship wrecked in the NWHI. After hunting on an unspecified ground to the west, the New Bedford owned vessel arrived at Honolulu on April 5, 1867, discharged a small amount of oil for transshipment and departed again five days later to continue whaling "to the northward" (*Pacific Commercial Advertiser* 27 April 1867). Sailing in clear weather on April 14, 1867 the barque was running a course to pass between Necker Island and French Frigate Shoals. Though the captain had earlier determined their position to be clear of any danger, throughout the day strong and unpredictable currents altered the ship's course (Lydgate 1915:136; Schwemmer 2004). Around just after midnight the masthead lookout sighted breakers and despite efforts to avoid it, *Daniel Wood* struck French Frigate Shoals and drifted into the reefs where it heeled over in powerful breakers (*Daily Mercury* 25 June 1867). With no chance of saving the vessel, the masts were cut away and the boats launched; the crew rowed until they reached a low, sandy island with no vegetation. The following day they returned to the barque and despite heavy seas, salvaged all possible supplies from the wreck and stored them on shore. By the next day the vessel had broken up and no remnant of it was visible above the water (Lydgate 1915:136; Ward 1960:553–563).

Captain Richmond immediately determined that the best chance of rescue lay with an expedition back to Honolulu. Though handicapped by a lack of tools, the crew selected their best whale boat, salvaged wreckage and proceeded to build up its sides and deck it over – creating what sailors refer to as a "sister gunwale and washboard" (*Pacific Commercial Advertiser* 27 April 1867; Lydgate 1915:136). In only two days the vessel, *Anne E. Wilson*, was completed and fitted out with a small amount of provisions. Leaving 27 crewmembers with the rest of the supplies on the island, the captain and seven others embarked on the 450-mile (724 km) journey to Honolulu (Lydgate 1915:136). After resting briefly and resupplying at the island of Ni'ihau, the crew arrived in Honolulu; they were met by USS *Lackawanna*, which was immediately dispatched to rescue the remaining survivors (*Pacific Commercial Advertiser* 27 April 1867; Ward 1960:553-563).

Unidentified (Pre-1859)

Only one other whaling ship is reported to have been lost in the NWHI, though little historical information about it is available. The only known reference comes from the summary report of an 1859 survey by the Hawaiian Bark *Gambia*, which was looking for potential guano deposits in the archipelago. In that report Captain N.C. Brooks included a list of 11 shipwrecks and the islands on which they came to grief (Brooks 1860; Casserley 1998:4). Of those 11, one is initially recorded as being a "ship, name unknown, on Laysan Island" but supplementary data about it indicates that, "the wreck at Daysan [sic], the name of which I was unable to ascertain, was that of an American whaleship" (*The Friend* 3 September 1859; Ward 1960:309-310). Though Brooks generally included the relative locations of shipwrecks on the charts that he created, no map that he produced of Laysan has yet been found.

The preceding discussion illustrates the many dangers that awaited ships passing through the NWHI. Further analysis of shipwrecks throughout the rest of the nineteenth century provides insight into the activities that brought vessels into the North Pacific. For instance, aside from the 10 whaleships lost on the reefs between 1822 and 1867, only one other wreck is known to have occurred—the merchant ship *Huntress* which ran aground in 1852 on a run between San Francisco and Hong Kong (*New York Herald* 20 May 1852). Although the wreck of *Daniel Wood* in 1867 signaled the decline of whalers traversing the region and of pelagic whaling in general, the increase in the numbers of merchant ships falling victim to those same reefs after 1870 indicates that it was an important part of the route used by traders (Papahānaumokuākea Marine National Monument 2011:93-96). This wrecking data provides insight of the changing nature of commerce in the North Pacific region and into the shift in importance to other Pacific ports for American whalers.

Decline of Whaling Importance and its Effects on Hawaii

Without a doubt the economic impact that whaling had on the Hawaiian Islands was responsible for its transformation into a bustling entrepôt by the mid-nineteenth century. The income generated from purchases of provisions, goods, and services bolstered the growing Hawaiian economy (Dolin 2006:246-247). By 1870, however, the significance of the islands to the Pacific whaling fleets had diminished; as had occurred with the Japan Grounds it was the identification of new whaling grounds that caused a major shift in both industrial tactics and structure.

Just as the whalers shifted their focus from the Pacific sperm whale grounds to those of the right and bowhead whales in the Arctic, so did the New England whaling firms relocate their warehouses and transshipment agencies. Thanks in large part to the Californian gold rush, San Francisco quickly became an important American maritime port, and in a relatively short amount of time became the primary base of operations for Pacific whalers (Ellis 1991:163-167). Other factors affecting Hawaii's decline as a major port for whalers essentially mirrored those that led to the decline of whaling in general. These factors included over-exploitation of whale populations; the shift from whale oil to petroleum and other types of oil; increased outfitting and operating costs; and the decimation of the whaling fleet during the Civil War (Kugler 1971:26; Mrantz 1976:35).

Nevertheless, unlike the whaling industry, Hawaii's economy was able to survive. As the numbers of ships visiting the islands each year declined, entrepreneurs in Hawaii turned their focus toward expanding sugar cane and rice production. The climate and soils in the islands proved perfect for large scale farming of these and other agricultural commodities and was given a boon through a treaty of reciprocity with the US in 1875 (Freeman 1951:346-347). The capital generated from increased agricultural production was re-invested in the industry and plantations were quickly established throughout the islands. The success of the sugar industry also enabled Honolulu to once and for all emerge as Hawaii's most important shipping port, while its competitors from the whaling days simply languished (Ellis 1991:163).

The wrecks that occurred in the NWHI also had some direct effects on the development of Hawaiian Islands, though for the most part these can been viewed as positive. The simple fact that ships were lost on reefs to the northwest had a large impact on the transfer of knowledge about the region. As hazards were encountered, they were ascribed names and (when possible) their positions were recorded, and as soon as possible this information was disseminated among the whaling community in order to prevent any further losses. Evidence of the effectiveness of this 'word of mouth' knowledge transfer can be seen in the fact that out of the hundreds of ships that passed through the archipelago between 1822 and 1842, only three were lost in on its dangerous reefs.

While the relative locations of some of these reefs and shoals occasionally found their way onto nautical charts, for the most part they were manually added on the charts kept by individual captains. Eventually, however, the wrecks of American whalers that occurred in the NWHI—and those throughout the Pacific—led to official mapping expeditions being undertaken. Though many shippers and whalers lobbied the government to send a US Naval vessel into the region to conduct an examination of "the coasts, islands, harbors, reefs and shoals of the Pacific Ocean and South Seas" (Friis 1967:263), it was not until newspaper editor and Congressman J.N. Reynolds became involved that the government finally acknowledged the need to create accurate nautical charts of the region (Boggs 1938:184; Leff 1940:5-7; Friis 1967:263). Between 1839 and 1842 an American expedition led by US Navy (USN) Captain Charles Wilkes carried out extensive scientific research and mapping operations, with the main objective of providing assistance to the whaling industry (Freeman 1951:87; Dodge 1965:54). The Wilkes expedition produced excellent charts that were further refined through other expeditions into the NWHI over the next few decades, such as the 1859 USN expedition by John Brooke on USS *Fennimore Cooper* and the exploratory commercial voyage of Captain N.C. Brooks in the Hawaiian bark *Gambia*(Brooks 1860; Day 1967:171; Brooke, Jr. 1986).

CHAPTER 5. The History and Archaeology of American Whaleships Wrecked in the Northwestern Hawaiian Islands

Historical and archival research reveals that from the 1820s through the 1890s numerous whaleships wrecked on or around the islands and atolls of the Pacific. The reasons for those losses included encounters with uncharted dangers, intense and unexpected climatic conditions, miscalculations or errors in navigation, or simply accidents that occurred around known provisioning points. Regardless of the circumstances, the remains of such vessels hold tangible evidence that can be used to understand how whaleships operated as maritime industries.

While many ships are known to have wrecked throughout the Pacific region during this period, the remote locations of those sites has meant that most have been beyond the reach of archaeologists. Few whaling shipwreck sites have been identified and even fewer have been investigated archaeologically; a notable exception is those lost in the NWHI. During the early to mid-nineteenth century, six American whaling ships are known to have wrecked on the shoals and reefs of the NWHI, and of those, the locations of two have been identified in recent years. This chapter discusses the archaeological investigations of American whaling vessels located in Papahānaumokuākea National Marine Monument (PMNM). Presented in two sections, the first provides an overview of the physical environment of the NWHI, its development as a protected area, the activities of the PMNM Maritime Heritage Program, and efforts to locate the remains of the six American whaleships lost in PMNM. The second section focuses specifically on historical and archaeological investigations of the wrecks *Two Brothers* (1823) and *Parker* (1842).

Papahānaumokuākea Marine National Monument

The shipwreck sites investigated for this research are located within the boundaries of Papahānaumokuākea Marine National Monument (PMNM or 'the Monument'). PMNM encompasses the area commonly referred to as the NWHI, a chain that runs in an arc to the northwest of the main Hawaiian Islands and includes the remnants of ten volcanic islands eroded by the elements over millions of years (Figure 16). From the south they include Nihoa and Necker Islands, French Frigate Shoals, Gardiner Pinnacles, Maro Reef, Laysan Island, Lisianski Island, Pearl and Hermes Reef, Midway Atoll and Kure Atoll (Rauzon 2001:2). Together these islands, atolls and reefs have the distinction of being the world's most remote archipelago, as well as one of its most significant marine protected areas (Papahānaumokuākea Marine National Monument 2008:6).

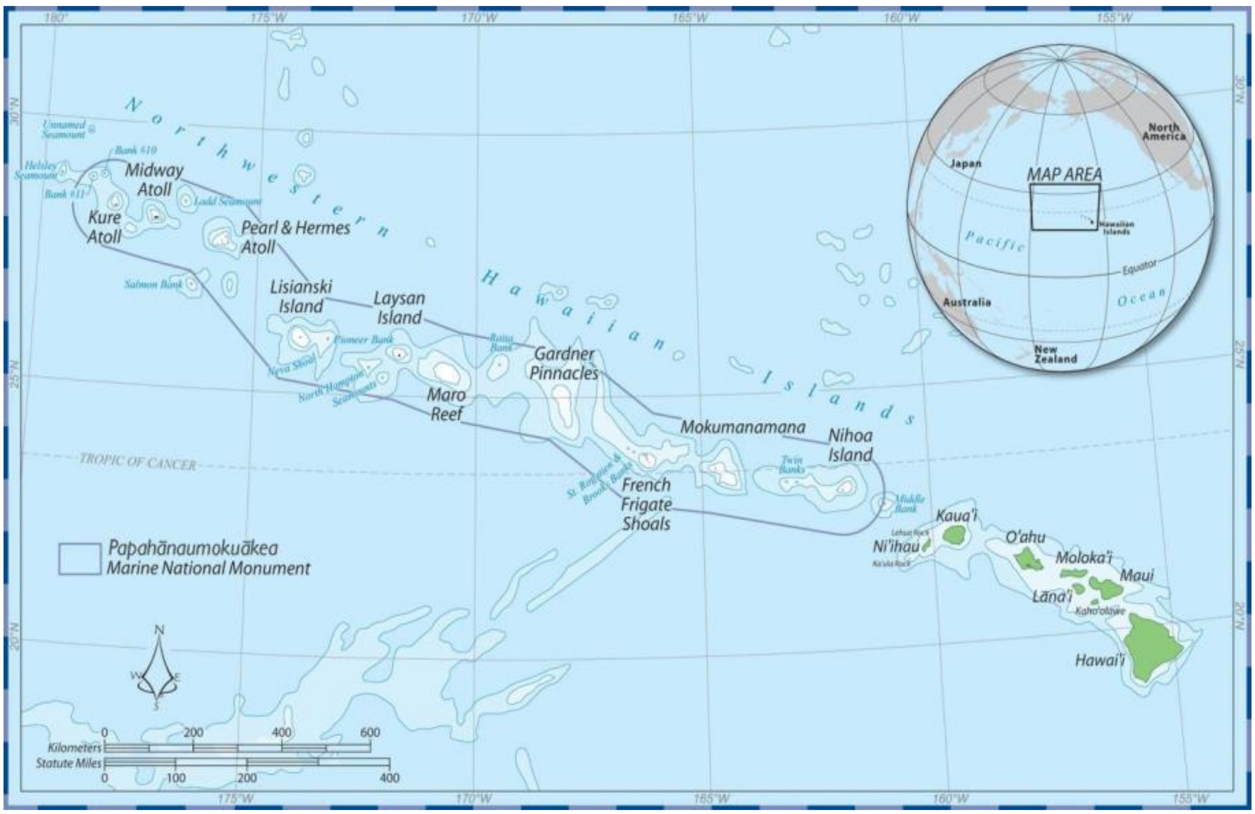

Figure 16. Papahānaumokuākea Marine National Monument in the central North Pacific Ocean (image courtesy of Papahānaumokuākea Marine National Monument).

Situated in a vast, remote, and largely uninhabited region of the Central Pacific (Figure 14), the Monument's boundaries extend roughly 1,200 miles (1,931 km) in length by 115 miles (185 km) in width and cover approximately 140,000 square miles (362,100 square km) of the Pacific Ocean (Papahānaumokuākea Marine National Monument 2008:2-5). This area was set aside as a marine protected area in 2006 under *Presidential Proclamation 8031* (Papahānaumokuākea Marine National Monument 2011:1) and was originally called the

Northwestern Hawaiian Islands Marine National Monument. In 2007 the title was changed to Papahānaumokuākea Marine National Monument to signify the importance of the area to Native Hawaiian culture, with the name reflecting "the ancient Hawaiian tradition that relates to the birth or formation of the Hawaiian Islands as is personified by the earth" (Van Tilburg and Kikiloi 2007:56).

The oceanic features of the NWHI region include "shallow coral reefs, deepwater [sic] slopes, banks, and seamounts" and support an array of marine life (Papahānaumokuākea Marine National Monument 2011:1). Due their remote oceanic location the atolls of the NWHI are considered one of the most pristine marine ecosystems in the world (Pandolfi et al 2005; Smith 2010:3) and provide refuge and habitat for a wide array of threatened and endangered species (Papahānaumokuākea Marine National Monument 2011:1). Though the reefs were impacted by roughly 150 years of human exploitation, for the last half century the ecosystems have been in a recovery mode (Kittinger 2010) and "intact populations now characterize the predator-dominated reefs" (Friedlander and Martini 2002; Kittinger et al 2010:2). To date over 7,000 species of fishes, birds, marine mammals, invertebrates, and algae have been described in PMNM, though many researchers believe that the region's true biodiversity is far greater (Fauzin et al 2010; Toonen et al 2011:2).

Ecosystem protection of this area has a long history which began when US President Theodore Roosevelt established what is now known as the Hawaiian Islands National Wildlife Refuge to protect its natural resources in 1909 (Kittinger et al 2010:2; Papahānaumokuākea Marine National Monument 2011:1). Since that time conservation efforts in the region have strengthened through the establishment of other federal protections including the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve, Midway Atoll and National Wildlife Refuge (NWR), the Battle of Midway National Memorial, and the Hawaiian Islands NWR (Ward 2010:6). The State of Hawaii has also acknowledged the significance of the region through the designation of the Northwestern Hawaiian Islands State Marine Refuge (DLNR 2005; Kittinger et al 2010:209). The most recent recognition of both the natural and cultural uniqueness of this place came in 2010 with the United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Committee's unanimous inscription of PMNM as a mixed site—the first of its kind in the United States and one of only 27 such sites in the world (Papahānaumokuākea Marine National Monument 2011:1).

Management of PMNM is the responsibility of three co-trustees: the State of Hawai’i Department of Land and Natural Resources (DLNR); the US Fish and Wildlife Service (FWS); and the US National Oceanic and Atmospheric Administration (NOAA). These agencies work cooperatively to fulfill the tasks of “preserving the ecological integrity of the Monument and perpetuation of the NWHI ecosystems, Native Hawaiian culture, and historic resources" (Papahānaumokuākea Marine National Monument 2008:1). Protocols for management of this marine protected area were outlined in a memorandum of agreement between the co-trustees, whose policies and regulations are enforced in conjunction with applicable state and federal laws (Kittinger 2010:209).

Maritime Heritage Program

The heritage of PMNM represents hundreds of years of continuous utilization of the NWHI. Polynesian voyages of exploration, commercial ventures during the ages of sail and steam, fortification and battles during WWII, fishing activities, and even present-day research expeditions have all left reminders to help tell the story of human interaction with the archipelago. The Monument’s diverse heritage includes oral histories, chants, and archaeological sites associated with the Native Hawaiian voyaging and use of the region, as well as many terrestrial and submerged sites related to the colonial and historic periods (Papahānaumokuākea Marine National Monument 2010:1). In order to best understand and preserve these diverse and complex cultural remains, they are divided into three categories for management: *Native Hawaiian Culture and History*, which includes both the tangible and intangible heritage that relates to the deep genealogical, cultural, and spiritual connections of Native Hawaiians to the region (Van Tilburg and Kikiloi 2007:58); *Historic Resources*, which include historic period remains located on the various islands; and *Maritime Heritage Resources*, which include submerged and beached shipwrecks, aircraft, and other sites of historic, cultural, and archaeological significance (U.S. Fish and Wildlife Service et al. 2008; Papahānaumokuākea Marine National Monument 2010:1-5).

Maritime heritage resources located within the Monument are managed by the PMNM Maritime Heritage Program (MHP), which is based at Monument headquarters on the island of Oahu. Under state and federal mandates, this program is charged with inventorying and assessing historic and archaeological resources underwater and sharing information about them with the public (Van Tilburg 2010:300). Archival research indicates that as many as 60 ships and at least 61 aircraft are known to have wrecked in PMNM waters and efforts to identify those remains have resulted in the location of wrecks ranging from the early historic period ships to WWII aircraft (Papahānaumokuākea Marine National Monument 2010:*vii*).

Access for MHP staff and partners is provided through multidisciplinary research cruises aboard the NOAA research vessel *Hi'ialakai.* Each year archaeological surveys are conducted in target locations at varying atolls and reefs; survey techniques have included tow boarding, drift diving, magnetometer, and side scan sonar surveys. When sites are identified they are recorded using global positioning systems (GPS), traditional mapping methods, photography and video. Once documentation of a site is complete it is generally left completely *in situ*, though occasionally a limited numbers of artifacts are permitted to be recovered, conserved, and used for interpretation. Because many of these have been submerged so long and have become a part of the ecosystem, MHP archaeologists have also worked in cooperation with scientists from other disciplines to better understand the relationships between the sites and the surrounding environment (Smith 2003). Data recovered from these surveys are used for public outreach and education purposes with products including web pages, documentaries, museum exhibits, public lectures and professional conference presentations, as well as publications in popular and professional journals (Raupp & Gleason 2010:72).

Whaling Research in PMNM

Ten whaleships are known to have been lost in the NWHI between 1822 and 1867 (Table 3). For over a decade the search for wrecked whaleships and the documentation of the remains of those that are identified was and is a major focus for maritime archaeologists working in PMNM. Beginning in 1998 surveys were conducted by maritime archaeologists from the NOAA Office of Marine Sanctuaries Program, as well as partner organizations such as universities, other government agencies, and archaeological consulting firms. Because of the high expedition costs and the time constraints imposed by conditions in open ocean environments, researchers first consulted with marine scientists from other disciplines and marine debris cleanup surveys to understand indicators of possible shipwrecks and to gather information pertaining to previously sighted cultural materials. This approach proved successful and resulted in the identification of several sites, including three wrecked whaleships; the British whalers *Pearl* and *Hermes* and the American whaleship *Parker*. Archival records and historic maps indicating the locations of wrecks have helped to determine prospective survey areas and led to the identification tow whaleship wrecks, including a British whaleship *Gledstanes* (1837) and *Two Brothers* (1823). Overall, when considering the immensity of the area contained within PMNM boundaries the ability to identify half of the known whaleships, is a great accomplishment.

Table 3. Reported wrecks of whaling vessels in the NWHI between 1822 and 1867.

Vessel Name	Nationality	Home Port	Tonnage	Date Built	Date Lost	Approximate Location	Captain
Pearl	British	London	320	1805	1822	Pearl and Hermes Atoll	Clark
Hermes	British	London	262	1811	1822	Pearl and Hermes Atoll	Taylor
Two Brothers	American	Nantucket	217	?	1823	French Frigate Shoals	Pollard
Gledstanes	British	London	428	1817	1837	Kure Atoll	Brown
Parker	American	New Bedford	406	1831	1842	Kure Atoll	Sherman
Holder Borden	American	Fall River	442	1841	1842	Lisianski Reef	Pell
Konahassett	American	Sag Harbor	426	?	1846	Lisianski Reef	Worth

Vessel Name	Nationality	Home Port	Tonnage	Date Built	Date Lost	Approximate Location	Captain
South Seaman	American	Fairhaven	497	1856	1859	French Frigate Shoals	Norton
Daniel Wood	American	New Bedford	345	1852	1867	French Frigate Shoals	Tallman
Unidentified Pre-1859	American	Unknown	?	?	*Pre-8/30/1859	Laysan Island	?

* Wreck seen and reported by Captain N.C. Brooks of the Hawaiian bark *Gambia* on 30 August 1859.

Investigations of Wrecked Whaleships in PMNM

Of the six American whaleships known to have wrecked in PMNM, two of them have been located and documented. These sites represent some of the earliest remains of American pelagic whaleships that have been found and archaeologically investigated anywhere in the world. Thanks to the protections provided by both their remote geographic positions and their inclusion within the boundaries of a marine protected area, these relatively untouched sites offer perhaps the best opportunity to elicit information about the technologies and industrial processes employed, as well as the social and cultural conditions that existed, onboard American whaleships of this period.

Two Brothers

The first American whaleship that is known to have wrecked in the NWHI was the Nantucket vessel *Two Brothers*. Lost at French Frigate Shoals in 1823, just less than a year after the wrecks of the British ships *Pearl* and *Hermes*, it too was a victim of shallow reefs encountered while attempting to traverse the uncharted region. The *Two Brothers* shipwreck site has the historic distinction of being directly connected to one of the most storied episodes in the industry's history—the loss of the whaleship *Essex*. This tragic incident involved the sinking of a ship that was rammed by a whale in the middle of the Pacific Ocean and later became the inspiration for Herman Melville's famous work *Moby Dick* (1850). The same captain that operated *Essex*, George Pollard, Jr., was later the captain of *Two Brothers*. Archaeologically, the site is also distinct as it represents the earliest known wreck of an American whaleship identified in the Pacific region and provides the most complete artifact assemblage of any whaleship lost in the NWHI. Also of interest is the existence of multiple survivors' accounts of the wrecking event, which aided in the positive identification of the wreck. Together these factors make *Two Brothers* one of the most important and extensively documented shipwrecks located in PMNM.

History of the Whaleship *Two Brothers*

Unlike many of the other ships that came to grief in the NWHI, little is currently known about the construction or working life of *Two Brothers* prior to its loss at French Frigate Shoals. The few features of the ship that are available were gleaned from an entry in Alexander Starbucks's *History of the American Whale Fishery* (1878). The Nantucket-owned *Two Brothers* first appears in this register in the year 1818, where it is described as being 217 tons, ship-rigged, and captained by George B. Worth (Starbuck 1878:226). With no owner or agent listed, the ship sailed for the Pacific Ocean on September, 25 1818 and returned on October, 20 1820 with a cargo or 378 barrels of 'Sperm-oil' and 1,836 barrels of 'Whale-oil' (Starbuck 1878:227). Though no data about the actual cruise is recorded, the much greater cargo of whale oil than sperm oil might suggest that they encountered large numbers of right whales while passing through the South Atlantic—possibly on the Brazil Banks—and hunted there for at least part of the cruise. Though the object of a cruise may have been the more lucrative sperm whale oil, during this period it was common to take right whales when they were seen since "cargoes of the cheaper (whale) oil could be obtained much more quickly, with shorter voyages and equal profits" (Richards 1994:23). The same 217-ton ship *Two Brothers* appears only one other time in Starbuck's table; in 1821 it is listed as having been "lost on a coral reef" while under the command of George Pollard, Jr. (Starbuck 1878:236-237).

Using Starbuck's data (1878:227-237) regarding the size and rig of the ship as a guide, efforts were made to identify the origin, build date, and any other construction data pertaining to *Two Brothers*. While the name appeared to be popular for vessels of all classes during this period, only one matched the known dimensions listed by Starbuck—the 217-ton ship *Two Brothers* built at Hallowell, Maine by Joseph Glidden in 1804 (Barker 1879:9; Baker 1973:929). Regional shipbuilding records indicate that this vessel measured 84 feet and 4 inches in length, 24 feet and 4 inches in width, and 12 feet and 2 inches in depth. They also state that its original home port was Gardiner, Maine, that its first owner was S. Bradstreet, that the first Master was James Purrington, and that it was fitted with a female figurehead (Baker 1973:659-929). The dimensions of this vessel fit perfectly with those desired for whaleships of this period and many vessels employed by Nantucket whaling operations were constructed in Maine shipyards, which "turned out many superior ships for the trade" (Martin 1975:45). Thus it is possible that this record was that of the same *Two Brothers* that was lost in PMNM in 1823.

If this Maine-built ship was in fact the same *Two Brothers* as that commanded by Captain Pollard, as yet no information about the vessel has been found pertaining to its career between the years 1804 and 1817. While it is possible that it was employed in the whale fishery during that period, it would seem unlikely since no mention of it is found in Starbuck's comprehensive shipping returns table for the period (1878:202-225). Instead, it is probable that, like many other New England ships, it was laid up during the period of Jefferson's Embargo and the War of 1812 (Baker 1973:186), and then later used in some branch of the merchant service before being sold to Nantucket owners to be refit as a whaler.

The next known historical mention of *Two Brothers* comes with its association of the whaleship *Essex*. This now famous incident involved the harrowing experience of the crew of an ill-fated whaleship that was twice rammed by an angered whale while hunting in an open stretch of the Pacific Ocean, roughly 1,200 miles (1,930 km) northeast of the Marquesas Islands (Whipple 1979:85). According to an account of the loss (Chase 1821), the whale's second sortie resulted in the hull being stove in at the bow and the ship quickly taking on water (Dakin 1934:88). Salvaging what little provisions they could access, Captain George Pollard, Jr. and the 20 crew set out in three whaleboats hoping to make it to the coast of South America. Though efforts were made to keep the three small boats together, storms soon separated them. After surviving a traumatic 94-day journey that resulted in sickness, starvation, and ultimately cannibalism, the crew in two of the boats were rescued at sea within five days of one another but the third boat was never heard from again (Whipple 1979:87).

The five survivors of the *Essex* tragedy were taken to Valparaiso, Chile. There they recuperated for a few months, before four of the crew returned home aboard the Nantucket whaleship *Eagle*. Deemed too weak to accompany the crew, Captain Pollard remained a further two months in Chile before gaining passage to Nantucket aboard the whaleship *Two Brothers* (Philbrick 2000:193). All five of these men returned to sea and in the course of their careers each one went on to become a ship captain (Whipple 1954:34). For his part, Pollard's integrity so impressed Captain George Worth over the course of the two-and-a-half month return voyage, that he was recommended as a replacement master of the whaleship that brought him home (Philbrick 2000:203). The freakish nature of the accident that led to the loss of *Essex* did little to tarnish Pollard's reputation as a fine skipper and he soon found himself preparing for yet another voyage to the Pacific, this time in command of *Two Brothers* (Heffernan 1981:145).

In late November 1821, little more than three months after his return to Nantucket, Pollard sailed for the Pacific Ocean as master of *Two Brothers* (Macy 1835:249). Interestingly, Pollard was not the only *Essex* survivor on board; as a sign of their trust in his skills, both Thomas Nickerson and Charles Ramsdell chose to serve under him again (Philbrick 2000:206). After a long and stormy, yet uneventful, passage through the Atlantic the ship rounded Cape Horn and eventually arrived safely in Talcahuano, Chile, where it met the Nantucket whaler *Martha*. There the captains of the two vessels agreed to "throw their chances together and cruise for whales far to the westward" (Nickerson n.d.). This hunting strategy appears to have been more commonly used by American and British whalers in the early years of the Pacific fishery and involved two ships agreeing to 'mate', or unite, forces in a temporary partnership (Brown 1884:260; Fonda, Jr. 1969:11; Kugler 1980:7; Vickers 1985:282). After each took on recruits in that port, the two ships met off the coast of Peru and cruised west northwest on a course for the recently identified Japan Grounds - possibly even passing over the spot where the whale had struck *Essex* only two years earlier (Heffernan 1980:149).

By early February 1823 *Two Brothers* and *Martha* turned more to the north and were cruising in roughly the same latitude as French Frigate Shoals when the weather deteriorated

(Nickerson n.d.). Despite only being able to rely on dead reckoning due to overcast skies, both captains judged their position to be well west of any danger and maintained their courses (Philbrick 2000:208). The two ships were barely visible to one another when, on the afternoon of February 11, heavy squalls and severe gales caused the crew of *Two Brothers* to reduce sail. Soon large breakers were seen and though an attempt was made to change course, "the high sea running behind" them affected the ships' steering and almost immediately it struck on a reef (Nickerson n.d.). Though the vessel briefly refloated, it quickly struck again with such force that it shattered the stern (Gardner 1823). In his account of the wrecking event, boatsteerer Thomas Nickerson stated that there were "breakers apparently mountains high" and that soon the stricken ship was being pushed over onto its broadsides and pounding so hard "that one could scarcely stand upon his feet" (Nickerson n.d.). The ship was beating to pieces and water filled it so quickly that the pumps were of no use (Macy 1835:249). Nickerson (n.d.) noted that while "Captain Pollard seemed to stand amazed at the scene before him," two of the mates stepped in and ordered that masts be cut away in an attempt to save the ship. Luckily Pollard came to and realized that *Two Brothers* was beyond saving; knowing that the falling masts and spars would likely damage the whaleboats, he ordered the crew to drop their axes and instead to prepare to abandon the ship (Nickerson n.d.; Philbrick 2000:209). Two whaleboats were each loaded with four oars, a sail, and some navigational equipment; however, no fresh water, provisions or spare clothing could be obtained (Gardner 1823). The entire complement of officers and crew – including Pollard who did so reluctantly – escaped in the crowded boats (Nickerson n.d.; Philbrick 2000:209) as the ship was smashed by the heavy surf.

The *Two Brothers*' crew passed the night being tossed around in the tempestuous seas and eventually the boats became separated. In the morning one of the boats noticed a sail in the distance; they rowed towards it and as they neared found it to be their companion *Martha*. Though it too had run aground on a reef after parting an anchor cable during the storm, quick action by the chief mate freed it with little damage sustained (Nickerson n.d.). The other boat saw a high rock in the distance and pulled for it through the night, but upon reaching it found the area to be inhospitable. Instead they rowed to the south where the following day they encountered three small islands, one of which they were able to land upon and take refuge.

They established a makeshift camp and began to search for food, but soon one of the men saw a sail on the horizon, which proved to be *Martha* (Gardner 1823). They rowed the whaleboat out to meet the ship and with the crews of both whaleships onboard, *Martha* sailed for the island of Oahu. They arrived three weeks later and after a brief rest, the ship soon departed for Nantucket (Macy 1835:250). There is no indication that any attempt to salvage the wreck of *Two Brothers* was ever undertaken.

Site Location and Research Expeditions

During tow boarding operations in the northwestern section of French Frigate Shoals in August 2008, maritime archaeologists with PMNM, NOAA's National Marine Sanctuaries, and Flinders University noted a previously unidentified ship's anchor on the edge of a reef in the extreme northwest corner of the shoals. Extending the search out from the anchor, researchers found the remains of a wooden ship scattered in pockets on top of the surrounding reef and spilling over its sides. Preliminary *in situ* analysis of the artifacts identified on the site suggested that they belonged to an early nineteenth-century whaleship. As discussed earlier in this chapter, only three whaleships are known to have wrecked at French Frigate Shoals; those are *Two Brothers* (1823), *South Seaman* (1859) and *Daniel Wood* (1867). Though the physical evidence strongly indicated that the remains belonged to the earlier of the three, as no definitive proof of the vessel's identity was found, the wreck was given the working name 'Shark Island Whaler,' in reference to a nearby sandy island. The site and all artifacts were then surveyed thoroughly, mapped spatially, and recorded photographically as part of the 2008 site inspection.

The next visit to the Shark Island Whaler site occurred in 2009 and resulted in the unanticipated detection of a second portion of the wreck. This chance find was a byproduct of an ecological research project conducted by a graduate student from the University of Hawai'i, the purpose of which was to determine whether "shipwreck sites have distinct ecosystems and if there are residual effects from shipwreck disturbances that manifest as differences between wreck and surrounding coral reef communities" (Smith 2011:4). In order to collect the necessary data for this research, known shipwreck sites were studied in detail using a number of predetermined methods; once the study of the wreck was completed, the same methods were applied to a randomly selected control area of "comparable size and habitat composition approximately 100 meters away from the wreck plot on the contiguous reef" (Smith 2011:5). In the case of the Shark Island Whaler site, the selection of the control location proved serendipitous and divers quickly noted shipwreck artifacts. Closer inspection by the PMNM maritime archaeologist revealed remains of the same vintage to those recorded on the Shark Island Whaler site documented previously (thereafter referred to as Section A). Thus the area was deemed to be a second part of the same site (Section B) and researchers quickly recorded as much data as possible from the new section in the time available.

Maritime archaeologists and volunteers from PMNM and Flinders University returned to Section B of the Shark Island Whaler site as the main research focus for the 2010 Maritime Heritage Expedition to the NWHI. A large area of the reef was surveyed visually and the scattered remains were recorded thoroughly using multiple methods including spatial mapping, artifact recording, and photography. Prior to the expedition, further historical research was also undertaken into the known wrecks that occurred at French Frigate Shoals, as well the artifact types recorded previously on the site. The information gleaned from these investigations led to the determination that the remains were those of the Nantucket whaleship *Two Brothers*. As such, specific efforts were made to identify and record as many diagnostic artifacts as possible in the hope of making a conclusive identification. A 'Conservation and Management Permit' (PMNM-2010-016) was also obtained which allowed for the recovery of a small number of diagnostic artifacts from the site for conservation, study, and later public display at PMNM's Mokupāpāpa Discovery Centre in Hilo, Hawaii. Marine remote sensing was also undertaken in the area surrounding the reef and island to determine the extent of the site and to identify any associated anomalies or debris. A magnetic contour map (Figure 17) and side-scan sonar mosaic for the surveyed areas were created and numerous anomalies were detected (SEARCH 2010:71-79).

Data from the 2010 site investigations were analyzed over the following year as part of this study. After thorough consideration of all of the evidence presented (discussed in detail below), it was formally announced that the identity of the site was that of the whaleship *Two*

Brothers on February 11, 2011 –the 188th anniversary of its loss. In the meantime, plans were made to create a museum exhibit highlighting the importance of the wreck to both the NWHI and the island of Nantucket. An agreement was made between PMNM and the Nantucket Historical Association to display the exhibit. After obtaining a permit for artifact recovery, a PMNM maritime heritage team visited Section B of the *Two Brothers* site in August 2010 to retrieve the artifacts. The artifacts chosen were three harpoon tips, two lance tips, two ceramic sherds, and a cast iron cooking pot. Once conservation of these objects was completed, the exhibit – entitled *Lost on a Reef* – was installed at the Nantucket Whaling Museum and opened in the summer of 2012.

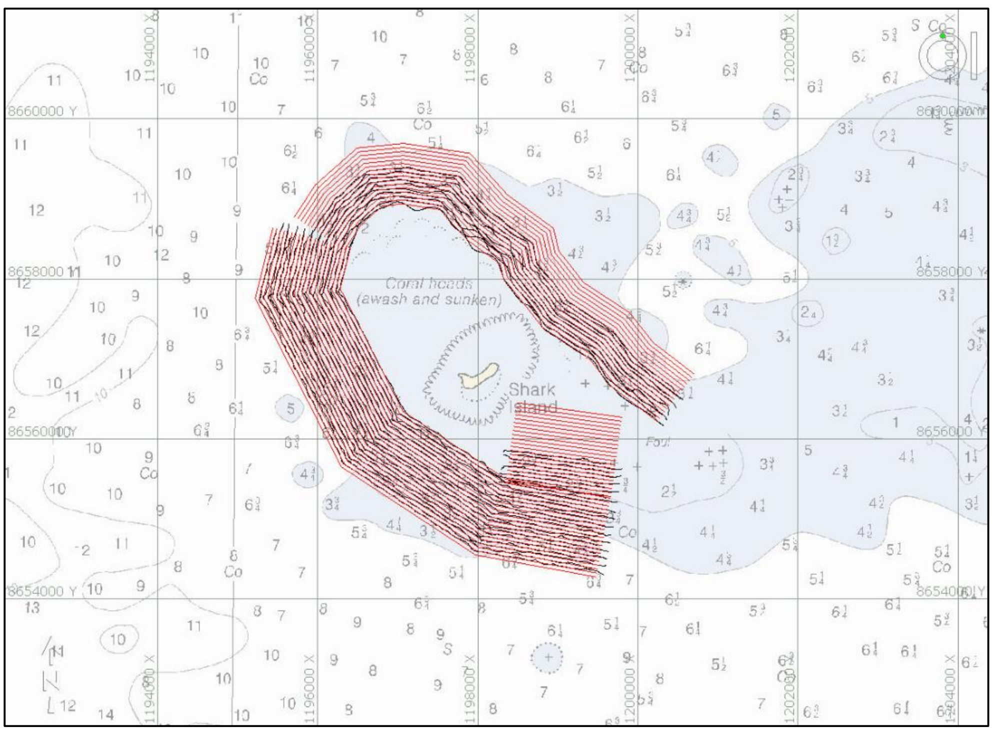

Figure 17. Magnetic contour map of areas surrounding Shark Island and the *Two Brothers* shipwreck site at French Frigate Shoals (Image courtesy of Papahānaumokuākea Marine National Monument and SEARCH, Inc.).

The *Two Brothers* site was again visited as part of the 2012 Maritime Heritage Expedition to the NWHI. The heritage team consisted of maritime archaeologists with PMNM, NOAA's National Marine Sanctuaries, Flinders University and the US National Park Service's Submerged Resources Center. The focus of the trip was twofold; it included public outreach and education activities, as well as further archaeological research and documentation. Due to the remote location of the *Two Brothers* shipwreck site and the desire by management to showcase it to the public, PMNM maritime heritage staff contracted Open Boat Films to create a documentary about the loss of the ship and the archaeological investigation of the site. Filming occurred throughout the expedition and subjects included artifacts and features of both sections of the site, marine life on the reef, and archaeological recording activities. Archaeological research included high quality photographic surveys and detailed recording of all visible artifacts, metal detector surveys, extended visual surveys, and target testing of remote sensing anomalies recorded during the 2010 expedition (SEARCH 2010:74).

Site Description

The shipwreck site of the whaleship *Two Brothers* is located in the extreme northwestern portion of French Frigate Shoals near a small sandy islet named Shark Island. Positioned among the shallow reef complex immediately to the east of the island, the site measures approximately 100 m (330 feet) in length by 150 m (490 feet) in width. Depths on the site range from 1-8 meters (3 to 26 feet) depending on tides, and visibility generally ranges from 10 to 20 meters (33 to 65 feet). The reef on which the wreck is located is typical of those in French Frigate Shoals and includes abundant marine life and coral species, including rare large table corals known as *Acropora* (Maragos and Gulko 2002:32).Coral encrustation on the cultural material associated with shipwreck site is generally moderate to heavy (Souza 1998:33).

The shipwreck is comprised of two parts separated by a relatively wide channel between two reefs. The first of these, known as Section A, stretches over an area of reef that measures approximately 120 m (394 feet) in length by 100 m (330 feet) in width (Figure 18). It is characterized by cultural materials associated with an early nineteenth-century wooden sailing vessel engaged in pelagic whaling, which are scattered mainly in pockets in the reef and extend onto the reef flat to the north. Diagnostic evidence supporting the vessel’s function includes anchors, rigging components, an abundance of copper rather than iron fasteners, and hawse pipes, as well as the bases of two trapezoidal-shaped bottles; artifacts specifically associated with whaling include three trypots and hundreds of tryworks bricks. No wooden structural elements of the ship have yet been noted and are unlikely to be present on the site; due to the dynamic tropical environment in the region it is probable that such remains would have either floated away as the ship broke apart and/or were eaten by wood boring organisms over time.

The area known as Section B of the *Two Brothers* site (Figure 19) is located approximately 200 (656 feet) meters to the south of Section A. This section of the site is much smaller than the other and measures approximately 50 m (164 feet) in length and 30 m (98 feet) in width. While it can also be described as being characterized by whaleship artifacts located on top of and in pockets of a central reef structure, much of the diagnostic cultural materials are found on the on the reef flat to the south or in a large, sloping depression toward the northern part of the reef. Many of the diagnostic artifacts identified indicate an association with the aft section of a whaleship; these include a possible kedge anchor, a grinding stone, ceramics, galley wares, several items of whalecraft, and possible components of navigational equipment. As with Section A, no wooden elements of the ship were noted during investigations of the site.

Evidence for Identification as *Two Brothers*

While the archaeological data indicated that the Shark Island Whaler was indeed the wreck of *Two Brothers*, two main issues needed consideration before a positive identification of the site could be made confidently. The first of these relates to the possibility that the remains represent another, completely undocumented whaleship that wrecked on that reef. While this possibility is always a concern when dealing with shipwrecks found in remote locations, the fact that the crews of contemporary ships wrecked in the same region all survived those wrecking events and that their losses were duly reported in several news sources makes an unreported shipwreck an unlikely conclusion. Instead it is far more probable that the site is in fact the remains of *Two Brothers* and that the historically reported location of its loss was incorrect. In order to better understand this second issue, the available accounts of the loss of *Two Brothers* were scrutinized along with other historical information pertaining to it.

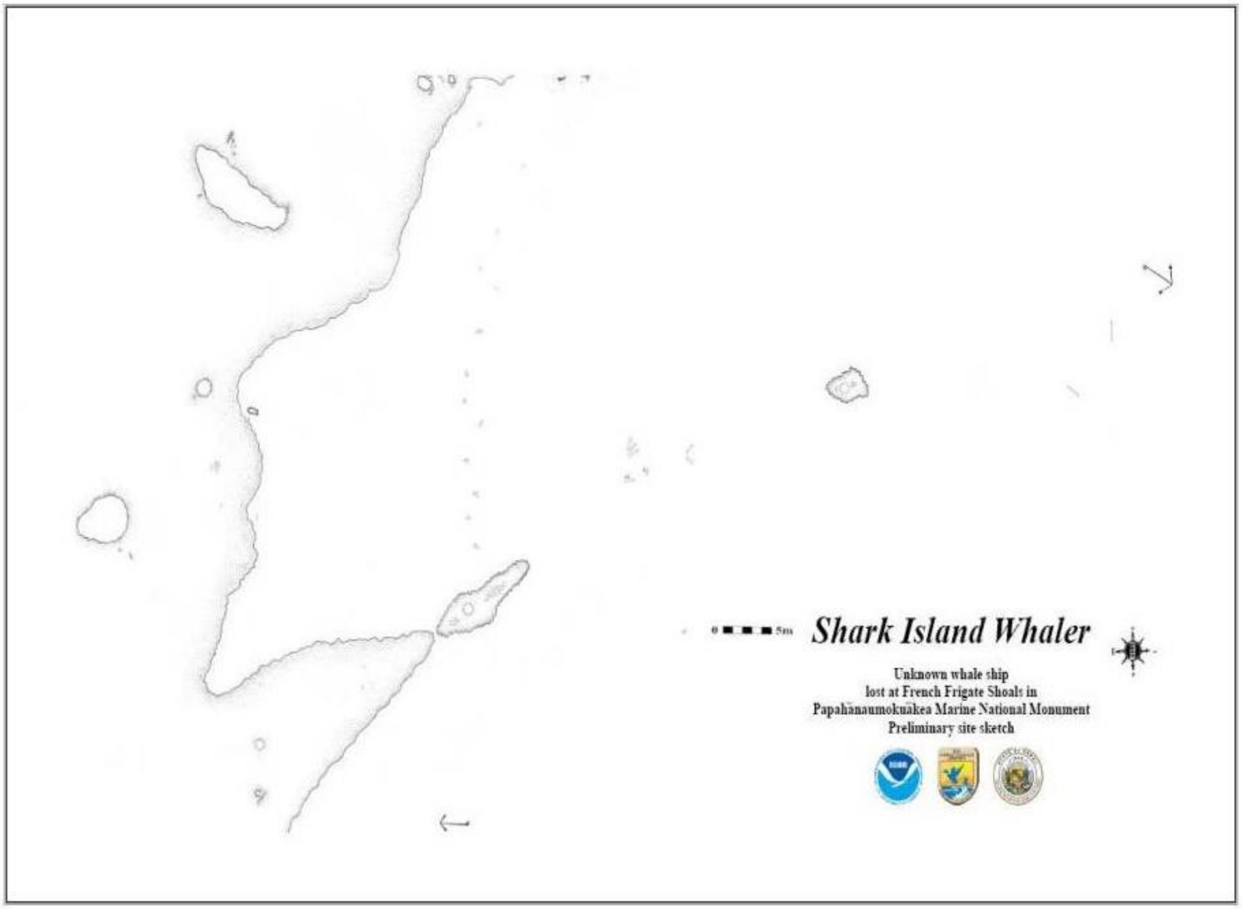

Figure 18. Site Plan for Section A of the *Two Brothers* shipwreck site (previously referred to as Shark Island Whaler) at French Frigate Shoals (image courtesy of Papahānaumokuākea Marine National Monument).

By all accounts the captains of both *Two Brothers* and *Martha* were convinced that the reef their vessels encountered was uncharted. Since the geography of the region was largely unknown at the time of the wrecking, its existence was not questioned; instead its position was dubbed ‘Two Brothers Reef’ and included on nautical charts for many years (Figure 20). Some doubt about the veracity of their positioning, however, can be found in a letter by Thomas Nickerson to author Leon Lewis dated October 1876. In it Nickerson described discussions he had with Thomas Derrick, the first mate of *Martha*, in which they both agreed that the reef on which *Two Brothers* was lost was in fact French Frigate Shoals, “notwithstanding our two Captains believed and reported that this was a new discovery” (Nickerson to Lewis 1876). The two mates alleged that an error of navigation was made as a result of nearly two straight weeks of poor weather, which prevented the captains from taking the far more accurate lunar observations to determine their position; instead they were forced to rely solely on dead reckoning (Nickerson to Lewis 1876; Philbrick 2000:208).

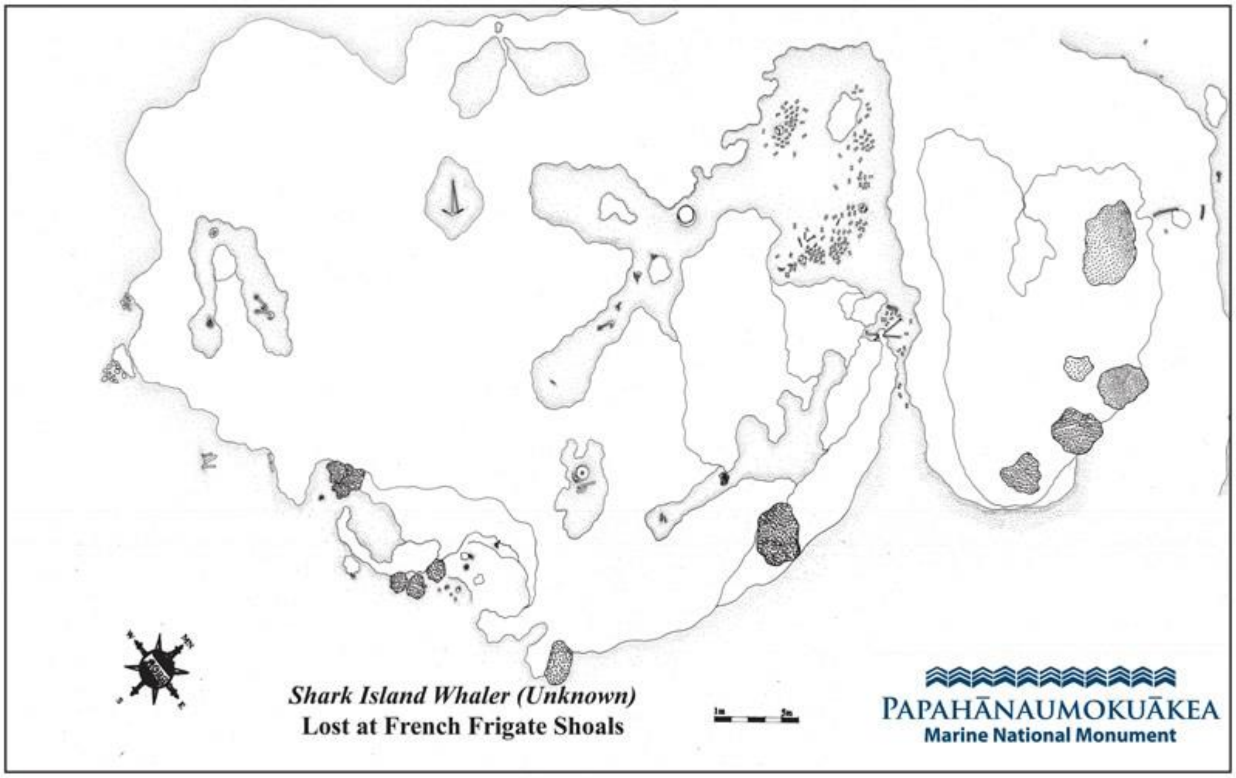

Figure 19. Site Plan for Section B of the *Two Brothers* shipwreck site (previously referred to as Shark Island Whaler) at French Frigate Shoals (image courtesy of Papahānaumokuākea Marine National Monument).

The assumption made by Nickerson and Derrick was eventually verified through the voyages of several vessels that surveyed the region over the next century. While it is probable that other whaleships passing the area attempted to validate the supposed location of Two Brothers Reef, the first known record of such activity occurred through an 1859 USN survey of the region by Lieutenant J.M. Brooke in USS *Fennimore Cooper*. In his journal of the voyage Brooke referred to it as 'Brothers' reef and, though he expressed doubts about its existence, he nevertheless passed over the assigned position "without perceiving any indication of land or shoal" (Brooke 1986:43). Later in that same year during pioneering investigations of the NWHI, Captain N.C.

Brooks of Honolulu crossed over the given position in the bark *Gambia* but, finding no shallow reef, determined that *Two Brothers* struck on French Frigate Shoal (Brooks 1860:500; Hydrographic Office 1903:145). Subsequent attempts to identify the reef also proved fruitless; these include efforts by USS *Albatross* in 1902 (US Coast and Geodetic Survey 1919:51) and USS *Tanager* in 1923 (King 1931:16). As only "great depths were obtained at its reported position" (US Coast and Geodetic Survey 1919:51), the location for Two Brothers Reef was eventually stricken from official charts. While none of these attempts to verify the position given by captains Pollard and Pease for the loss of *Two Brothers* was successful, when combined with modern hydrographic and satellite imaging data that indicate no shoals in the region, provides strong support for the theory that the whaleship was indeed lost on French Frigate Shoals.

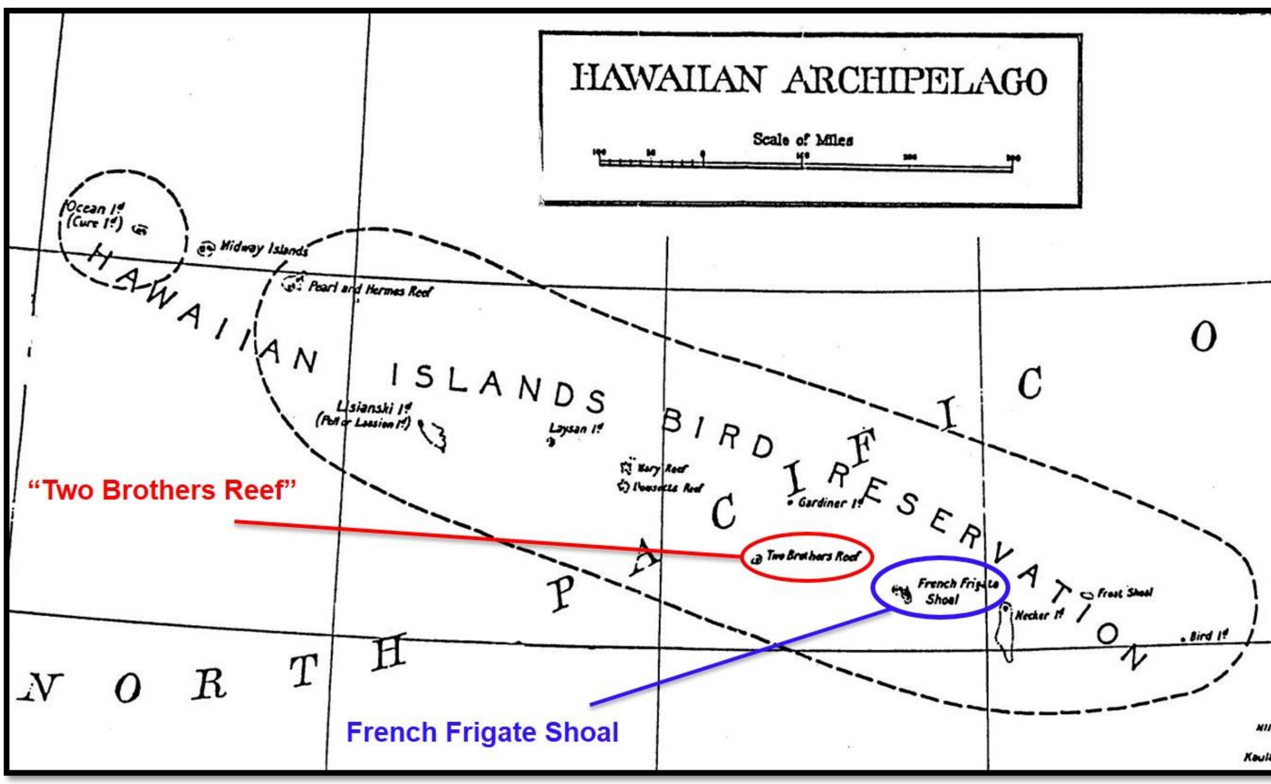

Figure 20. 1911 map of the Hawaiian Islands Bird Reserve which indicates the existence of Two Brothers Reef as a separate geographic feature located to the northwest of French Frigate Shoals. Base image from Arnold, J.A. 1912.

Clues to the ship's identity were also found using the accounts of first mate Eben Gardner and boatsteerer Thomas Nickerson, two of the shipwreck's survivors. Details extracted from their accounts provide not only a provocative image of the wrecking event and the destruction of the ship; they offer spatial data that was used to analyze the site layout and distribution of artifacts at the shipwreck site. For instance Gardener states that after the initial impact on the reef, the hull briefly refloated before it “struck again so heavy and shattered her whole stern” (Gardner 1823). To this description Nickerson adds that the ship was soon “careening over upon its broadsides and thumping heavily…” (Nickerson n.d.). When taken together, these two descriptions indicate that the ship broke apart and scattered over a large area of the reef, spilling the contents of the ship as it moved.

Upon completion of archaeological recording of the site, plan view illustrations of each section were made. When georectified using global positioning data, these two plans matched the information put forth in the survivor’s accounts. The approach from the south leading to the wreck is deep enough to allow a ship the size of *Two Brothers* to easily pass until it encountered the inner line of reefs – which could be the location of the ship’s initial impact. Because the depth of this inner reef is not shallow, it is probable that the “mountainous seas” described by Nickerson (n.d.) could have refloated the ship after grounding. And if the survivor’s accounts are correct, the following sea that affected the ship’s steering (Nickerson n.d.) would have pushed them directly into the next reef in the complex, which is much shallower and roughly the distance of “once the length of the ship,” posited by Gardner (1823). Furthermore, as described above, Section B of the *Two Brothers* site (Figure 19) encompasses a relatively small area and is characterized by artifacts associated with known use areas of a whaleship’s aft section such as the galley and “bo’s’n’s locker” (Stackpole 1967:31). Thus, Section B likely represents the stern of *Two Brothers* that is described as having been shattered in the second impact with the reef.

The physical remains documented on Section A of the Shark Island Whaler site (Figure 18) also matches Nickerson’s assertion that the ship was soon “careening over upon its broadsides and thumping heavily…” (1984). The composition of the reef complex in this area is such that the sections of reef holding the remains are separated by a relatively deep – approximately 10 m (33 feet) – sandy channel. The artifacts found scattered across the reef to the north indicate that they were likely associated with the midships and foreword parts of the vessel; it is possible that Nickerson was describing the motion of the ship after losing its steering from the smashing of its stern. Uncontrollable, the vessel could have bounced along until reaching the channel, where it began to list and then was pushed onto the subsequent reef where it spilled open and foundered. This supposition is further supported by the fact that numerous rigging components were recorded on the reef flat on the northern side of the outer reef likely indicating that the masts of the vessel came to rest there.

The historical information pertaining to actual location of the site of the wrecking for the whaleship *Two Brothers* and the physical descriptions provided by survivors present a solid case for the identity of the shipwreck. Furthermore, the archaeological deposits found at the site are indicative of those associated with an early nineteenth-century wooden ship employed in pelagic whaling operations. While it is true that no particular object can be viewed as a "smoking gun" (i.e. a bell with the ship's name inscribed on it), as with other shipwreck identifications that have recently come under scrutiny, "the preponderance of the evidence supported the wreck's identity… and often, with archaeology, that is as good as it gets" (Wilde-Ramsing and Ewen 2012:113).

Parker

After the loss of *Two Brothers*, nearly 20 years elapsed before another American whaleship wrecked in the NWHI. In the autumn of 1842 the New Bedford whaleship *Parker* became a total loss after encountering the fringing reef at Kure Atoll during a squall. The approximate location of the loss, wrecking event, and subsequent stranding of the surviving crew on Ocean Island was detailed in an account given by the ship-keeper, which was first published in 1843. The remains of *Parker* were relocated in 2002 by staff and students from the University of Hawai'i (Van Tilburg 2002).The site is characterized by numerous artifacts scattered mainly over a large area of the lagoon and is archaeologically significant as it provides evidence of the advances in ship technologies employed by American whaling interests. As with the *Two Brothers* shipwreck, the account of the wrecking and subsequent activities of the survivors offered information that proved useful in the positive identification of the wreck.

History of the Whaleship *Parker*

The whaleship *Parker* was a typical vessel of the American whaling fleet in the 1830s. Information pertaining to its construction was compiled by The Survey of Federal Archives, an initiative by the Works Progress Administration (WPA) tasked with collecting data on all vessels registered through the federal Customs Districts (WPA 1940). According to the program's publication entitled *Ship Registers of New Bedford, Massachusetts* (1940), *Parker* was built at Fairhaven, Massachusetts, in 1831 by master carpenters Fish and Delano and was jointly owned by Fredrick Parker, John A. Parker, Hayden Coggeshall, and Joseph Dunbar. Purpose-built for use in the whaling trade, the 406 ton ship is described as having had two decks, three masts, a square stern, no galleries, and a billethead on the bow. The ship measured 112 feet and 2 inches (34 m) in length by 28 feet and 6 inches (8.7 m) in width, and had a depth of 14 feet and 3 inches (4.3 m) when it was surveyed by L.M. Allen and registered at New Bedford on October 6, 1831 (WPA 1940:248). Interestingly, measurements for the ship found scribbled in two places in the back of the log of *Parker*'s maiden voyage differ slightly from those of the original survey; while the length and breadth dimensions match closely, the statement "Depth of hold from sealing [sic] to under space of upper deck beams 19 ft~6 in (5.9 m)" indicates a difference in depth of several feet (Brown 1835:229). This discrepancy likely results from the point at which the measurements were taken. Though the hold of most ships was generally considered to be the intended cargo space in the lowest part of the ship, whaling captains used all available interior space for oil storage, and thus the definition of *Parker*'s hold was likely extended to include the between decks area.

Prior to its loss at Kure Atoll in 1842, the whaleship *Parker* successfully completed two lucrative cruises under the ownership of J.A. Parker & Sons (Starbuck 1878:282-283). The first of these voyages departed on the same day of its initial registration with the Customs District at New Bedford. In his "Table Showing Returns of Whaling Vessels from American Ports," Alexander Starbuck (1878:282-283) lists the ship as bound for the Pacific Ocean under the command of Charles F. Brown on October 6, 1831. Over the next three years *Parker* hunted on unspecified grounds and called at Honolulu at least four times, transshipping approximately 3800 barrels of oil back to New Bedford (Van Tilburg 2003:32). On February 24, 1835 the whaleship returned to New Bedford with a profitable cargo of 3150 barrels of sperm oil (Starbuck 1878:282-283).

The log for this voyage survived and is now part of the Nicholson Whaling Log Collection at the Providence Public Library in Providence, Rhode Island. Aside from the daily observations and comments expected to be found in a ship's log, additional data includes details of provision management onboard, exact specifications for parts of the ship and whaling equipment, a tally of whales taken per boat, and an extensive table that recorded air and water temperature, wind direction, and weather observations made during the passage from the Equator to the Pacific Ocean (Brown 1835:248-252). Included among the entries on the final pages of the log are coordinates for a right whale ground east of New Zealand which was provided by the captain of the whaleship *Golconda*, the same for a sperm whale ground west of the Marquesas Islands given by the captain of the ship *Lancaster*, and the general comment "Dusky Bay New Zealand is said to be a good place for right whales in June & July" (Brown 1835:254).

With the success of *Parker*'s maiden voyage, its owners wasted little time in outfitting the ship for a return to the Pacific Ocean. Under the command of Master William Austin, *Parker* departed New Bedford on May 30, 1835 and remained at sea for four years. Though the log for this voyage is not known to have survived, New Bedford whaling agent Dennis Wood provided a brief summary of the ship's movements in his unpublished manuscript "Abstracts of Whaling Voyages of the United States 1831-1873." From Wood's description it is clear that the aforementioned information noted in the back of the log of the previous cruise had an effect on the decision of where to hunt. Over the course of the voyage *Parker* spent some time hunting sperm whales around Tahiti, but was most often reported as hunting the waters off of New Zealand and calling at its ports (Wood n.d.:397). This strategy proved very productive and on May 3, 1839 the ship sailed into its homeport laden with a mixed cargo of 1,523 barrels of sperm oil, 1,539 barrels of whale oil, and 15,200 pounds (6,894 kg) whalebone (Starbuck 1878:316-317; Wood n.d.:397).

The continued success of *Parker* and the seemingly endless stocks of whales found in the Pacific led owners J.A. Parker & Sons to organize another trip soon after its return. Under the command of Captain Prince Sherman, the whaleship departed New Bedford on August 26, 1839 for a 40-month voyage with orders to "cruise for 25 months for sperm, but if unable to procure 2,000 barrels in that time to proceed to the N.W. for right whale" (*Temperance Advocate & Seaman's Friend* 27 June 1843). According to the entry in "Abstracts of Whaling Voyages of the United States 1831-1873", much of the early part of the cruise was spent hunting sperm whales off the South American coast (Wood n.d.:397). In December 1841 *Parker* was cruising on the 'On the Line Grounds' around the Equator when its captain was drowned after an encounter with a large sperm whale to which his boat was fastened. At that point first officer George M. Smith succeeded him in command of the ship and decided to call at Lahaina to recruit before continuing the voyage (*Temperance Advocate & Seaman's Friend* 27 June 1843).

Upon leaving Hawaii in April 1842 Captain Smith followed the orders of *Parker*'s owners and steered a course for the N.W. coast. The ship spent the following months hunting right whales – likely on the newly discovered (1835) Northwest Grounds off the coast of what is now British Columbia (Van Tilburg 2003:32) – and then set off around the first of August bound for Hawaii (Wood n.d.:397). It appears that their course led them onto the eastern part of the Japan Grounds since the Wood abstract for this cruise indicates they encountered the ship *Geo. Champlin* on September 15, 1842. Only eight days after this sea meeting the weather deteriorated and *Parker* was "lost on a ledge of rocks" (Wood n.d.:397).

The ship-keeper, Mr. Richard F. Quinn, provided an extensive account of the wrecking event, stranding on Ocean Island, and later rescue of the survivors that was first reported in the Hawaiian newspaper *Temperance Advocate & Seaman's Friend* on 27 June 1843. As was common practice of the time, various sources in New England used direct transcriptions of that account to report on the wreck (Ward 1967:505-533). According to this account, on September 23, 1843 *Parker* encountered squalls and rain from the north to northeast that continued to build throughout the day. Despite having shortened nearly every sail in an effort to weather the storm, the ship drifted until Ocean Island was sighted several miles to the southeast. At 2:30 on the morning of September 24, "a sea dashed through the cabin windows of the *Parker* and she struck the reef 8 miles (13 km) N.N.W. from the centre [sic] of the island" (*Temperance Advocate & Seaman's Friend* 27 June 1843). Within an hour of impact it was clear that the ship was a total wreck so members of the crew cut away the masts before abandoning the ship. Four members of the crew were lost in the ensuing struggle, but the rest were able to cling to a makeshift raft of floating masts and spars and eventually make their way across the reef. After eight days and seven nights of suffering and fighting intense currents to remain in the lagoon, the survivors succeeded in reaching Ocean Island (*Temperance Advocate & Seaman's Friend* 27 June 1843).

Though the survivors were physically debilitated after the ordeal, they understood the severity of their predicament and the reality that it would likely be some time before they could be rescued. The crew searched the beaches and found some wreckage of the British ship *Gledstanes* – lost at Kure Atoll in 1837 – which served for firewood and construction material for a simple shelter (Woodward 1972:4). Although only a few provisions were able to be salvaged after *Parker* broke up, the island provided plenty of food; over the next six months the castaways estimated that they consumed over 7,000 sea birds, 60 monk seals, and a dog which had been left by the crew of *Gledstanes* (*Temperance Advocate & Seaman's Friend* 27 June 1843). Food was prepared using utensils fashioned from pieces of copper that they salvaged from *Parker*'s wreckage (Woodward 1972:4; Van Tilburg 2003:33). The newspaper account states that a constant "look out" was maintained and that the captain held small religious services daily.

On April 16, 1843 signals were made to a sail seen on the horizon, which proved to be the New Brunswick ship *James Stewart*. On the following day, Captain Smith and three other survivors were taken aboard and offered passage to Honolulu. A quantity of provisions and some other useful articles were provided to the remaining 20 members of *Parker*'s crew, and the captain of *James Stewart* pledged to return for them as soon as possible. On May 2, 1843, however, the remaining survivors were rescued by the New Bedford whaleship *Nassau* and transported to Honolulu. There 13 of the survivors remained under the protection of the US Consulate, while the other seven signed on with Captain Weeks to serve as crew on *Nassau* (*Temperance Advocate & Seaman's Friend* 27 June 1843).

At the time of its wrecking the whaleship *Parker* had onboard 2,000 barrels of sperm oil and 1,000 barrels of whale oil, all of which was lost (Starbuck 1878:354-355). The ship was insured for a total of $55,800 under separate policies issued by five different companies – two of which were based in New Bedford and the other three in New York. When combined, the value of these policies and the market value of the cargo onboard amounted to $82,000 (*Whalemen's Shipping List* 7 November 1843). There is no record of any salvage of the wreck having ever been undertaken and the only remains that are known to have been recovered were those found and utilized by the survivors in their camp.

Site Location and Research Expeditions

The wreck of the whaleship *Parker* was first examined by maritime archaeologists in 2002. Working as part of a larger multi-disciplinary research expedition known as the Northwest Hawaiian Islands Coral Reef Assessment and Monitoring Program (NOWRAMP 2002), the team from the University of Hawai'i documented the site while conducting baseline cultural heritage surveys of Kure Atoll (Van Tilburg 2002:1; Papahānaumokuākea Marine National Monument 2011:11). While investigating a reported anchor resting in shallow water in the northwest section of the lagoon, they instead found the remains of what appeared to be a mid-nineteenth-century shipwreck. Recorded artifacts include three anchors, anchor chain, copper fasteners, iron strapping, mast hoops, deck machinery parts, copper sheathing, a brick, pipes, pieces of lead, and a variety of encrusted unidentified artifacts (Van Tilburg 2002:54). Though limited by time constraints, an initial measured sketch of the site was completed and the artifact scatter was documented photographically (Van Tilburg 2003:33). Analysis of the artifacts indicate that the site likely represented the bow section of "a broken vessel that was pushed over from the original wreck site just north of the reef crest, settling out later in calm interior waters" (Van Tilburg 2002:54). No positive identification of the site was made at the time; however, artifact analysis suggested that the remains were most likely those of either the British whaleship *Gledstanes* or the American whaleship *Parker* (Van Tilburg 2002:54).

In 2003 a team consisting of maritime archaeologists from the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve, East Carolina University, and Panamerican Consultants returned to the site to conduct further investigations (Van Tilburg 2003:1). The primary focus of this project was to better delineate the site boundaries by visually surveying and recording areas inside the lagoon that surround the artifact concentration recorded in 2002, as well as conducting marine magnetometer surveys outside the reef. These surveys resulted in the detection of an extensive scatter of fasteners, machinery, anchors, chain, rigging elements, hull sheathing and bricks, and a ship's bell, all stretching in a line from the inside of the reef crest to the northwest of the initial area. The magnetometer surveys detected numerous potential magnetic anomalies in the area outside the reef corresponding to the scatter trail; limited testing of these identified only a small number of fasteners. Overall this project expanded the boundaries of the site and reinforced the theory that the remains represent those of a mid-nineteenth-century whaleship that collided with the reef and was subsequently pushed over the crest, dropping artifacts in a trail as it broke apart. Again, no conclusive identification for the wreck was made; however, data analysis indicated *Parker* as being the most likely candidate (Van Tilburg 2003:33).

In 2005 and 2006, teams from the NOAA Maritime Heritage Program undertook research expeditions to the NWHI and among their objectives was the accurate recording of the spatial distribution of the scattered site (Van Tilburg 2006). To achieve this, the major artifacts were first tagged and recorded with GPS before being documented using digital still photography and high-definition video. Artifact locations were then recorded using the baseline trilateration method between permanent datum points specifically installed for this purpose (Van Tilburg 2005:14). The archaeological data recorded during these two field seasons was used to complete a site plan showing all visible artifacts and topographic features (Figure 21) and to create a descriptive artifact database (Van Tilburg 2006). Additionally, a small number of diagnostic artifacts were collected under an Archaeological Resources Protection Act (ARPA) permit and a Special Use permit issued by US Fish and Wildlife Service (USFWS) and reviewed by the State Historic Preservation Division (SHPD)/Department of Lands and Natural Resources (DLNR). The recovered artifacts were photographed, sketched, tagged, and appropriately stored on board the ship during the cruise and later conserved (Van Tilburg 2005:11; Fox 2006; Fox 2010; Fox 2012). Once conserved and stabilized, many of the artifacts were incorporated into museum exhibits and the rest are curated at the Bishop Museum in Honolulu (Van Tilburg 2005).

In 2008 the *Parker* site was visited by staff from PMNM, NOAA's Maritime Heritage Program, and Flinders University as part of a PMNM Maritime Heritage Cruise. While the researchers used the opportunity to monitor the condition of the site and photograph exposed artifacts, the main objective of this project was to recover the ships' bell. The recovery of this heavily concreted artifact was considered important both for its potential to provide the identity of the wreck (i.e. if the ship's name was marked on it) and for use as an interpretive device. The bell was collected under an ARPA permit and a Special Use permit issued by USFWS and reviewed by the SHPD/DLNR. As with the artifacts recovered previously from the site, it was photographed *in situ* and in the lab, sketched, tagged, and stored appropriately before being conserved professionally. Once the conservation treatment was completed the bell was incorporated into a permanent exhibit about shipwrecks within the Monument, which is on display at PMNM's Mokupāpā Discovery Center in Hilo (Fox 2010:8).

The *Parker* site was among a number of shipwreck sites inspected at Kure Atoll by both the 2010 and 2012 PMNM Maritime Heritage Cruises. The primary objectives for these visits to *Parker* were to conduct condition assessments of the site in order to monitor any impacts that occur over time and to conduct research relevant to this study. Each of the condition assessments indicated no noticeable impacts; despite the rough weather experienced at Kure Atoll each winter, the site is considered stable. The research component entailed inspecting the artifact assemblage in an effort to classify the types or function of some of the many previously unidentified objects. Prior to each of these expeditions, studies of the material culture specific to pelagic whaling and the ships employed by the fishery were undertaken; this approach proved effective with numerous artifacts being identified positively. During each visit archaeological photographs were taken of each artifact (or a representative sample where numerous artifacts of the same type exist). Additionally, in 2010 marine remote sensing was again undertaken outside the reef to further refine the data acquired in 2003. Rough sea conditions prevented side-scan sonar data from being collected, however, the magnetometer survey identified far fewer magnetic anomalies than those detected in the 2003 survey (SEARCH 2010:71-79). Though an attempt to identify the source of the single promising target was unsuccessful, some cupreous fasteners were identified on the reef crest before the survey had to be abandoned due to rough sea conditions.

Site Description

The wreck site of the whaleship *Parker* is located in the north northwestern portion of Kure Atoll. The site is characterized by a scatter of artifacts stretching over an approximately 400m (1300 feet) in length by 30m (98 feet) in width area with components existing on the surface (outside) reef, back reef, and inside the lagoon. Depths at the site range from between two and five meters and visibility generally ranges from 5 (16 feet) to 20m (65 feet). The majority of the site features are located in a low energy area inside the lagoon on a bottom consisting of patch coral reef, coralline substrate, and rubble and sand areas (Van Tilburg 2006). Coral growth at the site is highly variable; cover on the surface reef is minimal, whereas that on the back reef is dense with a wide array of coral species (Dana 1971:83). Coral encrustation on the cultural material in the areas inside the lagoon has been described as abundant, with *Pocillopora ligulata* and *Porites lobata* being frequently encountered species (Dana 1971:83; Van Tilburg 2003).

The scattered remains of the whaleship *Parker* stretch in a line along a scour channel from the ship's point of impact on the reef into the lagoon (Van Tilburg 2003:33). Though the largest concentration of artifacts lies in the sheltered confines of the lagoon, some artifacts were located on the surface reef and in a channel leading to the back reef area. Since these areas are prone to dangerous swells and diving surveys could only occur during calm weather, limited surveys were conducted (Van Tilburg 2006). Artifacts identified on the surface reef were noted in 2003 and 2010 and include three types of fasteners – spikes, nails, and sheathing tacks (Van Tilburg 2003:33). Surveys of the small pass in the reef crest leading to the back reef area conducted in 2005 and 2006 detected a number of diagnostic artifacts including numerous bricks, iron straps, and broken trypot shards (Van Tilburg 2006). No wooden structural elements of the ship were noted on the surface reef or back reef areas; between the effects of the violent storm that caused the ship to quickly break apart and the dynamic tropical environment, it is unlikely that any such remains exist.

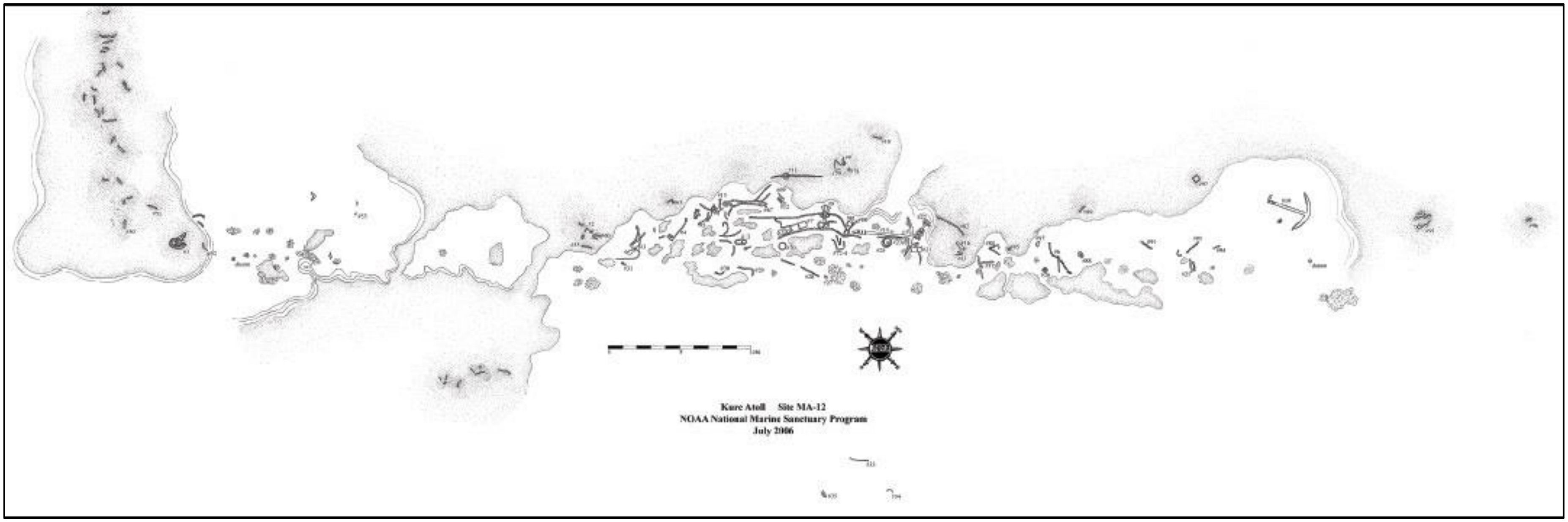

Figure 21. Site plan of the Parker shipwreck at Kure Atoll (image courtesy of Papahānaumokuākea Marine National Monument.

The area between the back reef and the main concentration of artifacts at the *Parker* site consists of shallow patch reefs and sand pockets. Though the shallow depths in much of this section make surveying difficult, portions of it were explored in 2003, 2006, and 2010 in an attempt to further delineate the extent of the site. These surveys resulted in the location of a number of diagnostic artifacts including a ship's bell, a possible gudgeon, four cupreous rudder pintles, cupreous drift pins, cupreous spikes, copper sheathing, and the bottom half of a stoneware container, as well as numerous metal objects of unidentifiable function. All of these objects were presumably deposited as the ship broke apart after being pushed over the reef. Analysis of these remains indicate that at least the rudder – and possibly a portion of the sternpost – came to rest there; it is highly possible that other, better persevered remains are buried in the many sand pockets in this area.

The main section of the *Parker* wreck site consists of a concentration of scattered artifacts measuring approximately 75m (246 feet) in length by 15m (49 feet) in width (see figure 18). Beginning roughly 300m (984 feet) south southeast of the proposed point at which the ship impacted the surface reef, this section of the site rests largely in a sand pocket between patch reefs. Artifacts identified include two large sheet anchors, a possible kedge anchor, scattered chain, numerous copper fasteners of varying size, iron strapping, mast hoops, rigging elements, wire rope, parts of deck machinery, copper sheathing, a brick, hawse pipes, and pieces of lead, as well as a variety of unidentified artifacts (Van Tilburg 2002:54). Analysis of the cultural materials identified within this area indicates that they represent those associated with the bow of a large wooden nineteenth-century sailing ship (Van Tilburg 2002:53-54). A small number of the copper drift pins found in this area were found to have very small portions of wood adhering them. Though wood sample analysis can be extremely helpful in determining the origin of a ship's construction, the condition of these particular remains were assessed as being too degraded and insubstantial in size for such testing to be successful.

Evidence for Identification as *Parker*

The shipwreck site found in the north northwestern section of Kure Atoll has been determined to be that of an early to mid-nineteenth-century whaleship. Diagnostic materials supporting this conclusion are numerous pieces of rigging and other materials associated with a wooden, sail-powered vessel, as well as multiple bricks and trypot shards found at the site. A review of the historical record of ships known to have wrecked at Kure Atoll during this period revealed two candidates – the British whaleship *Gledstanes* wrecked in 1837 and the American whaler *Parker* wrecked in 1842. Since American and British whaling vessels of the period were outfitted with similar equipment and the amount of time between the losses of these two ships was relatively short, positive identification of the wreck proved difficult. Careful analysis of the physical remains at the site and of historical records, however, coupled with continued archaeological research at the atoll, ultimately led to the determination that the wreck was that of the whaleship *Parker*.

The main indicator for the identification of this wreck resulted from comparisons of the physical evidence found at the site with the descriptions of the wrecking events of each of the whaleships lost at Kure. Analysis of the wreck indicates that the ship impacted the northern part of the reef at a bearing of 135 degrees (magnetic) with enough force to be driven over it and into the lagoon. As the ship was violently pushed over by the heavy swells it created a scour channel in the reef crest and some of the deck features (i.e. the tryworks) were lost overboard (Van Tilburg 2006; Van Tilburg 2010:312). Once inside the shallow lagoon the swells continued to wreak havoc on the vessel, breaking it apart and scattering remains along a trail before finally depositing the bow section nearly 300 m (984 feet) from the point of initial impact. Using this interpretation as a model, data from survivor's accounts of *Gledstanes* and *Parker* was scrutinized to determine which, if either, of the events described best matched it.

The British whaleship *Gledstanes* wrecked at Kure Atoll on the night of June 9, 1837. According to an account provided by the ship's master John Richard Brown, the 428-ton London whaler was cruising for whales when Ocean Island was sighted approximately 12 to 15 miles (19 to 24 km), southwest by south. Thinking that the strong northern current they experienced throughout the day would help to keep them clear of danger, the captain ordered the course changed to south by west and the sails shortened to reduce speed. These efforts proved futile and *Gledstanes* struck the reef at 2330 hour; the crew immediately launched three boats and abandoned ship (*Sandwich Island Gazette* 11 November 1837). All but one of the crew succeeded in landing at Ocean Island and in the days following, the ship went to pieces. A camp was established on the island and a schooner – named *Deliverance* – was built from fragments of the wreck. Captain Brown and nine of the crew departed on December 15, 1837 in this vessel bound for the Sandwich Islands; upon their arrival the British Consul sent a vessel to rescue the remainder of the *Gledstanes* crew (*Sandwich Island Gazette* 11 November 1837; *The Friend* 1 Feb 1871). Based on Captain Brown's description of the wrecking event, it appears that *Gledstanes* made contact with the east side of the reef since Ocean Island was first sighted at a bearing of roughly 200 degrees (magnetic).This determination is supported by a chart of Kure Atoll that clearly marks the location of the wreck (Figure 22) and was produced by Captain Brown to accompany his account (*The Hawaiian Spectator* July 1838).

Further evidence of the location of the *Gledstanes* site was provided by an officer of USS *Saginaw*, a US Navy gunboat lost at Kure Atoll on October 29, 1870. The survivors of that wreck noted seeing some wooden remains of *Gledstanes* washed up on the beach and others emergent on the reef (Read 1912:12; Van Tilburg 2010:229). The location of the wreck of *Gledstanes* was included on a map of the atoll (Figure 23) made by Lieutenant Commander Montgomery Sicard; it is positioned to the north of the spot at which USS *Saginaw* hit the reef(Read 1912:12). Considering that the location indicated on both of these maps is almost exact, it is evident that the wreck in the north northeastern section of Kure Atoll was not that of *Gledstanes*.

The details of the loss of the whaleship *Parker* provided by its ship-keeper offer a much more plausible identification for the wreck in the north northeastern section of Kure Atoll. From the description presented in the survivors' account it is clear that the ship was sailing to the north and west of the atoll prior to its loss since Ocean Island was sighted as being south by east. With no change in course indicated and with heavy winds blowing form the north to northeast, it is likely that the ship was driven on a direct trajectory toward the reef. While no maps marking the location of the wreck of *Parker* have yet been found, the statement in the account that the ship "struck the reef about eight miles (13 km) N.N.W. from the center of the Ocean Island" (*Temperance Advocate & Seaman's Friend* 27 June 1843) is telling since it positions the point of impact as being along the north northeastern part of the reef. Though this reported distance is slightly farther than the actual distance of approximately 5.5 miles (8.9 km) from the center of the island to the archaeological site, it is also the farthest distance from the center of the island to any point on the reef. When compared to the interpretive model for the wreck site, these observations closely match the physical evidence and indicate that the wreck in the north northeastern section of Kure Atoll is most likely that of the whaleship *Parker*.

One other significant piece of evidence supporting the identity of the remains as belonging to the whaleship *Parker* came with the location of the wreck of *Gledstanes*. Though the exposed location of its loss made accessing the spot marked on the map difficult, in 2008 a period of calm weather allowed for surveys close to the reef. These resulted in the identification of the remains of a whaleship with diagnostic artifacts including anchors, iron tryworks knees, a partial trypot, chain, bricks, and numerous pigs of iron ballast. While most of these artifacts are indicative of a wooden sail-powered whaleship of the period, the presence of pig iron was key to the positive identification. British sailing vessels of the eighteenth and nineteenth centuries carried iron ballast bars (often called pigs) measuring approximately 90 cm (35 inches) x 15 cm (5.9 inches) in their lower holds to help the ship sail upright relative to the winds (Roberts 1992:55; Tuttle 2008:43). Since most of the pigs documented on the site at Kure Atoll closely matched those dimensions, it was highly likely the wreck is that of the British whaleship *Gledstanes*.

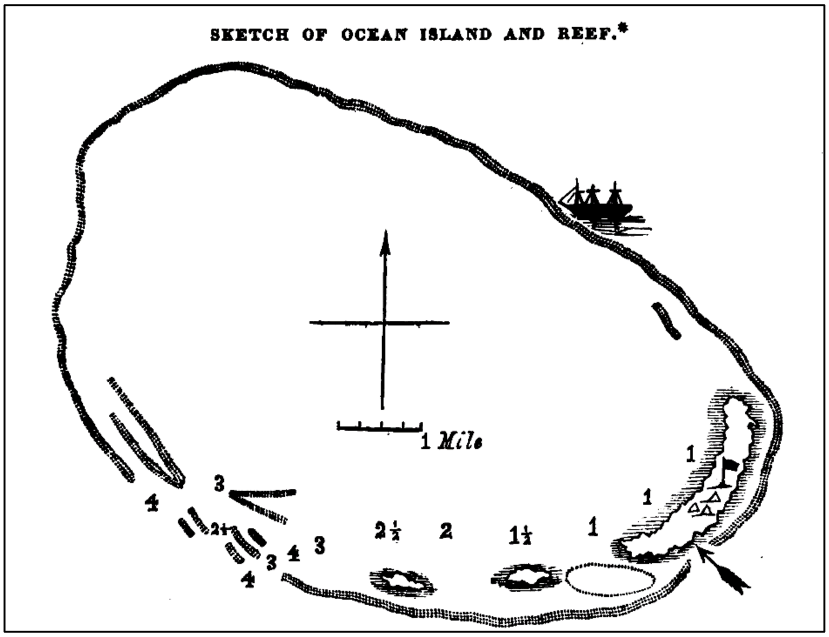

Figure 22. Map of Kure Atoll made by Captain John Richard Brown in 1837 which indicates the approximate locations of the British whaleship *Gledstanes*. From Couthouy, J.P. 1844.

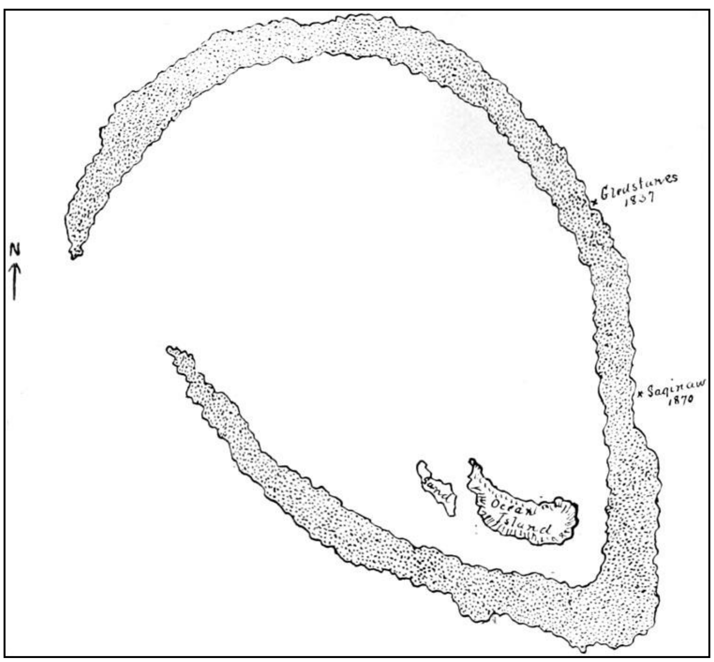

Figure 23. Illustration of Ocean Island and reef by Lieutenant Sicard indicating the locations of the wrecks of *Gledstanes* (1837) and USS *Saginaw* (1870). From Read, G.H. 1912.

CHAPTER 6. 'American-style' Whaling

Early to mid-nineteenth-century pelagic whaling represented a culmination of industrial organization that developed out of mid-eighteenth-century technological innovation. Often referred to as the 'American-style' of whaling, this highly efficient system began with the installation of shipboard tryworks around 1750 and its operational structure was securely in place by 1775 (Davis et al 1994:56). Refinement of the associated technologies employed onboard American vessels in the decades following the American Revolution was quickly seen as a formula for success, and from 1800 to approximately 1860 it was also employed with little variation by the Pacific whaling fleets of Britain and some European countries.

The basic structure for this system involved not only the specific industrial processes and specialized technologies used at sea to capture whales and extract oil; it also required the human effort that effectively drove the process. This aspect of the system included a division of labor that prescribed strictly-defined roles, a wage structure that rewarded hard work and successful hunts, an operational schedule which maximized profit potential though vessel and equipment maintenance, and risk management overseen by the hierarchical labor structure. All of these aspects of the 'American-style' system combined to produce a specific workplace that existed onboard whaling vessels of the period, and in turn, this produced a distinctive assemblage of material cultural remains and archaeological signatures. This chapter explores pelagic whaling as a three-part system and explains how the stages involved in organizing and conducting a cruise are reflected in the archaeological record of wrecked whaleships investigated in the NWHI.

Pelagic Whaling as a System

To understand how the remains of American whaleships can be interpreted as maritime industrial workplaces it is first necessary to briefly explain the larger system within which this maritime resource extraction operated. By the turn of the nineteenth century, pelagic whaling operations were for the most part standardized and determined by the stages of a voyage. For this discussion the pelagic whaling system is divided into three main stages: the 'Pre-Cruise

Stage', in which investors agree to finance a whaling cruise and all necessary preparations for it are made; the 'Cruise Operations Stage', which included all relevant operations of a vessel from its departure to its return; and the 'Post-Cruise Stage', which involved settling accounts and preparing the vessel for refit. Each of the three stages represents a combination of several operations and processes that must be carefully considered; Figure 24 presents the various stages of a whaling cruise and illustrates the system's cyclical and interrelated nature.

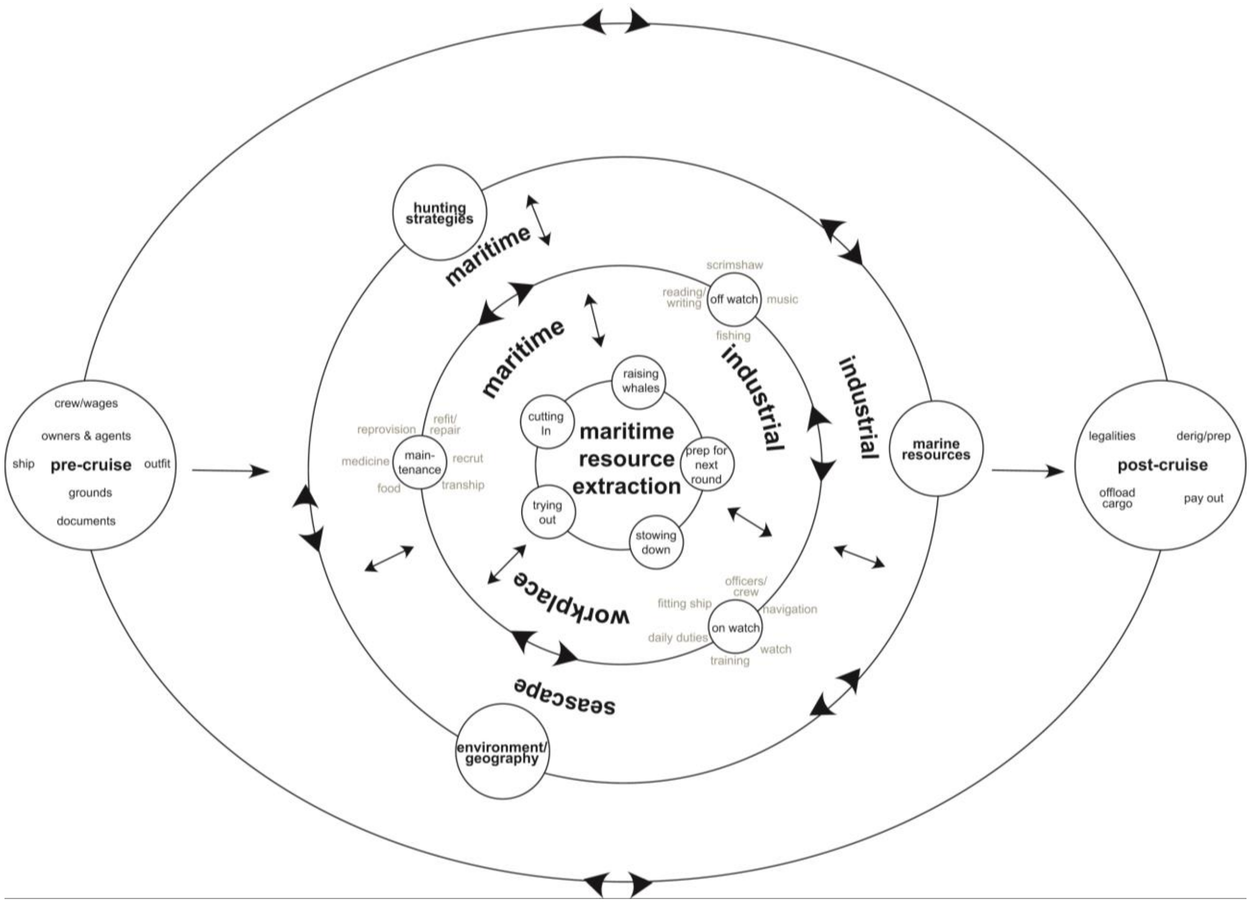

Figure 24. American pelagic whaling as an industrial system.

Because of their importance to the overall success of pelagic whaling, each of these stages is described, to some extent, in nearly every historical interpretation of whaling. In some cases particular aspects of each stage have been examined in detail to provide insight into their role in the success or failure of the overall whaling voyage (see for example Tower 1907; Jenkins 1921; Hohman 1928; Davis et al 1987; Davis et al 1997; Finney 2010). While this study is mainly concerned with the system's *Cruise Operations Stage* and its associated material culture, it is important to understand how each stage contributed to the whaleship's function as an industrial platform throughout the process. Though a wide array of factors affected every aspect of managing cruises, for the purpose of discussion, this description is based on the general structure of cruises that operated out of New Bedford, Massachusetts from the 1820s to the 1840s.

Pre-Cruise Stage

The 'pre-cruise stage' of the pelagic whaling system was perhaps the most important stage in the success of a venture due to the remoteness of the field of operations and the requirement for careful planning. By the early nineteenth century the majority of whaleships leaving American ports were bound for the largely uncharted expanse of the Pacific Ocean. As such, it was necessary that the ships carried onboard everything they could possibly need to undertake industrial operations—including stores of food, fresh water, and medical supplies that might need to last several years since there was no guarantee that places to reprovision would be found. Thus, from the initial steps of securing sufficient financial support and the appointment of experienced managers to oversee all aspects of outfitting and operations, the decisions made at this stage required utmost consideration and directly affected the financial success of a voyage and the safety of the crew.

Investors and Agents

Long before a whaleship ever set sail, an investor or group of investors first agreed to provide the capital for the voyage. In the eighteenth century, when Nantucket ships dominated the industry, investment in cruises was generally a group venture by members of the community who together accepted all risks involved, as much as they did the potential for profit. Community members, officers and crew, vessel owners, rope makers, blacksmiths, bakers and many other merchants responsible for provisioning a ship all contributed with the knowledge that their payment depended on the success of the voyage (Fairburn 1945:257). As the center of activity shifted from Nantucket Island to the coastal towns on the mainland, such as New Bedford, the system of ownership in whaling cruises changed to favor more capitalist approaches. By the early nineteenth century ownership was a more consolidated affair and the number of investors decreased to the extent that voyages were more likely to be coordinated by agents from whaling firms who invested only with close business associates and/or small family groups (Finney 2010:74).

Regardless of the number of investors, the business of whaling began and ended with the agents (Finney 2010:75). Agents were entrepreneurs who took responsibility for managing the entire whaling voyage, from the initial investment to the finalization of financial and legal matters. After 1819, it was standard that agents were also part owners in the venture; this meant that they took on great financial responsibility and risk, which consequently helped to instill confidence among investors (Davis et al 1997:400). Once they procured the capital, the agents acted on behalf of the co-owners and made all necessary decisions and preparations for the cruise. It is important to note that although the steps in planning for a prospective voyage were not always made in a particular order, each decision affected choices made about other matters relevant to the cruise (Davis et al 1997:214).

Engaging a Master

One of the most important decisions that an agent made was procuring the services of an experienced whaling master to oversee operations while the ship was at sea. Though these individuals were addressed as 'captain' while onboard (Finney 2010:2), the title of master is perhaps more apt given the responsibilities pursuant to the position. Commanding a whaling vessel demanded a range of talents and tremendous responsibility (Vickers 1985:283) and as such the master "…was given full responsibility and supreme authority over every detail of the cruise and every crew member... and although accountable for his conduct to the courts and owners ashore, he was the most unbounded of autocrats at sea" (Hohman 1928:119). As with the agent, masters also often invested in whaling voyages, which meant that the management of provisions and efficiency of the whaling operations were all the more important to them. Their responsibilities included determining hunting strategies and understanding seasonal movements, conducting all ship's business, and doctoring the sick, as well as governing the officers and crew and, most importantly, returning to port with a full ship (Shapiro 1959:22). In addition, whaling masters also required a high degree of literacy and a greater proficiency in sailing and navigation than the captains of other types of contemporary vessels. As with all sailing ships of the period, whaleships were among the most complex machines in use and operating them required a great deal of knowledge and skill (Vickers and Walsh 2005:88; Sievers 2009:402). In contrast to contemporary merchant ships, which travelled on well-established routes between ports, for the most part early nineteenth-century whaleships operated in mainly uncharted waters, necessitating greater skill for safe passage (Finney 2010:2).

Grounds to be Hunted

Once the agent and master agreed to terms of the contract, the next decision was to determine the primary grounds that would be hunted. Grounds were areas where particular species of whales congregated, fed, mated, or calved and were thus more likely to be located (Leavitt 1970:125; Morton 1982:85; Finney 2010:46). These areas were not contained within rigid physical boundaries, but instead were general parts of a particular ocean, and knowledge of them allowed for seasonal hunting patterns to be established (Davis et al 1997:108). Since opportunistic whaling occurred as soon as a ship left its home port, the choice of a primary whaling ground affected the route to be taken (i.e. passing through other known grounds), necessary modifications to the vessel based on expected conditions (i.e. additional hull reinforcement for particular environments), and the projected length of the voyage (i.e. amount of outfitting required).

Noticeable depletions in whale populations in the Atlantic grounds led whalers to round the continental capes and begin fishing new grounds in the Pacific by 1789 (Kugler 1980:22) and the Indian Ocean by 1791 (Wray and Martin 1979:213). The waters of the Pacific proved to be well stocked and by 1819 the locations of several grounds in the south and central parts of the ocean were commonly known within the whaling scene. When hunting on those grounds, whaleships pushed farther offshore hoping to expand boundaries or find new grounds; over time this practice helped to develop a better understanding of the seasonal migration patterns of whales in the Pacific. Thus, once the whaling agents and masters agreed on a primary ground, the master drew on his own experiences as well as reports from others to determine the movements of the ship while at sea (Kugler 1980:22). A review of Alexander Starbuck's (1878) list of "Returns of Whaling-Vessels, Sailing from American Ports" indicates immense variability in the detail offered by agents regarding this decision. Though some ships are simply listed as having sailed for the "Pacific" or a general area of it (i.e. N.P., North Pacific or S.P., South Pacific), others are more specific and provide the name of the actual ground (i.e. Japan Ground) to be fished (Starbuck 1878:166-167).

Vessels and Rigs

As aforementioned, the decision to hunt on a particular whaling ground had a direct effect on subsequent decisions regarding the physical aspects of voyage preparation. Primary among those decisions was the choice of a vessel that was appropriate for the cruise. The ships employed in sperm whaling in the early to mid-nineteenth century were the most important factor of the whaling business (Hegarty 1964:18). The ship provided the vehicle for transportation to and from the hunting grounds and the platform for onboard industrial operations, and also acted as a home away from home offering accommodation and other spaces that officers and crew shared over the long voyages. Thus, the choice of a suitable vessel and its continual maintenance were tantamount to the success of a voyage.

As the length of voyages grew longer, crew numbers increased, and as the seas hunted became more remote, whaleships grew in size and in complexity of their outfitting. By the 1820s ships often spent three or more years at sea where they experienced climates that ranged from blistering heat to freezing cold. Over the course of a voyage a ship's timbers were slowly weakened not only by the punishing environmental elements they routinely encountered, but also by the silent, destructive infestation of wood-boring organisms such as toredo worms (Gibson and Whitehead 1993:134). As such, all of these expected conditions and potential dangers were considered when a ship was chosen for a whaling cruise.

The primary decision regarding the choice of a vessel was whether a hull was to be reused or if a new one would be constructed. Though recycling hulls from the merchant service had long been practiced by whaling agents, after the War of 1812, the dramatic increase in the numbers of ships being employed in the fishery made finding them difficult. Thus, the 1820s and 1830s saw the advent of the purpose-built whaleship (Mawer 1999:253). The obvious advantages to new construction were the ability to incorporate the latest technical improvements (Davis et al 1997:216) and achieve optimal cargo capacity. Although new hull construction became more common and preferred, it was nonetheless expensive. Nantucket historian and whaleship owner Obed Macy listed the cost of new whaleships built in Nantucket in the 1820s as averaging $22,000, and explained that such costs were necessary to produce vessels "fit for the arduous and protracted voyages they are destined to perform" (1835:221). Construction expenses included fees and shipping costs for raw materials such as live oak and yellow pine timber from the southern states, as well as copper fasteners and sheathing, cables and ropes, anchors and chains, and ballast. Other costs included labor for the tasks performed by carpenters, caulkers, blacksmiths, painters, riggers, and sailmakers (Macy 1835:221; Hohman 1928:324; Schultz 1967). These costs continued to grow with the numbers of ships entering the fishery and by 1841 a newly constructed New Bedford whaleship required an outlay of over $31,000 (Hohman 1928:324).

Because of the high costs, many agents opted to recycle any existing hulls that could be found. Some of the recycled vessels were used in the merchant service and required some reconfiguration; others were employed in whaling for a short time and needed only relatively minor refitting; and still others were whalers beyond retirement age but could be acquired cheaply due to the extensive work needed to make them seaworthy (Davis et al 1994:58; Davis et al 1997:216). Because so many different types of vessels were converted for use as whalers, no one hull type is considered as typical. Whaleship historian Joseph T. Higgins (1927:5) explained the variations in hull form by stating, "some were deep and some shallow, some blunt and some sharp, some had flat transoms and others had shallow ones that were curved". Despite this range, the type most favored for reuse was the relatively slow trans-Atlantic packet ship, which was intended for carrying passengers, mail, and cargo. Since speed was not a requirement and the desired characteristics of a whaling ship were that they be extremely seaworthy, small, and burdensome with a full buoyant bow, the hulls of packets proved to be ideal and many were converted for whaling (Fairburn 1945:1627).

If the decision was made to redeploy an existing whaling vessel, a suitable candidate could often be found tied alongside the wharves of New England ports awaiting return to service (Littlefield 1906:4). Interestingly, a whaleship's age was not always a concern. Despite the harshness of the conditions to which they were subjected, whaleships often had lengthy working careers—some as long as ninety years (Church 1938:19-20; Davis et al 1987:48)—in part due to the diligence of their masters regarding maintenance. Another factor that is speculated as contributing to this longevity was the preservative qualities of whale oil that leaked from the casks and saturated the wood (Fishman 1975). As maritime historian William Fairburn suggests, "the whaling service seems to have operated actually to preserve the timbers and planking of the wooden vessels steadily engaged therein, as the oil impregnated the structure and prevented rot and general deterioration" (Fairburn 1945:1007).

Regardless of whether the hull was to be reused or newly constructed, its size was an important factor. Size was recorded in tonnage, which until after 1865 was a simple measurement based on overall length, breadth, and depth of hold (Morrison 1921:14; Davis et al 1997:215). Factors affecting size included the capacity of holds for carrying oil, the number of officers and crew required, and the length of the voyage (Fairburn 1945:1022). In the rush to re-establish Pacific whaling immediately following the end of the War of 1812, much of the fleet was comprised of a variety of available vessels, many of which proved to be too small. Peacetime, however, allowed the Pacific whale fisheries to flourish and with this came capital increases; between 1820 and 1840 vessel size steadily increased from roughly 280 to around 400 tons (Spence 1980:99). Thus, an average whaleship of this period was around 350 tons (Davis et al 1987:9) and measured roughly 110 feet (33.5 m) in length, 27 feet (8.2 m) in beam and 14 feet (4.2 m) in depth (Leavitt 1970:13).

Closely aligned with the choice of vessel size was the rig composition (Davis et al 1997:216). Though pelagic whaling vessels were generically referred to as 'whaleships,' several different rig configurations were employed including sloops, schooners, brigs, ships, and barks (Davis et al 1987:23). Prior to entering the Pacific Ocean, whalers commonly used schooners and brigs for Atlantic voyages, which generally lasted less than a year. By 1800, however, extended voyage lengths required more substantial platforms and increased cargo space which resulted in the full rigged ship becoming the most common rig used for vessels destined for the Pacific grounds (Kugler 1980:21). Vessels configured as ships (Figure 25) utilized three masts, all of which carried multiple square sails hung from yards attached perpendicular to the mast, as well as triangular jib sails rigged to a large bowsprit (Paasch 1885:1). With the larger spread of sails came increased speed; and because they could be employed on vessels of greater carrying capacity, the ship rig became the most popular with agents and masters in the early decades of the nineteenth century.

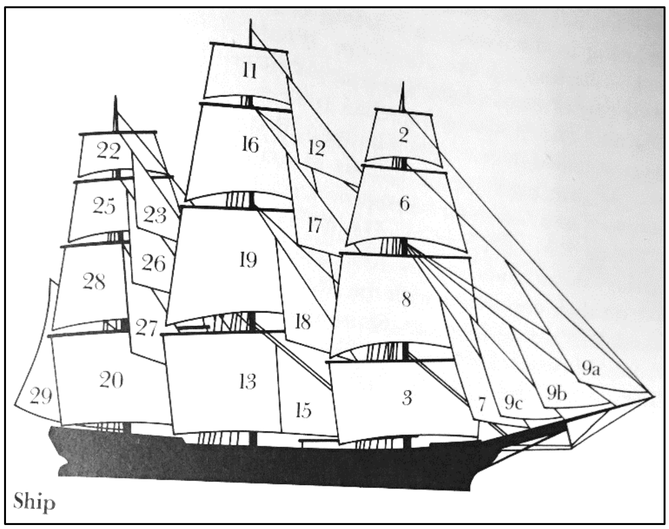

Figure 25. Illustration depicting the sail pattern of a fully rigged ship. From Doane, B. 1987.

By the 1850s the bark became the dominant rig in the American fleet due to changes in hunting grounds, which required more maneuverability and thus a different sail pattern (Kugler 1980:21). Having the advantage of greater maneuverability over ships, the bark rig proved itself among the dangerous ice floes encountered in the Arctic and eventually replaced the ship rig altogether (Davis et al 1997:270). Whaling barks (Figure 26) were three-masted sailing vessels that carried square sails on the fore and main masts, fore-and-aft sails on the mizzen, and jib sails attached to a large bowsprit (Leavitt 1970:122). Though this rig had previously been limited to ships of less than 100 tons, by the 1830s improvements in geared winches, iron strapped blocks, geared steering, better mast and spar ironwork, and lighter canvas for sails all combined to enable their use onboard whaleships (Chapelle 1967:279; Davis et al 1987:26; Davis et al 1997:270).

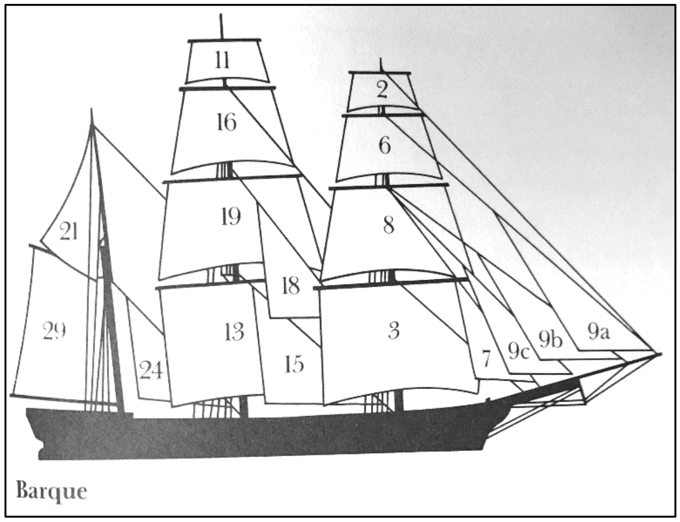

Figure 26. Illustration depicting the sail pattern of a barque. From Doane, B. 1987.

The two ships under consideration for this study are indicative of the trends of their period of use. In the first instance, information pertaining to the two known voyages (1818-1821 and 1821-1823) undertaken by the Nantucket whaleship *Two Brothers* indicates that it was a 217-ton vessel and rigged as a ship (Starbuck 1878:226-237). Because the original construction data for this ship is unavailable, it is unknown if it was purpose-built for whaling. Its relatively light tonnage, however, may be seen as a solid indicator of the reuse of an older hull since, according to Obed Macy (1835:221), whaleships built at Nantucket immediately following the War of 1812 "were about 300 tons burthern [sic]…". The New Bedford whaler *Parker* on the other hand, was built specifically for use in pelagic whaling. Constructed in 1831, customs records indicate that it was a 406-ton ship-rigged vessel that measured 112 feet (34 m) in length by 28 feet (8.5 m) in width and 14 feet (4.2 m) in depth (WPA 1940:248). These registered physical dimensions closely match those for an average whaleship of the 1820-1840 period, though the tonnage is actually at the upper end of the weight range (Leavitt 1970:13; Spence 1980:99; Davis et al 1987:9).

Crews

An agent's decisions regarding the grounds to be hunted, the vessel's size, and its rig also had implications for the number of required crew (Davis et al 1997:228). Though a large number of personnel were certainly needed to handle the numerous, massive sails and rigging of any ship or bark, the main determining factor in the size of a whaleship's crew was the number of whaleboats (Tower 1907:89). Although the larger crew numbers meant increased operating costs for the owners, the more whaleboats that were hunting directly increased profit potential. Since the effectiveness of the whaleboats was crucial to success, over time a standard crew structure developed; each boat required a boat header, boatsteerer, and four or five average seamen to operate the oars (Tower 1907:89). Thus, the personnel of an early to mid-nineteenth-century whaleship carrying four boats consisted of the captain, four mates (boat headers), four boatsteerers, a cooper, blacksmith (though these duties were often performed by the cooper), carpenter, cook, steward, cabin boy, and about 16 to 18 foremast hands—roughly 32 crewmembers (Brown 1884:221; WPA 1938:13). Because the number of crew required was greater than those of merchantmen of similar size and rig, their presence onboard became a distinguishing feature of nineteenth-century whaleships (Brown 1884:234).

The size and quality of the crews required to operate American whalers changed over time. In the earliest period of pelagic whaling, the typical Nantucket whaler was a small sloop of less than 80 tons and crewed by 13 hands who had a gone to sea as a calling or a profession (Hohman 1928:51; Sievers 2009:402). These early whale fishers followed a long-established tradition on Nantucket that saw them first join the crew of a whaleship in their early teens (often following the lead of a family member) and embracing it as a career path by learning the skills required of each role before eventually taking command of a ship in their early twenties (Sievers 2009:402). These crews were considered hardy and expert seamen and the American whaling fishery was revered as a nursery for the merchant marine (Fairburn 1945:172; Stackpole 1953:317; Olmsted 1969:120). The shift in industrial dominance from Nantucket to New Bedford, however, saw this old system decline; the explosion in the number of vessels engaged in the fishery, the increase in their size, and the changes in rig saw the need for a greater number of crew. By 1825 vessel size was closer to three hundred tons and crews numbered 25 (Hohman 1928:51). The increase in crew numbers inadvertently resulted in a noticeable decrease in the quality of hands recruited, which in turn had a direct effect on the corporate knowledge and skills of the officers. Maritime historian William Fairburn suggested that this was the result of exploitation and abuse on the part of increasingly unscrupulous owners and that "young Americans with enterprise and enthusiasm gradually became disillusioned and increasingly disgusted with whaling in the 1830s and 1840s, and when the supply of American youth failed in the forecastle, the quality of men for the cabin was lessened…" (Fairburn 1945:1037).

In the early decades of the 1800s whaling agents personally engaged in recruiting and often relied on the advice of the ship's master to find experienced officers and crew. But by the 1830s they depended more on outfitters, or shipping agents, for recruiting (Hohman 1928:70; Dolin 2007:221). Often referred to as 'land sharks' (Brown 1884:289-290), these companies or individuals assisted with outfitting the crew and for this service received a small fee from the agent and the exclusive rights to equip recruits with essential clothing and gear—for which they charged exorbitant prices (Verrill 1916:88; Dulles 1933:94; Finney 2010:233). If using a shipping agent, the whaling agent provided the number of crew required and roles that needed to be filled; this allowed the whaling agent to return to the task of managing the overhaul of the vessel in preparation for the cruise. Shipping agents devised effective methods to target would-be whalers, including posting attractive advertisements in coastal towns and regional newspapers that offered advances on pay and painted "glorious verbal pictures" of the easy life at sea, the huge profits to be made, and the exotic locations to be visited (Verrill 1916:88; Dulles 1933:94; Dolin 2007:221). And there was no shortage of interested parties ranging from experienced whalers to neophytes known as 'greenies' or 'green hands' (WPA 1938:28).

By the 1830s crews were increasingly drawn from all parts of the world and social strata; sons of the famous New England whaling families hoping to carry on a tradition could easily find themselves working alongside adventurous youngsters from inland farms, mariners from all nations of Europe, free black seamen, or criminals (Hohman 1926:657; Bolster 1990). Experienced Native American whalers and Indigenous islanders from places like the Azores, Cape Verde—and by the 1820s Hawaii and other Pacific Islands—were desirable as crew members on whaleships largely because of their reputations as skilled watermen (Hohman 1926:657; Lebo 2007:16). As a rule, labor onboard nineteenth-century whaleships was strictly a male activity (Norling 1996:71); though it was not uncommon for wives and families of captains to accompany them on a voyage, female involvement in actual whaling operations was rare (Verrill 1916:278-282; Creighton 1996:125).

American whalers were not paid a monthly wage, as were other merchant sailors of the time; instead they were offered a pre-determined fractional share of the revenue (less costs) generated from the cruise (Creighton 1990:543; Davis et al 1997:154; McConnell and Price 2006:295). Known as the 'lay' system, this method of payment had long been used in the New England fisheries, and was effectively a partnership between owners and crewmembers in which risks were shared and hard work was financially rewarded (Fairburn 1945:983; McConnell and Price 2006:296). Historian John R. Spears described the effects of this "no oil, no pay" system on the whalers by stating that it, "sharpened the eyes of the lookout, gave strength to the arm of the men at the oars, and cooled the nerves of the man who thrust the lance under the shoulder blade of the whale" (Spears 1910:201; Fairburn 1945:1015). The lays offered to mariners who signed on to a whaling voyage were relative to the amount of experience and the responsibility ascribed. The hierarchical structure of a whaleship's labor meant that the range of lays directly reflected the position in the chain of command or the importance of their skill. The lays offered to the captains and crew represented a percentage of the net profit; for instance a 1/12th lay meant that the recipient received one barrel in every twelve (WPA 1938:18). In general officers, boatsteerers, and highly skilled coopers might expect 'short lays' ranging from 1/8 to 1/100; experienced seamen, stewards, cooks, and blacksmiths received shares from 1/100 to 1/160; while the greenies and cabin boys had to be content with 'long lays' of between 1/160 and 1/250 (Hohman 1926:645; Grant 1932:36). Through the contracts they signed the crew also agreed to have fees deducted for outfitting, insurance, pilotage, wharfage, and cooperage—all of which affected their final earnings (Dodge 1882:7; Hohman 1926:645). Though the lay system was designed to provide incentive for whalers, there was no guarantee that a cruise would be profitable. The main factors that affected profitability included: trouble finding prey and taking enough whales to make the cruise financially successful; debts incurred through cash advances from the captain or by purchasing goods out of the highly overpriced ‘slop-chest’ or ‘skipper’s store;’ and unexpected fluctuations in oil prices resulting from voyages that were longer than anticipated (Morrison 1921:321; Fairburn 1945:1016; McConnell and Price 2006:296). Because of these and other factors, quite often the hands on a whaleship holding ‘long lays’ were lucky if they broke even at the end of a long and dangerous voyage.

Outfitting: Readying the Ship

Once an agent and master settled on a vessel and rig for a particular voyage and determined the number of crew they would need, the next step in cruise preparation was to outfit the vessel. Although the distinction is sometimes blurred, outfitting can be seen as having two phases: readying the hull, masts, rigging, and sails of a vessel for the cruise; and stocking the ship with supplies necessary to sustain the long voyage (Davis et al 1997:214). The first phase involved ensuring that the chosen vessel was physically equipped for the conditions expected. When a newly constructed hull was to be employed the amount of work required for this phase was limited. When using a recycled vessel, however, the need to thoroughly inspect the hull and repair all weak or deteriorated components was of utmost importance.

Refitting the Hull

As was customary of the period, at the conclusion of each voyage the hull of a whaleship was completely emptied and the rigging and spars were stripped (Littlefield 1906:4). Doing so lightened the ship and allowed for easier inspection through the process of careening. Careening involved hauling the vessel over on one side to expose the portion below the waterline (Figure 27) and then replacing any rotten timbers, planking, and fasteners (Doane 1988:260). Once the shipbuilder was satisfied with the vessel’s structural integrity on the exposed side, the exterior of the hull was prepared for the voyage. Three to five inch (7.6 to 12.7 cm) thick pitch-pine boards were attached to the outer face of the frames and then the seams between them were made watertight by thoroughly caulking with oakum and pitch (Hall 1884:25-26). To protect it from marine borers, the part of the hull that remained below the waterline was first coated with either 7/8 inch (2 cm) cedar planks (Spence 1980:101) or with a thin layer of cement or tar and 'paper' or felt; a fresh layer of copper or 'yellow metal' sheathing was then attached to the keel, rudder, stem, sternpost, and planking (Hall 1884:27; Ronnberg, Jr. 1974:183). Any modifications to the interior of the hull were also made at that time; for instance, if a ship was intended to work in arctic seas, the bow would be reinforced with thick oak planks and an iron shoe fitted over the fore foot to protect against heavy blows from ice (Littlefield 1906:6). When hull preparation of the first side was completed, the ship was refloated and repositioned before the careening process was repeated for the other side.

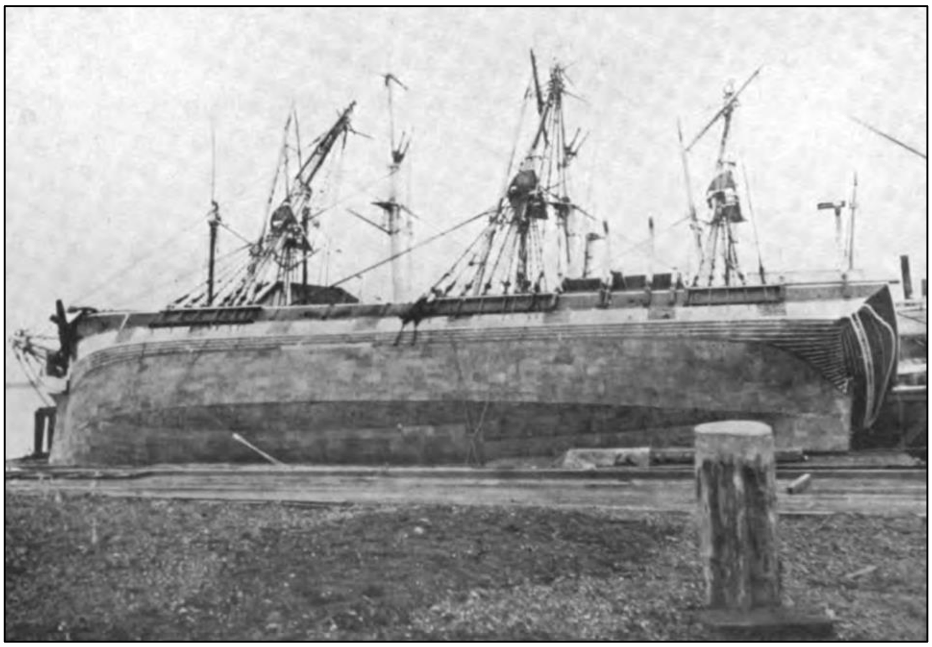

Figure 27. Whaleship *James Arnold* careened onto its starboard side while being refit. From Maury, N.B. 1896.

As with most wooden ships of the early nineteenth century, aside from timber dowels (known as treenails), which were sometimes used to attach hull and ceiling planks (Hall 1884:26), all of the structural timbers and various finishing pieces were joined using metal fasteners. Fastenings ranged in size, type, and metallic composition depending on their planned usage; during this period fasteners intended for use above the waterline were usually iron, while those installed below were made of metals that resisted corrosion such as copper, brass, bronze, or other composition metals (NHA Shipbuilding Contract 1834; Burns 2003:56). A review of documents relating to the construction and outfitting of the newly-built whaleship

William Rotch (1819) illustrates the many different types of fasteners used in its construction. Among the types of fasteners listed in these accounting records were copper bolts, ring bolts, spikes, deck spikes, staples, nails, copper nails, pump nails, deck nails, mast nails, cut nails, brads, tacks, copper tacks, and screws (NBWM *William Rotch* Outfitting Records 1819). Though numerous, these fastener types are only a sample of the fittings used in whaleship construction and fitting out; as the nineteenth century progressed the variations in size, shape, proportion, and manufacture of fasteners was almost endless (Higgins 1927:27-28).

As with fasteners, the sheathing attached to nineteenth-century whaleships for protection from wood-boring marine organisms was also typical of that used for other wooden ships of the period. Although the practice of covering hull planking with extra material can be traced back thousands of years, the different coatings used for this purpose were only minimally successful (Staniforth 1985; McCarthy 2005). Experiments with copper in the early to mid-eighteenth century, however, showed it to be the first truly effective barrier against fouling (Stone 1993:23; McCarthy 2005:102-103). The use of copper as a sheathing material not only resisted the attack of the shipworm (*Toredo navalis*) and the gribble (*Limnoria* sp), the cleaner bottoms also achieved greater speeds, were more maneuverable, and required less time for repairs (Staniforth 1985:21; Bingeman et al 2000:222). A major disadvantage in the early period of its use was the galvanic action that occurred due to contact with copper and a ship's ironwork (McCarthy 2005:103). Nevertheless, this issue was solved with the development of various copper-alloy fasteners that were much harder than pure copper and could be driven into hard wood (Staniforth 1985:26; McCarthy 2005:105-107).

Although there is some speculation that the Chinese—and then the Dutch—had employed copper sheathing on the hulls of vessels as early as the seventeenth century, it was the adoption of this technology by the Royal Navy that set the standard for its use (Bingeman et al 2000:220; McCarthy 2005:102). In the 1770s copper sheathing was attached to the hulls of some British merchantmen and by the end of the eighteenth century it was common for French and American craft to be 'coppered' (Stone 1993:23). In a relatively short time this practice became standard for all ocean-going vessels, which led to an increase in demand and cost for copper. Although the copper used for sheathing ships was pure throughout the early part of the nineteenth century, experiments with the different alloys were undertaken. In 1832 a copper-zinc alloy known as 'yellow-metal' or 'Muntz' proved to be tougher, longer wearing and less expensive than copper (Ronnberg, Jr. 1974:183; Stone 1993:23; Crothers 1997:330; McCarthy 2005:115-121). These qualities were quickly realized and by the 1850s Muntz metal—so named after its inventor—replaced copper as the most widely used sheathing metal (Burns 2003:63). The increased use of copper-alloy sheathing for whaleships is evident in the growing number of advertisements in the *Whaleman's Shipping List* over the mid-nineteenth century and by 1860 most whaleships were sheathed with it exclusively (Hegarty 1964:49; Ronnberg, Jr. 1974:183).

Archaeological evidence of ship architecture is found at both the *Two Brothers* and *Parker* shipwreck sites. Although the wooden elements of both of these ships have long since vanished (Thomson 1997:124), their metal components are less susceptible to biodegradation or the harsh tropical environment of PMNM. Thus, their architectural remains are mostly pieces and fragments of sheathing metal and the fastenings that either held timbers together or were kept onboard for repairs. In general the context for these fasteners is distorted from the timbers that once held them; this is because the same conditions that worked to smash the ships and destroy their organic structures also tended to disperse the remaining fasteners and sheathing over large areas (McCarthy 1983:1).

A number of fasteners were found among the remains of *Two Brothers*, such as bolts, spikes, nails, and tacks and all but one of them were manufactured using a copper alloy. Although recorded in both sections of the site, the majority of fasteners were found in Section B (Figure 19). Several factors are thought to contribute to this disparity. The large area encompassed by Section A (Figure 18), its pocked reef top environment, the scattered nature of the remains located there, and the difficult sea conditions at the time of investigation, all made identifying objects as small as fasteners difficult. As a result, only three fasteners were identified in Section A; a portion of a 15 cm (six inches) long copper bolt and a 10 cm (four inches) long copper nail, both of indeterminate function but clearly intended for use below the waterline, and a partial iron bolt of indeterminate function that measures roughly 20 cm (eight inches) in length and 2.5 cm (one inch) in diameter.

In Section B of the *Two Brothers* site (Figure 19), numerous copper-alloy spikes and tacks were found in pockets in the reef and on the seabed. The intended uses for these types are known; square-headed spikes of this size—13 to 16 cm (five to six inches) in length—were often used for attaching planks to the hull below the waterline and for general fastening, while the 2.5 cm (one inch) long tacks were probably used to secure sheathing plates (Steffy 1994:289) or for repairing damaged or building new whaleboats when necessary. Most of the spikes showed signs of wear such as bending or breakage, which indicates that they were in use and damaged during the wrecking event. Though a small number of copper-alloy tacks were scattered throughout the southern part of Section B, the majority of them were found in two pockets in the reef (Figure 28). These concentrations of tacks most likely indicate that they were not used. Instead it is probable that they were stored in wooden kegs in the stern of the vessel and deposited on the reef as the ship broke up; as the kegs deteriorated the tacks settled in place.

Figure 28. One of two dense concentrations of copper-alloy tacks located in a pocket in the reef at Section B of the *Two Brothers* shipwreck site (image courtesy of Papahānaumokuākea Marine National Monument).

Unlike the fasteners recorded at *Two Brothers*, most of those identified at the *Parker* site were used for securing structural timbers to one another. The majority of these were copper or copper-alloy drift bolts, which are thick, round fasteners commonly used for attaching major timber pieces such as the frames, keel, and keelson (Stone 1993:34-35). Often simply referred to as ‘drifts’, these bolts were cut from a rod to a specific length and then tightly driven into timbers via pre-augured holes. To produce an extra-strong joint and to prevent loosening, one end of the bolt was generally driven thoroughly down over a washer called a ‘clench ring’, while the other end was bent over for added strength (Stone 1993:34-35).

Drift bolt length depended on the width of the timbers to be joined; those recorded at the *Parker* site (Figure 29) ranged from roughly 30 to 80cm (12 to 31 inches). According to whaleship historian Reginald Hegarty, whaleship keels were “built up of two lines of hewn oak logs 14 to 16 inches (35 to 41 cm) square, placed one upon the other and securely bolted together” (1964:27). Thus, the length of the larger bolts found at the *Parker* site are consistent with the sizes needed to secure the keel timbers. The shorter drift bolts from the site were likely used to attach the 12 inch (30 cm) square floor timbers to the keel, connect the 12 inch (30 cm) square paired frames together, secure the 40 cm (16 inch) square keelson through the floors and into the keel, or attach the 15 cm (6 inch) thick sister keelsons to the frames (Hegarty 1964:30-31). Further evidence of the function of these bolts is found in a table of fastener dimensions published by David Leigh Stone (1993), which provides the diameters of different types of metal fasteners relevant to the tonnage of a ship. This table indicates that 2.8 cm (1 1/8 inch) bolts are a diameter prescribed for keel, keelson, rider keelson, and deadwood bolts (all drifts) of a 350 to 450 ton ship; these are consistent with the measurements recorded at the *Parker* site (Stone 1993:36).

Three smaller fasteners types were identified among the remains of *Parker*. A total of 34 fasteners used to attach the ship’s pintles to the rudder were found intact within the four pintles (discussed in the next chapter). Known as rudder nails, these roughly 12.5 cm (five inch) copper-alloy fasteners were also used for attaching the gudgeons to the rudder post by driving into the timbers via pre-made holes (McCarthy 2005:174). A small number of spikes commonly used for attaching planking to the hull were also identified scattered around the site; these are approximately 15 cm (6 inches) in length and their bent and twisted appearance indicates that they were in use when the ship wrecked. Copper tacks were the other type of fasteners found on the site. Measuring roughly 2.5 cm (one inch) in length, at least 70 of these tacks were identified and all were found still attached to sections of copper sheathing.

Figure 29. Drift bolts documented at the *Parker* shipwreck site (image courtesy of Papahānaumokuākea Marine National Monument).

Evidence of sheet copper was recorded in Section B of the *Two Brothers* shipwreck site (Figure 19). Interestingly, of the six sheathing fragments identified only one was recorded *in situ*. This fragment—approximately 7 cm (2.75cm) in length—was situated on the seabed among a concentration of copper-alloy spikes. In fragile condition, no indication of fastener holes were noted and it appeared to be either part of a single piece that was folded onto itself during the wrecking event or portions of more than one sheet that could have been stacked together for storage. Outfitting records indicate that all early to mid-nineteenth-century whaleships carried extra sheets of copper for use in case of emergency (NBWM *Condor* Outfitting Book 1832; NBFPL *Canton* Outfitting Book 1841; NBFPL *Mars* Outfitting Book 1845; NBFPL *William C. Nye* Outfitting Book 1851; Kirby 1860). The five other fragments of copper sheathing were extricated from a concretion that had formed around an iron cooking pot that was collected (discussed in chapter 7). These small pieces were discovered during mechanical cleaning of the pot while it was undergoing conservation treatment and were stabilized as part of the process (Fox 2012:6). Although it likely that this copper sheet was used or intended for treating the exterior of the ship's hull, it could also be associated with parts of the tryworks or possibly even the copper tank used for cooling whale oil.

Two sections of copper or yellow metal sheathing were also identified among a large concentration of artifacts resting in a pile near the northeastern edge of the *Parker* site. Associated with these fragments are numerous, closely-spaced sheathing tacks; the presence of *in situ* tacks may be an indication that the section of wood to which they were attached deteriorated in place (Figure 30). One piece measures roughly 49 cm (19 inches) in length and 5 cm (2 inches) in width is likely a fragment of a sheet and it is ragged edges indicate that it was probably sheared off at some point. The other is 90 cm (35.5 inches) in length and 8 cm (3 inches) in width and has sheathing tacks running along both of the long edges. The standard size for copper sheets of the mid-nineteenth century measured 35.5cm (14 inches) in length by 122 cm (48 inches) in width (Hegarty 1964:49; Ronnberg, Jr. 1974:183). It is generally accepted that these sheets were applied to a ship's hull as a full sheet with the overlapping edge running on top of the next sheet aft. Thus, it is likely that this section is a what Hegarty (1964) referred to as a 'filling piece', which along with wedge-shaped 'goring pieces', were added where necessary to fill gaps (Hegarty 1964:50).

Re-rigging

Once hull repairs and modifications were completed and the ship was again on an even keel, the next step was rigging. The task of re-rigging involved an initial inspection of the masts, spars, and bowsprit and their associated ironwork to determine their condition; components deemed unsatisfactory for further use were repaired or replaced. Though time consuming, this step was necessary to ensure that the ships were well equipped to withstand whatever conditions they might encounter.

To carry out the various tasks involved in re-rigging, skilled craftsmen who specialized in particular trades were contracted. And though the wages paid for the different services varied greatly, each was performed with attention to detail (Hegarty 1964:129). Primary among these

Figure 30. Two strips of copper-alloy hull sheathing and tacks documented at the *Parker* shipwreck site (image courtesy of Papahānaumokuākea Marine National Monument).

craftsmen were the ship smiths. These were essentially blacksmiths who specialized in nautical fabrication and were employed to repair or manufacture anew all of “the bolts, straps, trusses, bands, hooks, pins and shackles upon which the life of the ship depended” (Hegarty 1964:129). Riggers worked closely with block-makers who crafted the deadeyes used to stay the masts and blocks to work the running rigging. They also coated the lines with tar to make them more resistant to the damaging effects of sea water before running them aloft and securing them (Verrill 1916:60).

Because the intense environmental conditions experienced at sea battered the sails and cordage, as a general rule they were completely replaced and overhauled (Baker 1974:3). As aforementioned, the predominant sail configuration in the early nineteenth century was the full-rigged ship; thus an enormous amount of canvas was required to manufacture the sails. Since laying out and cutting each sail necessitated such a large floor space, the upper floors or attics of buildings—referred to as sail lofts—were generally used for this purpose (Hegarty 1964:99). Once they were properly sized, sailmakers and their apprentices hand stitched iron attachment points such as clews, eyelets, and cringles to the new canvas where necessary. When ready they were ‘bent’ or attached to the spars (Paasch 1885:147; Hegarty 1964:99).

Extra canvas and ropes were also purchased to be used as replacements; these were prepared and then stowed in casks with their contents marked so that they could be used when needed (Baker 1974:3).

Archaeological material associated with the rigging of early nineteenth-century whaleships was documented at both the *Two Brothers* and *Parker* shipwreck sites. As with the artifacts related to the ship's architecture, none of the organic components have survived in the waters of PMNM. Instead, the remains found at these sites consisted mainly of metal fittings from the ship's rigging. Among the types identified were mast and bowsprit fittings, chain, ironwork associated with components of standing rigging, portions of wire rope, and blocks used for running rigging.

A small number of iron hoops found among the main concentration of artifacts at the *Parker* site were interpreted as 'mast bands'. Full-rigged ships such as those used for pelagic whaling employed three wooden masts; each of those consisted of a lower mast of white pine and two smaller spruce timbers known as topmasts, which were used to extend overall heights and add sail area (Hegarty 1964:94). Each mast and topmast was fitted with numerous iron collars called mast bands, which were heated and driven down on the mast to provide reinforcement (Campbell 1974:113). The number of bands depended on the size and composition of the mast and some of them were fitted with eyes or swivels for attaching lines or tackles (Campbell 1974:113; Stone 1993:70). Although these artifacts are encased in marine growth and concretion, no eyes or other attachment points were noted on any of them. Based on their location and size, these are considered to have been associated with the foremast.

Other important rigging elements include 'mast caps' or 'bowsprit caps'. These were iron fittings that were added at the junction of two mast or bowsprit timbers. In order to provide the required support for partnering the two timbers, they overlapped and were held in place by mast caps. These pieces were configured with a square hole and a circular hole on either side of a frame; since the head of the lower of the two mast or bowsprit timbers was intentionally squared, the square side of the mast cap was fitted over it; the bottom of the upper mast timber was rounded and therefore the circular portion was fitted over it (Kipping 1859:26; Stone 1993:62). Earlier designs – referred to as 'ironbound wooden caps' – employed solid blocks of hard wood with pre-made holes for the two masts and a thick iron frame fitted around the outer edge for reinforcement (Campbell 1974:115). Three rectangular iron bands with rounded corners were recorded at the *Parker* site and interpreted as being mast caps of this early design (Figure 31). The largest of these is mostly intact and likely joined the lower foremast to the top mast; the others are smaller but similar in design and likely connected either topgallant and/or royal masts or the two bowsprit timbers (Doane 1987:270-274).

Figure 31. An 'ironbound wooden cap', or mast cap, documented at the *Parker* shipwreck site (image courtesy of Papahānaumokuākea Marine National Monument).

Attached to the masts were numerous spruce timbers known as 'yards' or 'yard arms', which were hung cross ways to carry the many different sized square sails that propelled the ship (Hegarty 1964:94; Stone 1993:64). The length of each of these spars varied with its position and they were attached to the masts using iron fittings known as 'parrels' or 'trusses.' These strong iron pivots were attached to the center of the yard and allowed them to move in order to trim the sails and be braced as required (Kipping 1859:112; Doane 1987:274; Stone 1993:65). The remains of four iron trusses were recorded at the *Two Brothers* site. Although heavily concreted, each of these consists of the thick central piece of the fitting which is basically a U-shaped iron bar with a short arm extending down from the center (Figure 32).

Although only one of these was identified in Section A (Figure 18), the three others were identified in close proximity in Section B (Figure 19), which suggests that the mizzen mast – farthest aft from the bow – came to rest and deteriorated there.

Figure 32. One of three iron trusses documented at Section B of the *Two Brothers* shipwreck site (image courtesy of Papahānaumokuākea Marine National Monument).

As with masts, yards were reinforced along their length with iron bands, many of which were equipped with one or more eyes for attaching blocks or lines. Known as ‘cranse irons’, these fittings were also used for creating attachments points on the bowsprit, which was a spar that projected forward of the ship from the bow and angled slightly upward (Stone 1993:60-65). Other fittings that were often added to the yards were ‘boom irons’, which were metal rings fitted on the yards and used to connect extra sails in light winds. To do connect the timbers the lower hoop of a boom iron was slipped over the outer ends of the yard arm and then a small boom was inserted through the upper hoop; from this extension small sails call ‘stunsails’ or ‘studding sails’ were flown to add extra sail area (National Historic Sites 1992:59).

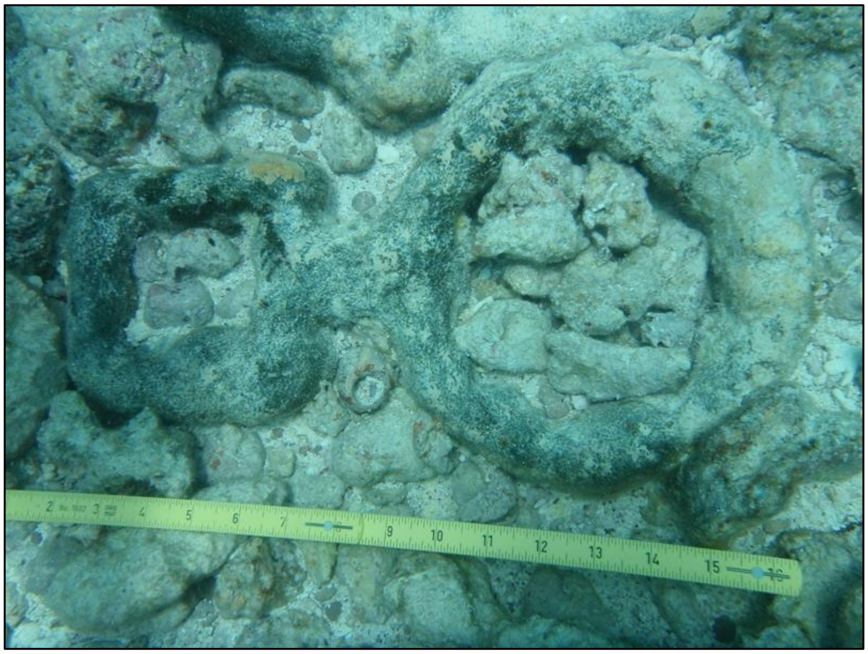

Figure 33. A possible 'quarter iron' documented at Section B of the *Two Brothers* shipwreck site (image courtesy of Papahānaumokuākea Marine National Monument).

A number of fittings associated with either the fore-yards or bowsprit were identified at both of the shipwreck sites. Two cranse irons encased in dense marine encrustation were found at the *Two Brothers* site. These specimens included one with a single-eye that was probably used on of the upper yards and a larger three-eyed band that could been used on the yard attached to the main foremast. Two cranse irons were also recorded at the *Parker* site including one with a single eye that was likely positioned near the center of a spar and a heavily concreted two-eyed band may have been fitted toward the outer end of one of the upper spars. Two other metal yard or bowsprit fittings were identified among the remains of *Two Brothers*, however, their exact functions are undetermined. These unidentified artifacts include two pieces that are thought to be boom irons; one of which resembles a 'quarter iron' (Figure 33) that was attached "3/16 the length of the yard form the outer end" (Kipping 1859:28-29), while the other could be a 'yard arm iron' (Figure 34) which was attached to the end to the spar and had another band projecting down form it.

Figure 34. A possible ‘yard arm iron’ documented at Section B of the *Two Brothers* shipwreck site (image courtesy of Papahānaumokuākea Marine National Monument).

A relatively large amount of chain was also recorded at the *Parker* shipwreck site, including numerous lengths comprised of two different sized links. The presence of chain among the remains of a ship lost in 1842 is not uncommon since chain was regularly used for anchoring merchant vessels by the 1820s (Stone 1993:12). Not long after being introduced, mariner’s realized the versatility of chain onboard ships and soon it was used for many purposes other than as cable for anchors. Chains of smaller sizes were particularly favored for staying the bowsprit to the bow of the ship. Since the smaller of the two sizes of chain recorded at the *Parker* site is not considered to be thick enough to have operated as anchor cable and other fittings associated with the bowsprit rigging are present, it is possible that it was used for ‘bobstays’, or the guy lines that connect to the stem to steady it (Stone 1993:61).

Perhaps the most prevalent of the rigging-related artifacts at both sites were ‘deadeye strops’ and ‘chainplates’. Important components of a ship’s standing rigging, strops and chainplates were used for attaching and tightening the shrouds, or ropes that supported the masts (Davis 1918:80; Biddlecombe 1925:7). ‘Deadeyes’ were flat circular blocks of hardwood such as elm or *Lignum vitae* that had a grooved outer edge and three to four holes piercing their faces. They were firmly bound within either an iron strop or the end of a rope and used in pairs to secure the ends of shrouds and stays (Biddlecombe 1925:11; Doane 1987:262; Stone 1993:71-72). A short section of rope called a lanyard was threaded between the deadeyes and used to stiffen the rigging when tightened (Stone 1993:71). Since whaleships often encountered treacherous conditions while at sea, it was vital that their masts were kept steady; deadeyes proved to be the most effective method for doing so until the 1860s, when turnbuckles began to replace them. A number of different sized deadeyes were used at various points in both the upper and lower rigging, with the largest of them added to chainplates to support the masts (Stone 1993:72).

Chainplates, also referred to as simply 'chains', were iron rods that were bent in such a way as to create a closed loop that incorporated a small diameter hole at the bottom end and a larger diameter hole at the upper end (Hegarty 1964:88). They were bolted to the topside portion of the outer hull planking through the small hole on the lower ends and reinforced using smaller iron rods known as 'preventers' (Desmond 1919:208). Chainplates were usually bent out from the side of the ship and ran through a thick, horizontal oak plank called a channel, which kept them clear of the bulwarks (Davis 1918:80; Stone 1993:72; Steffy 1994:269). A whaleship generally had six or eight chainplates located abreast of each mast on each side of the vessel (Figure 35). The shrouds attached to the tops of the masts included a deadeye at their lower ends and were brought to the tops of the chainplates –which were also equipped with deadeyes – to work as vertical pairs to stiffen the mast (Stone 1993:71). Ratlines, or small shots of evenly spaced rope, were placed horizontally above the forward pair of chainplates of each mast and whaleboat crews used them to easily climb up and over the bulwarks (Biddlecombe 1925:23; Higgins 1927:15).

Eleven possible deadeye strops or partial chainplates, as well as two complete chainplates were documented at the wreck of *Two Brothers*. All of these were identified on the reef flat within a portion of Section A (Figure 18) and were either concreted together in a small

Figure 35. Chainplates attached to the mid-ship portion of the hull of the whaleship *Charles W. Morgan* and used to stay the mainmast (image courtesy of Mystic Seaport).

pile or were found resting among the broken coral seabed (Figure 36). Since many of these artifacts are damaged or are heavily concreted into the reef structure, determining whether they are partial chainplates was not possible. A number of smaller deadeye strops – some of which are connected to short loops of iron rod – were also identified. Based on their sizes, these are interpreted as having been used in the upper rigging for steadying topmasts. Although concretion and marine growth distorts their actual dimensions, the inner diameters of the holes intended for deadeyes on these artifacts ranged from 10 to 19 cm (4 to 7.5 inches), which is consistent with the deadeye measurements offered by historian Reginald Hegarty in his *Birth of a Whaleship* (1964:88-89). The spatial location of all of the rigging components within the *Two Brothers* site supports the interpretation that the ship foundered on the reef top after its stern was smashed open and that the masts and rigging came to rest on the backside of the reef.

A smaller number of deadeye strops and chainplates were identified among the main artifact concentration at the *Parker* shipwreck site. As with the standing rigging components recorded at the *Two Brothers* site, the thick concretion and coating of marine growth distorts

Figure 36. A pair of deadeye strops documented at Section B of the *Two Brothers* shipwreck site (image courtesy of Papahānaumokuākea Marine National Monument).

the actual dimensions of these artifacts and makes determining their actual functions difficult. Only three of them were determined to be mostly intact chainplates, although portions of other broken deadeye strops are also present. Identifying features for these chainplates include the large hole intended for a deadeye to be inserted and the section of iron rod that extends below – these examples range from 1.6 to 2.0 m (63 to 79 inches) in length. Based on their location and the other remains found in this area, these probably were associated with the foremast.

Other remains of standing rigging identified at the *Parker* shipwreck site include portions of wire rope. Sections of this fragile material were found scattered among the main concentration of artifacts with lengths ranging from 9 cm (3.5 inches) to approximately 3 m (118 inches). All of the portions recorded are heavily encased in calcareous marine encrustations; two small samples recovered in 2005 revealed that the wire inside the encrustation is extremely fragile, with one of them having mostly deteriorated to a black sludge (Fox 2006). Based on its location and proximity to other standing rigging pieces such as chainplates and deadeye strops, this wire rope could have been used as shrouds for securing the foremast or as forward stays. The presence of wire rope onboard an American vessel of this date is peculiar since it was only developed in England in the early 1830s. The durability, lighter weight, smaller size, and economy of this material, however, led to its rapid adoption onboard both British Naval and merchant vessels (Stone 1993:69-70; Martin 2014:153). Although it did not begin to supplant manila ropes on American ships until the 1860s, patented wire rigging is known to have been in use on some American vessels by 1840 (Van Tilburg 2003).

Three rigging blocks were also documented at the wreck of the whaleship *Parker*. Blocks consist of a frame within which one or more grooved pulleys are mounted on a pin; ropes are passed through the frame and over the pulleys to increase lifting or holding power (Biddlecombe 1925:3; Doane 1987:258). As with all sailing vessels of the early nineteenth century, numerous blocks of varying size and configuration were used throughout the rigging for lifting and lowering everything from sails to cargo and for tightening guy lines (Doane 1987:258; Stone 1993:71). A review of various pre-printed outfitting books dating from the 1830s to the 1860s reveals a number of different types of blocks and spare parts listed as part of the ship's complement; these include burthen blocks, purchase blocks, guy blocks, and cat blocks (NBWM *Condor* Outfitting Book 1832). Although heavy marine encrustation obscures much of them, each was recorded to note size, style, and components. Ranging in overall size from 23 cm (9 inches) to 57 cm (22 inches), all three appear to be iron-framed single blocks with at least a partial sheave intact and one has a hook connected to one end. Since each of these was recorded among the main concentration of artifacts, they were probably associated with the foremast.

Other rigging elements identified at both of the shipwreck sites were thimbles. These were iron rings with grooved outer faces for seating a line that were inserted into eyes made in ropes; once in place the line was then spliced back into itself around the ring or 'seized' by tightly binding the end back onto itself using smaller line or 'spunyarn' (Davis 1918:120; Biddlecombe 1925:26-34). Thimbles of varying sizes could be found connected to the rigging in many places on any working whaleship of the period. Large quantities of thimbles were also shipped onboard as spares; outfitting records for the New Bedford whaleship *William Rotch*, for example, indicate that they were purchased by the pound rather than actual numbers because they were so numerous (NBWM *William Rotch* Outfitting Records 1819). Being such ubiquitous objects on sailing ships, it was expected to find numerous thimbles scattered among the remains of both *Two Brothers* and *Parker*.

Topside Refit and Painting

Carpenters found no shortage of work to keep them occupied during the refit; below deck they renovated the cabin and forecastle and inspected all of the interior spaces for rotting timbers (Littlefield 1906:10). On the whaleship's topside, they checked the condition of deck furniture such as hatch and companionway coamings, the skylight, fife rails and stanchions, and repaired or replaced these where necessary (Stackpole 1967:31). By the 1860s deckhouses became prominent features at the after end of the whaleship and carpenters would also attend to these; however, for the period under consideration, no such structures were incorporated since a flush deck was considered more convenient by most captains (Doane 1987:61; Leavitt 1970:14). Painters were kept busy coating nearly every surface of the vessel—inside and out—with fresh paint. The hulls of most ships were painted black from the upper edge of their copper sheathing to the tops of their gunnels, and a white band was generally added around the ship above the water line (Decker 1974:29). Onto this white band, false gun ports were sometimes painted in black (Figure 37), in an attempt to trick would-be attackers into thinking that the ship was an armed man-of-war (Littlefield 1906:10; Dickerman 1949:5; Hegarty 1960:37; MacGregor 1989:87).

Industrial Elements Added

Also added to the ship during outfitting were some of the vessel's industrial elements. These features included the davits on which multiple whale chasing boats hung, hull and rigging modifications required to accommodate carcass flensing, and the large brick tryworks that were used for boiling blubber. Once added, these features altered the profile of the ships and made them unmistakable to those who they encountered (Brown 1884:234). Unique to whaleships, these features evolved with the sperm whale fishery; as seen in the discussion of the industry's historical development, the whaling vessel underwent a marked evolution with the expansion into deep-sea whaling in the early decades of the eighteenth-century (Tower 1907:86). Each

Figure 37. Painting of the whaleship Konohassett showing the false gun port paint scheme. From: http://www.skinnerinc.com/auctions/2431/lots/275.

phase in that development brought the need for larger and more complex vessels that could withstand the increasing pressures associated with greater distances traveled, which in turn helped to formalize the system for catching and processing whales and standardize the equipment employed.

The first industrial element to be added was related directly to the hunting and capture of whales. Because early nineteenth-century ships were far too slow to actively chase whales, ships generally carried between three and five small, fast whaleboats for that purpose. The practice of employing a 'mother ship' and chase boats can be traced back to the earliest sperm whaling cruises of the seventeenth century by single-masted colonial sloops (Stackpole 1953:31; Fonda, Jr. 1969:24-25). Though faster than nineteenth-century whaleships, the seventeenth-century 'Nantucket sloop' also proved impractical for taking whales due to its size; to overcome this issue, small boats used in the shore fishery were hoisted onboard and carried on deck on wooden arms called 'tail feathers' projecting from the stern, or were simply towed if conditions allowed (Hall 1884:23; Fonda, Jr. 1969:24-25; Kugler 1980:7). Boats that were kept onboard were deployed through the use of curved or straight-armed wooden cranes called davits that suspended the boats over the sides of the mother ship without interference (Doane 1987:262). The inclusion of whaleboats onboard a larger vessel was the first significant step in the establishment of a standard form for the pelagic whaleship, and from that point one could always be recognized by the numerous boats hanging on davits (Hegarty 1964:81).

By the early nineteenth century, the system for launching boats to chase whales from the ship had been perfected and davit design was standard. Built of a hardwood such as white oak or elm, the davit timbers stood at least ten-feet high and were positioned at specific stations along the sides of the ship. Each of these had a particular name such as aft, waist, or bow boat that corresponded to their position on either the starboard or larboard (port) rail (Brown 1884:243; MacGregor 1989:87). Each boat required two davits, each of which was rigged with blocks for raising and lowering them (Figure 38). Each station also utilized other timbers to form a cradle for supporting the boats when raised. Those timbers included two uprights called bearers, which were stanchions placed between the davits and onto which the whaleboat's gunwale rested (Ansel 1978:142); triangular wooden brackets called cranes, which were attached to the bearers using pintles and eye-bolts and swung out into a horizontal position so the whaleboat could rest on its keel when raised (Brown 1884:243; Leavitt 1970:122-126); and vertical slide boards, which were light, springy boards attached to the ship's side from the rail to the waterline to prevent whaleboats from being damaged from rubbing(Brown 1884:243-244; Hegarty 1964:80-81; Leavitt 1970:122-126). Once raised into the cradle the whaleboats were secured using an iron rod that was attached to an eye on the side of the cradle arm and was hooked to an eye on the boat, as well as a rope called a gripe, which was passed from the ship, underneath and then over the boat, and back to the ship where it was made fast (Doane 1987:65). Though iron davits were increasingly used onboard whaleships by the mid-1840s, many whaleships continued to use the wooden form throughout the entire 1800s (Doane 1987:262).

Along with the installation of the davits came the need to procure the whaleboats. Since the ship was too large and slow to actively chase whales, whaleboats were among the most important factors in the capture of whales (Brown 1884:240). By the 1820s, a well-equipped whaleship usually carried four or five whaleboats on davits and two or three spare boats lashed

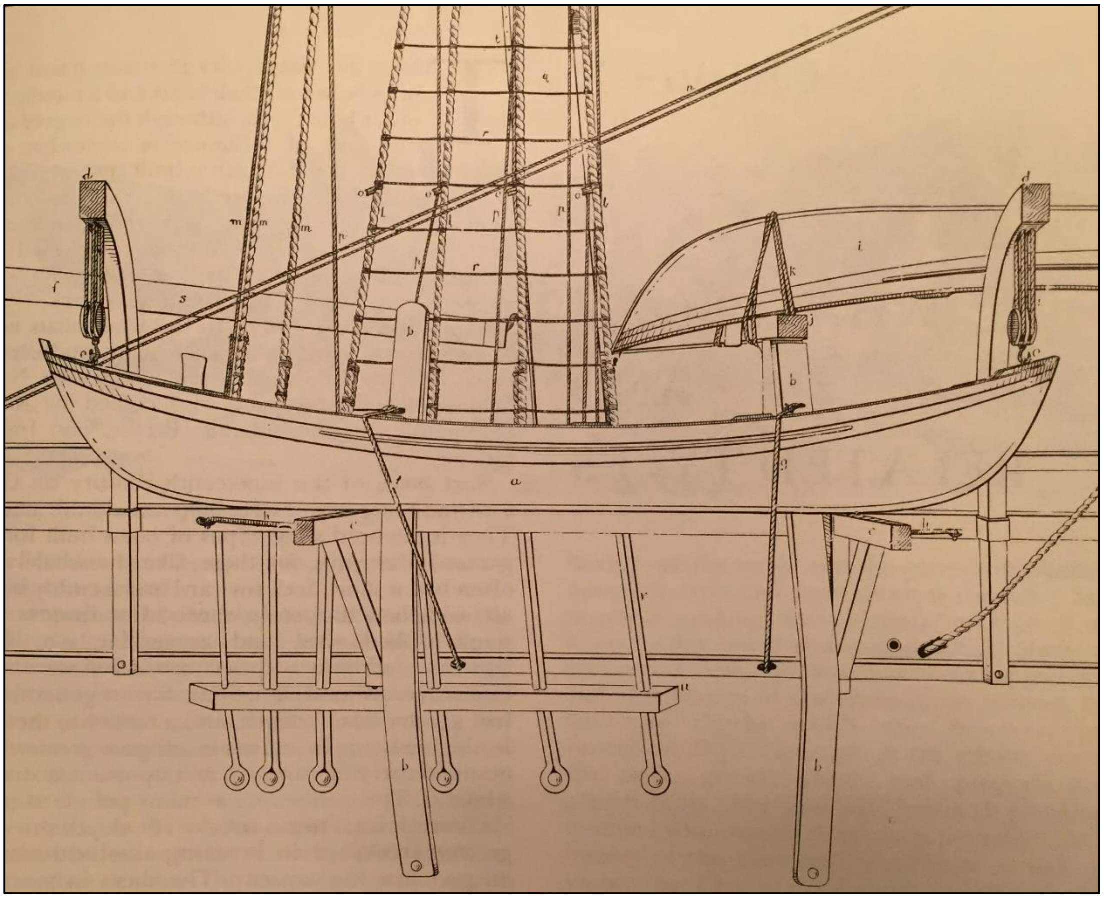

Figure 38. Whaleboat (a) resting on cranes (c); note the slideboards (b) attached to the stanchions located just to the inside of the cranes, as well as the blocks and tackles from the davit heads (d) for raising and lowering. From Goode, G.B. (ed.). 1887.

to a simple wooden framework called a 'skids' erected roughly six feet above the deck between the main- and mizzenmasts (Nordhoff 1874:44; Brown 1884:245; Littlefield 1906:8). Because of the long duration of the cruises and the many perils involved in hunting whales, whaleboats were often damaged or destroyed; thus, most ships also carried 'knocked down' boats, the components of which were prefabricated to be assembled when needed. With the increase in the number ships engaging in sperm whaling after the War of 1812, came a great demand for quality whaleboats. Thus, it was important to engage local shipwrights early in the outfitting process so that the desired number of boats would be ready by the intended date of departure.

Between 1750 and 1800, the boats used onboard American whaleships evolved into an apex form that changed little over the following century (Kugler 1971:21). Designed to be as versatile as possible, these were relatively lightweight, narrow, smooth bottomed craft that offered both great velocity and safety in rough seas (Olmsted 1841:19; Hall 1884:23). They measured approximately 8.5 m (28 feet) in length, 1.8 m (6 feet) in beam at amidships, and 0.6 m (24 inches) in depth, and were sharp at both ends so that they could be rowed from either direction (Olmsted 1841:19; Davis 1874:158; Starbuck 1878:123; Brown 1883:6; Morrison 1921:318; Spence 1980:101). Oak, spruce, and pine were used in building the boats and cedar was the wood preferred for planking due to its qualities of being lightweight but tough when wet. The planks were attached in a lapstraked construction technique (i.e. overlapping hull planks) and all timbers were connected with copper fasteners. By 1820 it was common to paint these boats white with their sheer strakes green, black, or blue (Davis 1874:157; Starbuck 1878:123-124; Brown 1884:241; Hall 1884:23; Morrison 1921:318). The few modifications made to these boats after the middle of the nineteenth century included the addition of centerboards and a change in the planking assembly employing a combination of lapstraked (clinker) and carvel (edge to edge) methods (Kugler 1971:21; Ansel 1978).

Whaleboats of the early nineteenth century were propelled either by rowing or sailing. Each boat was equipped with five thwarts on which the boat header, boatsteerer, and oarsmen sat, which had specific names depending on their position and each had a corresponding cleat for peaking oars and either thole pins or an oarlock set into the top of the gunnels. These fixtures helped to control the oars and were coated with soft rope to muffle the sound and keep from alarming whales of their presence (Davis 1874:157; Starbuck 1878:123; Higgins 1927:9; Edwards and Rattray 1932:55-56; Doane 1987:65). The lengths of the oars varied depending on the position, and all oarsmen were also furnished with a small paddle kept under the thwart for use when approaching whales (Olmsted 1841:19; Doane 1987:65). The sail configuration was simple; it employed a single mast that could be raised and lowered as needed and generally a single fore-and-aft rigged sail pattern (Kugler 1971:21).

Aside from the aforementioned thwarts, the features of the interior of whaleboats were mainly at the ends. In the bow was a box for coiling short ropes or warps; a plank called a 'clumsy cleat' that had a section cut out for the harpooner to rest his thigh when approaching whales; and an aperture on top of the stem called a chock, through which the whale line passed

(Doane 1987:65). The after section included a heavy post known as a loggerhead, which was used for managing the whale line; a projecting sternpost, to which a strap was attached for keeping the 6.1-m (20-foot) long steering oar in place; and a space large enough for the boat tub, into which was coiled 100 to 150 fathoms (180 to 270 m) of whale line for attaching to harpoons (Olmsted 1841:19; Davis 1874:157; Starbuck 1878:124; Ansel 1978:14; Doane 1987:67). The inside of the boat was covered with 'ceiling' planking and at each end a small, slightly raised platform was added to the floor; the one forward was called the 'bowsheets' and the one aft, the 'sternsheets' (Doane 1987:67).

Other modifications and additions to the ship's hull during outfitting were associated with stripping the whale's carcass; this process was called 'cutting in' by American whalers, 'flensing' by British, and 'flinching' by old Nantucketers (Brown 1884:277). From the advent of sperm whaling, American whalers always brought the carcass alongside the ship for flensing (Fonda, Jr. 1969:10), and over time a standard practice for cutting in developed, which required specific modifications to the ship. Weather permitting, cutting in was always done at the starboard gangway on the windward side where a 3 m (10 foot) long section of bulwark could be removed (Leavitt 1970:23). This detachable section provided the whalers deck-level access to the carcass, and from it, a small platform known as a 'cutting stage' was rigged so that flensing crews had access on both sides.

In the early nineteenth century this projection was simple and could be rigged either as a one or two section configuration. The single section form employed one plank roughly the length of the removed bulwark section, which sat at a right angle to the deck and was supported by tackles and lashings from the rigging and rails (Leavitt 1970:123-124). The double section form used a smaller platform of similar design rigged on either side of the gangway opening (Olmsted 1841:62; Ashley 1926:97). By 1860 the larger 'outrigger cutting-stage' came into general use (Ashley 1926:97). This was basically a modified version of the single stage with the outside planks extended to 6.1 m (20 foot) in length by 50 cm (18 inches) wide and braced out from the side of the vessel by boards about 3 m (10 feet) in size. These pieces were tied or bolted to the ends of the stage, and once rigged, were often left in place to be raised and lowered when needed (Lytle 1984:136-137; Davis et al 1997:274). This later configuration also included a special brace forward of the gangway and waist high iron stanchions that supported a pole railing along the length of the stage providing protection for the crew (Leavitt 1970:23,124). On the outside of the hull just aft of the gangway, small cleats were attached one above the other to form steps so that boat crews had easy access to the ship when the gangway was open (Higgins 1927:15).

Though a detailed discussion of the cutting in process is provided in the following chapter, it is necessary to explain some aspects of it here in order to understand other associated hull modifications. Once a whale carcass was near the ship, it was positioned so that the head pointed to the stern and the tail toward the bow (Scammon 1874:232). To hold the whale in place, it was fastened to the vessel using a chain which passed through small holes cut low through the bulwark and plank sheer forward of the foremast; the chain was then fastened to a heavy upright timber located abreast of the foremast on the main deck called a 'fluke bitt' (Doane 1987:63; Stackpole 1967:31; Leavitt 1970:124). The fluke bitt was a 25 cm (10 inch) square hardwood post that projected 85 cm (2 feet 9 inches) above the deck and had an iron pin running athwartship through its upper end (Higgins 1927:28). Either a section of heavy manila rope or a specially designed 2 cm (3/4-inch) iron chain fitted with a large iron ring one end—called a 'fluke chain'—was used for this purpose (Doane 1987:63). To prevent the rope or chain from damaging the wood of the starboard bulwarks, the holes were fitted with 10 cm (four-inch) diameter, circular iron pieces called 'fluke pipes' (Leavitt 1970:124), which had rounded lips on the outside edges and were reinforced on the inside of the bulwarks by a piece of oak 10 cm (4 inches) in thickness and 35 cm (14 inches) in height (Higgins 1927:15).

Another important part of the ship's cutting in equipment was the windlass. All merchant ships of the period were equipped with a windlass to assist in hoisting anchors (Desmond 1919:211), but by their nature whaleships had little use for an anchor; they spent several months in water that was far too deep to consider using one. Yet, like other merchant vessels of the period, the average whaleship left port with several anchors onboard; among them were the two large 'bower' anchors rigged on the bow of the ship and raised using the windlass, as well as the smaller and lighter ones called kedge anchors that were kept in storage and used to move the ship from one berth to the other or clear it if ran aground (Jobling

1995:139). Though for its primary purpose the windlass sat idle unless a ship neared land, whalers developed a secondary use for it—lifting the heavy blubber pieces onto the deck. It was this function that made the windlass an essential part of the whaling equipment.

Windlasses used on whaleships in the early nineteenth century were little more than two wooden uprights, a barrel, and a handspike. As such, using them required considerable time and exertion (Stone 1993:42; Mawer 1999:254). By the 1820s, however, the introduction of the geared windlass greatly improved its efficiency (Davis et al 1997:272). Known as pump-brake windlasses, these new models required four or five crew members on each side to operate by alternately pumping on a double-handled rocker lever which ratcheted the gear on the center of the barrel and increased tension (Grant 1932:32). A metal piece known as a pawl dropped into the teeth of the gear as it passed and kept the barrel from unwinding when pressure was released (Stone 1993:42).

The mechanical design of the ratchets and more effective positioning of the brakes resulted in increased power (Chapelle 1973:677) and significantly eased the task of lifting heavy objects. Whalers used this capability to their advantage by reconfiguring some of the rigging to enable the windlass to assist in getting blubber onboard and lowering casks into the hold. Rigging modifications were simple; a chain or rope pendant often called a 'necklace' was attached around the main masthead and rigging blocks known as 'guy tackles' were attached to the fore masthead (Scammon 1874:232; Leavitt 1970:124). These additions were mostly unnoticeable and went unused until a whale was brought alongside the ship for cutting in; at that point a number of oversized blocks known as 'cutting tackles,' were attached to the necklace on the mainmast and heavy manila lines called 'falls' were run through them and down to the windlass for lifting blubber pieces (Scammon 1874:232; Verrill 1916:41; Leavitt 1970:124). Since windlasses played such an important role in the industrial operations onboard a whaleship, great care was taken to maintain them; thorough inspection of the multiple wooden and iron components were included in a vessel's regular maintenance schedule while at sea.

The remains of a pump-brake style windlass were identified at the *Parker* site. Although the structural components of this machine were constructed of wood that has long since broken down and deteriorated, a number of the metal fittings associated with its revolving part—known as the 'barrel'—are present at the site (Hegarty 1964:55). These include the roughly 8 cm (3.5 inch) square iron shaft on which the wood barrel was built; the large, circular iron gears known as 'purchase rims'; and the multiple iron bands that were used to help bind the wood barrel (Chapelle 1973:677; Baker 1983:56). Despite being heavily coated in marine encrustation and concretion, all of these appear to be relatively intact and in stable condition. The purchase rims and some of the bands are still standing relatively upright in their original positions on the barrel and the metal shaft rests within them. Although the exact size of *Parker*'s windlass is unknown, the central part of the barrels equipped on comparable-sized American whaleships of the period measured between 10 and 11 feet (Hegarty 1964:55). Based on the context of these upright purchase rims, the windlass remains found at the site indicate an overall barrel length consistent with those measurements.

Closely associated with the windlass were the ship's anchors and their hardware. Although whaleships generally had little use for anchors unless they were calling at a port, all were equipped with a number of anchors of varying size. Three anchors were recorded among the remains of both the *Two Brothers* and *Parker* shipwrecks. These artifacts are all considered to be very well-preserved examples of their types, and the styles of those at each site are indicative of changes in anchor technologies that occurred between the 1820s and 1840s. Also documented at each site were some components associated with either anchors or the anchoring process; these include anchor rings, shackles, and hawse pipes.

Two of the three anchors identified at the *Two Brothers* site fit the description of 'old pattern long shank anchors' (Figure 39) due to their pointed crowns and the angles of their arms (Rubin 1971:231). This anchor design was commonly used on naval and merchant ships of the eighteenth and early nineteenth century (Nash 2009:136). Although there was some variation in form between the different countries that produced them, for the most part these were minor (Rubin 1971:231) and the basic style is commonly used as a diagnostic feature. The two large anchors recorded at the *Two Brothers* shipwreck have approximately the same dimensions—3.65 m (144 inches) in length and 1.9 m (75 inches) between the bills—and are interpreted as being 'bower' anchors, or the ship's principal anchors that were carried on the bow and generally rigged and stowed for immediate use (Jobling 1993:139; Steffy 1994:266). Although both of these anchors are located in Section A (see Figure 18), they are separated by over 170 meters—this distance can be taken as an indication of the violence with which the ship broke apart and scattered across the reef. A diagnostic feature of these anchors is the large iron 'ring' that was attached to the eye of the shank and used for fastening the cable (Jobling 1993:138). The presence of anchor rings indicates that they most likely pre-date the introduction of the shackle in the 1820s.

Although the stocks of neither bower anchors remain, the presence of a small notch on two sides of their shanks indicates that those used were wooden. Known as the stock key, this feature locked the stock in place and prevented it from pivoting around the shank. Stocks were cross-pieces mounted near the top of an anchor's shank and placed perpendicular to the arms to allow them to 'cant' or turn and dig into the sediment (Jobling 1993:139; Steffy 1994:267). Although later anchors used metal stocks, earlier examples were constructed of two pieces of wood that were joined around the shank and held together using fasteners and bands called 'hoops' (Jobling 1993:139). Though referred to as hoops, these iron straps were often square in shape. Generally two of them were used on each side with the outer being smaller in diameter since the wooden stocks tapered out from its center (Jobling 1993:137-139). A set of anchor hoops was recorded at the *Two Brothers* site; however, they were probably not associated with the bower anchors. Instead, their location in Section B (Figure 19) indicates that they were likely carried as spares and were stored in the stern at the time of loss.

The other anchor recorded at the *Two Brothers* site is probably a kedge anchor. This type of anchor was used for centuries to perform duties such as moving a vessel, temporarily holding one in a waterway, or clearing one that had run aground (Jobling 1995:139; Steffy 1994:267). Similar in shape to bowers though much smaller in size and lighter in weight, kedge anchors were generally kept stowed away and only deployed when needed (Desmond 1919:157). The possible kedge anchor found at *Two Brothers* measures 1.85 (73 inches) in length by 1.05 m (41 inches) between the bills and has a metal stock. Although it is commonly thought that metal stocked anchors were not introduced until the early 1800s, Steel's *Elements and Practice of Rigging, Seamanship, and Naval Tactics* indicates that iron stocked kedges were in use by at least 1794 (1794:80-81; Jobling 1993:110-113). The kedge recorded at *Two Brothers* has an eye at the top of the shank, but no ring is present; however, an incomplete anchor ring 30 cm (12 inch) in diameter that was recorded nearby could be associated with it.

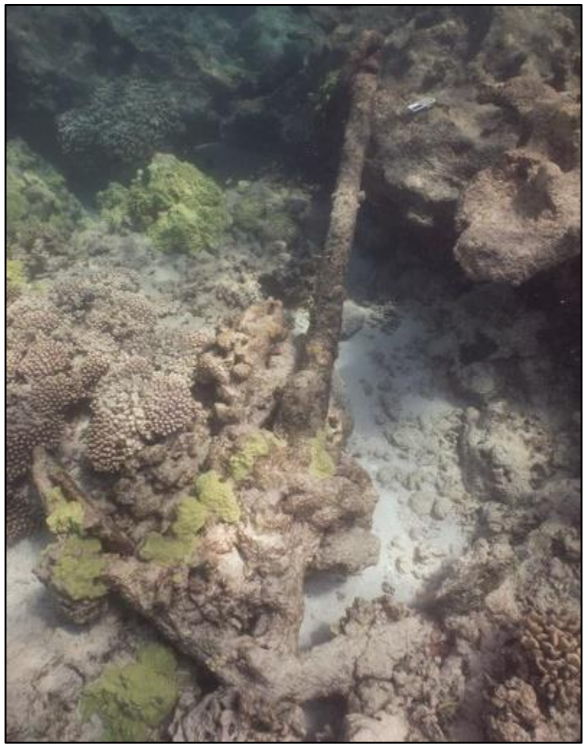

Figure 39. 'Old pattern longshank anchors' documented at Section A of the *Two Brothers* shipwreck site (image courtesy of Papahānaumokuākea Marine National Monument).

Two bower anchors identified among the main concentration of artifacts on the *Parker* shipwreck site are associated with the ship's bow. Based on their curved rather than pointed crowns, these were initially identified as being 'Admiralty style' anchors (Van Tilburg 2005). As this anchor type was only introduced to the British Navy in the same years that *Parker* was outfitted (1838), it more likely that these are of an earlier type on which the Admiralty pattern was based, such as those designed by Richard Pering around 1830 (Rubin 1971:231). Further evidence for this determination is provided by their dimensions; these anchors measure 3.1 m (122 inches) in length by 2.6 m (102 inches) between the bills and 2.85 m (111 inches) in length by 2.4 m (94 inches) between the bills (Figure 40). According to George Costell's *A Treatise on Ship's Anchors*, Pering's designs altered the proportions of the anchors such that they were known as ‘Pering’s Improved Anchors’ with ‘Short Shanks and Long Arms’ (1856:12). As with the bower anchors recorded at *Two Brothers*, these employed wooden stocks which were held together using fasteners and hoops. Two hoops were identified at the *Parker* site. Based on their close proximity to one another and the fact that one is larger than the other, these appear to comprise one side of the anchor stock for the westernmost of the two bower anchors.

One other anchor was identified among the remains of the whaleship *Parker*. This artifact was identified partially buried in the main section of the site and measures approximately 84 cm (33 inches) in length by 54 cm (21 inches) between the bills. No stock is evident and the crown is elliptical; small palms are present at the end of each arm. Although lighter, four-armed grapnel anchors are generally listed as the type used in whaleboats, some ambiguity exists in the outfitting records reviewed for this research. For instance, none of the outfitting books reviewed lists grapnels as being included with boat equipment, however, most include at least one ‘boat anchor’ being shipped onboard by the 1830s (NBWM *Condor* Outfitting Book 1832; NBFPL *Marcella* Outfitting Book 1840; NBFPL *Canton* Outfitting Book 1841; Kirby 1860).

Rather than using rings for attaching to the cable, iron shackles were documented at the upper end of each anchor at the *Parker* site. By the 1820s chain began to replace hemp rope as the preferred cable on merchant ships and shackles were used to connect chains to the anchor (Stone 1993:12). Shackles are composed of a U-shaped link with holes at its ends and a pin, which was inserted in the holes to create a closed loop; these were connected through the eye at the top of the shank (Stone 1993:7). And though numerous sections of chain that were likely used for anchoring the ship were identified at the *Parker* site, none of it appears to have been attached to the anchors when the vessel wrecked. Since the ship was accidentally lost on the reef while transiting through the region, this lack of attachment to chain could indicate that the anchors were disconnected and stowed while the ship was at sea.

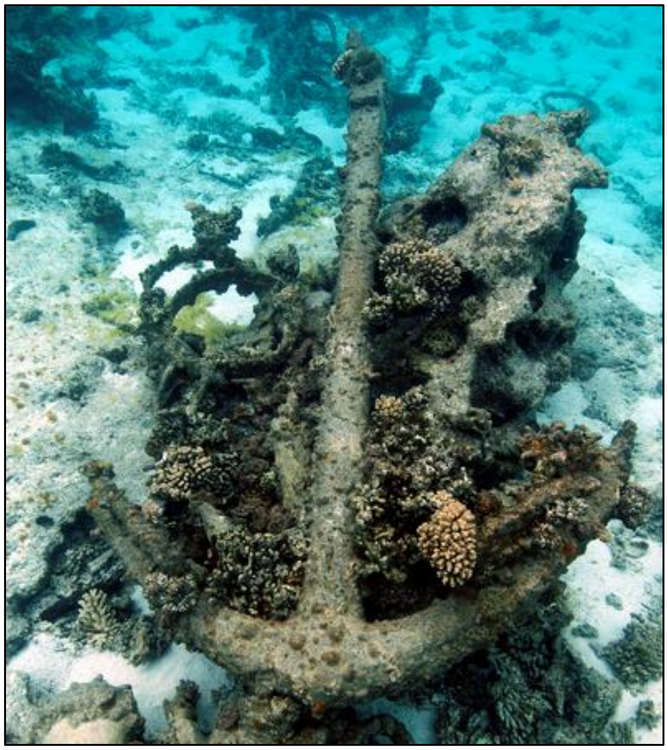

Figure 40. One of two bower anchors documented at the *Parker* shipwreck site (image courtesy of Papahānaumokuākea Marine National Monument).

One other artifact associated with the anchoring process found on both the *Two Brothers* and *Parker* sites were lead hawseholes. Hawseholes were tubes that lined the holes made in the ship's bulwarks and planking to allow the anchor cables to pass and protected the timbers surrounding them against damage from chafing (Stone 1993:38; Steffy 1994:272). According to Stone (1993), the presence of these artifacts is unmistakable proof of the bow portion of the wreck (Stone 1993:37). Two hawse pipes were recorded among the remains of the *Two Brothers* and both were located in pockets in the reef between the site's two bower anchors in Section A (Figure 18). The one identified at the *Parker* site was lying directly in front of one of the two bower anchors and next to the remains of the ship's windlass. Similar artifacts have been identified on the wreck of the British whaleship *Lively*, lost in 1811 off of Western Australia (Henderson 2007:97), as well as the Mica Wreck, an early nineteenth-century merchant schooner lost in deep water in the Gulf of Mexico (Jones 2004).

The other main component of the industrial equipment added to the whaleship was the tryworks. This large brick structure was central to pelagic whaling operations and was used for boiling blubber into oil. Hailed as the most revolutionary innovation in the development of offshore whaling (Davis et al 1997:36), the incorporation of the tryworks onboard American vessels transformed all aspects of the business. Prior to their installation, the vessels employed were mother ships of limited capacity that towed or carried smaller vessels to sea for a short time and returned with blubber in barrels for onshore oil extraction. With the introduction of the shipboard tryworks, however, whaleships became full-fledged offshore production platforms where all processes necessary for the industry's primary resource extraction were conducted. Though Basque whalers first experimented with shipboard tryworks in the late sixteenth century (Figure 41), the climate of the Arctic grounds on which they hunted and the strategy they employed meant there was little need for them (Morton 1982:30; Francis 1991:48; Barthelmess 2009:662). It was only in the mid-eighteenth century when American whalers moved into warmer waters to the south that this technology was embraced fully.

So basic was the process of trying out, that the structure of the tryworks changed little over the life of the fishery. The tryworks were essentially a large brick fireplace into which large iron cauldrons called trypots were situated (Hegarty 1960:75). Fires were built in furnaces beneath the pots to heat blubber until the oil separated from the fibers (Figure 42). When it reached a proper quality, the oil was then skimmed from the top and put into a cooling tank (Francis 1991:48). The structure of the tryworks had multiple components and, unless being installed on a newly built ship, building them first required that the deck be scrubbed and checked for rotten planks. Preparing the deck was made easier thanks to the common practice aboard nineteenth-century whaleships of 'heaving the tryworks' at the end of a voyage (Stackpole 1967:60). More commonly known as 'knocking down,' this time-honored tradition involved breaking up the structure and casting the bricks and mortar overboard, but retaining the pots and iron fittings (Ashley 1926:96; Chatterton 1925:171; Dakin 1934:4; Palmer 1959:145; Leavitt 1973:10; Ellis 1991:143; Davis et al 1997:247; Van Tilburg 2002:255). Doing this allowed the deck beneath them to breathe and dry out while the whaleship neared its homeport.

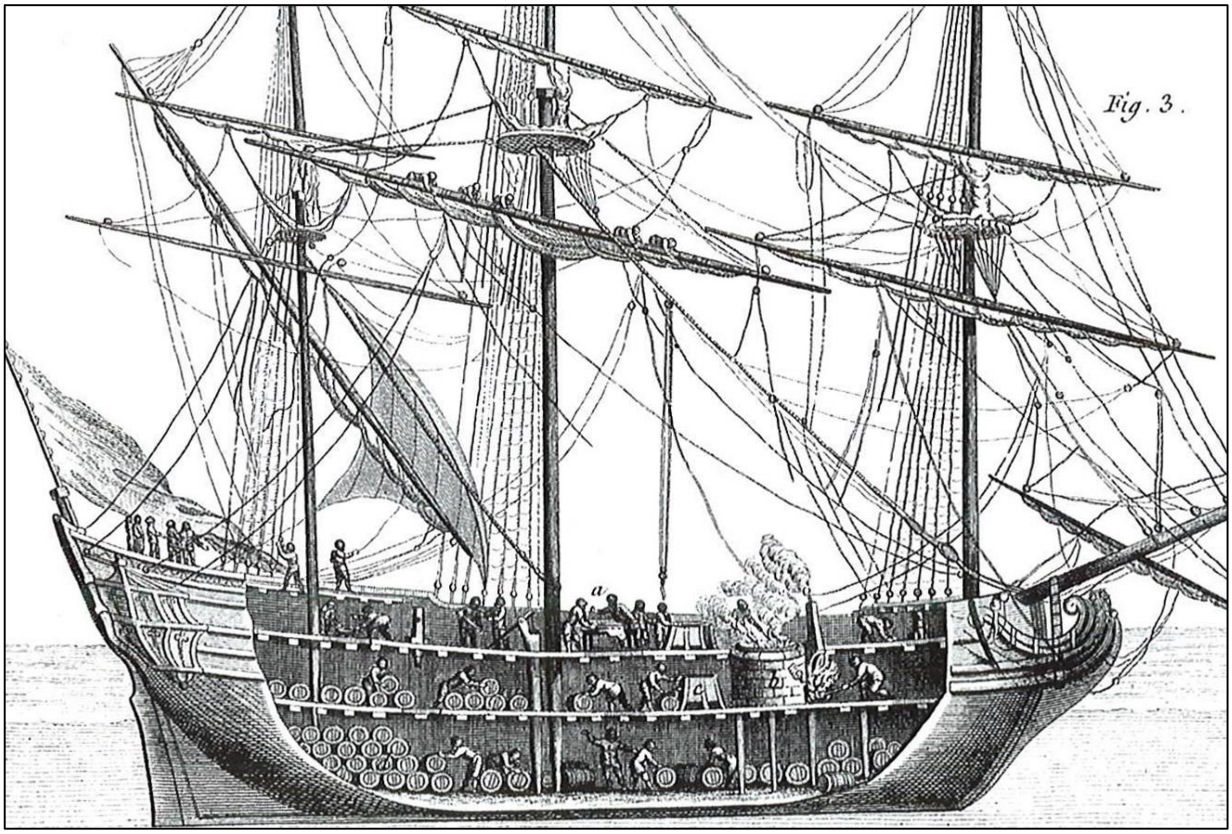

Figure 41. Illustration of a seventeenth-century Basque whaleship with experimental tryworks installed on the second deck. Etching by C. Milsan in Duhamel du Monceau, H.L. 1782.

The deck space needed for the tryworks was situated forward of the main hatch and the size varied slightly—on average it was roughly 3 m (10 feet) in length by 2.75 m (9 feet) in width (Littlefield 1906:10; Hegarty 1964:61). Once the deck was prepared, the brick structure that encased the trypots was constructed. Since the intense heat generated by the tryworks fire presented a major hazard on a wooden ship, the first step required the building of an enclosure that the whalers called a 'duck pen' or 'goose pen' (Church 1938; Hegarty 1964:61; Weslowski 1978:3). This was made either by laying several courses of bricks or 7.6-cm (3-inch) thick planks around the perimeter of a base of 5-cm (2-inch) thick planks and then adding a layer of sand and bricks. When the tryworks were in operation, water was continuously circulated around this enclosure to keep the deck cool and wet (Ambrose 2000:90; Hegarty 1964:61). On this layer, brick supports for the pots and the 1.5 m (5-foot) tall by 30 cm (12 inches) thick walls were erected; the upper foot of the walls was corbeled to fit the pots and on early whaleships the entire surface was covered in a 2.5-cm to 5-cm (1- to 2-inch) thick layer of cement mortar that slanted toward the pots (Hegarty 1964:61). The terms ‘camboose’ (Macy 1835:228; Ambrose 2000:90), ‘caboose’ (Hazen 1854:84), and ‘caraboose’ (Hawes 1924:172) have each been cited in whaling literature when referring to the entire brick structure; however, other authoritative sources (Hegarty 1960:32; Hegarty 1964:61) use the term ‘camboose’ to refer only to the water-filled enclosure beneath the fire. The word camboose is derived from the Dutch word *kombuis*—meaning galley—and it was also used to refer to a whaleship’s galley, which was located near the stern (Baker 1973:212).

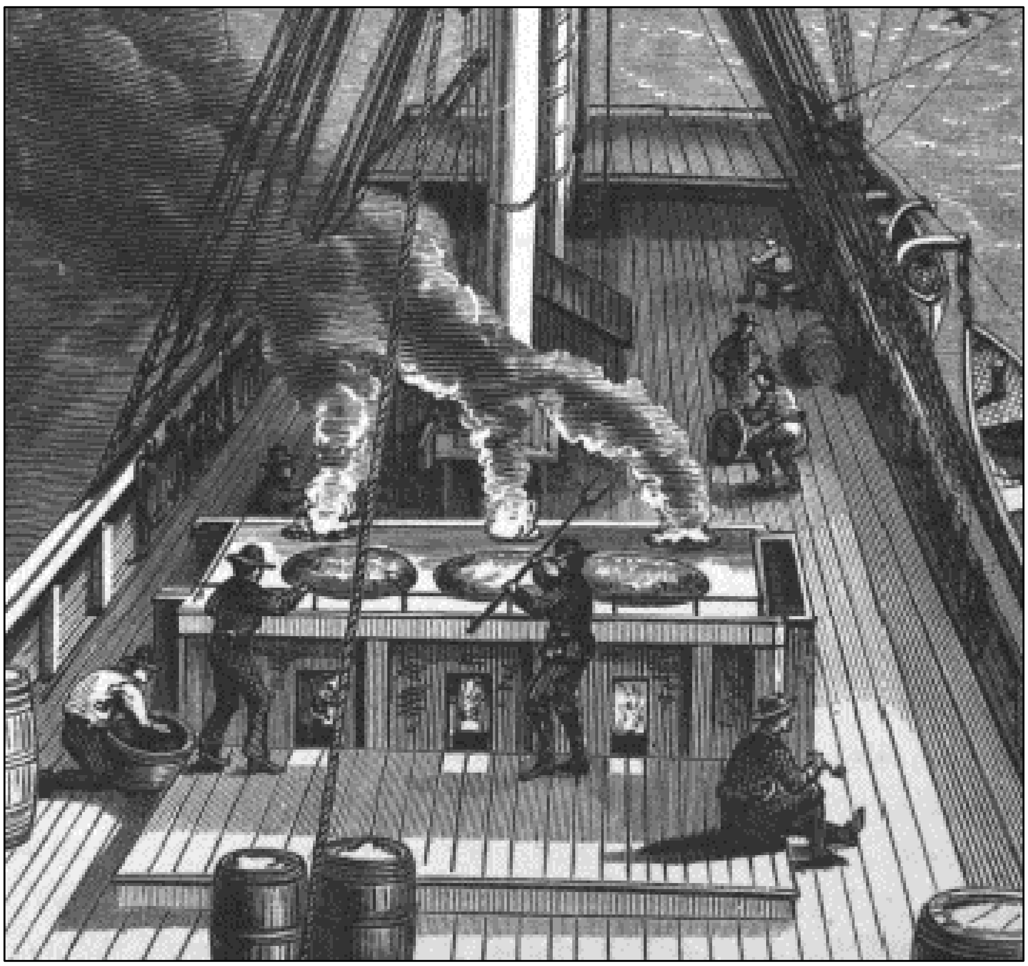

Figure 42. Illustration of whalers loading blubber pieces into a three pot tryworks. From Davis, W.M. 1874.

Though in later years the sides of the brick structure were sheathed with steel plates for reinforcement, in the early nineteenth century, wooden sheathing was used for the same purpose (Hegarty 1964:64; Weslowski 1978:3). The sheathing helped to strengthen the tryworks but the massive structure was held in place by two heavy iron knees bolted to the brick and the deck near the corners on each side. Known as tryworks knees, these were 10 cm (4 inches) in width on the face, roughly 1.2 m (4 feet) tall, and extended 60 cm (2 feet) onto the deck; about 20 cm (8 inches) from their tops were ring bolts (Higgins 1926:25; Hegarty 1964:62). On the forward edge of the tryworks were two 35 cm (14 inch) by 60 cm (24 inch) spaces that provided access to the fireboxes; these could be closed by sliding iron 'fire doors' that hung from a heavy iron rod (Hawes 1924:172; Hegarty 1964:62). Above the 'duck pen' on the inside of the structure were two square iron bars that supported multiple, smaller grate bars; these were used to make a base for the fire (Hegarty 1964:62). In the back part of the interior of the structure, the brickwork tapered to form flues that allowed the smoke to escape (Weslowski 1978:4).

Inside the tryworks were positioned two or three large iron cauldrons called trypots. These pots were purpose-built, and those used in the early to mid-nineteenth century ranged in capacity from 140 to 200 gallons (Macy 1835:228; Kirby 1860:5; Hawes 1924:172; Wiess 1974:87). The trypots had three pegged feet on the bottom and two lifting points positioned directly across from one another on the rim. Many of the pots used in the early nineteenth century had a flattened face on one side so that two pots could abut, ensuring optimum use of the furnace's heat (Pearson 1983:48). Since the trypots were so heavily cast, it was seldom that they became defective or cracked; regardless, it was standard practice to carry a spare pot lashed to the starboard fore-corner of the tryworks (Hegarty 1964:63). Another large pot carried onboard the whaleship was the oil cooler. This large copper or galvanized iron tank, lashed to the starboard side of the tryworks was used for cooling the oil before it was run into the storage casks (Littlefield 1906:10). The oblong-shaped cooler was roughly 60 cm (two feet) in width and 1.2 m (four feet) in length, open at the top, and was a few inches lower than the top of the tryworks (Hegarty 1964:63).

Finally, there was a workbench—often called the cooper's or carpenter's bench—constructed on the after side of the tryworks (Higgins 1927:28; Stackpole 1967:31; Doane 1987:62). Though not an actual piece of the tryworks or directly associated with processing blubber, this bench was nonetheless important and was added just after the tryworks were completed. The width of this six-legged bench was slightly less than that of the tryworks, its bench top was 60 cm (two feet) in width, and it stood approximately 106 cm (3.5 feet) tall (Higgins 1927:28). And as deck space was always at a minimum due to the massive amount of gear carried onboard whaleships, often the bottom of the bench was used as a coop by adding light strips nailed vertically to the three exposed sides (Higgins 1927:28; Whipple 1979:79). Livestock kept in coops onboard whaleships included pigs, fowl, and goats, and were luxuries used for the officers' meals (Littlefield 1906:12; Calkin 1953:31).

Outfitting: Supplying the Ship

Once all of the inspections, additions, and modifications were complete the ship was physically ready for the sea. Thus began the second phase of outfitting, which involved stocking the ship with all the supplies and stores that would be needed for the upcoming cruise. Even though it was standard procedure to re-provision at friendly islands when supplies of fresh vegetables, fruit, and water ran low, agents did their best to outfit the ship to last the entire voyage (Allen 1973:160; Finney 2010:78). Outfitting was a huge task since it required an incredible range of materials including industrial equipment, materials for making repairs to the ship and whaleboats, and casks necessary for oil storage, as well as provisions, medicine, galley wares, and other items for use by the officers and crew (Finney 2010:233). In his detailed treatise on the American whale fishery, Captain Charles Scammon stated that, "there are over a thousand different articles required to complete the outfit of a first-class whaleship, many of them of trifling value to be sure, yet all important to the success of the voyage" (1874:219).

As was the custom of every aspect of accounting in the whaling business during the Golden Age, the agent kept detailed records of all goods being brought onboard. Once at sea, the master was responsible for managing the supplies as efficiently as possible and keeping track of materials used. When a voyage was concluded an inventory of all remaining equipment and provisions was completed; since much of the gear could be re-used for subsequent voyages, this information allowed the agent to better determine actual profits by deducting those expenses. To assist in this operation it was standard that an outfitting record listing all of the items shipped aboard the vessel was completed at the beginning of each voyage (Davis et al 1987:35). Such meticulous recordkeeping can be traced back to the early pelagic whaling period, as is evidenced by documents on file in the Martha's Vineyard Museum archives. One such document is a hand-written list entitled 'Outfit for a whaling vessel in 1765' and was kept by the captain of the schooner *Lydia*, which sailed from Nantucket on a voyage to the Davis Strait grounds (Martha's Vineyard Museum Box 5, Folder 6; Starbuck 1878:110; Hawes 1924:99). Though not organized as such, several general divisions of goods can be differentiated including: food and drinks; arms; shipbuilding tools; spare lumber; fasteners; vessel and rigging maintenance; whalecraft; cordage; galley wares; fishing equipment; and navigational aids. This list is the earliest such record that was identified in a survey of the archives of several repositories in New England. Most of the records surveyed indicated that prior to 1765, materials intended for use on a particular whaling vessel were simply kept in the general accounts ledgers of local merchants or in those of vessel owners.

The increasing numbers of ships entering the fishery, the larger size of the vessels, and length of the journeys over the ensuing decades were all factors that led to an increase in the use of outfitting lists to keep better track of goods shipped onboard. A review of the numbers and quality of these kinds of records located in the whaling-related archives of the New England region indicate that a formalization of records occurred in the early 1800s. These records appear to have progressed from hand-written documents on unbound paper (NBWM 3 boat Outfitting Book), to paper folded and bound booklets (NHA Macy 'New Ship' Outfitting Book 1807), to ledgers devoted to keeping such records for a particular ship (NHA *Peru* Account Book 1820), to pamphlets with pre-printed pages listing necessary articles (NBWM *Condor* Outfitting Book 1832), and finally to booklets with decorative covers and pre-printed pages listing a wide range of articles (Kirby 1860). As the nineteenth century progressed, the use of pre-printed pamphlets and booklets appears to have become more common; hundreds of such files dating from the 1840s to the 1870s are preserved in the Whaling Room of the New Bedford Free Public Library and are testament to this development. Though it appears that not all agents chose to utilize these pre-printed lists in the early period, by the 1850s their use was commonplace.

Without a doubt the growth of the whaling industry and the number of printing presses available in the coastal towns by the 1840s combined to make the use of these booklets even more prevalent. Most of the pamphlets included advertisements for ship chandleries, grocers, and makers of nautical instruments and it is quite likely that they were printed by those businesses and distributed to the agents for free in the hope that agents would patronize the establishments. As the years of the 'Golden Age' passed, the types of materials and number of categories included on these lists increased; whaling historian Elmo Hohman indicated that by the mid-nineteenth century "the thousands of individual articles carried by a whaler, comprising more than one thousand *kinds* [sic] of goods, were classified under twenty-five different divisions…" (1928:331). A complete listing of all of the materials listed in outfitting books of the early to mid-nineteenth-century whaleship would be extraneous to this discussion; as such the complete text from one used for the ship *Condor* (1832) is transposed and listed in Appendix A. A review of the many and diverse items on that list make it easy to see why one historian commented that a whaleship was really a "floating department store, carpenter shop, blacksmith shop, ship yard, and several other things all rolled into one" (Verrill 1916:67).

Regardless of the format used for keeping track of outfitting, agents and captains recorded a great deal more information in the books than simply checking items off a list. In most cases the booklets tended to be used as a guide; the pages in most of those surveyed during this research are annotated with numbers beside particular items and any blank pages or empty spaces used for notes. Of course keeping track of every single thing that made it aboard a ship would have been impossible especially the items that might be brought on by the crew. Each general crew member was allowed a small amount of space for possessions—usually confined in a wooden sea chest or a canvas sack—in which they could keep personal supplies and souvenirs that they might accumulate (Dodge 1976:57-58). For the most part, however, a thorough account was maintained and the captain was aware of the items that could be found onboard.

Because the enormous amount of materials and provisions required so much space, a simple but effective system for storing it all was devised—encasing them in the same barrels that would later be used for whale oil storage. Though the term 'cask' was generically used for all of the wooden containers shipped onboard vessels of the nineteenth century, they ranged greatly in size and each had a particular name (Staniforth 1987:21). Casks were staved containers composed of three major types of parts: wooden staves, which were the numerous planks made to fit tightly on two sides with other staves to form the curved sides of the cask; head pieces, the planks used to create the upper and lower ends of the container; and hoops, narrow strips of wood or iron placed around the finished cask to tightly bind the seams (Ross 1985:3-8). All casks were constructed of oak which was highly regarded as "flexible, strong and close-grained, it is impervious to liquid, hard-wearing and will not usually crack when heated" (Howard 1996:437). Though the British used at least five different types of oak for cask construction, American coopers preferred New England-grown white oak (Howard 1996:437). Although wooden hoops were used for hundreds of years by whalers working in the cooler climes of the North Atlantic, by the early nineteenth century the hoops used for binding casks were made of solely of iron. Unlike their wooden predecessors, iron hoops could be driven farther down to tighten seams when needed and stop leakage. Historian Mark Howard suggests that this quality was a precondition for whaling moving into equatorial seas since warmer climates increased leakage (1996:436).

Before the work of outfitting was completed, the whaling agent had contracted the services of a neighboring cooperage to begin manufacturing the barrels that would be used onboard. The cooper began by taking measurements of the ship's hold to determine the exact number and sizes of wooden casks that would best fit the ship and with this information a gang of workers quickly engaged in pounding away at the enormous number of casks needed (Brown 1884:237-238). Casks were of utmost importance to a whaling cruise as they were the only reliable containers available in early to mid-nineteenth century; they could be broken down and carried unassembled, and the wood expanded when liquid was added which kept leakage to a minimum (Morton 1982:58). Whaleships carried thousands of casks, many of which were disassembled and stored in sets of staves and head pieces called 'shooks' (Olley 2004:150). Several shooks were often stored within a single, large cask; when a whale was taken these were broken out and easily re-assembled by adding iron hoops to hold them together. Since casks were essential to industrial success, their construction and reassembly took a great deal of skill. As such, good coopers were always in high demand and among the best paid of the crew of early nineteenth-century whaleships.

When the whaleship was ready to leave the dock it was loaded from keel to deck with casks—sometimes referred to as 'hogsheads'—in a range of sizes (Grant 1932:40; Doane 1987:74). The most common way to stow casks was the 'bilge and cantline' method, which involved placing the bottom layer of casks facing fore and aft next to one another, directly on the ship's ceiling (inner) planking and then loading subsequent levels—also facing fore and aft—such that the bilge, or widest part, of the cask lay in the cantline, or hollow, formed by the casks below them (Staniforth 1987:22). The largest casks formed the ground tier in the hold and served as ballast; they were filled with water and salted meat to prevent shrinking or rotting (Doane 1987:74). Long, narrow casks known as 'ryers' filled empty spaces and helped to secure casks filled with articles such as spare sails, food, and clothing for sale to the crew (known as 'slops' and kept in the 'slop chest'), which were deliberately stacked on top of one another in tiers (Grant 1932:40). Over the course of a successful cruise when the reserves of shooks and stored provisions were depleted, any available cask would be used for oil storage; this included the bottom tier ballast casks, which were pumped out, swabbed dry, and then refilled with oil (Morton 1982:58; Doane 1987:74). This system for recycling casks proved to be very effective and typifies the general attitude of owners and agents toward unnecessary waste or expense.

Ballasting

Although it was common onboard whaleships to use liquid-filled casks for ballasting a ship, a small amount of standard ballast was also added to spaces that casks did not fill. Ballast is a blanket term used for any heavy materials placed low in a ship's hold to increase its stability and to regulate its trim by reducing the center of gravity (Desmond 1919:201; Steffy 1994:267). Frequently used ballasting materials included stone, iron, lead, bricks, and in the case of whaleships, liquid. Iron bars known as 'pigs' or 'kentledge,' were often used onboard sailing vessels, particularly by the British Navy, throughout the eighteenth and nineteenth centuries (Tuttle 2007:42-43). The most common materials for this purpose, however, were river stones because they could be easily distributed where needed. Known as cobbles, these stones could be acquired for little or no expense, which makes it likely that they would have been favored by American whaleship owners and outfitters.

Approximately 30 ballast stones were recorded at the *Two Brothers* shipwreck site (Figure 43). Of those examined, all were roughly 15 by 10 cm (6 by 4 inches) in size, varied in shape, and had the appearance of having been smoothed by river water. Although it is possible that a place of origin for these stones might be ascertained by a specialist (Stone 1993:14), ballast was commonly added and removed at the many ports visited by sailing vessels, which makes obtaining a conclusive determination from such studies difficult. Based on the small number of stones and the fact that they were found clustered mainly in a small pile in Section B (Figure 19), it is likely that the ship was mainly ballasted using liquid and that the cobbles were placed aft of the bottom tier casks to add weight. In contrast to this wrecked American whaler, the only type of ballast documented among the remains of the three British whaleships lost in PNMN between 1822 and 1837 (see Table 3) was pig iron in standard lengths. This phenomenon may indicate a preference for metal over stone ballast among British owners.

Figure 43. A small pile of ballast stones documented at Section B of the *Two Brothers* shipwreck site (image courtesy of Papahānaumokuākea Marine National Monument).

Insurance and Certifications

Once all of the outfitting was completed and the equipment stowed, the lists were checked to assure that all of the multifarious articles required for a whaling voyage were actually onboard before sailing (Hohman 1928:331). While this final inventory was conducted, the agents were busy tending to matters that were crucial to the ship's departure and safe passage. Such chores included finalizing the marine insurance for the vessel and its outfits, making sure that all of the crewmembers had signed contracts, and that all necessary documents were ready for the captain to take possession. Insurance was an increasingly important aspect of the whaling industry and policies were generally underwritten by wealthy citizens or companies (Stein 1992:93). By 1820 marine insurance was readily available to all owners and costs ranged greatly due to factors such as vessel size and condition, estimated length of a proposed cruise, and the environmental conditions in the regions to be hunted (Hohman 1928:273-279). Regardless of the cost, most ships and their outfits were insured to some extent during the early to mid-nineteenth century since the potential for loss was so great.

The documents carried onboard a whaling vessel in this period were essentially the same as those required of all merchant vessels. Documentation resulted from legislative efforts by the US government to regulate and protect maritime commerce between 1776 and 1860 and the documents generated by those statutes were issued by the US Customs Service and US Consular Service (Stein 1992:12). The *Ship Register*, which provided official sanction from the federal government by acknowledging the ship as a representative of the USA was one of the most important documents (Allen 1973:160). Documents relating to the crew of the ship included *Articles of Agreement*, which were effectively contracts between owners and the crews of merchant vessels (Davis et al 1997:87), or a *Whalemen's Shipping Paper*, a type of crew list unique to the whaling industry that included the specific conditions for the whaling voyage, the name of each crew member, and the amount of their lay (Sherman 1965:59-60; Stein 1992:154). Other documents in possession of a whaleship's captain included *Certificates of Clearance*; *Consular Certificates*; and *Bills of Health* (Sherman 1965; Stein 1992:154; Davis et al 1997:87).

After all of the final checks were completed and the required documents were secured, the vessel was ready for departure. Since whaling was the main livelihood of many New England ports in the early to mid-nineteenth century, sailing day often brought great activity to the wharves as owners, their families, and the townspeople crowded the wharf to wish the whalers 'greasy luck' (Grant 1932:2). Once the officers and crew were aboard and accounted for, "the anchor was weighed, the sails were sheeted home, and the whaler slipped passed the harbor lights—outward bound" (Verrill 1916:95). Thus began the next stage of the pelagic whaling system, the 'Cruise Operations Stage'.

Cruise Operations Stage

The 'cruise operations stage' of the pelagic whaling system is without a doubt the most commonly described in the multitude of works dealing with historic whaling. Almost every history of the industry contains sketches—some sensational, others factual—describing the call of "thar she blows…" from the masthead, whalers pursuing their prey, the thrills and perils associated with the chase, and sometimes the filthy, disagreeable task of boiling blubber into oil. Without a doubt these industrial processes were the foundation to the financial success of a whaling cruise and many first-hand accounts accurately portray them in this light. When viewed as a part of the larger picture of life at sea on an early nineteenth-century ship, they were only sporadic bursts of activity that interrupted the otherwise mundane—but just as crucial—aspects of industrial life onboard (Figure 24).

By 1820 the average length of a whaling cruise was between two to three years and during most of that time crews were occupied with mundane, day-to-day aspects of the whaling life. Conducted under the supervision of the officers, these strictly regimented activities were interrelated and adherence to the daily structure meant that the ships were ready for action as soon as whales were sighted. While the decisions and preparation made during the 'pre-cruise stage' were without a doubt crucial to those that followed it, it was during the 'cruise operations stage' that the ship came to life as a maritime industrial workplace. This stage of the cruise was highly involved, thus the following chapter is devoted to a discussion of the process.

Post-Cruise Stage

The 'post-cruise stage' of the pelagic whaling system involved the unloading of cargo and preparing the vessel for refit, as well as settling accounts and formally registering any legal issues (Figure 24).The factors included in this stage could range from simple to complex depending on the success of the cruise and the conduct of the crew. And though detailed descriptions of all aspects of this stage are interesting in historical perspective, for the purpose of the discussion of how the remains of wrecked whaleships can be interpreted as maritime industrial workplaces, they are subsidiary.

Upon returning to port, the work of unloading the cargo and clearing the ship was carried out by local workers while the ship's crew was released from duty. Before the whalers could be paid it was first necessary to determine the amount of profit—if any—that the cruise generated. This process sometimes took as much as three weeks, and the whalers were obliged to remain in this port until it was complete (Davis 1874:394-395). The process began with the ship being 'broken out' by stevedores who were employed by the outfitter and who hoisted them from the hold (Ashley 1926:98). Once the ship was emptied of all cargo, equipment and any remaining provisions that might still have value, it was thoroughly inventoried and assessed for possible re-use on later voyages. All whaling tools and equipment were then placed in the lofts of buildings belonging to the owners and the oil was either sent to a warehouse or stored on the wharf (Figure 44)—often with seaweed piled onto the casks to keep them from drying out and leaking (Brown 1884:230).

Once complete, the final inventories were then taken to a counting house where clerks settled all accounts before determining profits and the crew's wages. As agreed to in their contracts, fees were deducted from earnings for services including sales commissions, insurance, outfitting, pilotage, wharfage, shipping fees, and cooperage (Hohman 1926:645; Dolin 2007:270). When the painstaking process of accounting was complete, the lays of all members of the crew were established. Before payments were made, however, subtractions were made for all deductions, advances, and credits that had been recorded in the ship's log and other ledgers or notebooks kept by the captain (Hohman 1926:646). "The most significant of these deductions comprised the slop-chest account, containing a notation of all the supplies which any man had purchased on credit from the ship's store, or slop-chest; the amounts of cash which had been advanced to him, mainly to provide spending-money while in port; and the interest charges, calculated at generous if not exorbitant rates, on the sums advanced" (Hohman 1926:647). Once all of these charges were tabulated and deducted, the crews finally received their wages, which were generally paid in cash or in a bill of exchange that would be converted to cash (Davis et al 1997:157).

Figure 44. Mid-nineteenth century photograph of casks of whale oil stored on a dock at the New Bedford waterfront. From Walton, P. 1915.

CHAPTER 7. Whaleships as Maritime Industrial Workplaces

The preceding chapter introduced the three part system for conducting 'American-style' whaling voyages and outlined the many steps involved in preparing and outfitting, as well as those required to conclude them. This chapter explores the 'cruise operations stage' of pelagic whaling to better understand how the ships operated as integrated workplaces (Figure 45). During this stage of the cruise, activities most often associated with whaling and described in popular literature on the subject, such as harpooning a whale or rendering blubber into oil, took place. And though such actions part of the central aim of the cruise, they were only a part of the day to day operations of an early to mid-nineteenth century whaleship.

To better understand the routines, the following discussion of 'cruise operations' is separated into sections relating to working and recreation periods, as well as matters pertaining to food, mealtimes, and the general health of the crew. The methods for capturing and processing whales are also described separately, since during these periods, the regular rotation of daily chores and downtime was suspended. And since it would be difficult to discuss the significance of many of the whaling-specific artifacts identified at the *Two Brothers* and *Parker* shipwreck sites without understanding their historical context, descriptions of daily life onboard and the industrial processes are followed by discussions of related artifacts found at these two sites.

Organization & Fitting Ship

With the land beyond the horizon, the whaleship became a world of its own (Allen 1973:162). Immediately the crew was organized so that work could commence. This process began with the division of the crew into two watches, which were short working periods designed to ensure that part of the crew was always alert. Designated as the starboard and larboard (port) watches and overseen by the second mate and third mate respectively, one of the watches (i.e. half the crew) was always on deck during the day (Brown 1884:229). The term 'watch' was used to refer to both the amount of time and the crew assigned to it (Dana 1842:129).

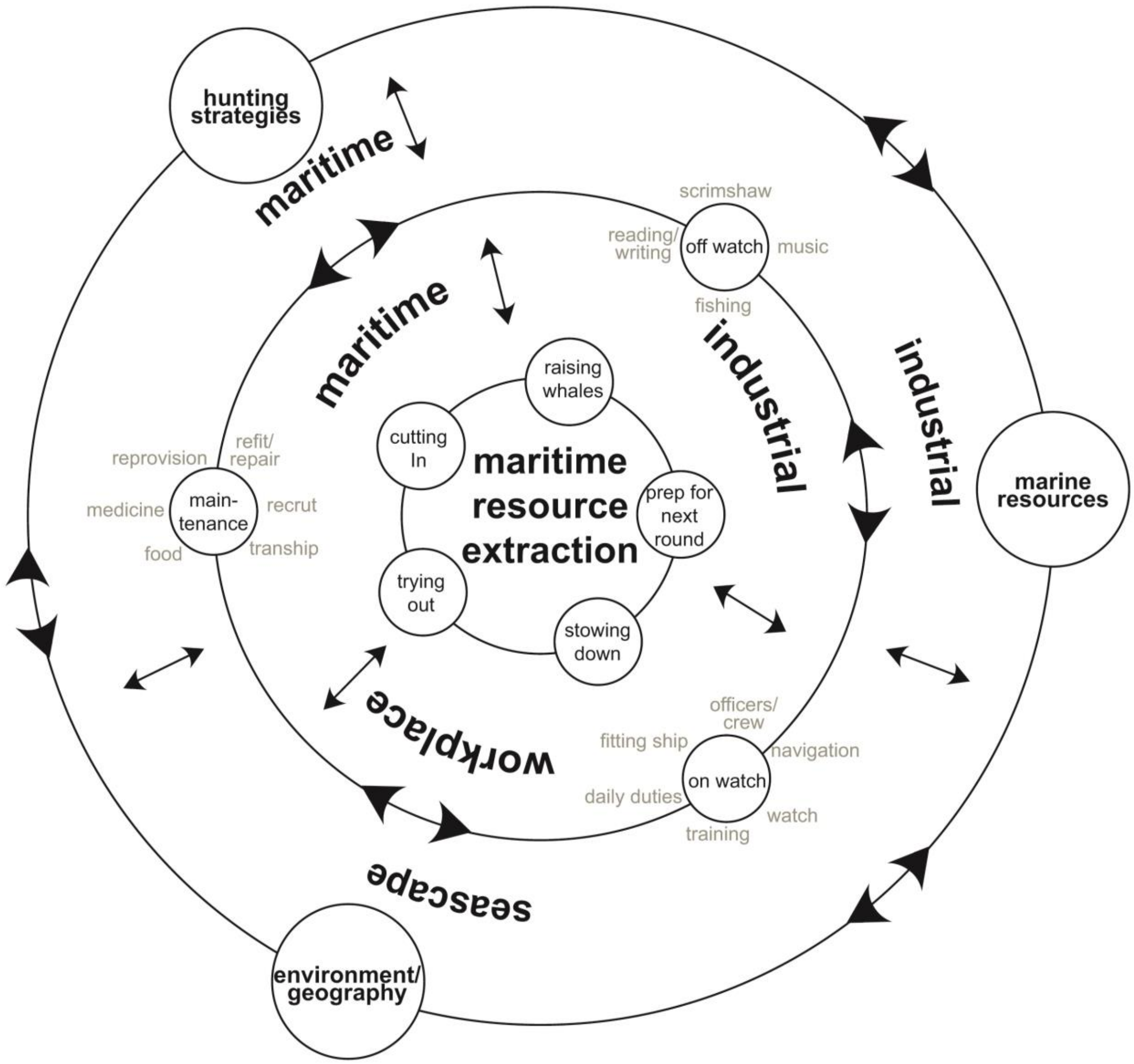

Figure 45. The interrelated components of the ‘Cruise Operations Stage’ of the American pelagic whaling system.

The organization of labor into watches was common practice on all merchant vessels of the early nineteenth century. On whaleships, however, crews were further divided by their assignment into whaleboat crews. Boat crews were chosen by the officers in charge, with each of them alternating to select a boatsteerer (also the harpooner) and four to five oarsmen depending on the size of the crew. The process involved questioning the hands about past experience and physically inspecting them in much the same way as farmers chose cattle (Grant 1932:5). Aside from their regular duties while on watch, each whaleboat crew and its officer was responsible for ensuring that all necessary gear was ready for action and that the boat could be launched at a moment's notice.

Watches were closely regulated and while making the passage to the whaling grounds, each watch worked four hour shifts throughout the day and night (Olmsted 1841:47; Doane 1987:275). Between four and eight o'clock in the evening, these were broken into 'dogwatches' of two hours to keep the rotation even and to allow the crews to eat dinner and relax (Scammon 1874:222; Brown 1884:229; Shapiro 1959:25). To ensure that the rigid schedule was maintained, two objects were critical—the ship's bell and a sandglass. In his marine dictionary J.H. Röding indicates the relationship between the two by stating that "at each change of watch, namely after four hours have elapsed and the sand in the half-hour glass has run out eight times, the bell is rung to awaken the watch below to come up." (Roeding 1793; Wede 1972:4). As demonstrated by the New Bedford Whaling Museum's half-sized model of the mid-nineteenth-century whaleship Lagoda, the bell and its associated assembly were situated in a framework mounted atop the sampson post at the front of the windlass.

Since the remains of the whaleship Parker at Kure Atoll are mostly associated with the bow of the ship, it is unsurprising that a bell was also recorded (Figure 46). Recovered for assistance in site identification, conservation of this artifact revealed that it is composed of almost solid copper (98%). Furthermore, it employed an iron clapper for ringing, suspended from an iron yoke encased in wood, and had no name marked on its surface (Fox 2010). The fact that this bell was plain and unadorned might be taken as evidence of its use onboard a whaleship; due to the general thriftiness of owners and agents, they were more likely to purchase a generic bell straight off the shelf at a local ship chandlery rather than justifying the expense of having one cast specifically with the ship's name (Wede 1972:44).

Figure 46. Ships bell on the seabed at the *Parker* shipwreck site prior to recovery and conservation (image courtesy of Papahānaumokuākea Marine National Monument).

The other material component of the watch keeping duty was recorded among the remains of *Two Brothers* at French Frigate Shoals. Believed to be part of a sandglass, a single shard of very thin, clear glass that appeared to conform to the shape of the globular end portions of a sandglass was identified in Section B (Figure 19). It is important, however, to note the small size of this artifact prevents it from being positively associated with the watch since sandglasses of various sizes were used on board ships for different timing purposes. Factors affecting the amount of time that a sandglass measured included its size and the fill material (Ford et al 2008:146-148). To determine the particular use for a sandglass would require a shard large enough to indicate overall size; the dimensions of the artifact recorded on the *Two Brothers* shipwreck gives no indication a possible height or diameter for the sandglass. Thus, while it is possible that this artifact was used in conjunction with timing of watch periods, no conclusive determination can be made.

Once the organization of the crew was completed and the roster set, it was customary for the master to address the crew on the first full day at sea (Kugler 1971:5; Mawer 1999:64). The speech delivered by the captain was intended to define the expectations of the hands and explain that failure to meet them would result in disciplinary actions (Brown 1884:230; Verrill 1916:80-81). The gist of this relatively brief message varied little among whaling captains and was performed without the aid of notes (Browne 1850:35-37; Grant 1932:6; Dulles 1933:109-110; Mawer 1999:64). One exception to the rule was that of Captain Edward S. Davoll, a whaleship master during the late 1840s and 1850s who kept a small notebook containing a written script for this purpose (Kugler 1971:6). Published in 1981 as a monograph entitled *The Captain's Specific Orders*, the text provides a rare glimpse of the expectations for the officers and crew aboard a mid-nineteenth-century whaleship. It is divided into the following sections: *To the Foremast Hands*, *Cook of the Vessel*, *Steward*, *Boatsteerers*, *Officers*, *To the Mate* and *To the Second Mate* (Davoll 1981). In each of these are addressed things like the duties of the position, the rules that must be followed, respect for others onboard and discipline, particular language to be used during operations, maintenance schedules, punishments, and particular physical boundaries to be maintained while on deck by the different ranks (Davoll 1981). Though not specifically stated, the data contained within Captain Davoll's notes was likely gleaned from his experiences while working up the professional ladder —or as whalers referred to it, 'through the hawsehole' —from the age of 18, and likely represents many of the same instructions that were given to him by previous captains (Whipple 1980:64). It might be noted that Davoll did not include position descriptions for the cooper, carpenter, or blacksmith; this is presumably due to the fact they were highly skilled craftsmen who knew their jobs and needed little instruction.

The first few days at sea often provided an opportunity for the crew to get their 'sea-legs'—many of the green hands needed time to overcome the debilitating seasickness often associated with a first trip on the ocean and some of the older sailors desired the same to sober up from their last round of 'parting drinks' (Scammon 1874:223; Hawes 1924:240). The amount of acclimation time afforded the crew depended entirely on the disposition of the officers; some were generous and recognized the issues as temporary, while others were more callous and demanded that the hands be put to work immediately (Dulles 1933:107).

Regardless of the period allowed for the crew to adjust, the first task needing attention was that of 'fitting ship' (Scammon 1874:223). Overseen by the first mate, fitting ship involved not only the usual work aboard any sailing ship of the period, such as reefing and furling sails, manning the wheel, and scrubbing the decks; it also meant readying the ship for whaling operations by 'breaking out' the casks containing the gear needed for the different processes of pelagic whaling (Scammon 1874:223; Dulles 1933:110; Davoll 1981:18). Among the many chores were re-organizing supplies; making brooms; outfitting the boats with the myriad supplies and whaling implements they required (see Appendix A); carefully coiling lines into tubs for attaching to harpoons; almost constantly turning the grindstone to ensure that all of the harpoons and lances, as well as the instruments associated with cutting-in were razor sharp; and setting up the tryworks, skimmers, ladles, and all of the other tools employed in rending blubber into oil (Perkins 1854:25; Scammon 1874:223; Grant 1932:42-44; Dulles 1933:110; Shapiro 1959:25; Hegarty 1960:37).

Though no single task involved in 'breaking out' could be viewed as more important than the others, the need for keeping the whaling implements sharp cannot be understated. Not only did dull harpoons and lances greatly decrease the probability of capturing a whale by not fastening properly, ineffective attempts at doing so often led to boats being destroyed by the jaws or flukes of an infuriated whale (Verrill 1916). The outcomes of either of those scenarios were unfavorable since they ultimately resulted in the loss of profit. Thus, what might seem to be an unimportant component of a carpenter's tool kit was in fact crucial to the success of the cruise and must be considered among the most valuable tools of pelagic whaling.

The grindstones used onboard early nineteenth-century whaleships were composite tools generally consisting of a wooden frame, a stone disc, and an iron crank. The frame was approximately three feet tall, rectangular in shape with an open center, and a beveled area on each side of the upper rim (Figure 47). The grindstone crank was inserted through a hole in the center of the disc and placed in the bevels to create an axle on which the stone revolved (Dow 1925). The grindstone wheel was often lubricated with water to keep it cool and free of residues (Light 2007:120). Though grindstones were portable objects, they were most often situated on the main deck aft of the carpenter's bench (Whipple 1979:92-93). Sharpening was undertaken by two or three crew members, one who held the tool to the stone and the other(s) turned the crank and kept it wet (Grant 1932:42).

Figure 47. A well-worn grindstone set inside of a wooden frame onboard the whaleship *Charles W. Morgan* in July 2015 (image courtesy of Mystic Seaport).

As with most important industrial objects redundancy was a consideration when outfitting a whaleship, so at least one spare grindstone was carried onboard. Made of durable sandstone, grindstones were among the equipment that might be reused for multiple whaling cruises. For example, the 1832 outfitting book for the New Bedford whaleship *Condor* indicates that one 'new' and two 'old' grindstones were included among the carpenter's tools (NBWM *Condor* Outfitting Book 1832). Because of its importance to operations and its dense physical composition, it is no surprise that a grindstone was identified among the remains of the wrecked whaleship *Two Brothers*. Resting in a pocket on the reef-top along with a small number of fasteners and other iron objects, this disc has a square hole in its center and showed no evidence of markings or whether it has been used previously (Figure 48). Since it was found in the area of the site considered to be the ship's stern, it is possible that this stone was not in active use at the time of wrecking and was instead a spare that was stowed away. A similar grindstone was recorded on the wreck of the British whaleship *Pearl*, which was lost in 1822 at Pearl and Hermes Reef in the NWHI (Van Tilburg 2005).

Figure 48. Grind stone documented in a pocket on the reef top at Section B of the *Two Brothers* shipwreck site; note numerous unidentifiable concreted iron objects situated nearby (image courtesy of Papahānaumokuākea Marine National Monument).

On Watch

Once the officers were content that fitting ship was complete and the workplace was ship-shape, the watches settled into the routine chores expected of them. Typically the day began with breakfast for all hands at sunrise, after which the rotation of the watches began (Scammon 1874:229). The schedule of work onboard a whaleship revolved around several regimented activities that were performed without fail. On a daily basis the duties of a whaler ranged from those of utmost importance of the conduct and maintenance of the ship and the industrial success of the cruise, to more mundane tasks like weaving mats for chafing gear (Brown 1884:229; WPA 1938:14) or cleaning the decks using scrub-brooms made from pickled blocks of seasoned-oak (Perkins 1854:29). Other activities that were attended to as part of the watch included patching, painting, caulking, pumping the bilge, and—once oil had been procured— 'wetting the hold' or keeping casks wet to prevent leakage (Brown 1884:289; Ashley 1926:98; Doane 1987:74; Dickson 2011:3). Thus maintenance of the ship and cargo occupied a large part of a sailor's working life, especially during the four- to six-month outbound journey to the Pacific, when whales were not expected (Delano 1846:80; Dulles 1933:112; Morton 1982:87).

Among the most important duties during the first part of the cruise was the training of the green hands onboard. Obviously this involved teaching them all manner of things associated with working on any sailing ship of the period such as handling sails and lines, tying nautical knots, and splicing. Whaleship crews, however, also needed to be able to launch the whaleboats in pursuit of prey at a moment's notice and seemingly endless drills helped them to fully understand that strict routine (Stackpole 1967:37). Training included instruction in the exact methods for lowering the boats from the davits and entering them; handling the sail and oars; techniques for approaching and killing whales; communication with the ship; attaching the carcass to the ship; and re-cradling the boats. To assist with these exercises, an extra spar was often lowered into the water and used as a 'dummy whale' for the crews to learn to maneuver around. Drills continued throughout the outward bound voyage—especially when the ship was becalmed—until discipline among the crew was established (Browne 1850:38; Payne n.d.:2; Verrill 1916:97). The value of this training cannot be understated; whaling was an extremely dangerous activity that demanded attention and proficiency on the part of whaleboat crews. When considering the range of skills to be mastered during this relatively short period, the training of green hands on a first cruise can be seen as an unofficial period of apprenticeship (Hohman 1926:658).

Also of utmost importance among the routine daily activities onboard a whaleship was manning the lookout. Since the obvious objective of the cruise was to take whales, no time was wasted in positioning crew high in the masts for this duty. Each day at dawn an officer or boatsteerer went aloft to the head of the mainmast and one or two hands ascended to the fore-top-gallant crosstrees to scan the horizon for whales (Weiss 1974:82; Payne n.d.:2). Around the middle of the nineteenth century a small platform was constructed at the heads of the masts that included a double-ringed iron railing—referred to as 'the hoops' (Stackpole 1967:38). This innovation increased safety and reduced the risk of falling since prior to this time crewmembers on lookout duty simply held on to the spars and mast (

Figure 49). Sharp eyes were of greatest importance for this duty, so the lookout crews were relieved every two hours from dawn to sunset (Macy 1835:223; Browne 1850:192). Being one of the main responsibilities involved in the watch, officers of whaleships kept a close eye on the men at the masthead to ensure that they were alert and that no prey was missed.

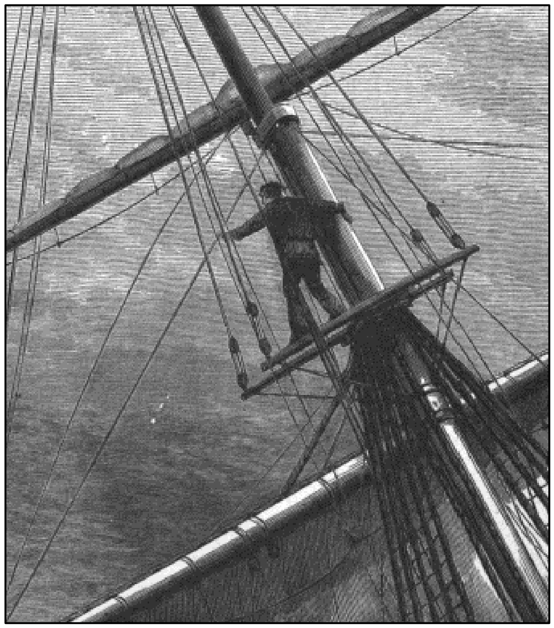

Figure 49. Illustration of a whaler aloft and signaling that a whale has been spotted. From Davis, W.M. 1874.

The rotation of the lookouts coincided with two-hour watches at the ships' steering wheel (Browne 1850:192; Perkins 1854:30; Scammon 1874:229). Standing watch at the wheel involved watching the sails and rigging, listening for calls from the lookouts, and keeping track of the needle compass mounted just forward of the helm (Higgins 1927:22). Maintaining the course established by the captain while en route to the targeted whaling ground was an important duty of those watching the helm, particularly once the ship entered the Pacific. Though innovations in the steering apparatus were common on merchant ships after the 1860s, American whaleships always used a type known as a travelling wheel (Higgins 1927:22; Grant 1932:28). This system involved the head of the rudder post protruding through the deck and with a connected tiller; mounted to the tiller was a helm consisting of a wheel and drum. The mechanism worked through a system of rigging that allowed it to move easily. Ropes were wrapped multiple times around round the drum, then looped through blocks on the tiller and on to another set of blocks attached to the bulwarks on each side of the ship (Higgins 1927:22;

Grant 1932:28). This projecting design—referred to by whalers as a 'shincracker'—required the helmsman to walk back and forth across the deck when the wheel was turned, which in turn kept them busy and alert (Grant 1932:28; Leavitt 1970:135).

Above deck, the 'shincracker' steering system was composed mainly of wooden and fiber components. The version of this assembly used on early nineteenth-century whaleships had few metal components aside from some fasteners, a rod used for the drum axle, small sheave pins in the steering blocks, and eye-bolts to which the blocks connected (Higgins 1927:22). As evidenced on both the half-model of *Lagoda* and the 1841 whaleship *Charles W. Morgan*, by the middle of the nineteenth century more metal parts were added including a strap and fasteners used to better secure the tiller to the head of the rudder post and a brass frame that was fitted over the front of the tiller and incorporated the two steering blocks.

The other main component of the steering system was the rudder. Affixed directly to the tiller and extending into the water to the depth of the keel, this large timber blade was hinged against the sternpost using pintles and gudgeons which allowed it to pivot and control the ship's direction while underway (Davis 1918:32; Steffy 1994:278). The rudder was composed of vertical planks that acted as a paddle and the forward-most of them—known as the rudderpost—projected up through the deck. The front edge of the rudderpost was notched to accept the four evenly-spaced pintles, which were straps connected to the rudder that had downward projecting pins on their faces. These pins were used to slot into a corresponding hole on the faces of gudgeons, which were straps that fastened to the sternpost (Nash 2009:135). As with the rest of the hull, the rudder was protected from marine borer infestation by adding first a horizontally-lain layer of 1.5 cm (5/8 inch) white pine and then a layer of copper or Muntz sheathing running from its bottom to one foot above the ship's load waterline (Hegarty 1964:49-50).

Because rudders were not fastened securely to the ship, a removable block known as a 'wood lock' was often added below one of the pintles to keep the rudder from floating off its hinges (Luce 1863:91; Stone 1993:59). Heavy ropes or chains, known as a 'rudder pendant', were connected to eyes mounted near the top of the rudder and used to tether it to the stern. With the rudder attached in this way, it was possible to re-hang or 'ship' it while at sea if it became dislodged (Luce 1863:91; Stone 1993:59). In some instances, however, weather conditions were so extreme that pendants broke and rudders were lost altogether, which rendered ships uncontrollable and often resulted in losses.

Four pintles were found situated in the area between the back reef and the main concentration of the *Parker* shipwreck site. As was standard for the nineteenth century, these were composed of either copper or a cuprous alloy and their number and varying sizes indicate that they represent a complete set. Based on the area in which they are located and that corresponding gudgeons were not identified near them, it is presumed that the rudder was unhinged from the ship at some point during the wrecking event. Since most of the fasteners remain intact or mostly intact, it is likely that the rudder timbers deteriorated *in situ*. Though the pintles identified at the *Parker* site are in excellent condition, unlike similar artifacts found on other shipwreck sites, these had no visible markings that might help to identify the foundry of their manufacture.

Directly related to steering the ship was navigation, which was among the many daily activities of the captain but usually carried out by the mate. As noted previously, captains of early nineteenth-century whaleships were required to be expert navigators. The search for new whaling grounds led the whaleships ever farther into unexplored regions where they often passed islands, reefs, and shoals that were previously unknown. And since it was not until 1828 that the US Government began to consider mounting a mapping expedition of the Pacific, when whaleships encountered new geographic features they were ascribed a name—often that of the ship or captain recording them—and their approximate latitude and longitude were charted (Kugler 1971:25). In an effort to prevent tragedy, these locations were shared among whaling captains and this practice gradually led to an expanding, communal knowledge of the Pacific region. Thus, of the many duties that the captain and officers attended to while the ship was under way, maintaining its position was of utmost importance.

Whenever whaleships encountered areas where the depth of water and the character of the bottom were not well known, measurements were taken using a weighted line called a sounding lead (Luce 1863:345). Sounding leads were standard components of the navigational equipment for all ships of the period and consisted of a line of varying length, which was attached to an elongated piece of lead that tapered out from top to bottom. Depth was obtained by counting knots tied in the line that indicated a specific number of fathoms (1.82 m). Bottom composition was ascertained by studying the 'arming', which was a lump of tallow placed in an indentation on the bottom of the lead used to capture a sample of sediment when it hit the seabed (Raper 1840:91). To use the sounding lead, the 'leadsman' threw it ahead of the ship while it was underway; the lead sank as the ship progressed and the depth was taken when the line was perpendicular (Luce 1863:3). When a captain considered the ship to be nearing a geographical feature, soundings were begun so that the course could be changed to avoid shallow water and grounding.

Two types and sizes of leads were used for sounding in the nineteenth century. The smaller of the two was known as a 'hand-lead', which weighed 7 to 14 pounds (3.2 to 6.4 kilograms (kg)) and was rigged with a line of 20 to 30 fathoms (36 to 55 m) that was coiled by hand. The larger was known as a 'deep-sea lead', which weighed 28 and 100 pounds (12.7 and 45.3 kg) and was rigged with 80 or more fathoms (146 m) of line often wound on a reel (Raper 1840:91; Luce 1863:3). Historic records show that both types were included among the many other articles carried onboard whaleships by at least the early 1830s (NBWM *Condor* Outfitting Book 1832; NBFPL *Mars* Outfitting Book 1845). And while it is certain that sounding leads were used as early as 1765, the records give no indication of their type or weight (MVM 1765 Outfitting List).

A small, octagonal-shaped sounding lead was found concreted to the reef in Section B of the *Two Brothers* shipwreck site (Figure 19). Clearly exhibiting an attachment eye at the top end and an indentation on its bottom, its size suggests that it is a 'hand-lead' (Figure 50). Similar artifacts have been recovered from the wreck of *Lively*, a British whaleship lost off the Western Australian coast in 1811 (Henderson 1983; Stanbury 2015), and the Mardi Gras Wreck, a 1820s-era trading ship sunk in the Gulf of Mexico (Hamilton 2007). Although numerical marks were identified on the sounding leads recovered from the Mardi Gras Wreck, the one found at *Two Brothers* was recorded *in situ* and no markings were visible due to marine growth. It is unclear whether it was in active use at the time of wrecking or if it was stored in the stern of the vessel.

Figure 50. A ‘hand-lead’ style sounding lead documented at Section B of the *Two Brothers* shipwreck site (image courtesy of Papahānaumokuākea Marine National Monument).

Once ships reached the deep water of the various Pacific grounds they drifted along under shortened sail in search of whales. To ensure that they avoided any known hazards, it was important to record progress by observing drift, which was done using a log line and log-glass (Freeman 1951:240; Fonda, Jr. 1969:8). In the early 1800s relative longitudinal positions were ascertained by taking lunar observations; this method involved using a quadrant to “observe the moon’s angular distance from the sun or a suitable star” and then comparing the local time with that of Greenwich Time, which was derived from a table predicting the moon’s position (Skelton 1954:109-113; Thrower 1967:35). Though for decades whaling captains used lunar observations with success, their reliability was subject to clear skies—extended periods of poor weather could result in inaccurate positioning and possible shipwreck (Philbrick 2000:208).

Since errors in longitudinal observations essentially resulted in lost revenue by requiring more time to reach a targeted whaling ground, and also complicated the identification of reported features, by the 1820s many whaling captains began using marine chronometers

(Littlefield 1906:13; Boggs 1938:180). Originally perfected by English clock maker James Harrison in 1759, the chronometer revolutionized navigation through the ability to "accurately record the time of day at a point of origin for comparison with local time, wherever the navigator happened to be" (Thrower 1967:35; Baker 1982:222). Essentially 'portable precision clocks', marine chronometers proved to be easier than taking lunar observations (Bartky 2000:12); thus, as their accuracy increased and price decreased, they were soon regarded as among the most important article of the ship's outfit despite their expense (Littlefield 1906:13; Songini 2007:330). Such was their value to captains, that by the early 1830s they were already included among the list of navigation tools in pre-printed outfitting books (NBWM *Condor* Outfitting Book 1832).

The marine chronometers used on early nineteenth-century whaleships consisted of a timepiece that was powered by a continuous spring and encased in a housing with a glass lens on the face (Porthouse 1848:6). Sometimes referred to as a 'box chronometer' since the entire mechanism was protected by a hard wood box, these sensitive instruments were suspended in brass gimbals affixed to the interior of the box; this allowed them to move freely with the motion of the ship (Porthouse 1848:6-7). Part of a possible lens from a marine chronometer was identified at the wreck of *Two Brothers*. This wedge-shaped shard of clear glass is 3 millimeters (0.11 inch) thick and appears to represent approximately one quarter of a round lens that was 5.5 inches in diameter (Figure 51). It was recorded in Section B of the wreck site (Figure 19) and rests in close proximity to several other artifacts associated with the navigation of the ship. Although the size of this lens piece closely matches those of box chronometer lenses from the period, accounts indicate that the Captain Pollard was forced to rely on dead reckoning due to poor weather might indicate that he was sailing without a chronometer in 1823.

Figure 51. A portion of a possible compass or chronometer lens documented at Section B of the *Two Brothers* shipwreck site (image courtesy of Papahānaumokuākea Marine National Monument).

The wedge-shaped shard of clear glass found at *Two Brothers* is more likely the lens from a small compass. The compass was a crucial piece of navigational equipment and was used to determine direction and maintain course. Although the actual number that might be onboard a particular whaleship of the early nineteenth century varied, they were generally outfitted with three types of gimbaled compasses. These included: the large compass, which was used in the steering of the vessel and mounted inside the gabled, glass-widowed skylight a few feet forward of the helm (Higgins 1927:22); the 'telltale' compass, which was designed to be read upside down and would have been mounted over the captain's bed to allow him to check the heading without getting out of bed (Hegarty 1964:78); and the boat compass, which was a small compass that was housed in a wooden box and mounted on each whaleboat for use in navigating back to the ship if necessary (Ansel 1978:58; Ronnberg, Jr. 1985:28-29). The lens of the large compass is estimated to have averaged 25 cm (10 inches) in diameter, while, the average diameters of the lenses of the telltale and the boat compass are estimated to have been 15 cm (6 inches). Based on the dimensions of the wedge-shaped shard documented at the *Two Brothers* site, it is a section of a lens that was 14-cm (5.5-inches) when it was whole. Since this artifact was recorded in the stern portion of ship, it probable that it is part of the lens of the captain's telltale compass or one of the boat compasses that was not in use at the time of loss.

Among other navigational aids in the possession of all whaleship captains was a copy of

Nathaniel Bowditch's *The New American Practical Navigator*. First published in 1800, this work was "intended to acquaint the reader with the whole field of tasks of the ship's officer" (Fairburn 1945:1067). Though other similar guides were available, Bowditch's text was considered superior since he corrected errors in those published before. Adopted as the 'Seaman's Bible,' a copy became part of the necessary equipment of every ship's officer, as well as those aspiring to take up an officer's berth (Fairburn 1945:1067). *The American Practical Navigator* is said to have given impetus to the transition from sailing by dead reckoning to the use of scientific celestial navigation, and by the 1820s multiple copies of this book were found onboard (Fairburn 1945:1068). On some whaleships of the period, the captain and mates encouraged eager members of the crew to study navigation and provided access to the books, instruments, and instruction in their use (Calkin 1953:23).

Evidence of the significance that whalers placed on Bowditch's navigation guide is provided in the accounts of survivors of the *Two Brothers* shipwreck. As discussed in a previous chapter, the wrecking occurred with little time to abandon ship before it went to pieces in the heavy seas. Though the crew left the ship with "no water nor provisions except two small pigs that washed into one of the boats", one of the mates made certain to grab a compass, one quadrant, and two "practical navigators [sic]" (Gardner 1823). It is presumed that the officers realized that once they were able to secure themselves in the whaleboats, their survival could rest in their ability to make an open sea voyage. Thus, having a copy of *The New American Practical Navigator* and navigations instruments was of greatest importance since it could increase their chances for success.

Along with advances in scientific navigation and more affordable instruments, mid-nineteenth-century whalers benefitted greatly from the US government's eventual efforts to chart the Pacific whaling grounds and to understand ocean currents and winds. Among the most important of these were the published results of the official exploration expedition led by USN Lieutenant Charles Wilkes (1842), which included a chapter devoted to the then popular whaling grounds. Also of significance were the works of Lieutenant Matthew F. Maury, whose maps helped to predict the best grounds to fish by season (Kugler 1971:25). Interestingly, both of these authors relied heavily on the experience of whaling captains who provided them navigational, geographic, and physical data. In Maury's case, data was recovered by studying logbooks and by enlisting captains to record observations at sea three times daily using a standard format; in exchange he produced his now famous *Whale Chart* (Figure 52), which illustrated seasonal whale migrations between grounds (Fairburn 1945:1063; Freeman 1951:240-241; Kugler 1971:25; Jones 1986:695; Mawer 1999:260). These publications and the aforementioned navigational tools and guides assisted in the daily navigation of the whaleships and in many cases, helped to avert disaster.

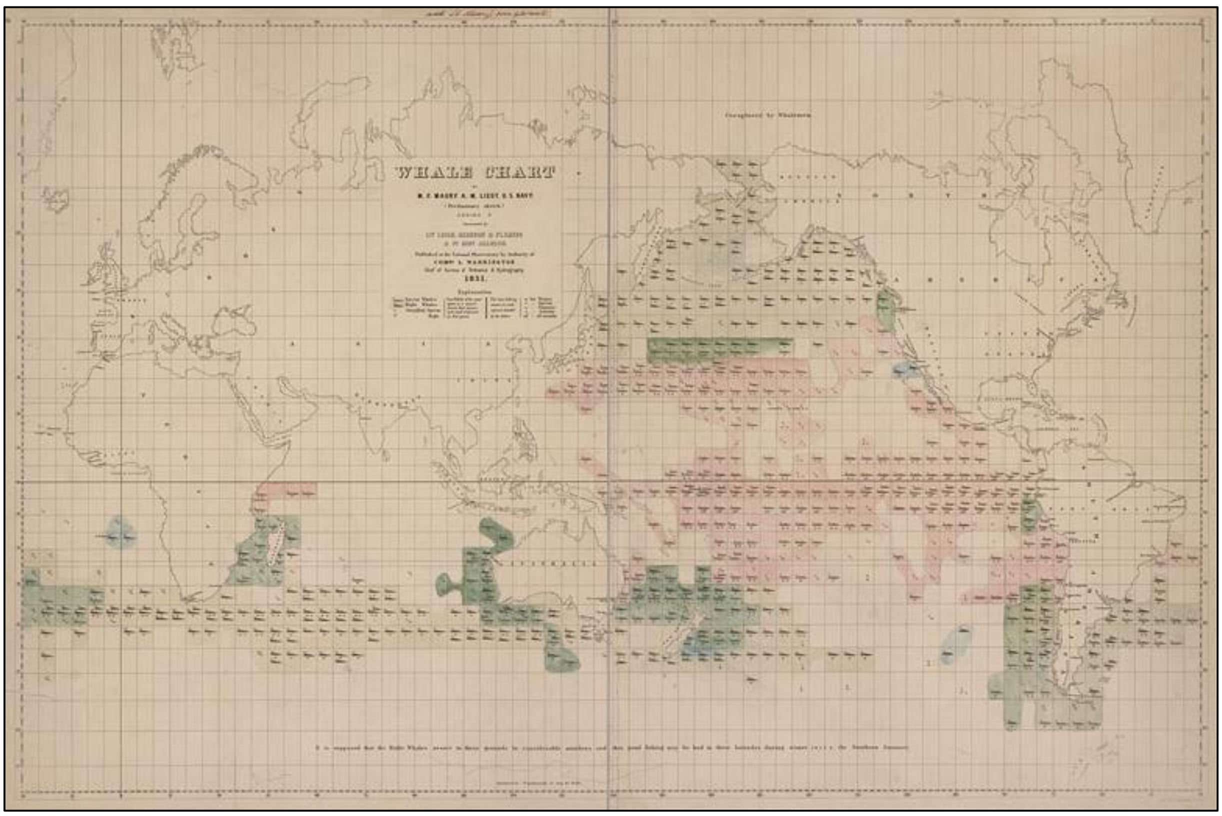

Figure 52. USN Lieutenant Matthew F. Maury's Whale Chart, which illustrated the seasonal migrations of whale populations between grounds From Maury, M.F. 1851.

Daily observations were taken from the deck of nineteenth-century ships and generally recorded on a 'slate-log' or a 'scrap logbook' (Wilson-Barker and Allingham 1890:41). Listed as standard items in outfitting books from at least the early 1830s, writing slates were often inscribed with columns for inserting information such as time, weather, distance travelled, and comments pertaining to the sailing of the ship (Young 1890:25; Stanbury 2010:15). A piece of slate found on the *Two Brothers* shipwreck is probably part of a log-slate (Figure 53). Because it was recorded *in situ* the marine growth covering the object prevented the detection of markings on either side. Though this artifact was located in the presumed stern section of the vessel along with other navigational equipment, it is unknown whether it was in active use at the time of wrecking or if it was stored. A similar piece of a log-slate was identified during the investigation of the whaleship *Lady Lyttleton*, lost on the southern coast of Western Australia in 1867 (Vosmer and Wright 1991:22; Stanbury 2010:15).

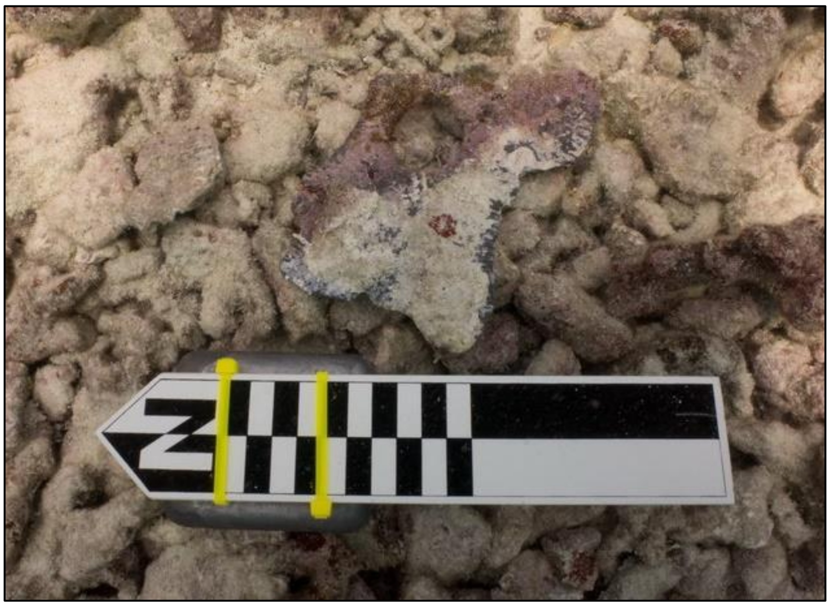

Figure 53. A portion of a possible log-slate documented at Section B of the *Two Brothers* shipwreck site (image courtesy of Papahānaumokuākea Marine National Monument).

For most of a whaleship's crew, work ended each day at around four o'clock in the afternoon after the decks were scrubbed and the tools put away (Browne 1850:38; Perkins 1854:30; WPA 1938:14). The masthead lookouts maintained their positions until sunset; at that time the ship was slowed by having its sails 'shortened' and the watch at the helm was set for the night (Perkins 1854:30; Scammon 1874:229). In the period between work ending and sunset, the two-hour dogwatches began; dinner being served at five o'clock, the shortened work period allowed each watch the opportunity to eat and rest (WPA 1938:14). At the end of each day the information recorded on the log-slate was later transferred to the main ship's log along with comments about daily activities such as the conduct of the ship and any whales taken (Wilson-Barker and Allingham 1890:41; Young 1890:25). Being the official record of the voyage, logbooks were kept by the first mate who often added a phrase such as “thus ends this day’s work” or “so ends this day” to indicate that nothing more would be accomplished (Dodge 1882:13; Verrill 1916:163; WPA 1938:29; Calkin 1953:23; Sherman 1965:32).

Off Watch

During the period between watches whalers engaged in a number of activities, many of which were dictated by the space afforded them. During the day the alternate watch was busy on the deck tending to the myriad chores ordered by their commanding officers, thus off-duty crew were obliged to spend much of their time in their quarters. Although the practice of recycling merchant ships for use in the whale fishery meant that the hull designs of nineteenth-century whaleships varied, the process of refitting whaling allowed interior spaces to be reconfigured to best allow for maximum cargo capacity. As such, the general layout of a wooden whaleship in the nineteenth century conformed to a standardized pattern that apportioned the majority of the internal space for oil storage or blubber processing, and the rest was compartmentalized to create accommodation and storage for supplies (Figure 54). Accommodation onboard whaleships was always located at its two ends; average seamen were housed in sparse and cramped conditions in the front of the ship, known as the ‘forecastle’ or ‘fo’c’sle’, while officers enjoyed better comforts in the more commodious aft end of the ship. This physical separation reinforced the hierarchy of the chain of command and is reflected in the terms used to refer to the groups—average seamen sailed ‘before the mast’ (Dana 1842), while the ship’s officers were often referred to as the ‘afterguard’, since they resided in the after section of the ship (Creighton 1990:537).

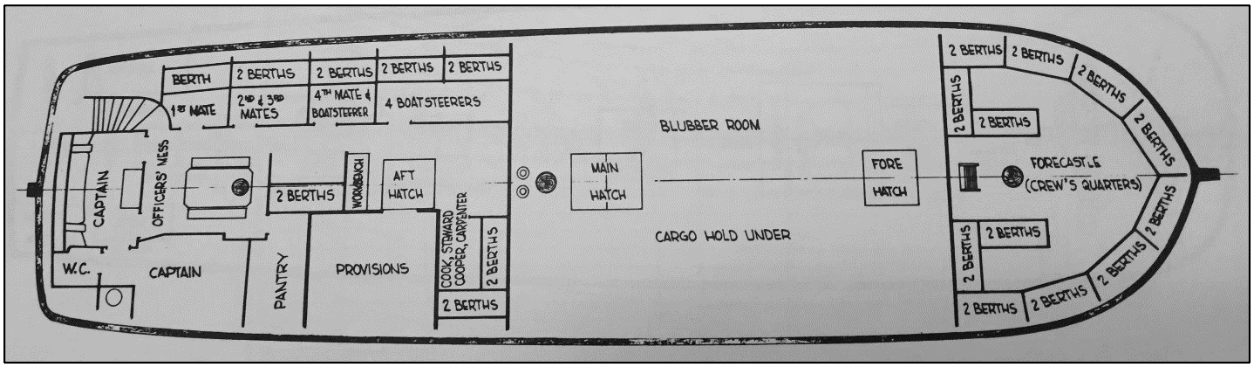

Figure 54. Arrangement of the lower deck of the whaleship *Charles W. Morgan* illustrating the difference in space provided for average seafarers housed in the f'o'c'sle to that of the 'afterguard' in the after end of the vessel. From Leavitt, J.F. 1970.

The forecastle differed little from vessel to vessel. Located in the extreme forward part of the ship and directly below the main deck, its form was of course roughly triangular and its sides were lined with parallel rows of narrow bunks that accommodated 12 to 20 hands (Perkins 1854:19; Hohman 1928:126). Made of ordinary plank timber and cushioned with an uncomfortable mattress of cornhusks referred to as a 'donkey's breakfast', the bunk was the only physical space onboard ship that a whaler had to himself; thus some were adorned with curtains of calico cloth to keep them private, were personalized with lithographic images or other mementos, and/or had makeshift shelves for holding a lamp (Perkins 1854:19; Ashley 1926:54; Dolin 2007:256). Each seaman shipped aboard with his few belongings usually in either a canvas sack or a sea-chest that was lashed to the floor of the forecastle and doubled as a bench—these were generally the only furnishings aside from a small table and lamp (Olmsted 1841:52; Perkins 1854:19; Brown 1884:226; Grant 1932:30). The forecastle was accessed via a small companionway, which also served as the only ventilation and source of natural light (Grant 1932:30; Freeman 1951:240). Due to the combination of poor air circulation and the odors from grimy and wet clothes, oil lanterns, tobacco, unwashed bodies, and the general filth associated with whaling operations, the quarters of average sailors were often described as vile (Perkins 1854:19; Brown 1884:226; Grant 1932:30; Dulles 1933:84). Though attempts were occasionally made to reduce the filth in these quarters by scrubbing them out, generally they were "black and slimy with filth, very small, and as hot as an oven" (Olmsted 1841:52; Browne 1846:43; Dulles 1933:84).

The after part of the ship was compartmentalized to create spaces not only for officers, but also for storage of ship supplies and food. Accommodation in this part of a whaleship was far better than those of the crew. The captain's quarters were furthest aft and included both a state-room on the starboard side, which was comfortably furnished—often equipped with a gimbaled bed—and a well-appointed cabin or private office in the center (Brown 1884:226; Whipple 1979:92). Just forward of the captain's cabin were smaller state rooms fitted with ordinary bunks, which were dedicated to the mates; on the larboard side adjacent to the pantry was the first mate's cabin and forward of it were bunks of the third and fourth mates, while on the starboard side in the same positions were the second mate's cabin (Brown 1884:226; Hohman 1928:125; Whipple 1979:92). Farther forward of the officer's staterooms and separated from them, was the area known as 'steerage'. This small, poorly ventilated, and dimly lit area contained eight bunks and accommodated the more skilled members of the crew including the boatsteerers, the carpenter, the cooper, the blacksmith, and the steward (Hohman 1928:126; Shapiro 1959:24). Though the quarters of those in steerage were spartan compared to those of the officers, they were better than those of the foremast hands; as historian Alan Mawer suggested, "if the forecastle was the ship's hell hole, steerage was its purgatory" (1999:174).

For the most part the foremast hands spent their free time in the forecastle where they could escape the watchful eyes of the officers (Martin 1974:36). There they could relax through reading, writing letters, keeping journals, sketching, and mending worn clothes. Or if rest was not desired they could indulge in less personally enriching pursuits such as gambling and fighting—provided the captain did not find out (Olmsted 1841:52; Browne 1846:111; Delano 1846:28; Verrill 1916:190; Martin 1974:36). As a general rule, except during the night, the quarters of the foremast hands were loud, active spaces where crew members chattered away, laughed, played music, sang ditties, and spun yarns (Browne 1846:43; Perkins 1854:19; Dulles 1933:84). All the while they smoked incessantly—tobacco being the 'whalemen's narcotic' (Whipple 1979:78; Mawer 1999:174-175; Dolin 2007:260) —and many spent idle hours carving knick-knacks and ornamental items out of shells, whale teeth and whale bone (Dodge 1882:15; Brown 1884:2310; Whipple 1979:126; Mawer 1999:174-175). Generally known as scrimshaw or scrimshander, carving was the favorite pastime of whalers who used little more than a jackknife to create crafts ranging from polished whales' teeth with intricate artistic scenes etched onto them, to more functional pieces such as tool handles, pie jagging wheels, yarn swifts, and walking canes (Sturtevant 1955:7-10; Whipple 1979:126-127). So pervasive was this practice that it became considered a sign of prowess among average whaler (WPA 1938:15). If the weather and conditions permitted, whalers spent the evening hours on the fore-deck where they sang, danced, spun yarns, and relaxed (Browne 1850:46).

Off watch times was undoubtedly spent differently by the officers and boatsteerers than that of the average foremast hands. Information pertaining to the officers during these periods is scant, but it is presumed that the duties and responsibilities of their position kept them busy, and fraternizing with the foremast hands was not tolerated. Since the hands holding these positions were determined to rise through the ranks it is likely that much of their free time was devoted to the study of navigation and seamanship, as well as to general personal enrichment through reading and writing.

One pastime activity enjoyed by officers and crew alike was fishing. When in warm latitudes fish such as bonita, barracuda, shark, dolphin, or porpoise could often be found off the bow and if conditions permitted, attempts were made to catch them using hooks baited with white rags or spearing them with harpoons. When successful, the products of these endeavors were taken to the cook to be fried and they always made a welcome change to an otherwise monotonous menu (Davis 1874:123-124; Dodge 1882:15; Brown 1884:228; Grant 1932:50; Whipple 1979:78; Davis et al 1997:251; Dolin 2007:260; Dickson 2011:173). The importance of accommodating fishing activities can be found in outfitting records in the form of fish hooks and fishing lines of various sizes and lengths being shipped onboard from as early as 1765 to at least the 1860s (MVM 1765 Outfitting List; NHA Macy 'New Ship' Outfitting Book 1807; NBWM *William Rotch* Outfitting Records 1819; NBWM *Condor* Outfitting Book 1832; NBFPL *Mars* Outfitting Book 1845; Kirby Outfitting Book 1860).

None of the artifacts identified at either the *Two Brothers* or *Parker* shipwreck sites are considered directly related to *off watch* activities of the crew. The lack of such evidence likely results from the fact that the personal effects of these individuals were few and for the most part organic. For instance, due to the cramped conditions of the forecastle, the belongings that a crewmember might bring onboard were limited to what would fit into a canvas sack or a sea-chest. And since whalers were responsible for being prepared for all conditions that might be encountered in the course of a cruise, much of that space would be taken up by clothing that provided protection from harsh conditions. Though artifacts identified as personal belongings of sailors such as jackknives or clay pipes have been found on the wrecks of many merchant ships, they have eluded researchers on these whaleship wreck sites. The absence of these types of artifacts likely results from the environmental conditions experienced in PMNM; thin metal pieces such as knife blades generally deteriorate in the warm and turbulent waters of the North Central Pacific, while pipe stems and bowls are almost impossible to recognize on the sea bed since it consists mainly of dead and broken coral resting on a marl substrate.

Crew Maintenance

Mealtimes onboard early nineteenth-century whaleships were one of the few parts of the day that whalers anticipated. Though the food was generally considered to be less than inviting, the opportunity to eat was a welcome break from the routine of watches and the boredom that came from waiting for whales to be sighted (Browne 1850:28). At the outset of the cruise, the captain announced that hard work would be rewarded with plenty of 'hot chow' and crews would be satisfied with the portions; however, many captains followed the orders of frugal owners and allowed cooks to use only minimal provisions (Browne 1850:37; Dolin 2007:260). Meals generally consisted of only a few ingredients and, unless the ship stopped at an island or port to re-provision and recruit, were basically the same day after day. Yet the simplicity of the ingredients was often not the issue; since few whaleships hired experienced cooks, the fare was generally thrown together in a haphazard fashion with little concern for flavor (Hohman 1928:130; Dulles 1933:87). Regardless of quality or appeal, meals provided sustenance, helped crewmembers avoid scurvy, and for the most part kept them healthy and ready for action.

Since the food served onboard whaleships was not necessarily made with taste in mind, the desirable characteristics of the supplies used by the cook were that they could be packed into casks and preserved for long periods of time. Shipped onboard in bulk were large quantities of salted beef and pork (commonly called ‘salt horse’ or ‘salt junk’), flour, pre-made biscuits called ‘hard tack,’ rice, legumes, dried vegetables, and dried fruits (Brown 1884:227; Dolin 2007:259). Freshness of the provisions dwindled with the amount of time spent at sea and exposure to tropical climates usually resulted in at least some spoilage; little could be done, however, to prevent this and cooks tried to make it edible (Dolin 2007:260). Though few meals could be considered treats, a few nights each week more desirable fare was prepared. These meals included a spiced, savory dish known as ‘scouse’ and a sweetened dish with dried fruit and molasses known as ‘duff’ (Brown 1884:227; Dulles 1933:87; WPA 1938:17; Mawer 1999:168-169; Dolin 2007:259-260).

Although the quality of food served on whaleships was considered poor by many whalers, others suggested that it was far better than that served on merchant ships of the period (Dulles 1933:87). Certainly, the crews of the schooners and brigs employed for Atlantic voyages would have offered few complaints. Since those cruises generally lasted less than a year, fresh provisions remained abundant and meals were followed with plum duff—hence those vessels were referred to as ‘plum pud’ners’ or part of the ‘plum pudding fleet’ (Brown 1884:233; Mawer 1999:201). Though the crews of the larger Pacific-bound ships were not as fortunate, outfitting lists indicate that the number of ingredients available to the cook for enhancing flavor increased greatly in the early nineteenth century. For instance, an outfitting book dating to 1807 on file at the Nantucket Whaling Museum’s Research Library shows that along with dried fruits and pickles, sweeteners such molasses, sugar, and chocolate were shipped onboard (NHA Macy ‘New Ship’ Outfitting Book 1807). By the early 1830s the menu of items had expanded to include spices such as mustard seed, black pepper, cayenne pepper, ginger, allspice, nutmegs, cloves, cinnamon, sweet oil, pepper sauce, lemon syrup, sage, and coarse salt (NBWM *Condor* Outfitting Book 1832). Though most of those ingredients were likely intended for preparing the meals of officers, the large quantities of some items suggest that the crew benefitted from them as well.

Provisions were tightly packed and sealed in casks which varied in size. For instance, large barrels were used for keeping salted meats, bread, and other foodstuffs since they were shipped in great quantities; however, much smaller casks would have been needed to store spices and other specialty items. None of the early to mid-nineteenth-century whaleship outfitting books reviewed for this study specified the names or sizes for those used for such purposes and instead the contents were generally measured in gallons (NBWM *Condor* Outfitting Book 1832; NBFPL *Marcella* Outfitting Book 1840; NBFPL *Canton* Outfitting Book 1841; NBFPL *Mars* Outfitting Book 1845). Once onboard, stowage of provisions depended on immediate need; some of the casks containing food were specifically placed in spots easily accessible to the cook, while the others were stored in the upper-tier of the fore-hold to prevent them from being contaminated by oil seeping from casks placed over them (Brown 1884:227; Howard 1996:441). Once a cask of provisions was opened its contents were kept with other daily use items in the pantry, which was a secured compartment located on the lower deck near the officer's quarters.

Archaeological evidence of the casks used for food storage on *Two Brothers* and *Parker* is impossible to distinguish. The tropical marine environment of PMNM is inhospitable to wooden remains and, as with the hull of the ship itself, all of the casks onboard would have been subject to decay caused by marine organisms soon after they were submerged. Once the wooden components were gone, all that remained of the casks were the iron hoops used for binding them. And though it is plausible that whole hoops found on shipwreck sites could be used to extrapolate the size of cask that they bound, the thin iron from which they were constructed has a tendency to become brittle and break down after extended contact with seawater. Thus, although pieces of a number of iron hoops were found at both of the shipwreck sites, it is impossible to determine what materials were stored in the casks or if they were unused and still stowed away when the wrecks occurred. While it is estimated that many thousands of individual hoops would have been shipped onboard a nineteenth-century whaleship, an actual count is difficult to determine since they were generally purchased in bulk. For example, the outfitting book for the New Bedford whaleship *Condor's* 1832 cruise simply lists two and a half tons of 'hoop irons' as having been loaded onboard (NBWM *Condor* Outfitting Book 1832).

Aside from cask hoops, the only other example of a food storage container identified is an intact stoneware jar (Figure 55). Located in section B of the *Two Brothers* site near other artifacts associated with a whaleship's aft end (Figure 19), this utilitarian vessel was likely used in the ship's galley for storing daily-use items. Generically referred to as a 'ginger jar' since its shape somewhat resembles Chinese porcelain vessels of that type, this piece of salt-glazed earthenware is made from a gray paste and its glaze has a yellowish appearance. Because the jar is firmly concreted into the reef, only half of it could be inspected; however, no signs of decorations or maker's marks were noted on any visible surface. Although no evidence of a lid was found, it is presumed that one would have accompanied this jar since it is a functional design.

Figure 55. Intact, undecorated stoneware jar documented at Section B of the *Two Brothers* shipwreck site (image courtesy of Papahānaumokuākea Marine National Monument).

Utilitarian salt-glazed stoneware ceramics were first made in New England in the early eighteenth century, but by 1800 several stoneware factories were operating in the region (Barber 1907:23-24). A photograph and brief description of a jar of similar style (Figure 56) is found in Edwin Atlee Barber's *The Pottery and Porcelain of the United States: A Historical Review of American Ceramic Art from the Earliest Times to the Present Day* (1909). According to Barber, this example was created by Paul Cushman at his factory in Albany, New York in the first decade of the 1800s (Barber 1909:112-113). Though closely resembling the basic shape of the jar identified at *Two Brothers*, Cushman's jar has decorations including two small handles set opposite one another, incisions around the lip and base, an impression of the marker's name, and an indeterminate design (Barber 1909:552). Although stoneware pottery fragments of various shapes and dating to this period are common among artifact assemblages of archaeological sites, the ginger jar identified at *Two Brothers* is the only known intact jar of this type documented in a shipwreck context.

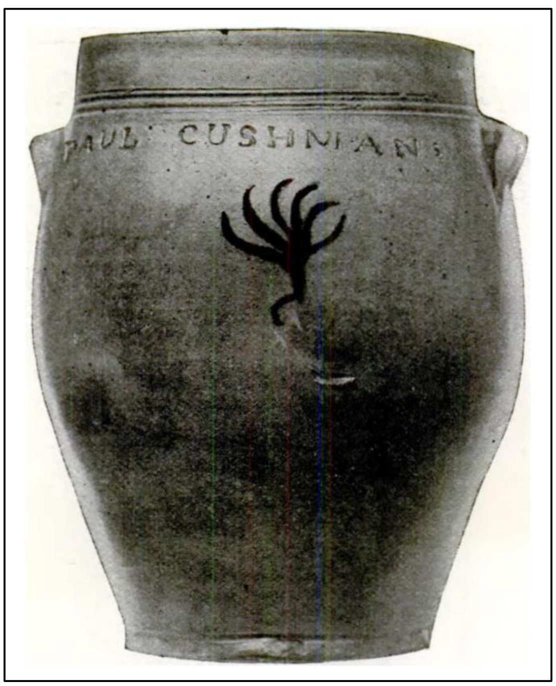

Figure 56. Decorated, brown stoneware jar made in 1809 by Paul Cushman in Albany, New York. Though similar in form to stoneware jar of the *Two Brothers* site, this example includes decorations and small handles near its rim. From Barber, E.A. 1909.

All meals were prepared in the designated kitchen area known as the 'galley,' which was generally located between the mainmast and the mizzenmast. Although on later ships the structure that enclosed this area was more substantial, early nineteenth-century whaleship galleys were little more than simple wooden shelters. Referred to by whaler Francis Allyn Olmsted as a "little kennel large enough for the cook and his stove" (1841:51), this tiny space was where the cook kept cauldrons and pans—collectively referred to as 'coppers'—as well as all other equipment used to prepare meals for all onboard (Olmsted 1841:51; Brown 1884:227; Draper 2001:30). According to various outfitting books, the cooking utensils used in the preparation of meals included 'cooks pots', sauce pans, stew pans, and frying pans, as well as ladles, carving knives and forks, chopping knives, and cooks skimmers (NBWM *Condor* Outfitting Book 1832; NBFPL *Marcella* Outfitting Book 1840; NBFPL *Mars* Outfitting Book 1845).

Four heavily concreted cast iron cooking pots were recorded among the remains of *Two Brothers*. These are all located in close proximity to one another in a large pocket in the reef in Section B (Figure 19); this physical location is consistent with historic descriptions of the galley being located in the after part of a whaleship (Olmsted 1841:51). Although there is slight variation in the sizes of these pots, they all appear to be similar in design and shape (Figure 57). Features include a bulbous body that narrowed toward the top, a flaring collar neck with two ear-like handles attached to the rim at opposing sides, decorative 'cordons' embossed around the body's exterior, and three small legs attached to the bottom (Hume 1991:175-176; Neuman 1984:176; Franklin 2005:139). Ivor Noël Hume (1991) suggests that cooking vessels of this basic form were made for centuries using cupreous materials, but by the seventeenth century the dangers of copper-poisoning led to a shift to iron production (Hume 1991:176). Iron cooking pots such as these were made using a method that involved creating a mold in sand and then pouring molten metal into the hollow of the shape (The Ironbridge Gorge Museum Trust 2014). Although cast iron stoves were popular onboard many ships from the latter part of the eighteenth century, aside from Olmsted's (1841:51) above-mentioned statement there is no indication that whaleships were equipped with them until at least the mid-nineteenth century. Thus, the multiple cauldrons among the remains of an early-nineteenth-century shipwreck confirm the large quantities of food needed to sustain the crew.

Figure 57. Post-conservation photograph of one of the four cooking cauldrons documented at Section B of the *Two Brothers* shipwreck site (image courtesy of Papahānaumokuākea Marine National Monument).

Similar artifacts have been identified on numerous mid- to late eighteenth-century shipwreck sites including the gondola *Philadelphia*, sunk in Lake Champlain in 1776 (Bratten 2002); the British transport *Industry*, lost at St Augustine, Florida in 1764 (Franklin 2005); and The Storm Wreck, in at St. Augustine, Florida presumed lost around 1780 (Meide et al 2011). One of the four pots was recovered from the *Two Brothers* site and, after undergoing complete conservation treatment and thorough analysis, is now on display in an exhibit at the Nantucket Whaling Museum. During conservation a possible mark which resembled a letter 'M' was noted on the pot's inner rim (Fox 2012:4). Although the meaning of this mark remains unknown the presence of markings on cauldrons was not uncommon; according to Ivor Noël Hume, who indicated that nineteenth-century cauldrons were frequently embossed with capacity numbers in Arabic figures (1991:176).

Meals were served at regular times each day unless whaling operations were underway; breakfast was served at seven in the morning, lunch at noon, and dinner at five in the evening (Brown 1884:228). Since the hierarchy of command was directly reflected in the quality of food served and in dining conditions, the commissary department was divided into three sections: one for the officers, one for those in steerage, and one for the foremast hands (Hohman 1928:130; Dolin 2007:259). The captain and officers took meals together in the cabin and were given the best quality food and condiments served on place settings of porcelain dishes and silverware (Perkins 1854:19; Shapiro 1959:24). Some captains allowed the boatsteerers to dine in the cabin after the officers were finished, but this was not always to case; though the food was much the same as that of the officers, often the boatsteerers were required to eat in steerage (Olmsted 1841:52; Brown 1884:228).

The dining experience for the afterguard afforded as many of the comforts of home as possible for a working ship. The cabin was well ventilated and lit via a large skylight and included a hardwood dining table fastened to the deck (Hegarty 1960:79). The ship was equipped with a range of tableware and serving dishes on which meals were formally served by the steward (Hohman 1928:133). Pre-printed outfitting books dating from the 1830s to the 1860s contain a standard list of dishes and condiment containers intended for the cabin under the subheading 'Crockery'. Pottery types include shoal plates, soup plates, small plates, pudding dishes, oval dishes, gravy dishes, soup tureen, sugar bowls, butter tubs, salts, castor bottles, tumblers, wine glasses, decanters, mugs and saucers, cups and saucers, bowls, covered dishes, pitchers, and platters (NBWM *Condor* Outfitting Book 1832; NBFPL *Mars* Outfitting Book 1845; Kirby Outfitting Book 1860:31).

A number of ceramic sherds thought to be associated with the aft dining experience were identified at the wreck of *Two Brothers*. Sherds of shell-edged green and shell-edged blue pearlwares, a pearlware mug handle, and molded pearlware sherds of possible mug form were all documented at the site. The most diagnostic of all of the ceramics recorded are the shell-edged pearlware sherds (Figure 58). Pearlware ceramics are British earthenwares that were first introduced by Josiah Wedgewood in the 1770s. Wedgewood modified the already popular creamware through the use of a blue-tinged glaze, a combination which produced a whiter ceramic that more closely resembled Chinese porcelains (Moran 1976:198; Sussman 1977:105). Pearlware achieved great popularity in the late eighteenth century and became the dominant ceramic ware until its use began to decline around 1820 (Hume 1991:129–130; Ford et al 2008:85). Although it was used to produce a wide range of ceramic forms, shell-edged plates with blue or green painted rims were the most common (Hume 1991:129–130). The decorative edges of pearlware plates changed over the course of their production; on early examples the molded relief on the edges takes the appearance of intricate ruffles, while later versions are simply impressed curved lines with both regular and irregular spacing patterns (Sussman 1977:106). The rims of each of the blue and green shell-edged pearlware sherds identified at the *Two Brothers* site exhibit the latter patterning. The outer edges of both are scalloped and have closely spaced vertical impressions of varying length to which pigment is added; this style was common on both eighteenth- and nineteenth-century pearlware plates (Sussman 1977:107).

Figure 58. Post-conservation photograph of green and blue shell-edged pearlware sherds documented at Section B of the *Two Brothers* shipwreck site (image courtesy of Papahānaumokuākea Marine National Monument).

As for crew meals, when they were ready the bell was rung to indicate the time and associated meal (i.e. ‘seven bells’ was breakfast) and the hands came aft to collect it. Regardless of its quality, they generally indulged in the treasured privilege of making “uncomplimentary remarks about the cook and all his ancestors” (Perkins 1854:29; Grant 1932:48). Depending on the weather, the crew took their meals either on the fore-deck or in the forecastle using sheath-knives, mugs, and small wooden tubs called ‘kids’ (Perkins 1854:19; Grant 1932:48; Shapiro 1959:24). If a foremast hand, however, preferred to use proper eating utensils, they could be purchased from the ‘slop chest’; records pertaining to the whaleship *Condor* list iron spoons, tin pots, and tin pans among the items available (NBWM *Condor*

Outfitting Book 1832). Regardless of what dishes they used, the whalers were responsible for washing them and cleaning up after meals (Brown 1884:227). No artifacts associated with foremast hand mealtimes were identified at either of the shipwreck sites; this is most likely due to the organic nature of the kids and thin metals used in the construction of other implements.

One of the main concerns regarding provisioning and meals was the constant threat from scurvy (Freeman 1951:240). Scurvy is a potentially fatal malady caused by a lack of essential vitamins and is often associated with long sea voyages (Hohman 1928:138; Nash 2001:34). Symptoms include sore gums, bleeding, extreme fatigue, foul breath, and swollen limbs; depending on the health of the crew at the start of the cruise, these can manifest in as little as six weeks and eventually cause circulatory failure (Nash 2001:34; Dolin 2007:261-262). The main defense against the disease is adding foods high in vitamin C to the diet. As such, among the fruits and vegetables shipped onboard during outfitting, were large quantities of potatoes and onions which were known to preserve better than other vegetables (Hohman 1928:138; Mawer 1999:170). Since sick crews generally meant poor outcomes when whaling, visits to ports or friendly islands were made to obtain fresh supplies when necessary, or if a convenient opportunity presented itself (Mawer 1999:170). Though many of the different types of foods that could be found in tropical regions helped to keep scurvy at bay, pure lime juice was the best 'anti-scorbutic' (Hohman 1928:138-139; Gifford 1998:142).

If a ship was offshore for an extended period and fresh provisions ran low, some captains elected to give rations of rum to stave off scurvy (Dodge 1882:21). In the early years of pelagic whaling, large quantities of rum and other types of alcohol were commonly included in the outfits of all whaleships and these were served from time to time as grog rations (Brown 1884:228). The presence of alcohol onboard New Bedford vessels is evidenced by records relating to the maiden voyage of the whaleship *William Rotch* in 1819. These documents indicate that a relatively large amount of liquors were shipped onboard including "132 gallons and four bottles of rum"; "gin case and barrels" (quantities unlisted); an undisclosed amount of "Lisbon wine"; and an undisclosed amount of brandy (NBWM *William Rotch* Outfitting Records 1819).

The temperance movement of the 1830s, however, resulted in many captains forbidding alcohol onboard ships (Brown 1884:228; Hohman 1928:136; Dulles 1933:88). This sentiment grew quickly and after around 1840 it was only allowed for medicinal purposes (Brown 1884:228; Littlefield 1906:10; Mawer 1999:138). Outfitting records from the 1830s to the 1860s indicate that the only officially sanctioned alcohol onboard were meager amounts of "N.E. Rum, Holland Gin, Brandy, and Port Wine" listed under the subheadings of 'For Medical Purposes', 'Medical' or 'Medicinal' (NBWM *Condor* Outfitting Book 1832; NBFPL *Canton* Outfitting Book 1841; NBFPL *Mars* Outfitting Book 1845; NBFPL *William C. Nye* Outfitting Book 1851; Kirby Outfitting Book 1860). That is not to say that no alcohol could be found on some ships of this period. On the contrary, spirits were sometimes shipped as a trade item and in some cases small amounts of it were also brought onboard by the captain and officers for personal consumption (Brown 1884:227). Though alcohol and all other intoxicants were forbidden by crews (Dulles 1933:88-89) and bootlegging was an offense of ship rules by the middle of the nineteenth century, it was often smuggled onboard by many of the foremast hands (Hohman 1928:136).

Whether doled out as grog rations to motivate crews on particularly wet and cold days (Delano 1846:24), served with meals to the afterguard, used for medicinal assistance, or snuck onboard as contraband, various types of liquors and wines would certainly have been found onboard early nineteenth-century American whaleships. Fragments of at least two glass bottle types provide archaeological evidence of alcohol usage onboard *Two Brothers*. Although the large quantities of alcohol often shipped on whaleships of this period would have likely been stored in wooden kegs, smaller and more manageable containers like bottles would have made serving easier.

The remains of one of the two bottle types identified at the wreck site include numerous green glass shards and the bases of dark olive green glass bottles. Found scattered around Section B (Figure 19), most of the shards are very small. Two shards are large enough to determine the part of the bottle that they comprised—one is a section of the cylindrical body and the other is part of a shoulder. A round bottle base was recorded in each of the two sections of the site. Though both of these were heavily coated with marine encrustation, their colors and some features were discernible: each is completely round in shape and approximately 9 cm (3.5 inches) in diameter; each has a 'kick up' that rises roughly 6 cm (2.5 inches) in the center; and each appears to be made of dark olive green glass (also referred to as 'black glass' for its dark hue: http://www.sha.org/bottle/colors.htm). These are most likely the bases of 'tall, moderately slender bulged neck spirits/utility cylinder bottles', which were first produced in the late eighteenth century and became highly popular for holding different types of liquids by the 1820s (http://www.sha.org/bottle/liquor.htm).

The other type of alcohol bottle identified at *Two Brothers* is a 'case bottle'. Distinguishable by its nearly flat base, square sides that taper in from the shoulder down, and short neck with a flared lip, case bottles were designed to fit together in a packing box known as a 'case' or 'cellar' (Hume 1991:62; http://www.sha.org/bottle/liquor.htm#Case Gin bottles). Although the shape and style of these bottles was first produced in Europe by the early seventeenth century, versions of them were made in the US by at least the early 1800s (http://www.sha.org/bottle/liquor.htm#Case Gin bottles). They are commonly referred to as 'Dutch gin bottles' due to their primary use of shipping gin known as 'Hollands' or 'Geneva' in the late eighteenth century (Hume 1991:62).

The bases of two case bottles were identified in relatively close proximity to one another on the northern reef flat in Section A of the site (Figure 18). Each of these measures approximately 8 cm (3 inches) squared, appears to be dark olive green in color, and exhibits a diagnostic round scar on its base (Figure 59). According to bottle historian Cecil Muncy, scars such as this are the result of a pontil rod being broken off during manufacture and indicates that the bottle was made prior to the mid-1800s (Munsey 1970:85). The presence of these artifacts at the wreck of a pelagic whaleship is not uncommon since 'Holland gin' was among the four main types of 'medicinal' liquors listed in the outfitting records of early to mid-nineteenth-century whaleships (NBWM *Condor* Outfitting Book 1832; NBFPL *Canton* Outfitting Book 1841; NBFPL *Mars* Outfitting Book 1845; NBFPL *William C. Nye* Outfitting Book 1851; Kirby Outfitting Book 1860).

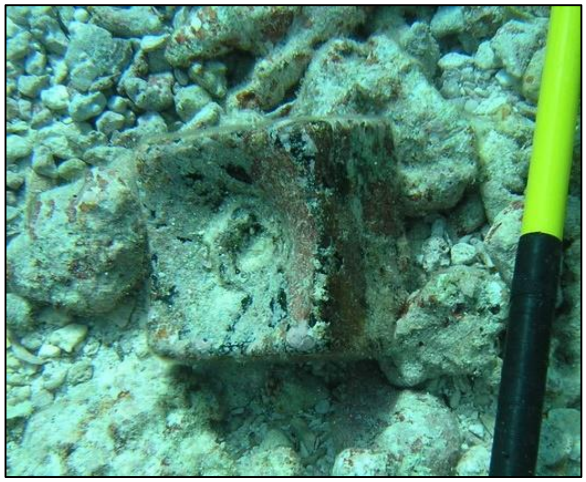

Figure 59. One of two bases of a case-style bottle documented at Section B of the *Two Brothers* shipwreck site; note the round manufacturing scar in the center (image courtesy of Papahānaumokuākea Marine National Monument).

The rough and filthy living conditions onboard whaleships, the long periods of subsistence on highly salty diets, and the environmental extremes experienced by whalers all contributed to the range of sicknesses seen onboard including tropical fevers, dysentery, venereal disease, rheumatism, tetanus, tuberculosis, pneumonia, common colds, and depression (Dulles 1933:88; Dolin 2007:261). And while British ships of this period were legally bound to employ trained doctors on cruises, health onboard American vessels was overseen by captains who were utterly untrained in medicine (Hohman 1928:137; Grant 1932:97; Mawer 1999:177). When acting as a physician, a captain was guided by the contents of the medicine chest and accompanying booklet of instructions that was legally required to be carried onboard (Hohman 1928:137; Poole 1977:3; Creighton 1995:95; Dolin 2007:262).

Sometimes called 'doctor boxes' (NHA Macy 'New Ship' Outfitting Book 1807), these standardized kits (

Figure 60) were contained a limited range of drugs, powders, and liquids housed in small bottles, as well as a few utensils such as mortars and pestles, balances, weights, and measuring devices (Lipman and Osborne 1969:124-125). Other items at the captain's disposal were bandages and splints for setting broken bones, a few surgical instruments, and varying amounts of liquor, which was often used as anesthetic (Littlefield 1906:10; Hohman 1928:137; Lipman and Osborne 1969:124-125). While these medical supplies helped to ease suffering and provide relief from pain, some afflictions and injuries were far more serious. In such cases, the captains of many ships set a direct course for a port where proper medical assistance could be obtained or the crewmember could be discharged to recuperate. If an ailing crewmember passed away onboard the ship it was customary to bury them at sea in a ceremony presided over by the captain and attended by the ship's company (Paddack 1893:87).

Figure 60. Mid-nineteenth-century ships' medicine chest. From Smithsonian Institution Museum of American History – 'On the Water' Exhibition: amhistory.si.edu/onthewater/collection/MG_302606.154.html

Providing assistance to a sick crewmember was just one of the causes that led captains to suspend whaling and make port. Among other main reasons were taking shelter from seasonal storms; refitting and repairing ships and rigging; transshipping cargos onboard homebound vessels; restocking supplies of fresh fruits, vegetables, firewood, and water; and recruiting replacements for crew members that had perished, deserted, or were discharged for legal issues. Whatever the initial reason, consideration of all other maintenance needs was given any time a ship came into port since fees for doing so were charged from a very early period (Browne 1850; Kuykendall 1934:367; Birkett 2000:76). Thus, full advantage would be taken of any visit to an established port, though no time was generally wasted for social purposes unless the ship was wintering over (Mawer 1999:138).

Watch Interrupted: The Process of Pelagic Whaling

Aside from the daily activities associated with time spent both on- and off-duty, there was the constant prospect of whales being sighted. Whale fishing was the central focus of the cruise and when it occurred the workplace changed; the rotation of the watches was suspended, all hands were immediately required on deck, and the ship bustled with activity in all quarters. Since whale hunting was an opportunistic pursuit, each missed whale effectively meant missed profit; thus when whales were seen, all other shipboard operations were suspended in preparation for pursuit. Capturing a whale and recovering the valuable commercial products from its carcass was a cyclical process involving a series of steps that were completed in order and designed to keep crews and equipment ready at all times. For the most part these steps did not start and stop when the previous one was complete; instead they were fluid and could occur simultaneously if necessary (Brown 1884:286). As stated previously, this operational formula developed with the installation of the tryworks onboard whaleships in the mid-eighteenth century and evolved into a structure that saw specific tasks being carried out by specific crewmembers using specific equipment. The following discussion provides a brief overview of the process as a whole and defines the five interrelated steps required for success.

Raising Whales and Capture

Daytime lookouts stationed at the tops of the masts from the outset of a whaling voyage constantly scanned the horizon looking for the low spouts of vapor that indicated the presence of a sperm whale (Verrill 1916:103; Shapiro 1959:32; Leavitt 1970:16). When whales were sighted or 'raised' (Scammon 1874:229), the lookout announced their presence with the call of "there she blows" or some derivative of that phrase (Olmsted 1841:55; Delano 1846:28; Browne 1850:115; Cheever 1850:52; Davis 1874:29; Scammon 1874:230; Brown 1884:257; Dodge 1882:12). Upon hearing this call the captain demanded the direction of the spout and often went aloft to survey the scene; there he could better determine the whale's distance from the ship and the chances of capture (WPA 1938:21; Leavitt 1970:16). Meanwhile the hands in the forecastle swarmed through the companionway to gather with the rest of crew on deck and await orders (Brown 1884:258). While the captain deliberated, the boat crews prepared the boats to be launched; if the whale was to be pursued, the captain chose a number of boats to engage (Leavitt 1970:16; Weiss 1974:82). If the spout was several miles away and sea conditions permitted, the sails were trimmed and the helmsmen steered the ship to position it to windward of the whale since approaching from downwind was always faster and easier (Hohman 1928:156; Allen 1973:171).

Since sperm whales possess a keen sense of hearing it was necessary to keep the ship at least a mile distant; at that point the ship was hove-to and the call was made to 'lower away' (Macy 1835:225; Verrill 1916:103; WPA 1938:21; Hegarty 1960:39). The mate and the boatsteerer boarded the whaleboat and then secured the tubs of whale line; the gripes were then freed and the mate ordered the crew to hoist the weight of the boat to allow the cranes to be swung clear (Stackpole 1967:39; Leavitt 1970:16). The boats were lowered straight down and once on the water the rest of the boat crew slid down the lines or scrambled over the side of the ship to take their places. Once set, the boat was unhooked and pushed away from the ship (Grant 1932:58; Allen 1973:172; Weiss 1974:82). Depending on the distance to the whale, either the boat's mast was raised and sails set or the oars were manned and the crew 'pulled' in its direction. In the meantime the boatsteerer prepared the first harpoon for action by attaching or 'bending' the whale line to it and then wrapping a length of it around the boat's loggerhead to ensure control once the harpoon was fastened to the whale (Grant 1932:60; Doane 1987:68).

When the boats were away, a small group of hands left onboard (generally the cooper and cook) acted as shipkeepers and looked after the vessel (Shapiro 1959:33; Howard 1996:441). As the boats moved farther away from the ship they communicated with it through a variety of signal flags and shapes flown high from the mast-head. Signals were used to direct the boats to the location of their prey, inform the boat crews whether it had sounded or been killed, or to tell them to return to the ship. Since the signals were particular to each ship, they were especially useful when a large fleet was cruising on the same ground (Scammon 1874:229; Verrill 1916:113-114).

Among the tools that shipkeepers used to communicate with the whaleboats was a 'mast-head waif'. Sometimes called a 'yonder' by British whalers, this tool was composed of a canvas covered hoop fastened at one end of a six- to eight-foot long pole and was used to indicate the direction of whales when the boats were long distances from the ship (Delano 1846:76; Scammon 1874:230; Verrill 1916:113). A concreted iron artifact identified in the sandy channel between the two sections of the *Two Brothers* shipwreck site could be the top section of a masthead waif. Though encased in corrosion, the shape of the object is easily discernible—a complete circle made of relatively thin metal strapping with a metal stem projecting from one side. Although the lower portion of the stem is deteriorated and appears to be incomplete, for the most part this object is largely intact.

As the whaleboats made progress over the water, the harpooner kept an eye on the mast-head and conveyed directions to the mate. Positioned in the stern, the mate maneuvered the boat toward the whale using the long steering oar (Brown 1884:259). When the boats were within a third of a mile of a whale, it was necessary to be as quiet as possible to keep them from being 'gallied' or alarmed (Olmsted 1841:57; Brown 1884:259; Leavitt 1970:126). Thus, if sailing, the mast and sails were lowered, and if rowing, the boat crew 'peaked' their long oars (i.e. took them out of the water and rested upright in slots in the gunnels) and took up smaller paddles (Davis 1874:157; Cheever 1850:53; Verrill 1916:104; Leavitt 1970:21; Dodge 1882:12; Doane 1987:68). Up to that point the boatsteerer had assisted with rowing, but he now turned his attention to preparing the craft by removing the wooden sheaths from the harpoons and lances and readying the whale line (Weiss 1974:84).

Approaching the whale quietly and positioning the boat was crucial; once it was forward of the whale's tail and aft of its field of vision (Figure 61), the mate instructed the boatsteerer to stand up and "give it to him" (Hohman 1928:159; Allen 1973:172; Weiss 1974:84). As soon as the boat was aside the whale the boatsteerer 'darted' it with the first harpoon, and if time permitted, then a second one attached to the same line was planted in case the first pulled out (Brown 1884:259; Hohman 1928:159; Hegarty 1960:38; Dodge 1971:7). The harpoons are not intended to kill the whale, but instead to fasten to it and sometimes several attempts—or even numerous boats—were necessary to secure it (Macy 1835:226). If the harpoon was successfully buried and attached solidly to the whale, the boatsteerer called out “all fast” or “clear to the hitches” and the mate quickly yelled “stern all” to signal the oarsmen to move the boat out of the range of the dangerous flying tail flukes (Grant 1932:66; WPA 1938:22; Stackpole 1967:41; Leavitt 1970:21; Allen 1973:172). Meanwhile the boatsteerer and mate switched places in the boat so the mate could prepare to kill the whale using the razor sharp lance (Hegarty 1960:39; Stackpole 1967:41; Allen 1973:172).

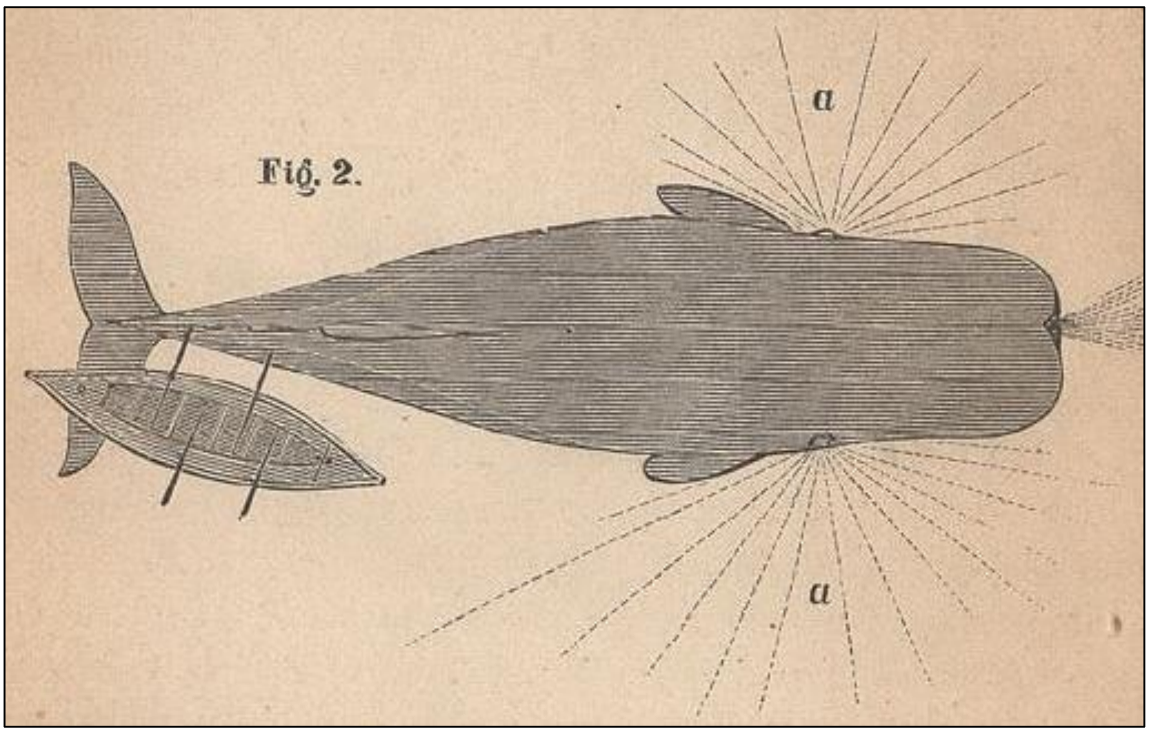

Figure 61. Top-down illustration of the approach for a whaleboat. The dotted lines indicate the whale’s field of vision; by avoiding visual detection the boat crew might avoid angering the whale until just before the harpoon was thrown. From Davis, W.M. 1874.

Though not naturally aggressive, sperm whales were known to become violent when attacked (Martin 1974:8). Once harpooned, the whale might respond in a number of ways including running wildly, sounding, turning to attack the boat with its jaws, or breaching (Grant 1932:68; Stackpole 1967:43). If it ran, the whale line was taken out at a terrific speed and the mate did his best to keep tension on the line and control the ‘Nantucket sleigh ride’ that ensued (Hohman 1928:159; WPA 1938:22; Hegarty 1960:39; Leavitt 1970:21). All the while one of the oarsmen used a small bucket to pour water over the rope while it ran over the loggerhead to keep the friction from causing it to smoke (Verrill 1916:106; Doane 1987:69). The literature on whaling is filled with instances of fouled lines causing boats to capsize; of broken or improperly rigged lines leading to crewmembers being maimed or killed; of boats being pulled deep under the water when whales sounded too quickly; and of whales crushing boats and crews in their jaws or smashing them with their massive tail flukes. Because of these dangers, sperm whales were said by whalers to be “dangerous at both ends” (for specific examples of the dangers see Brown 1884:263-277 or Verrill 1916:115-162).

Whatever the whale’s reaction, when it eventually became exhausted the line was slowly hauled in until the boat was close enough for the mate to thrust a hand-lance deep into its torso and ‘churned’ up and down in an effort to find vital organs (Cheever 1850:53; Spears 1910:211; Dulles 1933:122; Leavitt 1970:23; Weiss 1974:84; Doane 1987:69-70). Once the vitals were hit, the whale reacted with a sudden quivering of its body, emitted spasmodic spouts of blood—referred to by whalers as ‘flying the red flag’—and went into a final wild ‘flurry’ before dying (Brown 1884:267; Dulles 1933:124; Stackpole 1967:43; Leavitt 1970:23; Doane 1987:70). Once dead the whale was triumphantly referred to it as being ‘fin out’ or having ‘given up the ghost’ and its body floated on the surface (Dodge 1882:24; Brown 1884:267; WPA 1938:23; Shapiro 1959:35-36; Weiss 1974:84). If other ships were in the area and more whales were present, the dead sperm whale was ‘waifed’ to deter theft while they were pursued; this marking was done by inserting a five-foot long pole with a cloth flag into the carcass to indicate ownership (Olmstead 1841:58; Delano 1846:81; Hohman 1928:165-166; Grant 1932:78; Shapiro 1959:35).

Once a whale was killed, it was necessary to get the carcass back to the ship. If conditions permitted, the ship sailed as close as possible and took the whale alongside; if it was too rough or there was no wind, then it was necessary to tow the carcass to the ship (Dulles 1933:125-126; Doane 1987:70). Before transport began the carcass had to be secured, which was done by first using a tool called a ‘short-handled boat spade’ to cut a small hole either in the head near the blowhole or in the 'small' at the root of the tail and then connecting a length of tow line called a 'fluke strap' (Nordhoff 1874:121; Brown 1884:271-272; Verrill 1916:111; Hawes 1924:168; Grant 1932:78; Shapiro 1959:36; Stackpole 1967:43; Doane 1987:70). To the fluke strap a weighted line was attached, which was then connected to the boat via a towline secured to its loggerhead (Verrill 1916:111; Stackpole 1967:43).

Depending on the distance and the size of the whale, towing was an arduous task and sometimes took many hours to cover several miles (Hohman 1928:166). When the boats arrived at the ship the carcass was brought along the starboard side, with the flukes toward the bow and head toward the stern (Dulles 1933:126; Weiss 1974:84). The carcass was then secured by running the heavy chain around the 'small', through the 'fluke pipe' in the bulwark, and over the 'fluke bitt' on the foredeck (Cheever 1850:53; Doane 1987:63; Stackpole 1967:31; Leavitt 1970:124). With the carcass securely attached, the sails were reefed to halt the ship and all the boats were hoisted into their cradles (Delano 1846:26). The captain then ordered the cook to 'supper the watch' or 'dinner the watch'; once the meal was finished, the crew immediately began processing the whale or if too late in the day, prepared the ship to begin processing operations first thing in the morning (Nordhoff 1874:122; Brown 1884:278).

Archaeological Evidence of 'Raising Whales and Capture'

The specialized implements designed for and used in capturing whales were known as 'whalecraft' (Lytle 1984; Davis et al 1987:26). Along with the heavy manila lines, harpoons and hand-lances were among the most important pieces of whalecraft. In their most basic form these tools used for attacking and killing whales changed little from those used in the early days of the Atlantic whale fisheries (Kugler 1971:21; Spence 1980:114). And while the technique for employing them remained essentially the same, variations to the form of some of them were introduced during the early to mid-nineteenth century that proved highly effective and greatly increased industrial productivity. Thus the changes made to whalecraft are identified as among the major technological innovations experienced by the fishery (Davis et all 1987:60).

Though none of these tools was more essential than the others, harpoons were of primary importance since without them the boats could not fasten to the whale. Referred to in

American parlance as ‘irons’ (Kugler 1971:21; Leavitt 1973:125), the harpoons used on early nineteenth-century American whaleships were composed of a flat, sharpened head welded to an iron shank that tapered out at the opposite end to create a socket. In order to get the sharpest possible edge, the metal used in the manufacture of harpoons was of the finest quality (Harwood 1935:158); as historian John Spears stated, “… well-worn horseshoes and horseshoe nails were much used in forging these special weapons, and razor steel was used in making the cutting edges and points” (1910:206-207). The implement was completed when a 1.82 m (six-foot) long wooden pole—called an ‘iron pole’—was affixed into the socket and a short piece of rope was secured to the shank (Olmsted 1841:20). Called the ‘iron strap’, this piece of line had an eye spliced into one end and was used for ‘bending’, or tying, into the whale line when the harpoon was ready for use (Brown 1884:250; Spears 1910:206; Doane 1987:67).

As early as the eighteenth century, attempts were made to develop guns to increase the darting power and range of harpoons, however, American sperm whalers found these to be less effective than the primitive methods and and only adopted them in the 1860s (Spears 1910:206; Kugler 1971:21; Davis et al 1987:59). Instead, numerous variations were made to harpoon heads in an effort to improve their effectiveness. During the early to mid-nineteenth-century harpoon tips used by pelagic whalers appear to have followed three main designs: the two-flued, the one-flued, and the toggle (Davis et al 1987:60). In Figure 62 the original text that accompanied the illustration corresponds with the figure numbers and states: “Fig. 1. Improved harpoon or toggle-iron now in general use; Figs. 2, 3. First forms of toggle-iron made by Lewis Temple; Fig. 4. “One-flued” harpoon with hinged toggle; Fig. 5 “One-flued” harpoon; Fig 6. “Two-flued” harpoon” (Brown 1884).

Throughout the early decades of this period the most common design was the two-flued iron. Sometimes called ‘primitive harpoons’, this head style was sagitate, or arrowhead shaped, with sharp leading edges to cut into the whale and dull following edges to securely hook into the flesh and lodge there (Brown 1884:250; Giambarba 1967:53; Davis et al 1987:60). Though whalers achieved a great deal of success with these, the design was not without its problems; many were unsatisfied with the tendency of two-flued irons to ‘draw,’ or work their way out, and let whales escape (Brown 1884:250; Spears 1910:207; Kaplan 1953:84; Kugler 1971:21;

Spence 1980:49). The desire to reduce head size and in turn the cutting area of the two-flued tips led to the introduction of the 'one-flued' design in the early 1820s. Essentially a one-armed version of the older pattern (Figure 63), these were slowly adopted until eventually becoming popular around 1840 (Lytle 1984). Though the one-flued iron was considered superior to its predecessor, it was only favored for a short time due to the introduction of the 'toggle iron' in 1848 (Davis et all 1987:60). Sometimes referred to as 'Temple irons' after the African American whalecraft maker who first produced them, toggle heads were inspired by harpoons tips used by Eskimo hunters and incorporated a pointed barb sharpened on one side that was attached to the top of the shank with a pin at its center (Brown 1883:7; Harwood 1935:158; Kugler 1971:21; Spence 1980:114). When used, the barb entered the whale parallel with the shank; upon pulling back, it pivoted at a right angle to the shank and the head became transfixed in the flesh (Brown 1883:7; Harwood 1935:158). The effectiveness of the toggle iron was quickly realized and in a short time it became universally accepted among American whalers (Harwood 1935:158).

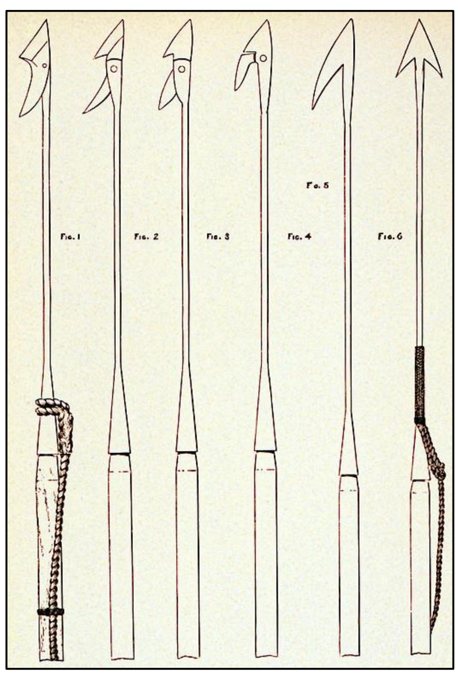

Figure 62. Early 1880s illustration of six types of harpoon heads used by American whalers in the nineteenth century; note that each of these is connected to an 'iron pole', or wooden handle, via the flared end of the shank known as the 'socket'. From Brown, J.T.

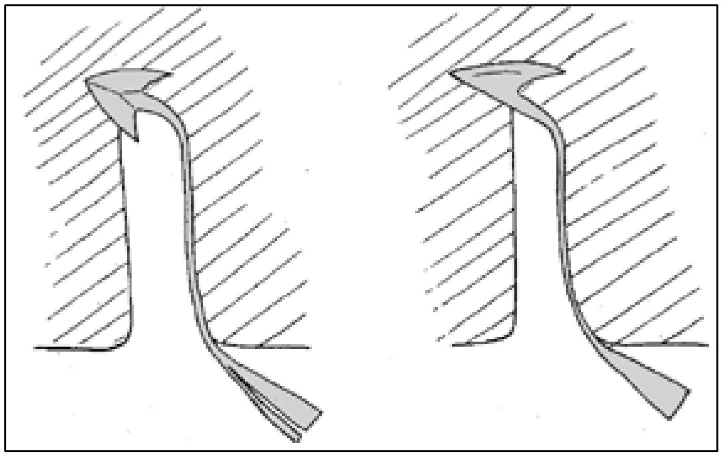

Figure 63. Interpretive illustration showing increased efficiency of the one-flued harpoon head over the two-flued design. From Lytle, T.G. 1984.

Since attempts at capture were sometimes unsuccessful, encounters occasionally resulted in whales escaping with harpoons still attached to them. To ensure that opportunities were fully attended to, it was standard for each whaleboat to carry four to five harpoons every time it was lowered (Olmsted 1841:20). Though two or three of these were intended as spares, the other two were referred to as ‘live irons’ and attached to the whale line for immediate use when the boat was in pursuit of whales (Olmsted 1841:20; Spears 1910:210; Leavitt 1973:18).). In order to distinguish ownership of a harpoon, it was custom to have the head of each one marked with initials designating the ship to which it belonged (Starbuck 1878:154). These marks were generally placed on the flat of the shank near the head and made either by punching the heads with a stamp or chisel when the iron was red-hot or by inscribing or etching them at a later point (Macy 1877:262-263; Lytle 1984). Stamps generally indicated the name of the blacksmith that crafted them, while inscriptions or etchings most often signified the name of the ship, its port, and often the whaleboat to which it was assigned (Starbuck 1878:154; Browne 1881:251-252; Spears 1910:208-209; Edwards and Ratrray 1932:62; Lytle 1984; Hellman 2011). If a whale was killed and a marked harpoon from a previous attempt to take it was found in the carcass, the whaler’s rule of the chase stated that “marked craft claims the ‘fish’ so long as it is in the water, dead or alive” (Macy 1877:262-263; Brown 1884:252; Spears 10910:209).

Next in importance to the harpoon was the hand-lance (Brown 1884:252). Also known as the 'killing iron', the lance was a spear-like stabbing device that was used by the whaleboat's mate to kill a harpooned whale (Harwood 1935:160; Francis 1991:50; Lytle 1984; Davis et al 1987:58-61). As with the hand-harpoon, lances were primitive tools that date back to the earliest period of whaling and their design changed little over time (Brown 1883:12). Its components included a barbless, flat, oval-shaped head sharpened on both sides and welded at its aft end to an iron shank. The shanks used for lances were approximately 1 m (three feet) longer than those used for harpoons and also tapered out to form a socket at the lower end (Olmsted 1841:21). Being a precision instrument for cutting into and out of flesh, the lance was ground to a razor edge from shank to point on each side. In order to achieve such a fine edge they were manufactured from the best quality materials which, until the introduction of steel just after the mid-1840s, was typically tough wrought iron (Brown 1883:12; Ashley 1926:87; Davis et al 1987:61-62; Doane 1987:67). As with the harpoon, this tool was completed when a 1.82 m (six-foot) long timber pole was affixed into the socket and an 14.5 m (eight-fathom) long rope known was a 'warp' was secured to the lance for retrieval after each jab (Olmstead 1841:21; Brown 1883:12; Spears 1910:211; Ashley 1926:87).

Despite the invention of various designs of explosive bomb-lances, American whalers preferred the hand-lance for the actual killing of whales until the latter part of the nineteenth century (Kugler 1971:21; Davis et al 1987:62-63). Each time whaleboats were lowered, every one of them was equipped with three to four hand-lances (Brown 1883:13; Brown 1884:252; Leavitt 1973:18). While one of these was used as an active tool and readied as soon as a whale was harpooned, the other two or three were kept onboard should they be needed as spares. Since they were not left in the carcass it was unnecessary to distinguish the name of the ship or boat with inscriptions or etchings; however, lances were generally stamped with the blacksmith's initials or symbol (Lytle 1984; Hellman 2011).

The desirable properties of the shanks used for both harpoons and lances were that they be tough and flexible. These qualities were extremely important both when a whale was harpooned, since it ran at great speeds while turning and sounding in an effort to break free, and when it was lanced, since the death flurry caused them to twist and turn wildly in all directions. These intense actions often resulted in the shanks being broken, twisted into fantastic shapes (Figure 64), and even reduced in diameter by “tractile force” (Spears 1910:208; Harwood 1935:158-159). As such they were manufactured from the highest quality wrought iron available to allow them to bend under pressure (Brown 1884:252; Davis et al 1987:61). Though references are made to the use of ‘soft, Swedish iron’ for this purpose, such references date to the later part of the nineteenth and early twentieth century (Brown 1883:12; Brown 1884:251; Brimley 1895:71; Harwood 1935:159); thus, it is unknown whether this highly regarded material was used in the early to mid-nineteenth century.

Figure 64. A toggle harpoon dating to 1882 which demonstrates the potential damage to whalecraft that could occur while raising whales. From: http://amhistory.si.edu/onthewater/collection/AG_056237.html

Hickory saplings with the bark intact were the preferred timber for whalecraft poles on American ships due to their strength and that the bark provided a good handhold (Spears 1910:206; Ashley 1926:86; Edwards and Edwards Rattray 1932:59-60; Davis et al 1987:59; Davis et al 1997:288). Though new whalecraft were sometimes coated in orange or red paint to prevent corrosion, aside from small amounts that adhered to crevices or the blacksmith’s stamps, this paint was usually cleaned off by sharpening (Lytle 1984). When not in use the heads of both the harpoons and lances were covered with wooded sheaths in order to keep their edges from being dulled and to prevent accidental injuries (Edwards and Edwards Rattray 1932:61). Harpoons were stowed forward in the whaleboat on top of the thwarts below the port wales; lances lay in racks under the wales on the forward portion of the starboard side with latches or pins to keep them in place (Ansel 1978:65). Because harpoons and lances were often bent during encounters with whales, American whaleboats were equipped with a hammer and a grooved port chock timber to allow them to be straightened before they were needed again (Pearson 1983:46).

Numerous pieces of whalecraft were identified among the remains of *Two Brothers* at French Frigate Shoals. These implements included harpoon heads, lance heads, and sections of whalecraft shanks. It is highly possible that other pieces of whalecraft are present at the site but are hidden due to thick layers of marine growth and iron concretion. All of these artifacts were found scattered in Section B of the shipwreck site (Figure 19) which indicates an association with the stern of the vessel. It is, however, impossible to determine whether they were spare implements that were stowed away or active pieces that were kept in the racks mounted directly under the skids or in the boats that did not survive the wrecking. Without a doubt, the tendency for whalecraft to be lost or damaged meant that ships were equipped with a large number of harpoons and lances for each cruise. For instance, the accounts book for the 1820 to 1824 cruise of the Nantucket ship *Peru* lists at least 85 'irons' and 36 lances (NHA *Peru* Account Book 1820). The outfitting book for the 1832 cruise of the New Bedford ship *Condor* is even more specific; for 'whale irons' it lists "100 two flue 30 one" and between 25 and 30 lances (NBWM *Condor* Outfitting Book 1832). Notes found in the back of the log from *Parker*'s 1831-1835 cruise indicate that 150 harpoons and 30 lances were shipped onboard for the cruise (Brown 1835:257).

Of the five harpoon heads located on the site, all are two-flued designs, which is consistent with the wrecking event occurring in 1823. Each harpoon is missing the shank and it appears to that they separated at the spot at which they were welded together. The conditions of these artifacts varied; some are easily discernible by their sagitate form (Figure 65), while others are harder to identify due to corrosion and deterioration. The lance heads from *Two Brothers* each shared the same standard elongated, oval-shaped design that are typical of hand-lances. The conditions of these artifacts is relatively good and two of them include a small section of shank attached to their lower ends while the other is missing the shank altogether. At least five sections of whalecraft shank were also found at the site. For the most part the poor condition of these short, broken sections prevents a determination of whether they were associated with harpoons or lances; however, one specimen appears to be largely intact and matches the length specified for harpoon shanks (Spears 1910:206).

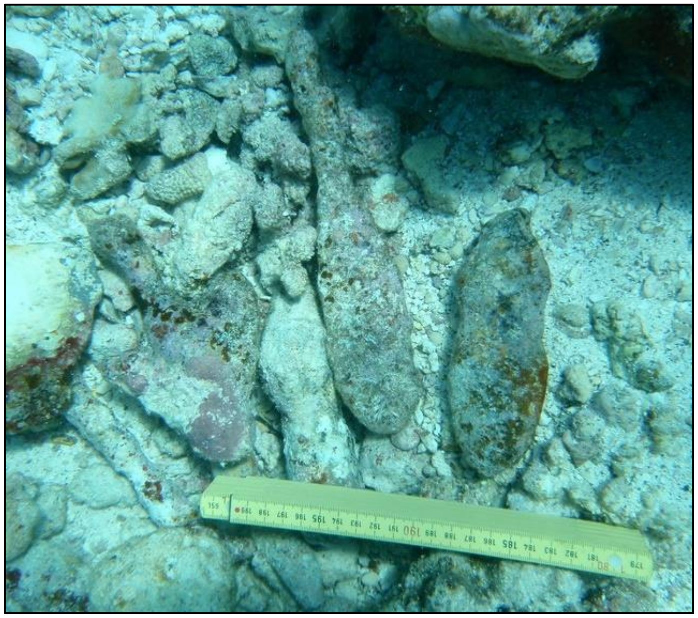

Figure 65. Five two-flued harpoon heads and three hand-lance heads were documented at Section B of the *Two Brothers* shipwreck site; this photograph shows one harpoon head and two lance heads *in situ* (image courtesy of Papahānaumokuākea Marine National Monument).

Because the better preserved harpoon and lance heads were encased in calcium carbonate marine deposits, any markings made on their surfaces could remain. This diagnostic potential coupled with a plan to interpret and display these objects for the public resulted in the recovery of three harpoon heads and two lance heads in 2010. Each of these artifacts was examined and determined to be composed of iron, before being analyzed using CT-scanning technology to assess their structural integrity and whether any intentionally-made surface marking was present (Figure 66). Each artifact had suffered considerable corrosion from long-term exposure to the marine environment and all were assessed as being in fair to poor condition with no indication of markings on their surfaces (Fox 2012:3).

Figure 66. Post-conservation photograph of two of the three harpoon heads recovered from the *Two Brothers* site for interpretation purposes (image courtesy of Papahānaumokuākea Marine National Monument).

Cutting In

Processing the whale was done as quickly as possible and carried out continuously until complete (Weiss 1974:84). The first step in processing was known as 'cutting in.' Historian John F. Leavitt (1970:123) defined cutting in as "the process of cutting the blubber or fat away from the carcass of the whale as it lies in the water while it was alongside the ship." Due to the large size of sperm whales, this operation was a formidable undertaking and involved using specific tools to precisely procure the blubber with as little waste as possible. Prior to beginning this process, the cutting and lifting equipment needed to be set up in order to ensure that it went as seamlessly as possible. Thus, when the shipkeeper determined that a whale had been taken, any available crew onboard was instructed to begin preparations and the ship erupted in a flurry of activity. Under favorable weather conditions and with skilled workers employed, an average sperm whale took approximately six to eight hours to prepare; however, in rough weather this same process could take as long five days (Brown 1884:283).

The steps taken during the fitting out period when the masts and working area on the ship's starboard side were set up greatly increased the efficiency of cutting in and the time taken to get organized for these operations. First, the heavy cutting tackles and immense blubber hooks stored below decks were fetched and sent aloft to be attached to the previously rigged ‘necklace’ or pendant on the mainmast and guy tackles on the foremasts, and then the 10 to 15 cm (four- to six-inch) diameter manila rope called the ‘falls’ was threaded through these and run ahead to the windlass (Hazen 1854:84; Perkins 1854:61; Davis 1874:77; Scammon 1874:232; Brown 1884:277; Leavitt 1970:25). While this was happening the removable section of the bulwark was taken out, the hatch to the blubber room was removed, and the carpenter erected the cutting stage which was then hung over the side (Perkins 1854:61; Doane 1987:70). The cutting utensils were also retrieved and re-sharpened on the grindstone; including cutting spades, boarding knives, pikes, and gaff hooks, all of which were made of iron and fixed to oak or hickory ‘poles’ or handles of varying lengths (Olmsted 1841:62; Browne 1850:57; Perkins 1854:61). Once the tools were sharp and the stations were prepared, the crew took their places and cutting operations began.

During the cutting in process each member of the crew was tasked with specific jobs based on rank (Dulles 1933:126). Since precision and experience was required during these operations, the officers and boatsteerers took roles of responsibility: “the captain, first and second mates worked on the cutting stage; the third mate, stationed in the waist, was in charge of hoisting and stowing away the blanket-pieces; the fourth mate divided his attention between the waist and the windlass; and the boatsteerers performed the most exacting tasks in the blubber room, in the waist, and on the whale” (Hohman 1928:171). The foremast hands performed a number of duties including heaving on the windlass, helping in the blubber room, handling a ‘scoop net’ to catch scraps of blubber that fell in the water, and guarding the boatsteerer when on the whale. And one crewmember was always detailed to turn the grindstone since the implements constantly needed re-sharpening (Hohman 1928:171).

The methods and patterns used for cutting in sperm whales were perfected by American whalers in the later decades of the eighteenth century, and illustrations depicting this (Figure 67) began to appear by the 1790s (Ashley 1926:96; Dyer 1999). The primary task of cutting in was removing the large head and securing it to the side of the ship. A sperm whale’s head constitutes approximately one third of its length and contains a large cavity filled with the highest quality oil, known as spermaceti (Davis 1874:82; Brown 1884:278; Stackpole 1967:50). The captain and mates accomplished decapitating the animal by using cutting spades to trace the incision pattern that followed the edge of the skull (just behind the eyes) and then cutting a hole to attach a blubber hook. The crew then wound the windlass to create strain and roll the carcass over to complete the cut and expose the joint between the skull and the vertebrae; the strain caused by the windlass and the chopping of the spades worked together to separate this joint. Chain strops were then roved through the cuts in the head and through a hawse pipe aft of the gangway to hang it securely over the ship's side while the rest of the carcass was processed (Olmsted 1841:64; Davis 1874:82; Leavitt 1970:25).

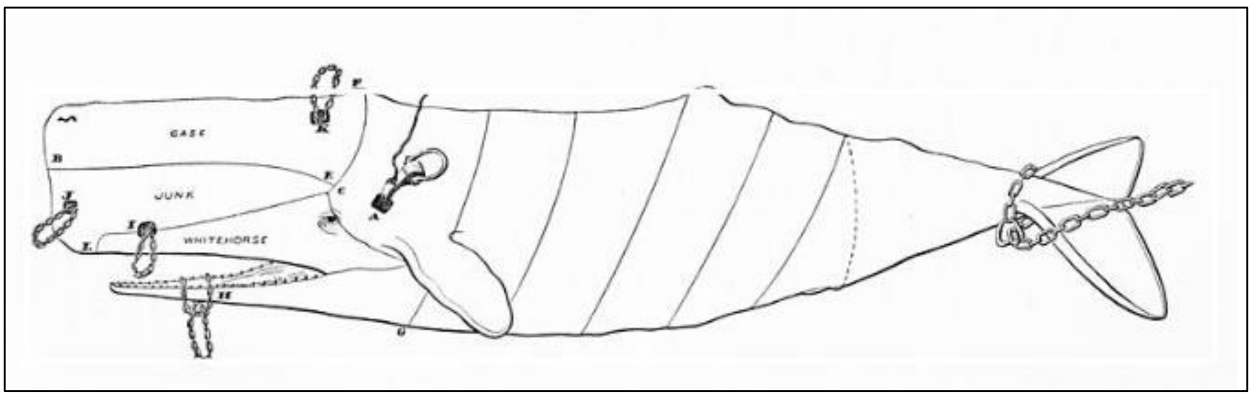

Figure 67. Illustration of the spiral cutting pattern used for removing blubber from sperm whales. From Scammon, C.M. 1874.

As the head was being removed, the second mate began 'scarphing' the body; this involved cutting one to two meter (three to six foot) wide incisions diagonally into the blubber (Olmsted 1841:64; Browne 1850:60; Hohman 1928:167; Doane 1987:71). A hole was then cut into the blubber between the left eye and fin using a boarding knife and a tethered boatsteerer went overboard to guide the blubber hook into it. With the blubber hook securely in place, six or eight of the crew cranked the windlass which in turn rolled the carcass and, with the help of the mates and their spades (Figure 68), stripped the blubber away in the same way that an apple or orange might be peeled (Delano 1846:26; Dulles 1933:127; WPA 1938:23; Shapiro 1959:37; Stackpole 1967:49; Leavitt 1970:25; Weiss 1974:86). Once the resulting strip of blubber reached the upper blocks, a boatsteerer cut a hole at the lower end and inserted into it a second blubber hook or a wooden toggle attached to the second set of cutting gear. Once both were under tension, the upper portion of blubber was severed above the second hook using the boarding knife and the free section—known as a 'blanket piece' and weighing around a ton—was dropped through the hatch to the blubber room floor between decks. In the blubber room, two crewmembers had the formidable task of reducing the 'blanket pieces' into smaller sections called 'horse pieces' which they stowed in preparation for trying out. This process continued until the blubber was completely stripped from the carcass (Macy 1835:227; Olmsted 1841:64; Browne 1850:128; Cheever 1850:58; Scammon 1874:236; Brown 1884:278-279; Dulles 1933:127; Shapiro 1959:37; Stackpole 1967:49; Leavitt 1970:25; Weiss 1974:86; Doane 1987:71; Payne n.d.:4-5). After most of the blubber was removed, a mate searched the inside of the stomach for ambergris, an extremely rare and pungent substance used as a base for perfumes and sold for the same price as gold (Shapiro 1959:38; Hegarty 1960:40).

Once the carcass was stripped and clear of ambergris, the tail was cut through and the remains set adrift to be devoured by the many sharks and flocks of screaming birds that had surrounded the scene from the start (Delano 1846:27; Scammon 1874:235; Brown 1884:279; Dulles 1933:127; Leavitt 1970:25; Payne n.d.:5). Attention then returned to the head, which was hooked and brought forward to the gangway, hoisted nose down, and either set onto the deck for dissection or, if it was too large, suspended over the side out the water as high as possible (Browne 1850:128-129; Leavitt 1970:25; Payne n.d.:5). Three parts of the sperm whale's head were of value to the whalers: the upper part of the head termed the 'case', which was the largest cavity filled with the purest oil; the lower half of the forehead called the 'junk', which was filled with oil and spermaceti; and the lower jaw with its numerous teeth, which were prized by whalers for use in scrimshaw and for trading with Pacific islanders (Delano 1846:27; Davis 1874:82; Hohman 1928:169; Shapiro 1959:36; Payne n.d.:5-6).

Processing the head started with separating the jaw, which was set aside for later removal of the teeth using the cutting tackle (Hohman 1928:169; Weiss 1974:87; Davis et al 1997:276). The junk was then cut from the skull and secured to the deck to ensure that it did not slide as the ship rolled. Next the case was breached by cutting a hole the size of a barrel through a thick membrane at the base of the skull known as the 'white horse'; once opened the spermaceti was bailed from the case. Bailing was achieved either by using a ‘tail block’ with a line and ‘case bucket’ rigged to the cutting tackle or by a crewmen entering and passing case buckets out to waiting crew members (Olmsted 1841:65; Delano 1846:27; Grant 1932:96; Stackpole 1967:49-50; Leavitt 1970:27). Generally between 15 and 30 barrels of spermaceti were recovered from the case, which in warm weather is in a liquid state but in cold has the consistency of lard; it was then carefully stored in special casks and kept separate from the rest of the oil (Dodge 1882:9; Grant 1932:96; Dulles 1933:128; Stackpole 1967:50). Once the case was emptied the head was pushed overboard and then the junk was processed; this clear, fatty, spongy, oily substance was as rich in spermaceti as the case, and ranked next in price (Hohman 1928:169; Doane 1987:73). It was cut into varying sized pieces, the larger having the oil removed by boiling and the smaller being squeezed out by hand (Doane 1987:73).

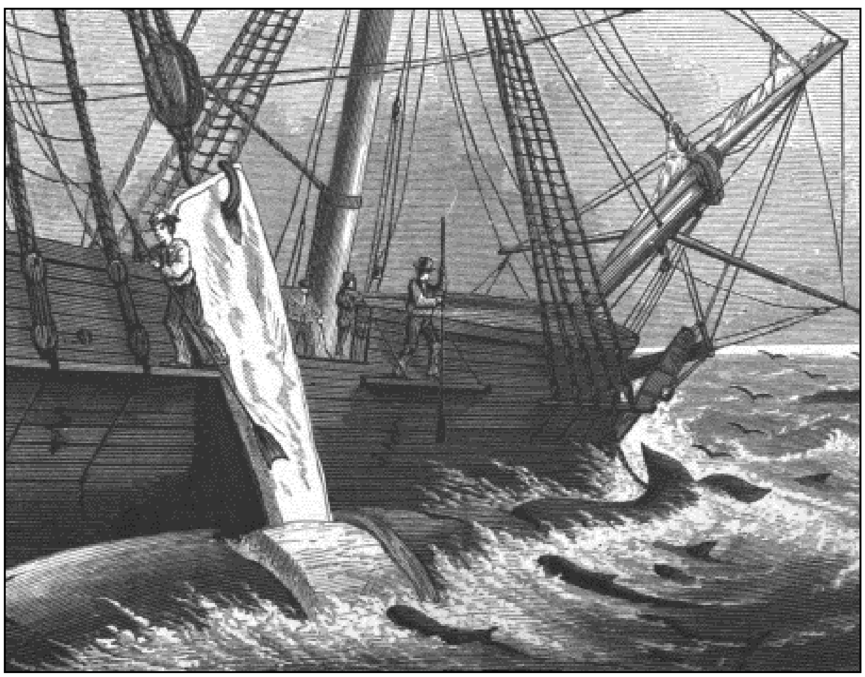

Figure 68. Historic illustration of whalers using removing blubber from a whale; note the numerous sharks depicted feeding on the carcass soon after this process was initiated. From Davis, W.M. 1874.

Archaeological Evidence of ‘Cutting In’

A small number of artifacts associated with the cutting in process were identified at the *Two Brothers* and *Parker* shipwreck sites. As the preceding discussion illustrates, the tools needed to carry out this stage of pelagic whaling included highly specialized implements such as blubber hooks and cutting tackle blocks, while others like the ship's windlass were multipurpose objects that might be found on any wrecked sailing ship of the period. Other than these artifacts, the only other materials associated with pelagic whaling's cutting in process so far found in an archaeological context include blubber hooks located on the wrecks of the British whaleships *Hermes* (1822) at Pearl and Hermes Atoll and *Lively* (1811) at Rowley Shoals off the Western Australian coast. Thus, the location of these associated objects and their interpretation as a group provides insight into their use onboard a working whaleship of the early nineteenth century.

One artifact found on the *Two Brothers* site and identified as specifically associated with the cutting in process was a deteriorated single-block. Essentially, pulleys used to assist in lifting objects by increasing purchase (Biddlecombe 1925:3), blocks were simple wooden devices composed of a heavy outer shell, at least one inner wheel known as a sheave that was grooved to seat a rope, and a pin which acted as an axle and allowed the sheave to turn. The sides of a block's outer shells were generally grooved at the top and bottom to receive a strap called a 'strop', which was used both to reinforce the shell and to provide attachment points (Stone 1993:74-75). All of the blocks used on sailing ships had to be extremely tough to cope with excessive strain and to withstand the harsh conditions experienced with an open ocean environment. Thus, they were generally made from hard, heavy woods such as lignum vitae, ash, or hickory (Stone 1993:74).

Though a large number of blocks of varying sizes and purposes would have been found on any early nineteenth-century sailing ship, those used for cutting tackle could be easily distinguished by their size. As described in the above discussion, the cutting tackle consisted of a single, large double-block known as the 'lower block', which was used for primary lifting; two large, single-blocks called the 'upper blocks', which were used for the secondary lifting; and a slightly smaller 'guy block' through which the guy line was rove. Historic descriptions of these blocks are rare; for the most part whaling historians have drawn from Captain Charles M. Scammon's extensive discussion of whaling gear (1874:216-240) but he provided no detailed information about cutting tackle. Some useful information about blocks is, however, provided in James Temple Brown's description of those included in a display about the American whale fishery installed at the 1883 International Fishery Exhibition (Brown 1883). In a booklet intended as a companion to the exhibit, Brown indicates that although using rope strops was the earliest method for strapping lower blocks, by at least 1883 these were being replaced by "the improved chain strop" (Brown 1883:63). He also provides the dimensions for the cutting tackle from the display as being, "lower block 18 by 12 by 10 inches; upper blocks 18 by 12 by 6 inches; guy block 13 by 9 by 6 inches" (Brown 1883:63).

The block identified on the *Two Brothers* shipwreck site is partially intact due to the hard wood from which it was manufactured. Though heavily deteriorated, the remains include two pieces of the block's outer shell and a single wooden sheave which are attached to the pin (Figure 69). Since the majority of it is missing, overall length and thickness dimensions could not be ascertained; however, the intact pin allowed for the artifact's width to be determined as approximately 30 cm (12 inches). Based on this measurement, the lack of any evidence of chain adhering to it, and the presence of only one sheave, these remains were determined to belong to one of the two 'upper blocks' of a cutting tackle.

Figure 69. Remains of an 'upper block' of a cutting tackle recorded at Section B of the *Two Brothers* shipwreck site; note the grooved face on the wooden sheave in the center and portions of outer shell and the pin are present (image courtesy of Papahānaumokuākea Marine National Monument).

The other artifact specifically designed for and used in the cutting in process was the blubber hook. Among the most iconic implements associated with the historic whale fishery, these large iron hooks were used for securing blanket pieces while the blubber was stripped from the whale's carcass. They were produced in blacksmith shops using high quality iron, measured roughly 76 cm (two and half feet) in height, and weighed between 70 and 150 pounds (31 to 68 kg) depending on the size of the ship (Olmsted 1841:62; Brown 1883:20). Though there appears to have been some variation in their design, they were basically j-shaped objects with an eye at their upper end for attaching to the 'lower block' using a shackle or thick rope. A loose ring was generally affixed into a small hole in the heel of the hook; this was used to attach a thin rope that allowed the point to be directed into the hole cut in the blubber for lifting (Brown 1883:64). Although the date of first production for large iron blubber hooks is currently unknown, the records of the trading sloop *Rholey* on file at the New Bedford Whaling Museum Research Library indicate that they were in use by at least the year 1773 (NBWM MSS 56 Box 39 Series H Sub-series 28).

In practice, blubber hooks were interchangeable with the big wooden toggles (Figure 70) that were often used for the same purpose. Hooks were, however, chosen for primary lifting during shipboard cutting in operations, which may indicate a preference for them. Despite being reinforced with extra thick iron in the throat (the curve at the bottom of the hook), blubber hooks were known to occasionally break under the immense strain of lifting blubber pieces (Brown 1883:64). Thus, it was standard for ships to carry a number of spares onboard. A review of a small sample of whaleship outfitting data for the period 1800 to 1840 shows that each ship went to sea equipped with three to four blubber hooks listed among their outfits (NBWM "3 Boat Ship" 1800; NHA *Peru* Account Book 1820; NBWM *Condor* Outfitting Book 1832; NBFPL *Marcella* Outfitting Book 1840).

Figure 70. A wooden toggle recorded onboard the whaleship *Charles W. Morgan* in July 2014 (image courtesy of Mystic Seaport).

Three large blubber hooks were identified among the artifact assemblage of *Two Brothers*. Two of these have almost the matching dimensions and are identical in design, with features including a heavily reinforced throat and a large eye at the upper end that was forged in the manufacturing process. While the other hook has similar dimensions and includes heavy reinforcement in the throat, the large eye is made of a separate iron ring that was inserted into a hole in the top of the hook's body and would have allowed it to pivot. Dense marine encrustation on each of these hooks prevented any markings or holes in their heels from being identified. All three of these blubber hooks were found in Section B of the site (Figure 19), with two of them lying side by side in a deep pocket at the edge of the reef (Figure 70) and the other in a small gulley on top of the reef. The close proximity of the two makes it highly likely they were spares kept in storage in the stern of the vessel, while the location of the other hook could indicate that it was in active use at the time the ship was lost.

Figure 71. Two blubber hooks recorded in a pocket in the reef at Section B of the *Two Brothers* shipwreck site (image courtesy of Papahānaumokuākea Marine National Monument).

A single blubber hook was recorded at the *Parker* shipwreck site. This hook is basically J-shaped and approximately 61 cm (two feet) in height. Though similar in design to the one found on *Two Brothers* with the separate ring affixed to its top, this one lacked the same amount of reinforcement in the throat and instead employed a heavy shackle with the pin inserted into the hole at the top of the hook's body. Thick marine encrustation and iron concretion on the back side of this hook prevented the identification of any possible markings or whether a hole was included in its heel. Notes pertaining to outfits found in the log from *Parker*'s 1831-1835 cruises list four blubber hooks as being on board (Brown 1835:257). The fact that this artifact was found in the bow section of the wreck near the remains of the windlass may indicate that it was an actively used implement temporarily stored on deck at the time the ship came to grief and that spare hooks were stowed away in the after part of the ship.

A smaller component of the cutting gear was the iron thimble or 'grommet' (Brown 1883:63; Higgins 1927:35). As discussed in the preceding chapter, these rings were added to the eyes made in rigging lines to keep their openings from cinching and to prevent chafing. Although varying sized thimbles could be found in many places on all working whaleships of the period, their ability to prevent distortion of the eye when under heavy strain meant that they were particularly useful for the cutting gear. An illustration of 'cutting-in tackle' in A. Hyatt Verrill's *The Real Story of the Whaler* (1923) indicates that thimbles were added to at least three specific sections: at the lower end of the manila strapping that surrounded the lower block, where a large thimble used for attaching the blubber hook was added; above the upper blocks, where a smaller one was inserted for connecting them to the pendant shackles (Figure 72); and at the end of the small line shackled to the ring of the back of the blubber hook, where a much smaller one was often inserted into the line used for directing the hook's point (Kipping 1859:86-87; Verrill 1916:41). Thimbles were also added at the ends of the thick cables that made up the 'pendants' and from which the cutting tackle hung (Brown 1884:281).

As discussed in the Chapter 6, a number of thimbles were documented at both the *Two Brothers* and *Parker* shipwreck sites. Because they were such ubiquitous objects, for the most part the small diameters of those artifacts prevented making a determination about where specifically they were used on the ships. A particularly large thimble documented at each of the sites was probably incorporated into either the cutting tackles or the pendant. The large diameters and width of the discernible grooves in the outer faces of these heavily concreted artifacts indicate that each would have been used for seating a very thick rope that could withstand immense strain without breaking. Both of these are considered to have been part of the cutting gear, but their positions within them are uncertain. The thimble documented at *Two Brothers* (Figure 73) was found in Section A of the site (Figure 18) among the dense scatter of iron rigging elements and could have been inserted at one end of the pendants, which remained around the mast until the last whale was taken (Brown 1884:281). Since the one found at *Parker* was resting among the artifacts associated with ship's bow and near the blubber hook it is suspected to be part of a cutting tackle.

Other objects recorded at the shipwreck sites were directly used for cutting in; these include the remains of a windlass on the *Parker* wreck and a grindstone among the artifacts from *Two Brothers*. Though each of these has been discussed in a previous section or chapter, it is important to note that on whaleships they were used to perform multiple functions. For instance, it is well known that the windlass was a critical part of all nineteenth-century ship anchoring systems. And while whaleships were equipped with a windlass for that purpose, it also functioned as an integral component of the cutting in equipment and without its adaptation for this purpose, blubber simply could not have been brought onboard. As for grindstones, while all wooden sailing vessels were equipped with them for keeping tools and knives sharp, the vast array of specialized implements need for pelagic whaling meant that they were said to have spun almost constantly and the chore of turning them was often lamented by the foremast hands (Browne 1850:131-132).

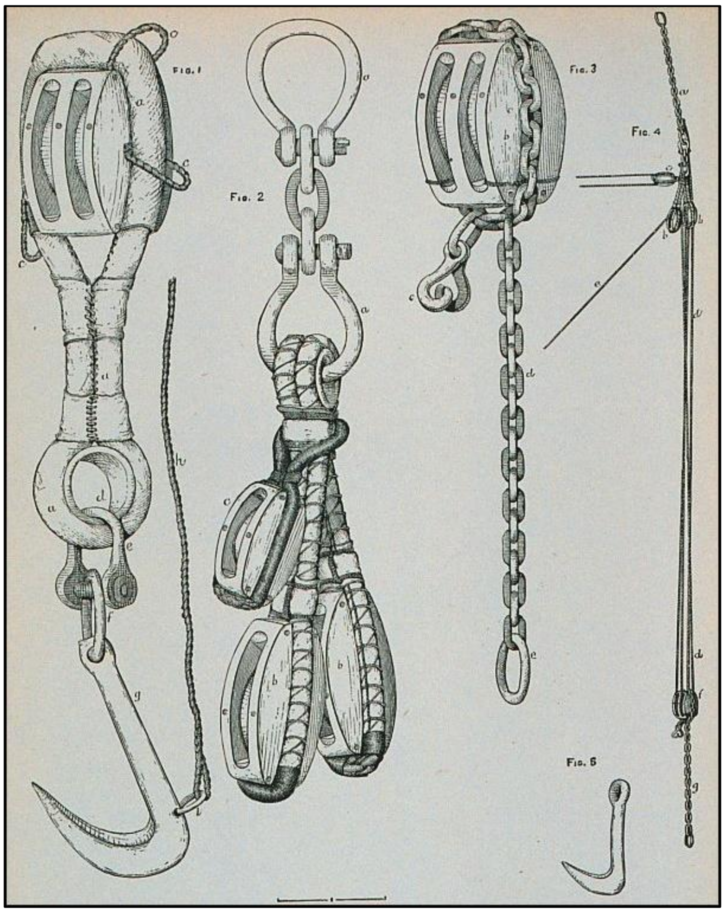

Figure 72. Historic illustration of the various components of cutting tackle including blubber hooks, upper and lower blocks, and thimbles. From Verrill, A.H. 1916.

Figure 73. Large thimble recorded at Section B of the *Two Brothers* shipwreck site; note the grooved external face used for seating a line (image courtesy of Papahānaumokuākea Marine National Monument).

Trying out

The next step in the pelagic whaling process was known as 'trying out.' This process involved removing water and extracting the oil from the blubber by boiling it in the large cauldrons situated in the previously discussed brick structure called the tryworks (Olmsted 1841:67; Doane 1987:266). Generally, trying out a large whale took about three full days, with crews working six-hour watches—known as the 'trying out watch' (Nordhoff 1874:128)—and operations running around the clock (Olmsted 1841:67; Robotti 1962:113). According to whaling historian John F. Leavitt(1970:28), an average-sized sperm whale could produce 40 to 50 barrels of oil and a large one might yield as many as 80 barrels.

As with other steps in the whaling process, crews were under close supervision since mistakes could result in diminished oil quality and in turn, reduced profits. Thus, when the pots were boiling, a mate or boatsteerer was relegated as 'officer of the watch' to superintend these operations. Other duties included preparing the blubber for boiling and carrying it from the blubber room to the deck, cleaning the decks to reduce slipping hazards, moving casks, standing lookout, manning the helm, and lending a hand whenever and wherever needed (Brown 1884:285; Hohman 1928:172-173; Doane 1987:73; Payne n.d.:6).

With the blubber and spermaceti onboard and the carcass cut loose, preparations were made to begin trying out. Although the trypots were covered with wooden lids when not in use, it was first necessary to clean the insides of the trypots with soapstone since rust reduced the quality of the oil (Browne 1850:60; Cheever 1850:87; Palmer 1959:145). Once they were clean, the fires under the pots were started by using a small amount of wood or coal. Once the blubber was boiling any pieces of skin floating on the oil were skimmed off using a perforated tool called a 'strainer' and added to the fire as fuel. These brown 'doughnut-looking' pieces were known as 'scraps' or 'cracklings' and were saturated with oil; as such they produced an intense heat and heavy black smoke that stained the sails (Browne 1850:56; Davis 1874:89; Verrill 1916:50; Hohman 1928:172-173; Dulles 1933:129; Shapiro 1959:39; Weiss 1974:87; Doane 1987:73; Davis et al 1997:274; Payne n.d.:6). At night scraps were also burned for light by being placed in an iron basket situated on the tryworks and called a 'cresset' (WPA 1938:24; Allen 1973:178). Some of the scraps were set aside in a 'scrap hopper' to be used later for fires, while the rest were either thrown overboard or saved to be traded with South Sea Islanders who enjoyed eating them—as did some of the whalers (Olmsted 1841:67; Scammon 1874:238; Doane 1987:73).

Also considered part of the trying out process was preparing the blubber prior to boiling (Brown 1884:285). While some of the boatsteerers attended to starting the tryworks fire and readying the implements, others oversaw the work of the 'blubber room gang.' Blubber preparation consisted of cutting the large 'blanket pieces' into smaller 'horse pieces' 15-46 cm (6-18 inches) in width by 30-61 cm (12-24 inches) in length; these were then thrown into open tubs and set aside until the tryworks were ready (Brown 1884:285; Dulles 1933:129; WPA 1938:23; Doane 1987:73; Payne n.d.:6). As needed the horse pieces were brought onto the deck and taken to a wooden table with a rounded top known as the 'mincing horse' or 'mincing block.' There they were sliced using a two-handled blade called a mincing knife to provide more surface area for quicker boiling (Macy 1835:228; Cheever 1850:61; Verrill 1916:49; Allen 1973:178; Weiss 1974:87). Care was taken to ensure that the slices were very thin, but did not quite go all the way through the piece; when done correctly the minced pieces resembled of the pages of a book and were referred to as 'bible leaves' (Grant 1932:92; WPA 1938:23;

Shapiro 1959:39; Doane 1987:73; Robotti 1962:112; Payne n.d.:6). Once prepared, the bible leaves were thrown into a 'mincing tub' near the tryworks to await boiling. In the meantime, while the preparations for trying out were being undertaken, the cooper was busy assembling casks from shooks, head pieces and metal hoops to receive the oil (Grant 1932:40).

If the spermaceti from the head was to be tried out while onboard, it was cooked together with the junk prior to the blubber being added to the pots. Segregating the raw materials prevented mixing it with lower quality oil and guaranteed the best price. When complete, the oil was again placed into special casks and marked as 'head-matter' before being stowed separately from the rest of the oil (Scammon 1874:239; Weiss 1974:87). Once trying the junk and spermaceti was done, the bible leaves in the mincing tubs were fed into the trypots using a two-pronged 'blubber fork' (Browne 1850:61). It took about an hour for a pot full of blubber to be rendered down and while it boiled, it was given constant attention and stirred frequently to ensure that it did not burn or settle in the bottom of the trypots (Scammon 1874:238; Robotti 1962:112; Doane 1987:73).

When the oil had separated from the water and flesh, a long-handled iron or copper bailer was used to scoop it from the pot and then pour it into a copper tank on the side of the tryworks; there it cooled until the next batch was ready to be bailed (Macy 1835:228; Browne 1850:56; Scammon 1874:238; Hohman 1928:172; Grant 1932:94; Stackpole 1967:50-51; Davis et al 1997:274). This rectangular tank was called a 'cooler' and provided a valuable function since boiling oil poured directly into a cask would have caused the wood to shrink and the oil to leak (Olmsted 1841:67; Doane 1987:73-74). A cooler was capable of holding six to ten barrels of oil and was equipped with a screen-covered valve called a 'stopcock' for transferring oil into storage containers (Olmsted 1841:67; Robotti 1962:112). After all of the blubber was tried, the fires under the pots were extinguished and attention shifted to storing and stowing the oil (Nordhoff 1874:131).

Archaeological Evidence of 'Trying Out'

As discussed in previous chapters, the inclusion of the tryworks onboard whaling vessels made trying out perhaps the most iconic activity associated with pelagic whaling since the mere sight of a plume of black smoke rising from a ship on the horizon was enough to alert passersby as to its function. In much the same way, the presence of numerous bricks and/or large iron pots found among the remains of a shipwreck site are the most obvious indicators of a lost whaleship. Although many of the other industrial artifacts from this period were made of wood or materials that would deteriorate quickly or be swept away after the initial wrecking event, the dense clay bricks and the heavy iron pots tended to settle on the seabed after the tryworks was broken apart. As such, these components are part of the artifact assemblage of nearly every wreck of a pelagic whaleship so far identified, and their diagnostic value cannot be understated. Though other heavy components of the early nineteenth-century tryworks, such as the iron knees, might also be expected to remain, they are less likely to be found on archaeological sites. Since tryworks knees were bolted to the deck, unlike the bricks and pots that scattered freely, the knees likely carried along with the wooden structure.

The most prevalent component of the tryworks documented at American whaling shipwreck sites are bricks. Although those used in early nineteenth-century tryworks construction were manufactured in the same way as others of the period, the only known historical information pertaining directly to them is found in an outfitting book dating to the 1860s. Included in the first pages among data about various industrial equipment are the specifications for the two types of bricks used on whaleships: “3 ½ by 7 inches (9 by 18 cm)” and “4 inches by 8 inches (10 cm by 20.5 cm)” (Kirby Outfitting Book 1860:5). The actual number of bricks used in the construction of a tryworks structure varied greatly depending on dimensions and design; however, for a general sense of the actual numbers needed, 455 bricks were used to build the two-pot tryworks onboard the half model of the whaleship *Lagoda* at the New Bedford Whaling Museum in 1917 (Olly 2004:150).

For the most part these structures were already installed on the ships by the time of outfitting; therefore there was generally no need to provide the number of bricks used in their construction. Most ships carried spare tryworks bricks among their outfits as well. The outfitters of some vessels listed an exact figure in their outfitting books; for example the whaleships *Marcella* (1841) or *Mars* (1845) reported carrying 200 and 250 spare bricks respectively (NBFPL *Marcella* Outfitting Book 1841; NBFPL *Mars* Outfitting Book 1845). Others, like the whaleship *Condor*, appear to have been less concerned with the actual number and simply note “got a plenty” in the margin next to the entry ‘Spare Brick’ (NBWM *Condor* Outfitting Book 1832). The implied need for carrying spare bricks and lime for mending a damaged tryworks is only one interpretation of the presence onboard. According to the mid-nineteenth-century narrative of whaler William B. Whitecar, Jr., a number of bricks were kept in each of the whaleboats and used to heave at a whale to determine whether it was belligerent in nature and if engaging it should be avoided (1864:344).

The scattered remains of tryworks bricks were documented at both the *Two Brothers* and *Parker* shipwreck sites. No markings were noted on any of the bricks at either site and measurements of intact samples from each were consistent with the specifications for the smaller of the two types described above (Kirby Outfitting Book 1860:5). Since machine made bricks did not appear until the 1860s (Smith et al 2006), it is presumed that these were manufactured using wooden molds. The number of bricks documented varies widely between the sites. For instance, at the *Two Brothers* site it is estimated that at least 150 bricks were seen scattered in pockets in the reef in Section A (Figure 18) and approximately another 50 bricks noted in Section B (Figure 19). Most of the ship’s remains are thought to be present and those from the tryworks, as well as any spare bricks would have undoubtedly scattered in these areas. In contrast, a smaller number of bricks were identified in the back reef section of the *Parker* wreck site, probably because the majority of the remains are associated with the bow section. That bricks remain on these sites confirms that they were both still engaged in fishing, since their tryworks had not yet been ‘knocked down’.

Among the other principle components of the tryworks were the ‘trypots’. Originally known as ‘try kettles’, these large iron cauldrons of varying size were used to boil oil a whale’s blubber to extract oil. Although they were integral to operational success, detailed information pertaining to trypots is rare. As with the tryworks bricks, the most useful data so far found comes from a blank outfitting book dating to the 1860s which provides dimensions for two types—the ‘Old Pattern’ and the ‘New Pattern’ (Figure 74). Although there is no indication of stylistic differences or of the time period associated with the two types, the ‘Old Pattern’ is shown to include four sizes (140, 160, 180, and 200 gallons) while the ‘New Pattern’ is limited to two (200 and 220 gallons). And while both types include a 200 gallon size, the noticeable differences in the length and width dimensions of the two would make distinguishing between them possible (Kirby Outfitting Book 1860:5).

DIMENSIONS OF TRY POTS.

OLD PATTERN.	Long.		Wide.
140 galls.,	3 ft. 9 in.	by	3 ft. 4 in.
160 "	4 " 0 "	"	3 " 4 "
180 "	4 " 0 "	"	3 " 6 "
200 "	4 " 3 "	"	3 " 8 "
NEW PATTERN.			
200 galls.,	4 " 9 "	"	3 " 6 "
220 "	4 " 9 "	"	3 " 8 "

Figure 74. Data contained on an introductory page of an outfitting book dating to the 1860s and pertaining to different styles, volumes, and sizes of trypots. From Kirby, H.S. 1860.

Most historic descriptions and illustrations of tryworks built on American whaleships indicate prevalence for two pots in the structure. Some examples of three pots is use, however, are known (Macy 1835:228; Davis 1874:24). The number of trypots taken onboard depended on factors including the size of the ship, the size of the intended brick structure, and the pots available at the time of outfitting. It was common for each ship to carry a spare trypot (Hegarty 1964:63). Many of the outfitting books reviewed for this study state that “2 sets” of trypots were carried (NBWM *Condor* Outfitting Book 1832; NBFPL *Marcella* Outfitting Book 1841); thus, it would be typical to find as many as four pots onboard a whaleship of this period.

Along with the tryworks bricks, several sherds of broken trypots were recorded at the *Parker* shipwreck site. Scattered along a trail leading through a small pass in the reef crest and throughout the back reef area are at least seven portions of trypots of varying size (Van Tilburg 2006). Although some large sherds were noted among these, it was not possible to determine the liquid capacity of the pots. The spatial distribution of these and the associated bricks indicates that the tryworks were already breaking apart as the ship was pushed over the reef. Due to the almost constant, heavy swells that pound the reef at Kure Atoll, the trypots have probably been smashed to pieces in this depositional environment.

Four largely intact trypots were documented at the wreck of *Two Brothers*. Scattered across both sections of the site, the trypots are in pockets in the reef which appears to have protected them from damaging swells. All four were assessed as being in fragile condition, however, the thick marine encrustation and iron concretion on each of them helps with preservation. Although a portion of the rim and sidewall of two of the pots has collapsed, each retains its over globular shape, as well as features including a flared rim, lifting eyes, pegged feet, and even evidence of the decorative rings on the sides (Figure 75). Although concretion has somewhat distorted their original dimensions, data extrapolated from these trypots indicates that their volumes range from 125 to 174 gallons, which closely aligns with the 'Old Pattern' trypots discussed above (Kirby Outfitting Book 1860:5). Three trypots were found scattered over the extent of Section A (Figure 18) which indicates that the ship was either equipped with a two pot tryworks with a spare pot lashed to its side or that three pots were built into the brick structure. Based on Nantucket historian Obed Macy's observation that tryworks on the island's early nineteenth-century whaleships were equipped with "two, and sometimes three pots" (Macy 1835:228), either of these configurations is plausible. The other trypot, documented in Section B of the site (Figure 19), was most likely a spare since it was found far from the others with objects thought to have been stored in the stern of the ship.

Another object documented at the *Two Brothers* site and thought to have been used for trying out is a hook found concreted to the reef in Section B (see Figure 19). Initially interpreted as one of many generic hooks that would have been used at various points in a whaleship's rigging, the large size of this artifact suggests that it is instead a 'small blubber hook' (Brown 1883:64). Also known as a 'junk hook', this iron tool measured 23 cm (9 inches) in length and incorporated a small ring at its upper end for attaching a rope. According to James Temple Brown, these were used onboard whaleships prior to the 1880s for "handling blubber, clearing the hatch when it was blocked with blubber, and hauling the junk aft when was it is to be *lashed* [sic]; hence the name junk hook" (Brown 1883:64). Although no illustration of a junk hook accompanies Brown's description, the features of the artifact are the same and it directly matches the size.

Figure 75. Intact trypot documented at Section B of the *Two Brothers* shipwreck site (image courtesy of Papahānaumokuākea Marine National Monument).

Stowing Down

Once the oil had cooled it was necessary to shift it into casks for storage. As long as it was properly handled, whale oil could be stored for long periods without spoiling; thus, this task—often referred to as 'stowing down' (Delano 1846:75; Melville 1851:475-477; Bronson 1855:52; Davis 1874:234; Nordhoff 1874:131; Ashley 1926:98; Hohman 1928:175; Stackpole 1967:51)—required the utmost care and attention to ensure that every drop of oil was preserved (Whipple 1979:41). A great deal of consideration was also given to the positioning of the casks in the hold; since the object of the cruise was to return with as much oil as possible, it was necessary to make the most of the available space by carefully and precisely stowing the casks. As such, no time was spared in stowing down and often it took several days to complete (Stackpole 1967:51). Few descriptions of the stowing down process are available; however, it appears that the two methods used in transferring oil into casks involved either a bailer or a hose (Leavitt 1970:27).

If more than one whale was captured, tryworks operations ran non-stop and as a result oil could only rest in the copper cooler for short time before a fresh batch was ready. Under such circumstances it was necessary to transfer the oil into wooden casks on deck to cool longer, which was accomplished by bailing (Hawes 1924:172). After being filled these casks were then lashed securely to the deck to reduce the chances of their sliding around and spilling or hurting someone as the ship rolled (Scammon 1874:238; Hohman 1928:173). Once the oil in them had cooled the casks shrank and the hoops were driven farther down onto them to tighten their seams (Macy 1835:228; Olmsted 1841:67; Scammon 1874:238). In his reflections of whaling operations in the 1840s, Captain Benjamin Doane suggested that “no cask was considered fit to stow down until it had been three times to the tryworks, that is, until it had been filled with hot oil and set to cool three times” (1987:74). This comment supports statements made by other early to mid-nineteenth-century whalers regarding the extent of cask shrinkage and further illustrates the care that was taken to prevent the loss of oil through leakage (Macy 1835:228). Once properly coopered, a ‘gimlet hole’ was made in each cask to allow them to vent; if this was not done the casks had the potential to burst from expansion in warm climates, or draw in their heads in cold weather (Doane 1987:74).

The other method for transferring oil from the cooler to casks involved the use of a hose. Referred to as ‘running down the oil’ (Brown 1884:286), when this method was employed it was first necessary to let the oil cool further by transferring it into a large iron ‘deck pot’ (Olmsted 1841:67; Scammon 1874:238; Leavitt 1970:27; Allen 1973:179). After the oil sufficiently cooled, it was necessary to then transfer it to the casks in which it would be stored for the remainder of the cruise. The easiest way to do this was by attaching a leather or canvas hose to the copper cooler or iron deck pot’s stop valve (Ashley 1926:98; Allen 1973:179; Doane 1987:74) or by bailing oil into a funnel attached to a hose (Bullen 1898:40). The other end of the hose was then sent below where casks were filled and stowed (Bullen 1898:40; Stackpole 1967:51; Leavitt 1970:27; Allen 1973:179). As described earlier, a common practice onboard ships hunting sperm whales was to fill the largest casks with water and stow them on the lowest tier for use as ballast until they were needed for oil storage. Captain Doane (1987:74) refers to this operation as ‘hosing down’ and described one way of doing it as follows,

> When a considerable quantity of oil is accumulated and cooled, in barrels on deck or in the between deck, the cargo will be broken out until the ground tier casks are reached; the salt water is pumped out of such of them as it is intended to fill [sic] at the time, and they are swabbed out dry. A tub made by sawing one of these tun butts [sic] in half is placed on skids over the hatch, a hole is bored in the bottom of it, and the end of a canvas hose 50 to 75 feet in length is tacked over the hole and the other end let down into the hold. The barrels of cool oil are then rolled up on the skids to the tubs, and the oil is allowed to run into it, whence it is directed through the hose into the ground-tier casks.

Regardless of which method was employed for filling casks, on sperm whaleships this process was overseen by the captain or first mate, who measured the hold to determine the best placement of casks and ordered the different sizes to be fetched from the cooper (Brown 1884:286). The first or second mate supervised the work on deck to make sure that it was completed as efficiently as possible; duties included overseeing one of the lesser officers or boatsteerers attending to the filling, inspecting the cooperage, and directing the positioning of the casks on deck. The rest of the crew on the watch might be tasked with assisting in filling and/or moving casks and lashing them to the deck where they were could cool longer; helping the cooper; or assisting in stowing the casks in the hold (Brown 1884:286). No matter the task, this work was filthy and there was always a danger of slipping because, despite the best efforts to avoid it, oil inevitably found its way onto the deck.

Once the oil in the full casks had sufficiently cooled, they were ready to be stowed. The process of stowage involved more than simply moving casks; it required preparation of the storage area and constant monitoring of progress to ensure that available space was maximized. Beginning with initial measurements of the lower hold, casks of varying sizes were sent down and positioned precisely before being chocked with wedges of wood to prevent movement. The task of moving these large and unwieldy containers was backbreaking and dangerous work, which required a great deal of skill even in calm seas (Ashley 1926:98). Casks were hoisted using heavy lifting tackle and 'can hooks' that gripped them at their chines, which was a much safer method than using slings (Ashley 1926:98). According to the outfitting book of the whaling bark *Mars*, small and large size can hooks were used on a whaleship (1845:30); the decision about which was needed was based on the size of the cask to be lifted. Once secured casks were passed down through the hatches on the decks and into the hold crew laid them their sides running fore and aft and manipulated them into the assigned place.

Evidence of the actual sizes of the casks used and their positions is available in two separate documents on file at the New Bedford Whaling Museum Library. The first of these, a one-page diagram of one quarter of the lower hold of the ship *Gratitude* dating to 1841, (Figure 76) indicates that stowage was done in three tiers, and the second tier was where most of the larger casks were stored (NBWM Plan of Stowage ship *Gratitude* 1841). The second document, from an unspecified ship, is far more detailed and includes a great deal of annotations. Although much of the text is illegible, it depicts the same stacking order for the lower hold through three cross section diagrams of it, and illustrates the stowage plans for the between decks area which were used for stowage once the hold was filled (NBWM Cask stowage plan for unidentified ship n.d.).

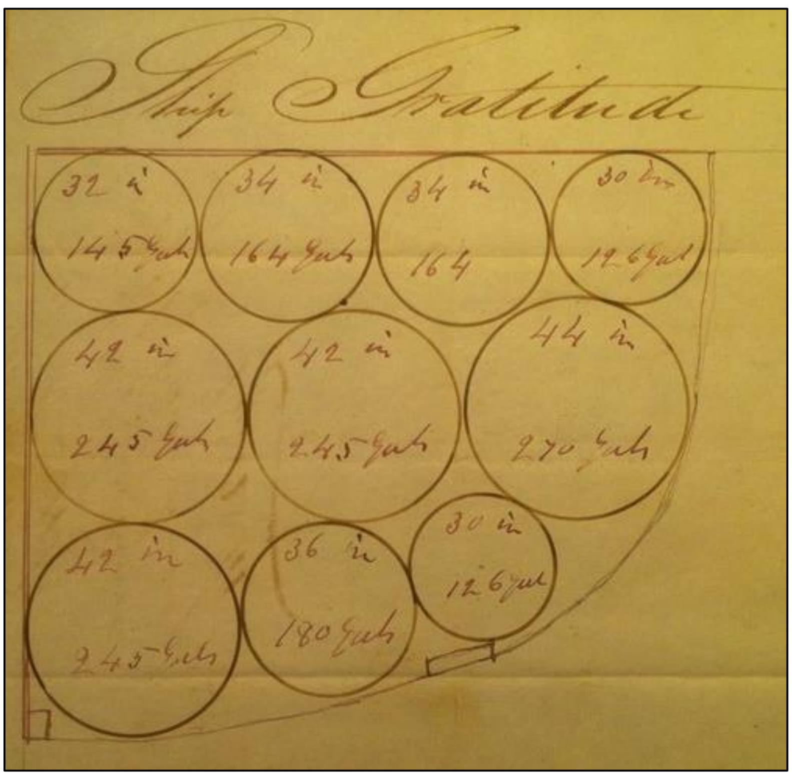

Figure 76. An 1841 diagram showing the intended stowage of casks of varying diameters and volumes in a section of the whaleship Gratitude (NBWM 'Plan of stowage in lower hold in ship *Gratitude* by Edwin Hussey 1 mo 28. 41.' MSS 78, Sub-group 3, Series J, Sub-series 1, Folder 2.).

Archaeological Evidence of 'Stowing Down'

Archaeological materials related directly to stowing down are difficult to identify at the *Two Brothers* and *Parker* wreck sites. Most of the components used for this purpose were constructed of organic materials that would have deteriorated rapidly after their deposition in a marine environment. Although outfitting records indicate that all ships of the period were equipped with hoses (leather or canvas) used to transfer oil to the wooden casks, for example, no physical evidence of these were found at either site.

As for the metal implements used in this process, aside from an iron deck pot, most were small and could be easily overlooked in the reef environment once marine encrustation covered them. So, although the 'can hooks' used for lifting casks were an integral tool and a standard item on outfitting lists from at least 1820, none were found archaeologically (*William Rotch* Outfitting Records 1820).

Although the wooden components of the casks for oil storage deteriorated quickly, the metal hoops used to bind them often remain. Numerous iron cask hoop pieces were identified at both the *Two Brothers* (Figure 77) and *Parker* sites. As aforementioned, thousands of hoops were shipped onboard whaling vessels to be used with shooks and head pieces to construct casks as needed. And though the primary goal of whaling was to fill casks with sperm oil, since so many were used to store food and other provisions it is almost impossible to determine exactly what was stored in the casks bound by these hoops.

Other artifacts found at the *Two Brothers* and *Parker* wreck sites that can be interpreted as being associated with stowing down are the remains of lifting devices. In order to shift the immense weight of full oil casks, whalers employed devices such as the windlass, rigging blocks, thick manila ropes, and chains. Although these were by no means specific to this stage in the pelagic whaling process, they were nonetheless essential for ensuring that casks were not damaged while being stowed and that no oil leaked unnecessarily as a result of mishandling. Since few detailed descriptions of stowing down are available, it is unknown which lifting tools were used. It is unlikely, however, that the relatively small blocks found at the *Parker* site were used to lower heavy casks into the hold. Instead it is probable that the large blocks of the cutting tackle—already rigged to the windlass for heavy lifting purposes—were utilized for this stowing down since larger blocks and sheaves produced far greater power (Stone 1993:75).

Figure 77. Portion of an iron cask hoop documented at Section B of the Two Brothers shipwreck site (image courtesy of Papahānaumokuākea Marine National Monument).

Preparing the Ship for the Next Round

Once the work of cutting in, trying out, and stowing down were complete, it was necessary to clean the ship and prepare all of the stations for the next time that whales were raised. This final step in the pelagic whaling process was crucial, since the lookouts were constantly manned and the potential for the next round of activity was ever-present. Thus, the less prepared the ship, equipment, and crew, the greater the chance of missing a whale—which in turn meant a direct loss of profit and an extended period at sea.

The processing of carcasses onboard a whaleship created an absolute mess. Every exposed surface on and near the deck was coated in oil, blood, and offal (known as gurry), while the smoke from the tryworks covered the masts and sails in oily soot (Grant 1932:98). The extent of the grime is illustrated in Reverend Henry T. Cheever's (1850:89) description of the aftermath of whaling operations onboard a whaleship in the 1840s:

> The decks, which have hitherto been kept scrupulously clean, are now covered with oil, and it is only by keeping a thick coat of sand scattered over them that the crew are enabled to get about without slipping. The smoke from the try-works blackens every face, so that the watch on deck resembles a party of colliers. Each rope, too, exposed to its influence, is coated with lamp-black, and the clothing of the men saturated with oil. Even the sails, which on the passage were of a snowy whiteness, receive their share of defilement…

Thus, all hands were ordered to clear the heavy, black, oily film and make the vessel ship-shape (Browne 1850:23; Cheever 1850:89; Dulles 1933:131; Weiss 1974:89). Cleaning involved clearing up all remaining blood and blubber from the main deck and between decks, then scrubbing all bulwarks, decks, bits, the gangway, the cutting stage, and every other surface using scrub brooms and lye made from the ashes of the blubber scraps, saltwater and sand (Olmsted 1841:68; Davis 1874:94; Brown 1884:287; Grant 1932:98; Stackpole 1967:51). “Sperm oil in its natural condition can be washed off with comparative ease, but after being cooked it removed with difficulty” (Brown 1884:287). The tryworks were scrubbed and the pots cleaned and polished inside until they “shone like silver punchbowls” (Grant 1932:98); they were then covered with wooden lids to keep debris from contaminating them (Palmer 1959:145). The day after processing was usually given to the crew to wash themselves and their clothes in an effort to remove the omnipresent oil and grease, as well as the odor of the fetid smoke of the fires, which all but the old whalers found to be disagreeable (Olmsted 1841:68; Browne 1850:51; Nordhoff 1874:129-130; Hohman 1928:173; Grant 1932:98). With the exception of the upper masts and sails, once the big clean-up was complete the ship and its crew appeared as they did the day they left port (Shapiro 1959:39).

While the foremast hands were busy scrubbing the ship, other tasks were completed in anticipation for the next round of whaling. All of the implements needed for cutting in and trying out were cleaned and put away. The carpenter and his assistants were kept busy ensuring that any damage to the boats incurred through encounters with whales was repaired. Occasionally it was necessary to completely replace boats that were stove or smashed—referred to by the whalers as having been ‘chawed’—during such encounters. Sometimes called ‘boat surgery’, this was done by constructing new ones out of wood shipped onboard for that purpose or assembling them from ‘knocked down’ or prefabricated parts (Grant 1932:72, 102).

The mates in charge of each boat again supervised their outfitting to ensure that no required gear was overlooked and the boatsteerer attended to the perfect coiling of whale line into the tubs (Grant 1932:44). In the meantime, the blacksmith (or cooper if no blacksmith shipped onboard) mended and straightened the whalecraft, while helpers incessantly turned the grindstone to ensure that all of the various hunting and cutting tools were sharp. Once sufficiently sharp, these were sheathed and stored in an easily accessible location (Browne 1850:131; Perkins 1854:25; Grant 1932:38-42; Dulles 1933:110; Doane 1987:67).

With the ship clean and all equipment prepared for whaling activities to begin anew, regular watches were resumed. Factors such as seasonal migrations of whales and numerous ships hunting in the same area affected the amount of time between whaling activity and sometimes weeks or months passed with no whales being captured. The time spent cruising the grounds, however, included other activities; the lookouts often sighted whales on the horizon and the boats were lowered in pursuit. Despite best efforts of the whalers, many of those attempts proved fruitless and they returned to the ship empty-handed (Dulles 1933:155-156). And each time the boats were hoisted back into their cradles, the ship and boats were again readied for the next call from the masthead and for the pelagic whaling process to begin again.

Archaeological Evidence of 'Preparing the Ship for the Next Round'

As with the gear associated with stowing down, many of the tools used for 'preparing the ship for the next round' were manufactured from organic materials and are thus difficult to identify on a shipwreck site. For example, the blocks and brushes used for the seemingly unending chore of scrubbing the oil and gurry from the ship were composed of wood and thick plant fibers (Perkins 1854:29). Evidence of other tasks carried out during this stage, like the sharpening of hunting and processing equipment, however, has been found at the *Two Brothers* shipwreck. Discussed previously, the grindstone found on the site is an artifact that was utilized at almost every stage of the cyclical pelagic whaling process. Since most of the industrial activities involved in pelagic whaling resulted in the dulling of tools, turning the grindstone was especially important in preparing for the next round of activity.

The other tasks undertaken at this stage were those carried out by craftsmen such as carpenters, coopers, and blacksmiths. These included maintenance duties such as the repair of damaged whaleboats or construction of new ones to replace those lost in the chase and the straightening of bent whalecraft. The need for accurate harpoons and well-built, sturdy boats was of utmost importance to a hunt; thus these tasks were critical for success and whaleships were equipped with a vast array of specialized tools to ensure that they could be completed quickly and properly. Most outfitting books include sections entitled ‘Carpenter’s Tools’ and ‘Cooper’s Tools’ (NBWM *Condor* Outfitting Book 1832; NBFPL *Marcella* Outfitting Book 1840), while others also include lists of ‘Blacksmith’s Tools’ or simply ‘Hardware’ (NBFPL *Canton* Outfitting Book 1841; NBFPL *Mars* Outfitting Book 1845). Among the many different classes of hand tools listed in those books were assorted types and sizes of hammers, mallets, saws, jointers, planes, axes, adzes, squares, compasses, vices, augers, drivers, chisels, irons, files, knives, awls and gouges, as well as larger items like anvils and bellows (NBWM *Condor* Outfitting Book 1832; NBFPL *Marcella* Outfitting Book 1840; NBFPL *Canton* Outfitting Book 1841; NBFPL *Mars* Outfitting Book 1845).

A number of heavily-concreted metal objects were recorded at the *Two Brothers* shipwreck site and at least two of them are thought to be craftsman’s tools. Located in a large pocket in the reef in Section B of the site (Figure 19), these were found along with a grouping of artifacts ranging from galley wares to whalecraft. Among this collection, two classes of tools have been identified: a possible caulking iron (Figure 78), which was a flat, broad implement used for driving oakum (caulking material) between the seams of vessel’s outer planks to make them watertight (Doane 1987:260); and a possible chisel, which was a kind of punch that tapered to an edge at one end and was used for shaping materials. Both to these tools were standard pieces of equipment on whaleships and were used by carpenters and coopers for maintenance. Their location on site suggests that they were likely kept together on deck (with many other tools) and were washed overboard during the wrecking event.

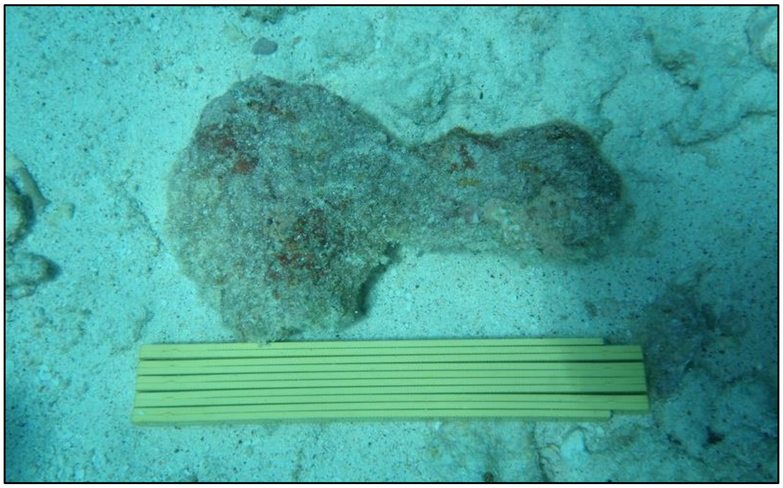

Figure 78. Possible caulking iron documented at Section B of the *Two Brothers* shipwreck site (image courtesy of Papahānaumokuākea Marine National Monument).

Homeward Bound

Early nineteenth-century whaling cruises generally lasted several years and were characterized by contrasting periods of idleness and intense activity. The advent of transshipping oil cargos at established ports resulted in voyage lengths becoming ever longer; this practice allowed the ships to continue whaling for successive seasons and to make the most of their time around Cape Horn. Eventually, however, it was necessary to return home and the decision regarding when that occurred wrested solely with the captain. Whether cargos were transshipped or not, it was only when the captain was satisfied that an acceptable quantity of oil had been obtained over the course of the cruise that he gave the order to begin the homeward passage (Grant 1932:124).

Since no opportunities were wasted while a ship was in transit, operations continued as usual and masthead lookouts were constantly maintained for the majority of this time. Even if the spaces for storing oil were full, a good whaling captain never passed on the chance to obtain more; thus, if whales were spotted, the boats were lowered in pursuit. It was only when a ship was in the Atlantic that preparations were made for concluding the voyage. Since most captains of the period took pride in their vessel's appearance upon its return, a number of chores were undertaken to ensure that it looked its best when entering port (Brown 1884:234). Among the many tasks were deeply scrubbing the decks with lye and sand until they looked new; painting the outside ship by hanging over the side in a sling attached to special rigging; scraping the masts; overhauling the rigging; and sometimes breaking out and bending a new suit of sails (Davis 1874:391; Brown 1884:234). When nearing the New England coast, crews could be certain that whaling operations were at last complete when the time-honored tradition of ‘knocking down’ was ordered and the tryworks were dismantled (Ashley 1926:96; Leavitt 1970:10). Furthermore, all of the boat equipment and accessories were cleaned and stowed in marked casks; the cutting tackles and pendants taken down; and all the whaling and processing implements were bundled in canvas and stowed away (Brown 1884:230, 288).

As the ship neared the shore and land was signaled, crews were overwhelmed with joy and anticipation (Browne 1850:480-481). Once the ship was safely anchored in port, the crew was required to await a ship-keeper to take over watch of it. Before leaving the ship, the crew went below to ‘take a glass of grog’, as was customary in the early nineteenth century (Delano 1846:65). After the crews had disembarked they remained in port until they received their lays, at which time they scattered like the winds—many of them to never go to sea again.

CHAPTER 8. Discussion

The intended goal of this study was to gain insight into the industrial nature of the ships used for sperm whaling in the early nineteenth century. Like all commercial ships of this period, whaling vessels provided a platform on which work was carried out in a structured environment and under the supervision of a strictly defined labor hierarchy. Whaleships, however, differed from other vessels of the period in that they were also outfitted with the equipment needed to chase and capture whales, remove blubber and process it into oil, and stow large quantities of oil until it could be transshipped to markets in New England. Since whalers were essentially floating industrial sites this research explored the industrial operations conducted on the ships by investigating factors such as: organizational structure; conditions experienced by the crew; different methods and material culture used for the varying stages of whale hunting; the scope of operations; and the environmental conditions that whaleships encountered while working in the Pacific Ocean. The following discussion considers the research questions proposed in chapter one in relation to the analysis of historical data relating to the American whaling industry and archaeological data recovered from the remains of the whaleships *Two Brothers* (1823) and *Parker* (1842), both lost in the Northwestern Hawaiian Islands. These questions pertain to the potential for exploring the remains of whaleships as industrial sites and how such as approach might offer insight into the American whaling experience in the Pacific and contribute to the archaeological study of shipwreck sites.

Do thematic approaches derived from industrial archaeology practice and theory adequately apply to the remains of wrecked whaleships when explored as part of a maritime resource extractive industry? What new perspectives for maritime archaeological studies could be gained by doing this?

Early nineteenth-century American pelagic whaling was without a doubt an industrial activity based on the extraction of resources from the marine environment. Success in this industry depended on adherence to a developed industrial system which involved considerable planning and strategic decision making, specialized tools and processes, and a rigid labor hierarchy. The industrial nature of the material culture assemblages associated with wrecked whaleships distinguishes them from vessels used in other nautical activities of this period. As such, the adaptation of themes commonly used for industrial archaeological research presents an opportunity to provide new perspectives on these site types.

Although some authors have referred to whaleships of this period as 'floating factories' (Day 1966:132; Allen 1973:159; Weiss 1974:79;), this analogy is flawed for two main reasons. First, the term factory implies that the shipboard activities involved with whaling included secondary manufacturing. While it is true that sperm whale products underwent secondary processing prior to being sold, the materials that were delivered to the dock by whalers were unrefined and thus primary in nature. Second, this analogy fails to consider the social and cultural aspects of the onboard industrial experience. Unlike factories, which were stationary and generally provided only space for work-related activities, early nineteenth-century whaling vessels were mobile production platforms that ranged throughout the world's oceans for years at a time with the goal of recovering raw materials when encountered. These vessels contained not only the technical components necessary for production activities, but also the domestic spaces used by the officers and crew when not on duty. Thus, rather than being compared to factories, early nineteenth-century whaleships are more closely aligned to some terrestrial sites associated with primary resource extraction. In particular, studies of late nineteenth to early twentieth century frontier mining settlements in the American West present an interesting correlate for the conditions experienced by pelagic whalers operating in the Pacific Ocean during the early nineteenth century.

Much like the whaleships that undertook extended voyages into the largely unknown waters of the Pacific, remote mining operations on the American frontier were microcosms of interrelated production activities that were isolated for often long periods of time. In order to succeed, both of these operations required a great deal of planning and outfitting, exploration of large geographic areas to find sources of raw materials, and technical knowledge and experience on the part of managers and crew. Due to the organizational and operational similarities between the two industries, some of the interpretative themes that have been used to explore frontier mining workplaces were adapted to interpret pelagic whaleships as industrial sites associated with resource extraction.

The ships that provided the platform for pelagic whaling activities can be seen as the main physical component of this maritime resource extraction industry. Although the designs and sizes of whaleships evolved with the expansion of pelagic whaling from 1750 to 1815, their hull characteristics changed very little over the industry's golden age (1820-1870). Despite modifications to the designs of the ships involved in other commercial enterprises of this period that led to greater speeds and efficiency in transporting goods and people from one place to the next, such results were of little importance to whaleship owners. Instead whalers preferred bluff-bowed hulls, which offered stable working platforms, could be easily arranged for industrial operations, and included the greatest possible cargo capacity. Since these same features were also found in vessels designed for the shipping of bulk cargos, hulls built originally for those activities were often recycled for use in pelagic whaling. This practice helped to keep initial investment costs down and in turn produced greater financial returns. And though it is true that by the 1830s many ships were constructed specifically for whaling operations, those ships were also designed with the need to provide steady working platforms and spacious cargo holds to accommodate large quantities of oil and other whale products.

Unlike frontier mining sites, the remains of the whaleships studied for this research are not characterized by the structures that supported them. While many of the metal fittings used to fasten ship's timbers or attach components of rigging are present, for the most part, the archaeological assemblages of early nineteenth-century pelagic whaleships lost in the NWHI are typified by the presence of specialized equipment used for resource extraction. American-style pelagic whaling was made possible through the adaptation of methods and tools used in shore whaling to suit the confines of a whaleship and the demands of seaborne operations. The processes employed and their associated equipment were developed in the mid- to late eighteenth century and changed little in the first half of nineteenth century. Figure 79 highlights the five phases identified in the cyclical process of shipboard whaling; each of these phases required specific tools that were used by crewmembers who performed specific duties according to prescribed methods under strict supervision. Among the most distinctive of these tools were the sleek whaleboats and honed whalecraft needed for pursuing and capturing whales; the windlass, specialized rigging implements, and razor-sharp hand tools used for stripping blubber from a carcass and preparing it for processing; the bricks, trypots, and various fittings that comprised the tryworks and the hand tools used in rendering blubber into oil; the casks, rigging implements, and hoses used to transfer and store oil; and the tools used by crewmembers to prepare the ship for the next round of whaling activities. All of these implements were crucial to the success of the industrial process of pelagic whaling and together they provide evidence for how it was undertaken during this time.

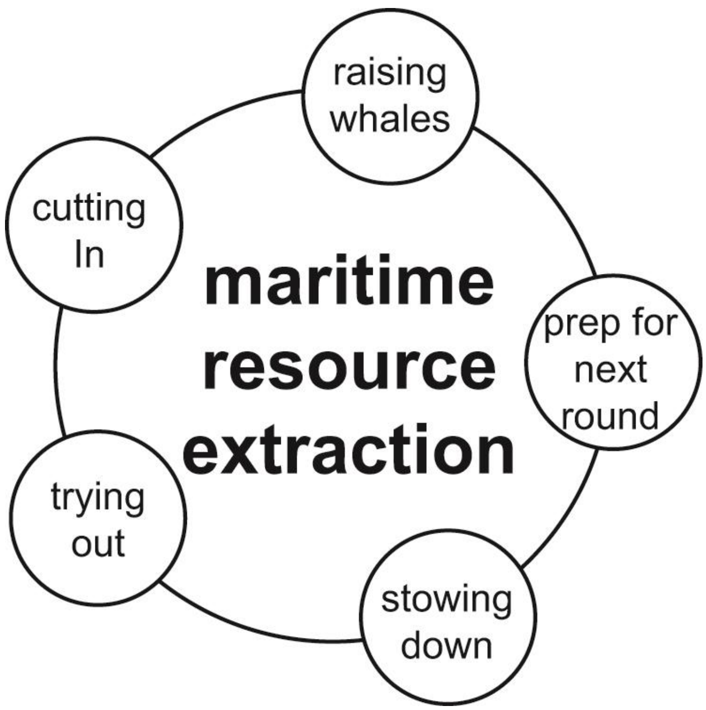

Figure 79. The five interrelated processes involved in 'American-style' pelagic whaling.

The presence of these specialized industrial implements at a shipwreck site is an immediate indicator of the vessel's involvement in the whaling trade. A number of the tools associated with the extraction and processing of whales were identified at the shipwreck sites of the two American whalers in the NWHI. Since organic objects deposited in the tropical environment of the region are quickly destroyed by weather conditions and marine organisms, the more robust iron objects associated with industrial activities are among the most prevalent. This is particularly true in the case of the whaleship *Two Brothers*, which has an assemblage that is overwhelmingly whaling-related and includes intact trypots and hundreds of tryworks bricks; iron hoop pieces likely used for binding the casks in which oil was stored; and numerous large iron hooks used for hoisting enormous pieces of blubber. The assemblage also included a number of small implements like harpoon and lance heads, which were used in capturing whales and are the first examples of these types of artifacts being recorded in an underwater archaeological context. Artifacts associated with different phases of resource extraction were also found among the remains of the whaleship *Parker* and include the remains of the windlass and a massive blubber hook used in lifting blubber pieces, as well numerous bricks and pieces of trypots used in extracting oil from whales.

The geographic locations of these shipwrecks in the NWHI provides an opportunity to better understand the maritime industrial seascape associated with American whaling and how hunting strategies were affected by them and how they in turn were affected. Since the aim of this study was to analyze the remains of pelagic whaleships as sites associated with resource extraction, is it important to understand how American whalers used knowledge of sperm whale behavior to identify potential hunting areas. For terrestrial extractive industries like frontier mining, the resources sought manifested as discreet ore deposits scattered across large geographic areas. The locations of these deposits were found through extensive exploration activities and once identified they became the focus of intense industrial activity that impacted the local environment. Pelagic whaling operated in much the same way; it also required a great deal of exploration to find resources that were scattered across a large geographic region and once located these were exploited to an extent that depletions in whale populations were eventually detected.

Information pertaining to the maritime industrial seascape of pelagic whaling was an important component of the system and was detrimental to industrial success. From the time that the first whaleships rounded Cape Horn and began to explore the Pacific, masters of vessels compiled information about the physical environment. The immense numbers of sperm whales that they encountered in the early voyages were seen as a harbinger for a shift in the fishery's geographic focus, so recording this data was considered important for planning subsequent expeditions. The types of information considered most useful pertained to areas where large populations of whales could be found, the locations of islands that offered safe anchorages and sources of fresh food and water, and the positions of geographical features that posed potential threats to passing ships.

As whaling captains learned while fishing in the Atlantic Ocean, sperm whales were a migratory species and their movements were predictable. Exploration efforts indicated that whales followed the abundant food sources found in warmer environments. In the Pacific this meant that sperm whales spent the cooler months in the southern and equatorial zones, but significantly expanded their range to the north during warmer months. Over time general areas where whales could be found in large concentrations were identified throughout the Pacific region and these were designated as specific named hunting grounds. Although the exact boundaries of these areas were fluid, their relative locations and data pertaining to the best season to fish them was recorded in journals, ships logs, and on charts carried onboard the ships. Unlike other marine resource extraction industries of this period in which attempts were made to keep new hunting areas secret, information about these rich zones was instead transferred among the whaling fraternity. In the early years of the Pacific fishery this was conducted by word of mouth, but over time it found its way onto charts of the region. Thus, data pertaining to the operations area for pelagic whaling was an ever-growing body of knowledge that was freely provided through both oral and written sources. Evidence that such information was shared between captains when ships met at sea is provided in the log of the whaleship *Parker*'s 1831 to 1835 cruise, in which notes are made of the newly designated ground off the coast of New Zealand.

The first Pacific hunting area to be designated was the 'On-shore' grounds along the southern coast of Chile. The earliest American ships to visit this ground found whales in abundance and quickly filled their holds before making the journey back to New England. As news of this discovery was shared, many other ships quickly sailed for this area and in a relatively short time whalers noticed a depletion of the whale population. This information led vessels to push the known boundaries and venture further from shore in search of the next rich spot and, in the early 1800s, numerous grounds around the southern and central Pacific were identified. As had occurred in the Atlantic Ocean in the mid- to late eighteenth century, however, the ever-increasing number of ships in the region led to a pattern—intense fishing depleted resources on new grounds, which then led to the search for another densely populated area. This pattern subsequently resulted in the exploration of large parts of even the most remote sections of the Pacific in a relatively short amount of time. By the early 1840s, whaleships had surveyed much of the previously unknown expanse of the Pacific and pushed as far north as the Bering and Chukchi Seas where they found a new species to exploit. Thus, the search for new hunting areas and quick returns expanded the operational range of whaleships, which in turn extended the average length of cruises, and had a direct effect on the sizes and rigs of the vessels employed.

Information concerning geographic features and oceanographic conditions was also of great interest to early whaling captains. While pushing the known boundaries of whaling grounds, whaleships encountered many previously uncharted islands, atolls, reefs, and shoals. In some cases these manifested as verdant island groups that provided a wide variety of fresh produce and presented potential points for ships to re-provision with food and water. In other instances, however, newly-identified areas posed the serious threat of shipwreck since they were often surrounded by extensive reef systems that were mostly submerged and often unnoticeable from a distance. Thus, when uncharted geographic features were detected, it was of utmost importance that their locations were recorded as accurately as possible. Since this could only be done using the surveying technology available, in the early period the reported locations were often only estimates. As the use of chronometers increased, however, so did the accuracy of these positions; these improved positons in turn had the effect of reducing the risk of shipwreck.

Although many of the early discoveries amounted to little more than a captain taking a sighting from a distance and ascribing a name to the feature, others were cautiously approached and examined. When possible, geographic position data was augmented with comments regarding physical information such as depth data, which was obtained from hand line measurements; hydrographic data pertaining to currents and tides; and/or data regarding the weather experienced during the visit. Any of this information would have been relished by whaleship owners and captains of the early nineteenth century since it assisted with safe operations and helped with voyage planning.

In terms of the cultural geography of the region, the lasting effects of these early exploratory voyages and sightings can be seen through place names located throughout the Pacific Ocean. Although many of these features were named, inhabited or at least known to Indigenous seafarers, when encountered by whalers their positions were generally recorded using titles derived from the names of ships, their captains, or their home ports. And though some efforts were made to integrate Indigenous names to some of these features, many others currently retain the names attributed to encounters with whaleships in the early nineteenth century. For example, Captain Joseph Allen of the Nantucket whaleship *Maro* conducted a pioneering voyage through the region in 1820 that resulted in the naming of features such as Maro Reef and Gardiner Pinnacles (Pukui et al 1974). In other instances, features were named as a result of a ship, or ships, coming to grief up on them. Such was the case of the British whaleships *Pearl* and *Hermes*, both of which were lost on the same night in 1822 on a previously unknown atoll that now bears their names (Speohr 1988:80). A testament to the presumed trustworthiness of such data is seen in the designation of 'Two Brothers Reef', which was attributed to an open-ocean location west of French Frigate Shoals based on the estimated position of the loss of that ship in 1823. Although several mapping expeditions in the mid-nineteenth and early twentieth centuries attempted unsuccessfully to relocate this reef—and numerous subsequent charts and publications list it as "existence doubtful"—it was nevertheless included on official maps of the region until at least 1919 (Hydrographic Office 1903:145; US Coast and Geodetic Survey 1919:51).

Although the expanse of the Pacific was largely unknown, it represented a rich, new industrial operations area for pelagic whalers and through the sharing of information they greatly increased the chances for financial success. By combining data about the seasonal movements of whales between known grounds, whalers could effectively hunt throughout the year to obtain the greatest returns in the shortest amount of time. And by using shared knowledge about areas that should be avoided due to hidden threats from submerged reefs or dangerous currents, captains were able to eliminate many of the risks that remained otherwise unknown until federal mapping expeditions placed them on official charts in the mid-nineteenth century. Thus, the various hunting grounds located around the Pacific were inextricably tied to the larger industrial seascape of marine resource extraction and the effects that they had on the environment can be seen through diminished whale populations resulting from intense utilization.

The use of a thematic approach based on industrial archaeology practice demonstrates that such applications can provide new perspectives to maritime archaeology. As illustrated in the preceding discussion, early nineteenth-century American whaleships were undoubtedly floating industrial sites and analyzing their remains as such can help to better understand the many interrelated—and often unconsidered—facets of the trade. For this study, organizational and operational similarities with frontier mining activities in the American West provided themes that allowed pelagic whaling of the period to be investigated as a maritime resource extraction industry, which operated within an enormous maritime industrial seascape. By incorporating these themes in the investigation of the wrecks of *Two Brothers* and *Parker*, new perspectives were gained on the archaeological remains of whaleships wrecked in this region. The integration of archaeological and historical data relating to these themes illustrates that not all of the industrial elements involved in these operations are visible in the archaeological record. As such, this approach not only provides insight into the material culture remains of these ships by exploring the particular methods and tools used in the various stages of extracting sperm oil, it also helps to understand how the shipboard processes functioned within the larger industrial system of pelagic whaling. Historical data pertaining to the vast amount of preparation that was required, as well as the shared knowledge of the physical environment and the behaviors of whales, were shown to be equally as important to industrial success as the physical characteristics of the ships that provided the platform for those processes.

What characterizes the maritime industrial workplace of the pelagic whaling trade in the early nineteenth century? How did this workplace change over time from the middle of the eighteenth century onwards?

The maritime industrial workplace that existed onboard whaleships of the early nineteenth century was characterized by physical and organizational features that developed out of mid-eighteenth-century technological innovation. The installation of the shipboard tryworks around 1750 resulted in unprecedented growth of American whaling enterprise, which in turn led to the standardization of practices and technologies. The result of this development was a highly efficient industrial system—often referred to as the 'American-style' of whaling—which was securely in place by 1775 (Davis et al 1994:56). Although there was some refinement of the technologies employed onboard American vessels in the decades that followed, throughout much of the industry's golden age the workplaces that existed onboard American whaleships adhered to this basic structure.

From a physical standpoint, early nineteenth-century pelagic whaling workplaces were characterized primarily by the vessels employed since they provided the platform for operations. The integration of shipboard tryworks saw the size and style of whaling vessels grow from roughly 60 ton sloops to full-rigged ships that ranged from approximately 200 to 400 tons. Once equipped for blubber processing, whaling vessels were free to extend the range of the waters in which they hunted, which in turn resulted in longer and longer voyages. In the decades leading up to the American Revolution, the success of vessels hunting throughout the Atlantic Ocean saw the fleet grow in size and number. The war had, however, disastrous effects on the fishery and by its end nearly every American whaling vessel had been captured or destroyed. When the war finally ceased, whalers recycled any available hulls and—in anticipation of resurgence in the industry—began constructing new ships that were larger and had greater cargo capacities than their predecessors.

This increase in vessel size also brought changes to the preferred rig, with brigs and then ships replacing the smaller schooners. The addition of these new rigs resulted in the need for larger crews to handle the numerous and massive sails and to operate the extra whaleboats that the larger ships also accommodated. The rounding of Cape Horn and location of rich whaling grounds in the Pacific at the turn of the nineteenth century brought many more ships into the whaling business. Tensions between the US and Britain, however, eventually led to the outbreak of the War of 1812, which crippled the industry for its duration. Although numerous whaleships were destroyed during this time, American naval success in the Pacific allowed American whalers to dominate the new grounds when operations resumed. The success of voyages in the early decades of the nineteenth century and reports of seemingly unlimited whale stocks, once again led to growth in the sizes of whaling vessels. From the 1820s to the

1840s the average whaler was a capacious, fully-rigged ship that averaged 350 tons and measured roughly 110 feet (33.5 m) in length, 27 feet (8.2 m) in width and 14 feet (4.2 m) in depth (Leavitt 1970:13). And, though by this time many of these ships were purpose-built for whaling, some used hulls recycled from other trades that offered the most desirable characteristics—stability and cargo capacity.

The other physical features that characterized whaleships of this period were the way in which they were fitted with specific industrial components. Without a doubt, the many industrial tools and gear with which these vessels were equipped were integral components of the workplace and in the decades leading to the outbreak of the American Revolution the methods for using these vessels to hunt and process whales and to efficiently store oil were refined. Although there was some variation in the basic forms of particular tools, for the most part, the equipment used onboard American vessels in the early nineteenth century changed little until around 1850. The three main physical features that distinguished whaleships from others of this period were: the numerous small but sturdy whaleboats that hung from the heavy wooden davits situated along both sides of the ship; the various features associated with removing the blubber from the whale, such as the cutting platform and the heavy tackles used in lifting blubber pieces; and the aforementioned tryworks, which was a large brick furnace-like structure situated toward the bow of the ship and which contained two to three heavy iron pots used for rending whale blubber into oil. Each of these industrial elements were tied specially to one of the five steps defined in the whaling process (Figure 79) and their presence onboard an early nineteenth-century sailing vessel was unmistakable evidence that it was engaged in the whale fishery.

From an operational standpoint, pelagic whaling of this period was characterized by its labor structure and wage system, as well as the outfitting of voyages. In their basic form, early nineteenth-century whaleships were sailing vessels that operated in the same way as those used for other nautical enterprises. Since the many and expansive sails associated with the ship rig required numerous hands to work them, everything from merchant ships to naval vessels had large complements of mariners onboard. Whaleships, however, required even larger crews than contemporary vessels of similar size due to the numerous whaleboats they carried. While the whaler was underway and hunting with lookouts at the mast tops, their crews performed the duties of average sailors; however, when whales were sighted the sails were taken in and the duties of the crew shifted to their industrial roles. Thus, the complex nature of the job resulted in hardy and expert seamen and the American whale fishery of the late eighteenth century was revered as a nursery for the merchant marine (Olmsted 1841:120; Fairburn 1945:172; Stackpole 1953:317).

As was common on all vessels of this period, the labor force was structured in a hierarchical manner that offered opportunities for advancement for individuals interested in progressing through the ranks. By the mid-eighteenth century, whaling was seen as an admirable profession and many young sailors followed in the wake of family members to pursue a life at sea. By signing on to a whaling voyage first as a ship's boy, young men gained experience on successive cruises by working in every role to understood the vocation inside and out; this path to advancement was known as rising 'through the hawsehole' and eventually led to a captainship (Whipple 1980:64). Although in the early 1800s this tradition was still alive onboard most Nantucket whaleships, as New Bedford grew in prominence and other opportunities presented themselves on the mainland, many of the more diligent young men were lured away from a career in whaling. Thus, as the nineteenth century progressed, owners and agents were forced to resort to filling crews with inexperienced sailors who lacked the discipline or desire to engage in more than a single voyage.

By the mid-nineteenth century, crew quality onboard American whaleships deteriorated and was characterized by a group of semi-experienced officers, a handful of specialized craftsmen, and large number of green hands—most of whom had never been to sea. By the 1820s whaling crews ranged in number from 25 to 33, depending on the size of the vessel and how it was rigged. The hierarchical structure gave the captain of the ship the ultimate control over every detail of the voyage, as well as the crew members (Hohman 1928:119). The other personnel onboard an early to mid-average nineteenth-century whaleship ship consisted of four mates (boat headers), whose authority was signified by their rank from one to four; four boatsteerers; a cooper; a blacksmith; a carpenter; a cook; a steward; a cabin boy; and 16 to 18 foremast hands (Brown 1884:221; WPA 1938:13). Because the number of crew required was greater than those of merchantmen of similar size and rig, their presence onboard became a distinguishing feature of nineteenth-century whaleships (Brown 1884:234).

The division of labor in this hierarchical system was physically manifested in the space provided for accommodation of the different positions of the crew at either end of the ship. The captain and officers were provided with relatively commodious and well-ventilated spaces in the stern of the vessel; this area was partitioned into numerous cabins, was well-appointed with a large table and lamps, and kept extremely clean by the ship's steward. Forward of this was an area known as steerage, which was equipped with a number of simple bunks for the boatsteerers, skilled craftsmen, and steward. Although the appointments were austere compared to those of the officers and the ventilation was generally poor, the crew in steerage enjoyed far greater comforts than the average sailors housed in the fo'c'sle. This small area was located in the extreme forward end of the ship and was characterized by a large number of tiny bunks in which the up to twenty individuals spent the majority of their time when not on watch. Due to its location near the bow, it was by necessity a poorly ventilated area and as such fo'c'sles were considered to be the most miserable of places onboard since they reeked of sweat, wet clothes, tobacco smoke, gurry from whaling operations, and any number of other foul sources. The physical division kept the officers from interacting with average seamen, which was strictly forbidden, and served to reinforce the power structure onboard whaleships.

Unless engaged in whaling activities, working periods were prescribed through a system known as the watch. This system was overseen by the officers and required every member of the crew to participate in an equal amount of work each day. Duties included masthead lookouts, steering the ship, cleaning the deck, and any other simple chore that might need to be completed. Crews not on watch were free to engage in recreational activities such as reading, writing, scrimshander, and fishing, but off duty activities were generally confined to particular areas of the ship. When whales were sighted, the watch system was suspended and the whalers split into previously designated whaleboats crews. These crews were also subject to a hierarchical structure that placed the mate in charge of the whaleboat, a boatsteerer second in command, and between four and six foremast hands as crew. If one or more of the boats was successful in the hunt, returning to the ship meant that foremast hands would be assigned to the many duties associated with cutting in or trying out operations, all of which were supervised by the officers. After all of the blubber was processed the oil was transferred into wooden casks and stowed in the hold. Before whaling operations were complete the crew was tasked with cleaning the ship and preparing the boats and all of the associated equipment for the next round of whaling.

Status within the shipboard hierarchy was also distinguished at mealtimes through the same three tiered structure that dictated accommodations onboard a whaleship. The dining experience of the officers was far more civilized than those of the crew, with their meals being taken at the table in the aft cabin and served on porcelain and silver place settings. And although the fare was often the same for all, officers were generally provided with a range condiments and spices that greatly increased its palatability. On some ships, when the officers had finished their meals and vacated the dining cabin, the occupants of steerage were allowed to dine there as well. In other cases, they were provided with the leftovers of the officer's meals, but were forced to eat them using plain utensils in steerage. Average seamen were provided with meals that were often considered to be less than appetizing and served in wooden bowls or tin pans called kids. Unless they owned personal forks or spoons, a jack knife was the only utensil used for dining. Depending on the weather, meals were either taken on the foredeck of the ship or down in the grimy fo'c'sle.

The financial compensation system employed was another organizational characteristic that distinguished whaling from many other nautical enterprises of the early nineteenth century and helped to shape the workplace. Unlike merchant sailors of the time, American whalers were not paid a monthly wage; instead they operated under the lay system, which offered whalers a pre-determined share of the profits from a voyage (Fairburn 1945:983; McConnell and Price 2006:296). And though the lay system had been used by other New England fisheries for centuries and was therefore not unique to the whaling, it was nevertheless an effective management strategy and motivator for crews since hard work was financially rewarded. The lays offered to whalers were relative to their experience and the position that they would fill within the hierarchical labor structure. These included what were termed as short lays paying between a $1/12^{th}$ and $1/100^{th}$ fractional share of the profit for the for the officers and some of the specialized craftsmen; medium lays of 1/100th to 1/160th share to the experienced seamen, stewards, cooks, and blacksmiths; and long lays of 1/160th to 1/250th share to foremast hand and cabin boys (Hohman 1926:645; Grant 1932:36; WPA 1938:18). Although this system was designed to stimulate crews to work harder, any number of factors could affect the profitability of a whaling cruise and the debts that crewmembers might accrue. Thus, those with long lays were often lucky to receive any compensation at all for their efforts.

Aside from the labor and wage structure, the other main organizational characteristic of the whale fishery involved supplying the ship prior to its departure. Although many of the commercial ships of this era required large amounts of provisions since they engaged in long voyages across vast stretches of ocean, none could compare to the sheer magnitude of the materials needed for a whaling voyage. With the installation of the tryworks onboard these ships in the mid-eighteenth century came the ability to undertake longer voyages to more distant grounds. And since the areas in which whalers hunted were generally remote and reprovisioning points were few and far between, it was necessary for whaleships to carry large quantities of fresh and preserved food, fresh water, and extra industrial equipment in order to sustain extended periods of time at sea.

As whaleships rounded the continental capes and entered the Pacific and Indian Oceans, the whaling grounds grew increasingly further away from known ports and the length of whaling cruises became longer. These factors resulted in the numbers and types of materials that were shipped onboard to increase accordingly. By the early nineteenth century the range of materials with which whaleships were outfitted included everything from spare industrial equipment and materials for making repairs to the ship and whaleboats to galley wares and other items for use by the officers and crew (Finney 2010:233). To keep track of all of the various goods that were brought onboard, detailed outfitting books were used. These records developed alongside the growth of the industry and archival data shows a progression from simple handwritten lists, to handwritten booklets that included specific categories, to preprinted books that included a large number of very specific categories, as well as advertising for local ship chandlers. Since space was always a concern on whaleships, a clever system for storing all of the material shipped onboard was devised; this involved packing as much as possible into casks that would later be used for oil storage. The casks were then stowed and detailed notes were made regarding the contents and location of each. When needed, the materials stored in any given cask could be quickly and easily accessed thanks in large part to this innovative system.

In order to ensure productivity and maintain order in the cramped environment that the ship afforded, pelagic whaling voyages were highly organized operations that involved strict adherence to the hierarchy of command and the structure of daily activities. As with the methods employed in the whaling process, the division of labor onboard these ships developed in the formative period of shipboard whaling during the mid- to late 1700s. Although the growth in ship size and changes in rig configuration resulted in the need for additional mariners, the basic structure of a whaleship crew and their responsibilities were defined by the duties they performed. Thus, the workplaces that existed onboard whaleships of the golden age of pelagic whaling were characterized by highly structured environments in which hard work and industrial success directly benefitted not only the investors in the voyage, but every member of the crew.

What was the significance of the Hawaiian archipelago to nineteenth-century American pelagic whaling operations in the Pacific Ocean? How did the establishment of trading centers within the archipelago affect the industrial organization of the pelagic whaling system?

The whalers that pioneered the treacherous passage around Cape Horn in 1789 were rewarded with extraordinary hunting success. Reports of immense stocks of whales to be found along the Pacific coast of South America led many vessels to expand their range and throughout the 1790s American whalers hunted there with great success. And though strained diplomatic relations between both France and the UK hindered these operations for a time, by 1820 the Pacific had become the main geographic focus of the industry and the number of ships outfitting for voyages grew exponentially. The increased activity in the region led some whaling captains to push the known boundaries and explore in search of new hunting grounds. These early nineteenth-century exploratory efforts succeeded in identifying not only numerous new whaling grounds, but many of the geographic features that dotted the ocean’s vast expanse.

For American whalers the most important of these was the Hawaiian archipelago.

Positioned in the tropical environment of the central Pacific, the islands of Hawaii offered fertile land, abundant sources of fresh water, and numerous safe anchorages. Although Captain James Cook is credited as the first European to explore the islands in 1778, merchants engaged in the China Trade were the first to utilize them as a strategic positon. Acting on reports from Cook's expeditions of large sea otter populations along the northeast coast of North America, American and British merchants established a lucrative trade with newly opened Chinese markets. The conveniently located Hawaiian Islands offered traders a place to take shelter from winter storms and to also establish friendly relations with native Hawaiians eager to obtain iron goods, guns, and artillery. Though the China Trade was short-lived due to the overexploitation of natural resources, the establishment of relationships and facilities within the Hawaiian archipelago helped to create a welcoming environment for the American whalers that followed in their wake.

As with the China traders, whalers initially viewed the islands simply as place to take shelter from storms, repair damages to their ships, and reprovision. The situation changed dramatically, however, with the location of a new whaling ground shortly after the first whaleships visited in 1819. Following the advice of a trading vessel captain, whalers explored the region to the northwest of the Hawaiian Islands and there they found what would later be recognized as one of the most productive whaling grounds ever identified. Known as the Japan Grounds, this massive hunting area extended from the top of the Hawaiian archipelago for thousands of miles across to the coast of the Japan. News of this discovery spread like wildfire and soon whaleships were regularly calling at Hawaii to reprovision before heading to this fertile new hunting area.

Throughout the following decade the number of ships that called at Hawaii increased exponentially and this influx resulted in several of the once sleepy settlements becoming the whale fishery's principal provisioning points for the northern Pacific region. By the 1830s new whaling grounds were identified in other parts of the region and the dissemination of their locations encouraged even more ships to frequent the islands. The financial benefits that came from harbor fees led to the development of port infrastructure and ship repair facilities in the larger towns. Realizing the need to protect their interests, the US government established an early presence in the islands and maintained good relations with the Hawaiian monarchy, which eventually led to American prominence there. This atmosphere in turn encouraged New England merchants to establish businesses that offered visitors to the islands locally-produced and imported goods, as well as services that catered to more recreational desires. These developments added to the attraction of the islands and helped to establish the Hawaiian archipelago as the primary entrepôt in the Pacific for American whaling until the 1870s.

The establishment of trading centers at the various Hawaiian Islands had a number of direct effects on the industrial operations of Pacific whaling. The first of these related to hunting strategies employed by whaling masters who observed the seasonal migration patterns and behaviors of sperm whales. Just as the whales moved with the seasons into different areas of the ocean to follow warmer water and better food supplies, whalers successfully maximized their efficiency by predicting those movements and hunting year-round. Since the main limiting factor in this strategy was the need to replenish fresh provisions when they were exhausted, the development of ports in the centrally located Hawaiian Islands proved to be a perfect solution. Added to this was the security of knowing that if they remained on the northern grounds too late in the year and were forced to winter over, then the many safe harbors found throughout the archipelago could provide shelter from damaging storms. Furthermore, the seasonal visits also allowed crews a respite from the monotony of life at sea, while captains could share knowledge of new grounds or of particularly dangerous geographic features. Over time the benefits of this practice for both the developing ports and the whaling fleet were realized and calling at Hawaii became an almost standard component of American pelagic whaling voyages to the Pacific in the early to mid-nineteenth century.

Closely related to the standardization of seasonal visits to the islands was the practice of transshipping cargos. As the number of ships regularly calling at the Hawaiian Islands increased and emporiums were set up to cater to them, the US government established a presence there to safeguard American commerce in the northern Pacific. With protection in place, whaling agents established the practice of transshipping cargoes of whale oil back to New England via merchant ships that arrived carrying trade goods or onboard other returning whaleships that had space in their holds. Among the numerous benefits of transshipment were infusing money from the sale of oil – albeit in lesser quantities – into the economy more frequently; reducing the risk of losing their entire investment in the event of a ship's loss; allowing whaleships to resume hunting operations with an increased cargo capacity; and extending the length of voyages and thereby increasing profit potential. The success of this practice soon led to the construction of warehouses and offices where oil offloaded from visiting whaleships was officially registered and stored until it could be transported. Ultimately, the system of transshipping cargos proved to be one of the most important developments in the nineteenth-century American whaling system.

The establishment of Hawaii as a trading center also had a major effect on the composition of the crews of American whaleships operating in the Pacific. Throughout the early to mid-nineteenth-century ships often arrived in ports in need of new recruits due to the attrition of crewmembers through either death, desertion, or disciplinary action. Though it was possible to find American and European mariners in Pacific ports who were willing to join a whaling voyage as a means of securing eventual passage home, often these were dubious characters who had either deserted from a ship or been cast ashore due to behavioral issues. Instead, experience in recruiting Indigenous islanders from Atlantic archipelagos had proven to be an effective strategy as they were found to be adept sailors and affable crewmembers. Due to the reports of China traders regarding the extraordinary skills of native Hawaiian mariners and their hardworking and even-tempered nature, many whaleship masters opted to fill empty berths on their ships with these people. As a result, thousands of native Hawaiians signed on to whaling voyages throughout the industry's golden age and many of them proved to be among the finest whalers and harpooners to sail in the fleet.

The Hawaiian Islands proved essential to the growth of American whaling operations in the Pacific Ocean. The number, size, and topography of the islands, as well as the tropical environment of the region offered fresh supplies and sheltered harbors. With the discovery of new whaling grounds in the northern Pacific, the central location of the archipelago was well positioned to provide a convenient stopover point for ships operating in the region. Over time the islands had a direct effect on the industrial organization of Pacific whaling by augmenting hunting strategies, reducing the risk of financial loss, increasing the operational efficiency, and significantly altering the composition of whaling crews. Ultimately, the establishment of the Hawaiian Islands as a an entrepôt for trade enabled the success of American whaling, which in turn led to US commercial importance in the Pacific.

Summary

The wooden ships employed in American pelagic whaling in the early to mid-nineteenth century were a unique type of sailing vessel. Although in basic design and construction they were similar to those used in other mercantile activities of the period, whaleships were in fact complex floating industrial sites that acted as mother ships for a number of smaller hunting craft, provided a platform for industrial scale production, and served as a meagre home for officers and crews for the duration of the multi-year voyage. Since the majority of the operations were conducted within the close confines of these relatively small vessels, a highly regimented and hierarchical system for management was employed. This system operated under three sequential stages that included both physical and organizational components that were designed to ensure maximum efficiency in all phases of the operations. These stages included: the 'pre-cruise' stage, in which investors agreed to finance a whaling cruise and all necessary preparations for it were made; the 'cruise operations' stage, which involved all relevant operations of a vessel from its departure to its return; and the 'post-cruise' stage, which required settling accounts and preparing the vessel for refit. Central to the pelagic whaling system were the interrelated industrial processes, which are termed 'raising whales and capture'; 'cutting in'; 'trying out'; 'stowing down'; and 'preparation of for the next round of whaling activity'. Each of these processes developed over the middle decades of the eighteenth century and required strict adherence to prescribed methods and the use of highly specialized tools. The effectiveness of this system allowed American whalers to hunt throughout the world's oceans with great success, the benefits of which had a major financial impact on the development of the United States and helped to establish American prominence in the Pacific.

Several fruitful avenues remain for research into nineteenth-century pelagic whaling. This study illustrated the usefulness of integrating archaeological and archival data for understanding the industrial nature of American pelagic whaling in the first half of the nineteenth century. Since several other countries also engaged in pelagic whaling during this period and most of them adopted the tools and methods used in seaborne whaling operations developed by American whalers, comparative studies of these other fisheries with those of the US could illicit interesting information about knowledge transfer, technological diffusion, and adaptation. Of particular interest would be the study of British whaling operations in the Pacific, as the two nations were historically known to have influenced one another in many ways. Such comparative studies could be highly beneficial in shedding light on the similarities and differences between the two fisheries and material culture studies of the known wrecks of British whaleships of contemporary vintage in the NWHI would provide an excellent opportunity to see how these are manifested archaeologically.

Another potential area of research that could prove to be an interesting extension to this research is the application of themes generally used in industrial archaeology practice to shipwreck sites associated with other types of marine resource extraction. Although whaling was distinctive from other seaborne trades since it incorporated oil production facilities onboard the ships, other trades such as fishing, pearling, and oyster harvesting might also be considered industrial in nature. Thus, the application of industrial research themes could help to better understand aspects such as organizational structure, conditions experienced by the crew, methods and technologies employed, scope of operations, and how environmental conditions that affected the outcomes.

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APPENDIX A

ITEMS INCLUDED IN A PREPRINTED OUTFITTING BOOKLET ENTITLED "ARTICLES FOR A WHALING VOYAGE" AND USED FOR THE SHIP *CONDOR* IN 1832.

From ‘*Condor* (Ship) Records, 1831-1850, Outfitting Book ca. 1832.’ MSS 41, Box 1, Sub-group 1, Series E, Volume 1).

ARTICLES FOR A WHALING VOYAGE

Provisions and Cabin Stores.

Flour Baked
Flour packed
Mess Beef
Prime do.
Mess Pork
Prime do.
Molasses
Sugar
Butter
Cheese
Rice
Coffee
Vinegar
Old Cider
Dried Apples
Codfish
Tongues and Sounds
Mackerel
Pickles
Raisins
Pork Hams
Smoked Beef
Kiln-dried Meal
Beans
Peas
Corn
Potatoes
Onions
Lamp Oil
Sperm Candles
Hard Soap
Oil Soap
Chocolate
Souchong Tea
Hyson do.
Loaf Sugar
Sweet Corn
Mustard
Mustard Seed
Black Pepper
Cayenne do.
Ginger
Allspice
Nutmegs
Cloves
Cinnamon
Selaratus
Sweet Oil
Pepper Sauce
Table Salt
Essence Spruce
Hops
Lemon Syrup
Sage
Summer Savory
Coarse Salt

FOR MEDICAL PURPOSES
N.E. Rum
H. Gin
Brandy
Port Wine

Hardware, &c.

Pitch Pot
Sauce Pans
Fry Pans
Grid Irons
Tea Kettles
Ladles
Tormentors
Skimmers
Shovels and Tongs
Scrubbing Brushes
Floor Brushes
Dust do.
Cooks Bellows
Chopping Knife
Chopping Tray
Dust Pan
Lamp Wick
Brimstone
Black Lead
Fire Steels
Flints
Bristol Brick
Rotten Stone
Glue
Coffee Mills
Britannia Ladles
do. Tureens
do. Teapots
do. Tumblers
do. Table Spoons
do. Tea do.
Iron Tea do.
do. Tea do.
do. Wash Basin
Coarse and Fine Seives [sic]

Hardware, &c. (cont.)

Cork Screws
Carver and Fork
Table Steel
Butchers Steels
Knives and Forks
Cabin Bell
Table do.
Cabin Lamps
Jacket do.
Socket do.
Brass Candlesticks
Mortar and Pestle
Time glasses
Spy Glass
Bread Tray
Looking Glass
Globe Lantern
Binnacle Lantern
do. Lamps
Hand Cuffs
Marlin Spike
Shot
Boat Corks
Palm Irons
Deep Sea Leads
Hand do.
Deep Sea Lines
Hand do.
Fish do.
Cod do.
Log do.
Fish Hooks
Houseline and Marline
Sewing Twine
Copper Pump Tacks
Iron do. do.
Iron Brads
Scupper Nails
Clout do.
Brass and Iron Screws
Scrapers
Steelyards
Butt Cock
Beer do.
Molasses Gates
Shovels
Hoes
Birch Brooms
Corn do.
Tar Brushes
Paint do.
Marking Brushes
Rigging Leather
Pump do.
Brad Awls
Sewing Awls
Table Covers
Shoe Thread
Log Book
Log Slates
Common Slates
Slate Pencils
Writing Paper
Ink
Ink Stand
Ink Powder
Quills
Signals
Jacks
Pendants
Ensigns
English Mincing Knives
Blubber Forks
Muskets

Sail Needles

Large Marline
Small do.
Large Bolt Rope
Middle do. do.
Small do. do.
Head Rope
Store do.
Tabline
Flat Seam

Nails

Clinch
Timber
Gunwhale
Lap
Foot
Ceiling
Wrought 20d, 10d, 8d, 6d.
Cut 20d, 10d, 8d, 6d.
Old Spikes

Cooper's Tools

Long Jointer
Jointer Irons
Truss Hoops
Axes
Adzes
Large Crose
Small do.
Crose Irons
Hollowing Plane
Heading do.
Bilge do.
Smooth do.
Levelling do.
Stock Howell
Draw Knives
Crooked do.
Champering [sic] Knives
Hampering do.
Bilge do.
Inshave [sic]
Dub Howell
Flagging Irons

Cooper's Tools (cont.)
Beek [sic] Irons
Marking Irons
Bung Borers
Tap do.
Compasses
Bitt Stock
Bitts
Vises
Gageing [sic] Rod
Red Cedar
Bungs
Chalk
Hammers
Drivers
Punches
Rivet Setts
Cold Chisels

Rivets
2d.
3d.
4d.
5d.
6d.

Iron Hoops
2d.
3d.
4d.
5d.
6d.

Carpenter's Tools
Long Jointers
Short do.
Jack Plane
Smooth Plane
Hollowing Plane
Rounding do.
Nail Hammers
Boat do.
Pump do.
Coopering Hammers
Broad Axe
Deck do.
Narrow Axe
Deck Hatchet
Boat Hatchet
Carpenter's Adze
Large Pincers
Small do.
Hand Saws
Back do.
Compass Saws
Wood do.
Drawing Knives
Spoke Shaves
Nail Gimlets
Spike do.
Ruff do.
Iron Square
Steel do.
Steel Tongue do.
Bevel
Carpenter's Compasses
Bench Vise
Hand Vises
Thumb do.
Marking Irons
Caulking do.
Screw Augers
Screw Divers
Saw Sett
Brace and Bitts
Old Stones
Water do.
Rifle do.
Sand do.
Flat Files
Half Round do.
Round do.
Wood Rasps
Three-square Files
Socket Chisels
do. Gouges
Firmer Chisels
do. Gouges
Scarf Chisels
Sets Chisels 1-8 to 1 inch
do. Chisels 1-8 to 1 inch
Board Gage
Square Plane Irons
Chalk Line
Trowell [sic]
Ruffs and Clinches
Pad Locks
Boat Knives
Leaning do.
Bullet Moulds
Blacksmith's Anvil
Sand Paper
Grind Stone

* Kegs Powder
Musket
Pistol

Crockery
Shoal Plates
Soup do.
Small do.
Pudding Dishes
Oval do.
Gravy do.
Soup Tureen
Sugar Bowl
Butter Tubs
Castor
Castor Bottles
Salts

Crockery (cont.)
Tumblers
Wines
Decanters
Bowls
Covered Dishes
Pitchers
Platters
Mugs and Saucers
Cups and Saucers
Spare Deck Lights

Tin Ware
Signal Lanterns
Boat do.
Cooks do.
Ladles
Dippers
Savealls
Scoops

Tinder Boxes
Tin Cups
" Pots
" Pans
Bake Pans
Pie Plates
Graters
Tunnels
Tea Cannisters [sic]
Oil do.
Powder do.
Molasses Cup
Protection Box
Soup Tureen
Trumpets
Blow Horn
Measures
Pudding Bag
Coffee Pots
Tea Pot
Lamp Feeders
Blubber Room Lamps
Wash Basin

Pepper Boxes
Gudgeon Boxes

* Flour Scoop
Dust Pan
Spitoon [sic]

Copper Ware
Cooler
Dipper
Skimmers
Pumps
Ladles
Tunnels
Tunnel Noses
Savealls
Vent Pipe
Cooler Cock
Hose do.

do. Joints
Tub Screw
Brass Trumpet
Binnacle Bell
Savealls
Vent Pipe
Cooler Cock
Hose do.
do. Joints
Tub Screw
Brass Trumpet
Binnacle Bell

Craft, &c.
Whale Irons
Lances
Head Spades
Boat do.
Blubber Hooks
Boat do.
Boarding Knives
Stearing Braces
Grindstone Cranks

Pikes
Gaffs
Line Hooks
Lilley Irons
Grains
Can Hooks
Chain Punches
Shackle Pins
Lance Hooks
Marking Irons
Crow Bars. Top Mall.
Tew Iron. Spike Tools
Rivet Tools
Blacksmith's Tools
do. Hammers

Cordage
Manilla [sic] Lines
Tarred do.
Manilla [sic] Cutting Falls
do. Cordage
Tarred do.
Wormline
Lance Line
Bolt Rope
Point Rope
Manilla [sic] Hawser
Tarred do.

Articles for Recruits
Tobacco
Cigars
Pipes
Powders
Muskets
Flints
Narrow Axes
Bleached Cotton
Unbleached do.
Blue do.
Furniture Prints
Fancy do.

Articles for Recruits (cont.)

Oil Soap
Bar do.
Lemon Syrup
English Green
Black Paint
White Lead
Linseed Oil

Spare Paints

White Lead
Black Paint
English Green
French Yellow
Verdigris
Prussian Blue
Vermillion
Crome [sic] Yellow
Venish Red
Japan
Linseed Oil
Spirits Turpentine
Copal Varnish
Spare Glass
Whiting
Bright Varnish

Blocks, &c.

Cutting Blocks
Burthen do.
Purchase do.
Guy do.
Spare do.
Cat do.
Shieves [sic]
Pins
Belaying Pins
Hanks
Pump Boxes
do. Breaks
Hand Spikes
Lance Poles
Spade do.

Slops

Pea Jackets
Blue Monkey Jackets
Drab do. do.
Blue Kersey Short do.
Drab do. do. do.
Satinett [sic] do. do.
Blue Thick Trousers
Drab Vermont do.
Satinett [sic] do.
Duck do.
Vests
Red Twilled Kersey Shirts
Striped do. do. do.
do. Cotton do.
Calico Full Bloom do.
do. Plain do.
Stockings
Mittins [sic]
Gurnsey [sic] Frocks
Duck do.
Cotton and Wool Drawers
Wool do.
Tarpaulin Hats
Blankets
Comforters
Braces
Cotton Handkerchiefs
do. Shawls
Thread
Scotch Caps
Sheaths and Belts
Sheath Knives
Jack do.
Palm Irons
Iron Spoons
Tin Pots
do. Pans
Shoes
Pumps

Spare Sails

Flying Jibb
Jibb
F.T.M. Staysail
Foresail
Fore Topsail
Fore T.G. Sail
Mainsail
Main Topsail
Main T.G. Sail
Main Spencer
Mizzen Topsail
Mizzen T.G. Sail
Spanker
T.G. Stud Sails
Lower do. do.

Spare Duck

Thick Duck
Heavy Ravens
Thin Duck

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* A single quotation mark and the abbreviation 'do.' were commonly used in outfitting books to indicate the repeat of a word directly above another on a list.

** Items listed after an asterisk were not preprinted; they are penciled in at some point during outfitting.

APPENDIX B

INVENTORY OF IDENTIFIED ARTIFACTS AT THE *TWO BROTHERS* (1823) SHIPWRECK SITE.

Site ID	Site Name	Section	Artifact Description	Comments/Location
PMN-17	*Two Brothers*	A	Anchor #1	Eastern extent of Section A; resting on edge of southern reef line
PMN-17	*Two Brothers*	A	Trypot #1	~161 gallons; large pocket in central part of reef
PMN-17	*Two Brothers*	A	Iron cask hoop section	Pocket in central part of reef part of reef
PMN-17	*Two Brothers*	A	Trypot #2	~174 gallons; large pocket in reef near it western edge
PMN-17	*Two Brothers*	A	Anchor #2	Reef top near SW edge of Section A
PMN-17	*Two Brothers*	A	Trypot #3	~135 gallons; Locate on reef flat western edge of reef
PMN-17	*Two Brothers*	A	Brick cache (3x2m)	Near trypot #1
PMN-17	*Two Brothers*	A	Bricks scattered (4x2m)	Near trypot #1
PMN-17	*Two Brothers*	A	Brick cache (2x1m)	Pocket in central part of reef
PMN-17	*Two Brothers*	A	Large brick cache (5x1m)	Pocket in central part of reef
PMN-17	*Two Brothers*	A	Small brick cache (2x1m)	Pocket in central part of reef
PMN-17	*Two Brothers*	A	Bricks cache (1x1m)	Pocket in central part of reef
PMN-17	*Two Brothers*	A	Brick scatter (.5x.5m)	Pocket in central part of reef
PMN-17	*Two Brothers*	A	Bricks scatter (1x1m)	Pocket in central part of reef
PMN-17	*Two Brothers*	A	Brick cache (3x3m)	NW reef edge
PMN-17	*Two Brothers*	A	Rigging element concentration (3x3m)	Deadeye strops, preventers, possible cranse iron pieces; north of trypot # 3
PMN-17	*Two Brothers*	A	Hawse pipe #1	Pocket in central part of reef
PMN-17	*Two Brothers*	A	hawse pipe #2	Pocket in central part of reef
PMN-17	*Two Brothers*	A	5 Iron bars/small hook	Undetermined function; near hawse pipe #2

Site ID	Site Name	Section	Artifact Description	Comments/Location
PMN-17	*Two Brothers*	A	lead pipe (45x10cm)	Undetermined function; north of trypot #3
PMN-17	*Two Brothers*	A	Brick scatter	Near trypot #2
PMN-17	*Two Brothers*	A	Iron strap & possible eyebolt	Near trypot #2
PMN-17	*Two Brothers*	A	Small rigging element concentration	deadeye strops; north of trypot #3
PMN-17	*Two Brothers*	A	Brick and iron scatter	North of trypot #3
PMN-17	*Two Brothers*	A	Multiple, intertwined rigging elements	Chain plates & deadeye strops; north of trypot #3
PMN-17	*Two Brothers*	A	Large thimble	North of trypot #3
PMN-17	*Two Brothers*	A	Small thimble	North of trypot #3
PMN-17	*Two Brothers*	A	Green bottle glass	North of trypot #3
PMN-17	*Two Brothers*	A	Case bottle base #1	North of trypot #3
PMN-17	*Two Brothers*	A	Case bottle base #2	North of trypot #3
PMN-17	*Two Brothers*	A	Possible cranse iron	North of trypot #3
PMN-17	*Two Brothers*	A	Iron vat - octagonal, 1m x 80cm diameter	Undetermined function; SW of Section A
PMN-17	*Two Brothers*	B	Possible masthead waif	Sand channel between Sections A & B
PMN-17	*Two Brothers*	B	Anchor #3	Possible kedge; Reef top near central part of reef
PMN-17	*Two Brothers*	B	Anchor ring	Disconnected from Anchor #4; small reef top pocket near anchor #3
PMN-17	*Two Brothers*	B	Large iron bar	Undetermined function; on reef top at north-central edge of Section A
PMN-17	*Two Brothers*	B	Iron rods (x2) in crossed position	Undetermined function; large sandy pocket at north-central part of reef
PMN-17	*Two Brothers*	B	Trypot #4	~125 gallons; large sandy pocket at north-central part of reef

Site ID	Site Name	Section	Artifact Description	Comments/Location
PMN-17	*Two Brothers*	B	Trypot #4	~125 gallons; large sandy pocket at north-central part of reef
PMN-17	*Two Brothers*	B	Harpoon & lance concentration	3 lance heads & 1 harpoon head; pocket in central part of reef
PMN-17	*Two Brothers*	B	Blubber Hook #1	Pocket in central part of reef
PMN-17	*Two Brothers*	B	3 iron bars	Undetermined function; projecting from seabed on reef flat off southern edge
PMN-17	*Two Brothers*	B	Ballast stone concentration	Southern edge of reef
PMN-17	*Two Brothers*	B	Ceramic jar, ceramic sherds, slate, & glass shard concentration	Intact stoneware jar, pearlware sherds, Green bottle glass shards, lens shard, time glass shard, log-slate piece; reef flat off southern edge
PMN-17	*Two Brothers*		Harpoon tips x 3	Southern edge of reef
PMN-17	*Two Brothers*	B	Ballast stone concentration	Southern edge of reef
PMN-17	*Two Brothers*	B	Ceramic jar, ceramic sherds, slate, & glass shard concentration	Intact stoneware jar, pearlware sherds, Green bottle glass shards, lens shard, time glass shard, log-slate piece; reef flat off southern edge
PMN-17	*Two Brothers*		Harpoon tips x 3	Southern edge of reef
PMN-17	*Two Brothers*	B	Sounding lead	Southern edge of reef
PMN-17	*Two Brothers*	B	Iron anchor stock bands	Southern edge of reef
PMN-17	*Two Brothers*	B	thimble x 2	Southern edge of reef
PMN-17	*Two Brothers*	B	Possible junk hook	Southern edge of reef
PMN-17	*Two Brothers*	B	Blubber Hooks #2 & #3	Pocket in reef near its WSW edge

Site ID	Site Name	Section	Artifact Description	Comments/Location
PMN-17	*Two Brothers*	B	Cooking cauldron concentration (4 total)	Large sandy pocket at north-central part of reef
PMN-17	*Two Brothers*	B	Ceramic sherd & glass shard concentration	Pearlware plate sherds, mug handle sherd, and green bottle glass; large sandy pocket at north-central part of reef
PMN-17	*Two Brothers*	B	Large brick scatter	Multiple sections of bricks still connected with mortar; large sandy pocket at north-central part of reef
PMN-17	*Two Brothers*	B	Ballast stone scatter	Large sandy pocket at north-central part of reef
PMN-17	*Two Brothers*	B	Grindstone & multiple iron pieces of undetermined function	Pocket in reef near its southern edge
PMN-17	*Two Brothers*	B	Copper tack & spike concentration #1	Small pocket in central part of reef
PMN-17	*Two Brothers*	B	Copper tack & spike concentration #2	Small pocket in central part of reef
PMN-17	*Two Brothers*	B	Possible caulking iron, possible cold chisel, iron cask hoop pieces, & numerous unidentified iron pieces	Large sandy pocket at north-central part of reef
PMN-17	*Two Brothers*	B	Intact whalecraft shank/socket and multiple broken shank pieces	Large sandy pocket at north-central part of reef
PMN-17	*Two Brothers*	B	Iron yard trusses (3 total)	Pocket in central part of reef

* Numerous iron objects or varying shape and size were also identified scattered throughout both sections of the site; however, due to their heavily concreted conditions their functions were not determined and as such they are not included in this inventory.

APPENDIX C

INVENTORY OF IDENTIFIED ARTIFACTS AT THE *PARKER* (1842) SHIPWRECK SITE.

Site ID	Site Name	Artifact Description	Comments/Location
PMN-12	*Parker*	Rigging element concentration	Numerous possible chainplates, deadeye strops; main wreckage area
PMN-12	*Parker*	Deadeye strop	Main wreckage area
PMN-12	*Parker*	Wire rope section	Main wreckage area
PMN-12	*Parker*	Wire rope section	Main wreckage area
PMN-12	*Parker*	Wire rope section	Main wreckage area
PMN-12	*Parker*	Iron chain	Main wreckage area
PMN-12	*Parker*	Iron strapping	Undetermined function; main wreckage area
PMN-12	*Parker*	Possible deck machinery	Undetermined function; main wreckage area
PMN-12	*Parker*	Deadeye strop	Main wreckage area
PMN-12	*Parker*	Copper sheathing	Main wreckage area
PMN-12	*Parker*	Spar hoop and chain	Possible 'sheet fairlead' with chain attached; main wreckage area
PMN-12	*Parker*	Small block and sheave	Main wreckage area
PMN-12	*Parker*	Iron strapping	Undetermined function; main wreckage area
PMN-12	*Parker*	Anchor #1	Possible 'Pering's Improved Anchor' style; main wreckage area
PMN-12	*Parker*	small boat anchor	Main wreckage area
PMN-12	*Parker*	iron bar	Undetermined function; main wreckage area
PMN-12	*Parker*	copper fasteners	Main wreckage area
PMN-12	*Parker*	Anchor #2	Possible 'Pering's Improved Anchor' style; NE portion of main wreckage area
PMN-12	*Parker*	Copper fastener	Main wreckage area
PMN-12	*Parker*	Lead hawse pipe	Near Anchor #1; main wreckage area
PMN-12	*Parker*	Windlass remains	Near Anchor #1; main wreckage area
PMN-12	*Parker*	Blubber hook	Under anchor #1; main wreckage area
PMN-12	*Parker*	Mast hoops	Near Anchor #1; main wreckage area
PMN-12	*Parker*	Iron bar	Undetermined function; main wreckage area
PMN-12	*Parker*	Iron ring and bolt	Undetermined function; main wreckage area
PMN-12	*Parker*	Single brick	Probable tryworks brick; main wreckage area
PMN-12	*Parker*	Iron chain	Main wreckage area
PMN-12	*Parker*	Iron chain	Main wreckage area
PMN-12	*Parker*	Fastener	Main wreckage area
PMN-12	*Parker*	Small block and sheave	Main wreckage area
PMN-12	*Parker*	Iron rigging element	Main wreckage area

Site ID	Site Name	Artifact Description	Comments/Location
PMN-12	*Parker*	Fasteners	Main wreckage area
PMN-12	*Parker*	Small block and sheave	Main wreckage area
PMN-12	*Parker*	Possible iron gudgeon or mast band	Possible iron gudgeon or mast band section; reef flat between main wreckage & back reef
PMN-12	*Parker*	Large iron bar	Undetermined function; reef flat between main wreckage & back reef
PMN-12	*Parker*	Brass ship's bell	Reef flat between main wreckage & back reef survey area
PMN-12	*Parker*	Iron strapping	Undetermined function; reef flat between main wreckage & back reef
PMN-12	*Parker*	Iron rigging element	Reef flat between main wreckage & back reef survey areas
PMN-12	*Parker*	Iron rigging element	Reef flat between main wreckage & back reef survey areas
PMN-12	*Parker*	Shackle	Reef flat between main wreckage & back reef survey areas
PMN-12	*Parker*	Iron strap	Undetermined function; reef flat between main wreckage & back reef
PMN-12	*Parker*	Fastener	Reef flat between main wreckage & back reef survey areas
PMN-12	*Parker*	Iron ring	Undetermined function; reef flat between main wreckage & back reef
PMN-12	*Parker*	Iron chain	Reef flat between main wreckage & back reef survey areas
PMN-12	*Parker*	Iron chain	Reef flat between main wreckage & back reef survey areas
PMN-12	*Parker*	Iron rigging element	Reef flat between main wreckage & back reef survey areas
PMN-12	*Parker*	Iron hoop	Undetermined function; reef flat between main wreckage & back reef
PMN-12	*Parker*	Copper fastener	Reef flat between main wreckage & back reef survey areas
PMN-12	*Parker*	Copper fasteners	Reef flat between main wreckage & back reef survey areas
PMN-12	*Parker*	Copper fasteners	Reef flat between main wreckage & back reef survey areas
PMN-12	*Parker*	Copper fasteners	Reef flat between main wreckage & back reef survey areas

Site ID	Site Name	Artifact Description	Comments/Location
PMN-12	*Parker*	Iron rigging element	Reef flat between Main wreckage and back reef
PMN-12	*Parker*	Iron ring	Undetermined function; reef flat between Main wreckage and back reef
PMN-12	*Parker*	Iron chain	Reef flat between Main wreckage and back reef
PMN-12	*Parker*	Iron anchor stock band	Reef flat between Main wreckage and back reef
PMN-12	*Parker*	Iron chain	Reef flat between Main wreckage and back reef
PMN-12	*Parker*	Angular iron strap	Undetermined function; reef flat between Main wreckage and back reef
PMN-12	*Parker*	Fasteners	Reef flat between Main wreckage and back reef
PMN-12	*Parker*	Copper fastener	Reef flat between Main wreckage and back reef
PMN-12	*Parker*	Iron fastener	Reef flat between Main wreckage and back reef
PMN-12	*Parker*	Iron ring and bolt	Undetermined function; reef flat between Main wreckage and back reef
PMN-12	*Parker*	Iron ring object	Undetermined function; reef flat between Main wreckage and back reef
PMN-12	*Parker*	Copper fastener	Reef flat between Main wreckage and back reef
PMN-12	*Parker*	Copper fastener	Reef flat between Main wreckage and back reef
PMN-12	*Parker*	Iron chain	Reef flat between Main wreckage and back reef
PMN-12	*Parker*	Iron anchor stock band	Reef flat between Main wreckage and back reef
PMN-12	*Parker*	Iron chain	Reef flat between Main wreckage and back reef
PMN-12	*Parker*	Copper alloy fastener	Reef flat between Main wreckage and back reef
PMN-12	*Parker*	Iron straps	Undetermined function; reef flat between Main wreckage and back reef
PMN-12	*Parker*	Rigging element	Reef flat between Main wreckage and back reef
PMN-12	*Parker*	Brick	Probable tryworks brick; back reef survey area

Site ID	Site Name	Artifact Description	Comments/Location
PMN-12	*Parker*	Iron strap	Undetermined function; back reef survey area
PMN-12	*Parker*	Large iron trypot piece	Back reef survey area
PMN-12	*Parker*	Iron pot pieces (x3)	Possible trypot; back reef survey area
PMN-12	*Parker*	Trypot piece	Back reef survey area
PMN-12	*Parker*	Round iron object	Undetermined function; reef pass area
PMN-12	*Parker*	Trail of bricks & broken trypot pieces	Reef pass area
PMN-12	*Parker*	Brick	Probable tryworks brick; back reef survey area
PMN-12	*Parker*	Possible trypot piece	Back reef survey area
PMN-12	*Parker*	Rigging element concentration	Undetermined function; back reef survey area
PMN-12	*Parker*	Iron strapping	Undetermined function; back reef survey area
PMN-12	*Parker*	Trypot piece	Back reef survey area
PMN-12	*Parker*	Copper alloy pintle 2 (3 bolts)	Smith survey area 2010
PMN-12	*Parker*	Copper alloy pintle 1 (4 bolts)	Smith survey area 2010
PMN-12	*Parker*	Copper alloy pintle 3 (6 bolts)	Smith survey area 2010
PMN-12	*Parker*	Copper alloy pintle 4 (6 bolts)	Smith survey area 2010
PMN-12	*Parker*	Copper alloy bolt	Smith survey area 2010
PMN-12	*Parker*	Small copper sheathing piece	Smith survey area 2010
PMN-12	*Parker*	Ringed fastener	Possible spectacle bolt; Smith survey area 2010
PMN-12	*Parker*	Copper alloy bolt	Smith survey area 2010
PMN-12	*Parker*	Copper alloy spike	Smith survey area 2010
PMN-12	*Parker*	Chain plate	Smith survey area 2010
PMN-12	*Parker*	Iron yard fitting	Possible cranse iron; Smith survey area 2010
PMN-12	*Parker*	Metal band	Undetermined function; Smith survey area 2010
PMN-12	*Parker*	Brick scatter	Less than 10 deteriorated tryworks bricks; Smith survey area 2010

* Numerous iron objects or varying shape and size were also identified scattered around the site; however, their heavily concreted conditions prevented their functions being determined and as such they are not included in this inventory.