DISCOVERED REPEATEDLY: ARCHAEOLOGICAL DOCUMENTATION AND SITE RESTORATION OF PACIFIC REEF WRECK (BISC-29, 8DA11953)

by

Madeline J. Roth

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Director of Thesis: Dr. Jennifer McKinnon

Major Department: Program in Maritime Studies, Department of History

Sitting at the northern end of the Florida Reef, Biscayne National Park is home to over 100 submerged archaeological sites. Part of the park's ongoing efforts to study, interpret, and stabilize submerged resources threatened by intensified storm activity and looting is the controlled excavation and in-situ preservation of previously disturbed sites. This thesis addresses the documentation and stabilization of Pacific Reef Wreck, a mid-19th century vessel targeted by both historic and modern salvage.

Park employees have monitored Pacific Reef Wreck (BISC-029) since the 1970s, yet they have only conducted preliminary archaeological work and no detailed site report exists. Resource managers visiting the site have noted disturbance including sediment loss, prop wash, and looting, however National Park Service personnel have not recorded any quantifiable estimate of damage or data loss in annual reports. While preliminary baseline data suggest that the site remains in good condition despite a noticeable loss of overburden, there has been no collection of quantifiable data addressing deterioration, history, or vessel identity. As such, staff determined that BISC-29 would be the focus of NPS field operations during the summer of 2016.

The aim of the 2016 fieldwork was site stabilization and data collection emphasizing vessel construction, nationality, and identity. The site, dated to the early 19th century, represents an important but little researched era of ship design and maritime commerce in park history. This thesis aims to analyze the results of the 2016 fieldwork in order to determine the site's significance and to provide park staff with resources for public interpretation as well as park area usage during the early 19th century. Furthermore, this thesis addresses the ongoing issue of illicit salvage in park waters and the need for new management strategies of submerged cultural resources in Biscayne National Park.

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by

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Madeline J. Roth

APPROVED BY:

DIRECTOR OF THESIS: _____

Jennifer McKinnon, Ph.D.

COMMITTEE MEMBER: _____

Jason T. Raupp, Ph.D.

COMMITTEE MEMBER: _____

Wade Dudley, Ph.D.

COMMITTEE MEMBER: _____

Charles Lawson, M.S.

CHAIR OF THE DEPARTMENT OF HISTORY: _____

Christopher Oakley, Ph.D.

DEAN OF THE GRADUATE SCHOOL: _____

Paul Gemperline, Ph.D.

Dedication

This work is for the field crew present at the very beginning of the project. In the words of Latour (2005:90), “we could attend, frame after frame, to the most incredible spectacle: truth being slowly achieved in breathtaking episodes without being sure of the result.” This work has become a confluence of factors, however, without your initial efforts, the stage would not have been set.

Thank you.

Acknowledgments

This thesis was a highly successful exercise in pre-planning and quick turnarounds, but it would never have made it off the ground if not for such a formidable team backing it. Charles Lawson, head of Cultural Resource Management at BISC, deserves a personalized acknowledgment section for his efforts in making this thesis a reality. His assistance and guidance with the permitting, pre-project research, planning, funding, site photography, and artifact conservation was invaluable in making this project a success.

Likewise, BISC NPS Archeologist Joshua Marano provided vital boating, mapping, and conservation services to the project. Aided by BISC VIPs, fellow NPS staff, and interns (including but not limited to Arlice Marionneaux, Gabe Taliaferrow, Caleb Henderson, Brett Lear, Lowell Evans, and Jessica Keller), the collective NPS/Biscayne crew deserves many thanks for their flexibility, energy, and persistent good humor. Dr. Kimberly Kasper also devoted precious time and resources to the examination of biological samples. Her work and help has been invaluable to this thesis.

Finally, the staff and students of the Program in Maritime Studies at East Carolina University deserve special thanks for their efforts. I want to sincerely express thanks to my thesis committee members—Dr. Raupp and Dr. Dudley—for their welcomed feedback and time. Allyson Ropp, too, deserves endless gratitude for her help and willingness to undergo a modern tarring for the sake of science. Finally, none of this would have been possible without the guidance of Dr. Jennifer McKinnon. Her support, feedback, and supervision were the driving forces behind completion of this thesis.

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Chapter 1. Introduction

Introduction

Biscayne National Park (BISC) consists of more than 270 cubic miles of mangrove coastline, seagrass meadows, inshore patch reefs, and the northern most Florida Keys (Figure 1.1) (EDAW 2003:1-1). Numerous archaeological sites are submerged beneath the park waters, including more than 75 shipwrecks and stranding sites (Lawson and Lubkemann 2015:i). While these sites differ in historic use, materials, age, and nationality, they share a common history of transportation and commerce in South Florida waters. Moreover, they are part of South Florida memory and are the materials used by National Park Service (NPS) employees to interpret the local community's history and identity. A long history of wrecking, salvage, and treasure hunting accompanies these sites and, in some ways, acts as a means of uniting them under the same management strategy.

Early efforts by the NPS to identify cultural resources in the park resulted in a database of more than 150 archaeological sites covering more than 2,500 years of human history (Carr 1984). One of the earliest recorded sites in the park is Pacific Reef Wreck (BISC-029, 8Da11953), a historic sailing vessel which dates to the mid-19th century. While little is known about the vessel's historic origins, NPS personnel have visited the site since the 1980s as the substantial wooden remains were uncovered by treasure hunters and remained exposed to chemical, mechanical, and biological deterioration (Meylach and Whited 1971; Wild et al. 1985).

Only recently have park resource managers undertaken any systematic evaluation of site deterioration. Although the Southeast Archeological Center (SEAC) conducted an initial site survey in 1984, there has been no further mapping of the site and as such, there is no quantitative

estimate of site loss or deterioration (Wild et al. 1985). Past illicit salvage has also impacted the site while looting remains an active threat.

FIGURE 1.1. BISC Park Boundary (Image courtesy of BISC, 2017).

This thesis addresses the analysis of Pacific Reef Wreck's material culture and vessel structure. It employs an actor-network theoretical approach to interpret the historic and modern usage of the vessel as well as the ongoing role of Pacific Reef Wreck within BISC. While the primary aim of this thesis is to discuss the material remains of Pacific Reef Wreck, secondary aims include a comprehensive study of known historic shipwrecks on Pacific Reef (as found in the local wrecking narrative), and a re-assessment of the current management strategy for historic sites located within the park boundary.

Research Questions

To address these research aims, this thesis investigates various topics such as historic background, laboratory analysis and cataloging of recovered material culture, and remaining vessel structure. Furthermore, this work analyzes past choices made by site managers, current stakeholders, and data loss from both illicit looting and poor management to propose a future management strategy for the site and associated cultural resources within BISC. To understand these research themes, the chapters address the following ancillary questions:

1. What are the origins of the vessel? What is the vessel form and what function did it serve? What cargo (if any) was present at the time of loss and how does this cargo fit into the historic narrative of South Florida?
2. Can Pacific Reef Wreck be identified using the historic record? What information is recorded in historic reports? Can this information be distilled given the available material culture to produce a viable list of vessel candidates?
3. Where does Pacific Reef Wreck fall in the history of South Florida? How are the vessel's features part of maritime trends in South Florida?

4. How have past management choices impacted the site? Who are the current stakeholders and how have they/are they impacting the site?
5. What are effective management strategies for comparable sites? How can they be modified to propose a new management strategy for Pacific Reef Wreck?

Justification

BISC currently manages Pacific Reef Wreck. As such, taxpayers and local community members are the primary stakeholders in the preservation and interpretation of this site (U.S. Department of the Interior [DOI] 2006). When investigated in the 1980s, SEAC deemed the site significant as they considered the wreck a transitionary vessel, featuring both iron frames and wooden timbers (Wild et al. 1985). Unfortunately, the site remained uninterpreted for visitors and at risk of further deterioration. Furthermore, the growing number of submerged archaeological sites in the park has led to a reduction in annual site visits conducted by park staff (Marano 2015). While sites are managed and understood to be "significant," there has only recently been an effort to understand them in their respective historic contexts and to interpret their significance to the public (Wild et al. 1985:ii–vi; Marano 2015:103; Wilson 2015).

By attempting to identify the form, function, and history of the vessel, this thesis will further avenues of site interpretation and outreach. Furthermore, it will produce tangible materials for stakeholders which address the site's cultural heritage. This thesis also proposes suggestions for the implementation of a feasible site management strategy applicable to other submerged resources managed by the NPS.

Theoretical Framework

To study the results of the 2016 fieldwork, this thesis takes a materialistic approach structured after Bruno Latour's Actor-Network-Theory (ANT). ANT studies associations within

a network where living and non-living entities are all considered actors (or relational effects) because they are defined in practice (Latour 1996:369; Dolwick 2009:22; Oyen 2015:66). ANT researchers place emphasis on how associations between actors are created, maintained, and fall apart (Dolwick 2009: 37). To study these associations, Latour challenges his readers to trace a string of actions, or network, where every actor has a role to play (Dolwick 2009:42). Thus, the actors within a network share agency while ANT removes traditional oppositions—individual versus social, global versus local, agency versus structure—and replaces them with the number of associations studied (Latour 1996:372).

Shipwrecks are often treated as passive remnants of the past—time capsules locked into specific eras and cultural groups (Muckelroy 1978:56). While researchers have expanded theoretical approaches to include (and ultimately control for) site formation processes, the emphasis remains the same—evidence of human interaction after the initial wrecking event is written off as "contamination" or a process which detracts from understanding the historic past (Muckelroy 1978:57, 159). Archaeologist Donna Souza (1998:5) cautions researchers who take this approach, stating "it is critical to remember that this 'moment in time' is only a brief instant in the constantly changing and ever-lengthening continuum of the past and is the result of several interrelated cultural and behavioral processes." Pacific Reef Wreck is not a time capsule that has laid undisturbed for a century and its history did not end at the time of sinking. Post-deposition, the site continued to form new relationships which remain today.

Ontological in approach, this thesis will contextualize Pacific Reef Wreck using ANT to study the relationships the site has built and maintained through practice (Oyen 2015:64). As actors created, adapted, or changed their practices to interact with the vessel, the definition of Pacific Reef Wreck multiplied. It is these relationships and definitions which "are driving

agencies that shape [future] possibilities" (Oyen 2015:66). Their study is crucial to understanding, and ultimately managing, the site for other actors within and outside the network. To investigate these actors fully, Latour (2005:22) suggests five areas to study: groups, actions, objects, facts, and how the research is conducted (all discussed below).

Investigating groups involves addressing "what actors were assembled together" based on the evidence present. These actors have their own agency, and as such can form alliances, organize, dictate the actions of others, and resist (Dolwick 2009:40). Dolwick (2009:40) defines groups as "social" in nature; the archaeological record expresses individuals or groups through both written sources and artifacts.

Actions result directly from the agency of actors and involve group manifestation through material evidence, including physical processes, written statements, and tools/techniques found within. Central to actions are controversies—negotiations, translations, and topics of concern (Dolwick 2009:41).

As actors can also be non-human, non-living entities, objects are the stabilizing elements that "mediate, frame, articulate, enforce, and give meaning to action" (Dolwick 2009:41). In other words, a study of objects involves identifying those that were mobilized, caused problems, or enforced actions (Dolwick 2009:41). Discussion of these objects also includes those intentionally deposited or removed from an archaeological site.

For Latour (2005:22), "facts" are the ideas created by actors and taken at face value until challenged by another actor (Dolwick 2009:41). Contradictions that arise through the challenging of "fact" are the essence of ANT; the aim is not to discern absolute truth, but the underlying arguments, evidence, and beliefs presented by actors.

Finally, the most reflexive aspect of this study is assessing how research was conducted.

Latour (2005:129) challenges the researcher by asking how far they followed associations. For this study, both the limitations and shortcomings of past and present scientific research are identified and discussed.

Current Site Management and 2016 Fieldwork

The current aim of cultural resource management within the NPS, as determined by the 1916 Organic Act, is to "conserve…historic objects and… to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations" (National Park Service [NPS] 2016). While interpretation of this act in the past has manifested in the park as non-invasive site documentation, disturbances from looting and storm events, as well as the continual threat of looting, have led to a renewed effort to undertake archaeological investigation of sites.

A reassessment of BISC-029 site condition reports from 1992 to 2015 suggested that the current management strategy of annual or semi-annual site visitation and rapid visual survey is inefficient in quantifying the ongoing deterioration and destruction of historic fabric. For example, while there has been a documented decrease in sediment covering the site and an increase in exposed artifacts (Roth and Marano 2015), condition assessments have failed to collect any quantifiable data, which has in turn prevented the implementation of any long-term preservation strategy.

As of spring 2016, Pacific Reef Wreck remained in a state of disequilibrium due to the previous removal of the protective layer of ballast by treasure hunters (see Chapter 3). Increased deterioration from marine borers, mechanical erosion, and bacterial degradation threatened the site and had produced noticeable deterioration to the vessel's structure (Helmers et al. 1988; Lawson and Bayliss 2010; Roth and Marano 2015). Staff therefore decided that the site would be

be the focus of the BISC cultural resource management (CRM) 2016 field season.

Archaeological assessment of Pacific Reef Wreck took place between 14 June and 13 July 2016. The crew chief and Principal Investigator were BISC volunteer Madeline Roth (East Carolina University student and past BISC intern) and NPS Archeologist Charles Lawson, respectively. NPS Archeologists from BISC, Everglades, and the NPS Submerged Resources Center (SRC), as well as BISC volunteers and CRM interns, formed the field crew. The team conducted work from the BISC 27 foot (ft.) resource management vessel. Weather during the project was atypical in that there was significantly more wind than in previous summers, however the crew lost very few days to weather. The project crew worked a total of seventeen days on site. Crew members spent a total of 11,089 minutes (min.) underwater, a sum of 184.8 dive hours (hrs.) representing 157 dives (averaging 71 min./dive).

2016 Research Methodology

Prior to excavation, a visual survey of the site served to delineate site extents. Staff identified two concentrations of ship structure (all previously noted in past conditions assessments) as areas of further study during the survey. Two copper pins were set northeast and southwest of the main site extents, creating a western datum and an eastern datum. Divers ran a fiberglass metric tape and a nylon string between the two data at a 70°NE/250°SW angle to create the baseline. Total length was 45 meters (m) (148 ft.) and covered both areas of the site. Archaeologists placed the 0 m datum on the eastern site extents (seaward) and the 45 m datum on the western (land-ward) portion of the site. Rebar (individually measuring 2 ft. (0.6 m)) marked the baseline at 2 m (6.5 ft.) intervals between 4 and 10 m (13 and 32 ft.), and 22 and 32 m (72 and 105 ft.) to create quadrats over the two visible timber concentrations (Figure 1.2). Each quadrat measured 2 × 4 m (6.5 ×13 ft.).

To further delineate site extents, divers used a hand-held metal detector (JW Fischer Pulse 8x Professional Underwater Metal Detector) to identify the extent of the material culture scatter. Swimming 20 m (65 ft.) transects perpendicular to the baseline (bisecting the baseline at the 10 m (32 ft.) mark on the transect) at 2 m (6.5 ft.) intervals, divers recorded all metallic anomalies with a pre-numbered flag and mapped each location via trilateration. Following the dive, staff mapped metal detecting hits onto the site plan (Figure 1.2). Metal detecting yielded a total of 33 anomalies (Appendix A). Photographs record each metal detecting anomaly with the magnetic orientation.

After completing the metal detection survey, divers began removing large ballast and coral rubble overburden from the structure. Divers deposited ballast and rubble on the nearby dead coral ridge created during the initial illicit salvage events of the 1960s and 1970s (Wild et al. 1985:11), taking care to reposition all ballast with live coral and sponge growth away from site. Once divers removed the initial layer of large ballast and rubble, they discovered a secondary layer consisting primarily of small *Acropora cervicornis* and *A. palmata* (staghorn and elkhorn) coral rubble (Humann and Deloach 2006:91-93). The change in coral rubble size accompanied a shift in sediment color from blond to ashy gray. Although initially thought to be an ash layer, the absence of burning on the ship's timbers suggested that this ashy layer resulted from coral deterioration and staining, possibly associated with a hurricane event.

Divers used gravel rakes to remove this new top layer of small rubble from the previously delineated 2 m (6.5 ft.) quadrats along the baseline. They then gathered the coral rubble at the northern extent of structure in each quadrat and hand sorted it for artifacts. Divers returned any artifacts to the vessel structure in the corresponding quadrat and deposited the remaining rubble off site. Any delicate or large artifacts present in the area mandated hand removal of coral rubble.

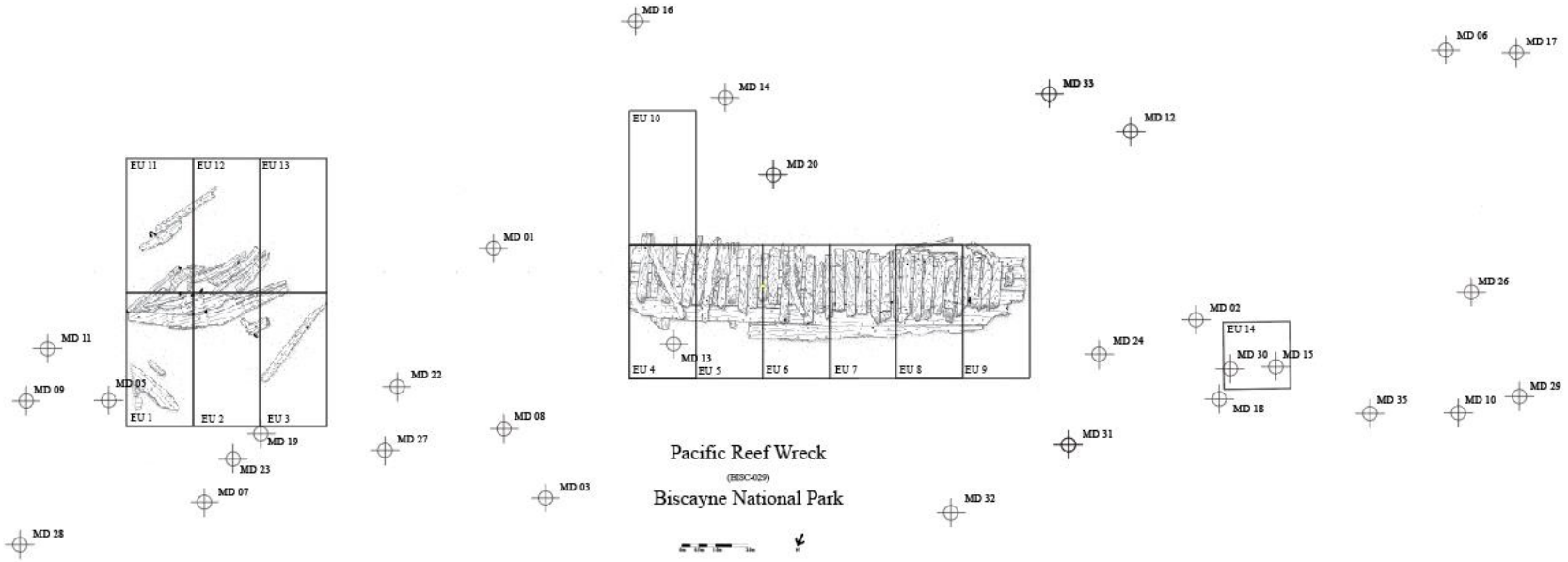

FIGURE 1.2. Quadrats used to delineate study areas on site. Targets are the metal detecting anomalies (Image by author, 2018).

After divers finished removing coral rubble, they installed rebar and nylon strings to mark excavation units (EUs). Thirteen 4 × 2 m (13 × 6.5 ft.) EUs demarcated the site—Area I consisted of six units (three north of the baseline and three south), while Area II contained seven units (six units north of the baseline and one unit south) (Figure 1.2). Staff placed a fourteenth unit measuring 2 × 2 m (6.5 × 6.5 ft.) over a concentration of copper sheathing located due west of Area II. Divers used a 2.5 inch (in.) (6 centimeter (cm)) induction dredge to remove sediment and small rubble from each unit. Mesh bags collected all rubble for hand screening through 0.25 in. (0.6 cm) screen at the surface. Staff placed all artifacts in seawater for transport to the lab at BISC headquarters.

Excavation followed natural site stratigraphy. The first excavation level in each unit consisted of blond sand covering the structure, approximately 10-15 cm (4-6 in.) deep. Once divers reached the second sediment type—the 'ashy' sand described above—they assigned the unit a new field specimen number for continued excavation. Area II contained the only example of the second sediment level, visible between the frames and underneath the outer hull planking. This sediment layer varied in depth, from 3 to 35 cm (1.2-13.8 in.). Following the removal of this second layer of overburden, staff stopped dredging as they considered the sediment underneath to be sterile.

While dredging in Area I, divers discovered that several disarticulated timbers lay under the timbers visible from the surface. These newly discovered timbers were incredibly fragile—project personnel decided that divers would only remove the first layer of sediment to prevent further site deterioration.

Following the dredging, staff collected sediment and timber samples for further analysis (see Chapters 4 and 5). Divers mapped the vessel structure and any non-portable material culture

using baseline offsets. At headquarters, personnel compiled a full site plan using individual maps of each unit (see Figure 5.1). Following the mapping, staff began photo documentation for photogrammetry—140 individual photos comprise the entire site, with a further 518 photos documenting Area II. The resulting three-dimensional models (created using Agisoft Photoscan Software) utilized these two photo sets (Figure 1.3).

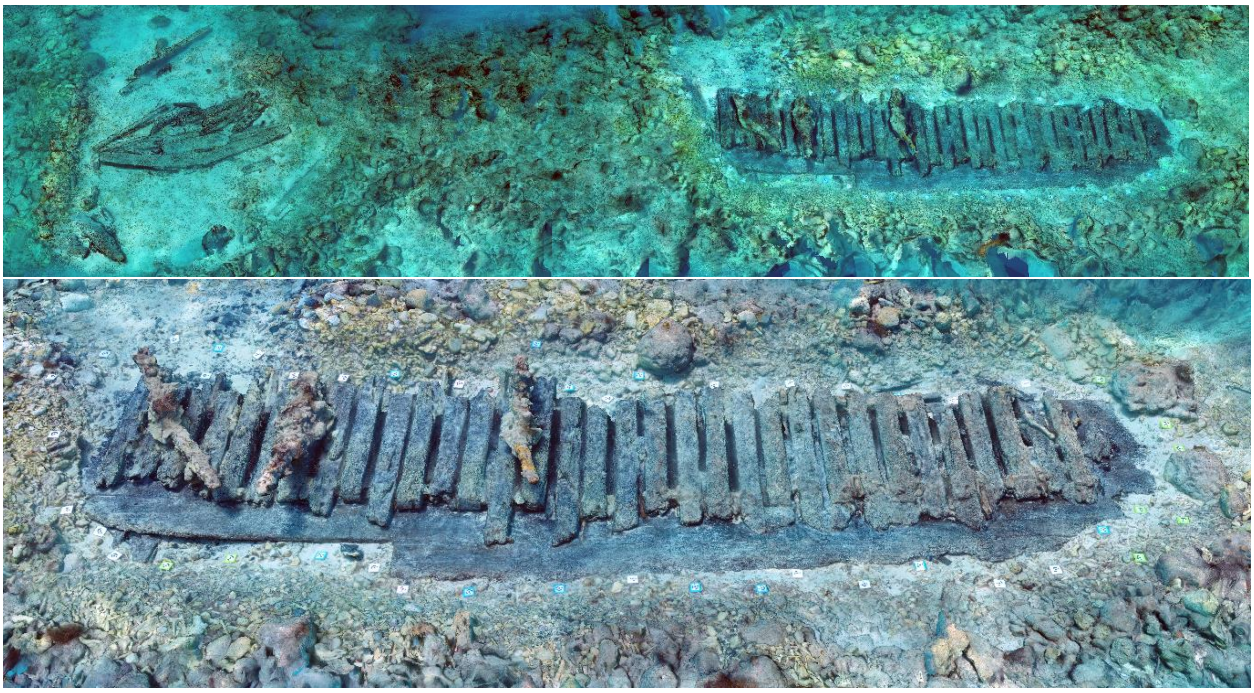

FIGURE 1.3. Top: Areas I and II on Pacific Reef Wreck photogrammetry model. Bottom: Detail from Area II photogrammetry model. (Images by author, 2018).

Artifact Conservation and Site Sampling

Staff kept artifacts recovered from site in a mixture of fresh and saline water in the resource management laboratory at BISC. Artifact recording included individual pre-conservation photos and a preliminary entry into the artifact catalog. Staff assigned each artifact or artifact group an individual field specimen (FS) and lot number. Staff returned all artifacts determined 'too fragile to survive conservation' to the site following mapping operations. The remaining artifacts received individual artifact catalog numbers and underwent conservation following the treatments outlined by Hamilton (1999) in *Methods of Conserving Archeological*

Material from Underwater Sites. Lab personnel gradually desalinated and air-dried ceramics, stone, coal, and glass. Lead, iron, copper, and copper-alloy metal artifacts underwent electrolytic cleaning in a tank containing a six percent sodium carbonate solution. The tank was connected to a power source which provided a continuous current set to 3 amps. Once stable, staff removed calceous growth by hand, completing conservation by boiling and air-drying the artifacts. Staff further applied Krylon spray and tannic acid coatings to cupreous and iron artifacts, respectively. Iron and lead artifacts received a final coating of microcrystalline wax. Bone underwent gradual desalination and a received a consolidation treatment of Acryloid B-72.

Lab personnel placed artifacts composed of plant materials and soft animal materials in vats containing polyethylene glycol (PEG) 540. They increased the percentage and temperature of the PEG solution over a three-month period and removed materials from solution once the PEG concentration reached 80%. Any artifact treated with PEG was air dried.

After completing conservation, BISC staff updated the subsequent artifact catalog following guidelines set forth in the Cataloging Manual for Archeological Objects Vols. I, II, & III (NPS 1990) and the Museum Handbook, Museum Records, Part II (NPS 1984). Project staff conducted analysis of all cultural materials and entered all resulting data into the Interior Collections Management System (ICMS) database using the Southeast Archeological Catalog System (SACS). Archival quality polyethylene bags marked with indelible ink house all curated artifacts. BISC Accession 531 (BISC Acc531) contains all the artifacts generated during the project. Accession records and materials exist in the NPS regional repository for archaeological collections at SEAC in Tallahassee, Florida, but may be held temporarily (pending display) at the South Florida Collections Management Center (SFCMC) in Everglades National Park. Furthermore, artifacts from the project may be on display in rotating exhibits at the Dante Fascell

visitor center at BISC[1]. It should also be noted that original documents including, but not limited to, excavation forms, maps, dive logs, field notes, photographs, SACS artifact record forms, historic documents, correspondences, conservation logs, geospatial data, presentations, papers, and reports are all part of BISC Acc531, and are held in collections as SEAC, SFCMC, and BISC.

Reburial and Post-Fieldwork Condition Assessment

Following timber mapping and photography, divers returned 651 artifacts (896.5 grams (g) wet weight) to the site. These artifacts included copper alloy sheathing fragments and copper alloy tacks that would not survive conservation. The artifacts remain under the outer hull structure in the northern extents of EU 6 in Area II, covered with sediment. Full artifact catalog analysis records exist for each of the re-buried artifacts, as well as pre-conservation photographs.

After the artifact reburial, divers covered the visible ship structure and portable artifacts found during metal detecting in Areas I and II with small coral rubble and ballast (Figure 1.4). Divers placed all rubble by hand to ensure they did not damage the vessel structure. Large coral rubble, again placed by divers, forms a secondary layer in Areas I and II to prevent sediment movement. Divers used sand removed during the dredging process to cover the remaining visible structure. While divers were unable to attain a depth of 15 cm (5.9 in.) of sand (the depth which had previously covered the site and prevented further timber degradation in EUs 4-6), the coral overburden was effective in creating a sediment trap for the sand returned to the structure via the induction dredge. Furthermore, project personnel are hopeful that the large sand patch to the

[1] In an effort to increase visitor access to archaeological collections recovered from sites within the park, BISC has a temporary exhibition space devoted to interpreting the park's submerged cultural heritage (Marano 2015). Limitations to accessing collections, however, have slowed exhibit rotation. Thus, while recent archaeological projects have been conducted within park waters, dissemination of project results via public displays lags (J. Marano 2018, pers. comm.). It is likely that materials from the BISC-029 2016 fieldwork will be displayed for the public following final artifact conservation.

south of the site will contribute to the build-up of sediment on site, as the crew noted sediment traveled from south to north during the field project.

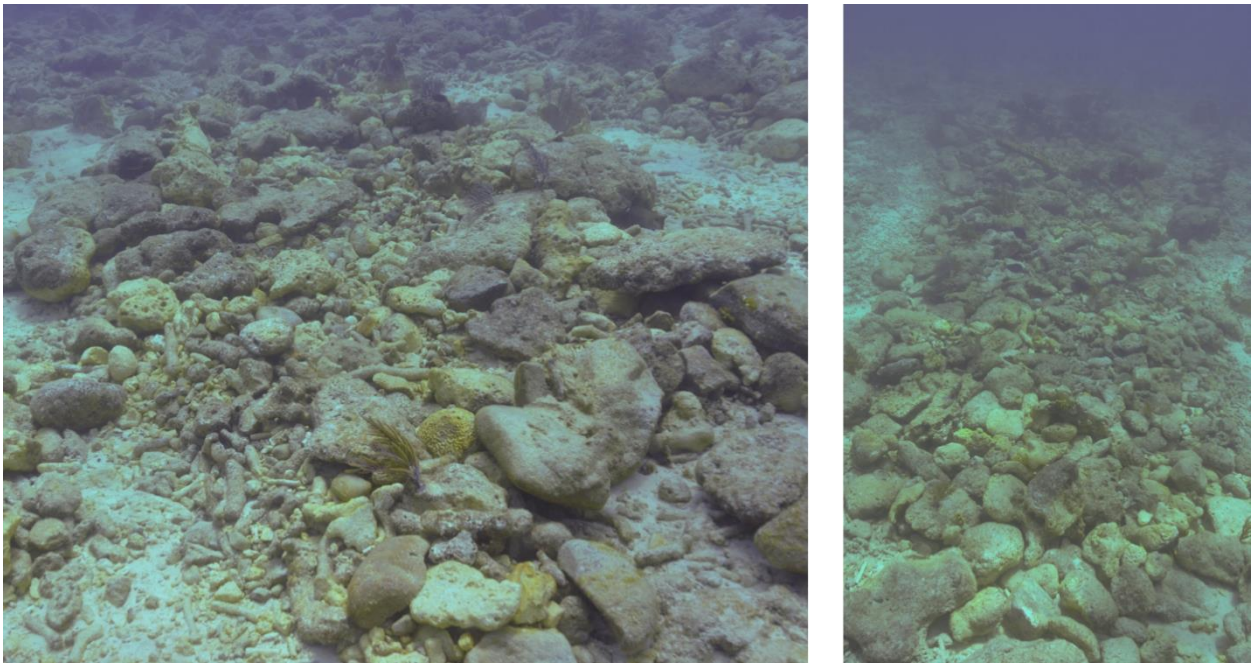

FIGURE 1.4. Pacific Reef Wreck following reburial. Areas I and II are on the left and right, respectively. (Images by C. Lawson, 2016).

Following the end of the project, park staff continued to monitor the site to determine the efficacy of the sediment trap. In 2017, the site received a direct hit from Hurricane Irma, a tropical cyclone which struck the Florida Keys with category four wind speeds (115 knots/hour) on the Saffir-Simpson Hurricane Wind Scale (Cangialosi et al. 2018:1). When visited for the post-hurricane assessment, park staff noted "the site has experienced considerable differential erosion as sediment has been scoured from one portion of the wreck and accumulated in another" (Marano et al. 2017a). Ten feet of the vessel structure remains uncovered in Area II. Staff noted ballast covers the wooden structure in Area I, however stability remains unknown.

The only visible damage in Area I consisted of the deck stanchion (see Chapter 4) recorded during the 2016 fieldwork. Surge and wave action dislodged the stanchion, which remains on site in a poor condition (Marano et al. 2017a). Considering the damage to other

submerged resources in the park, NPS CRM staff are cautiously optimistic that the site structure fared well during the storm and that the creation of an anaerobic environment on site is still possible. Furthermore, the main site structure and portable artifacts remain covered post-hurricane, a success in regards to site visibility (Marano et al. 2017a). Prior to the fieldwork, the site was highly visible from the surface, and anyone snorkeling or diving in the area could readily identify it as a shipwreck. Following reburial, the site appeared indistinguishable from the local environment to the untrained eye. While the iron framing elements are still visible, their lack of context greatly reduces the association of a shipwreck with the site.

Conclusions

The 2016 fieldwork documented the material remains of BISC-029, an early 19th century vessel first recorded by NPS personnel in the 1970s and now under NPS stewardship. The aim of this thesis is to re-examine the vessel's history and physical remains to determine site significance and to assess the efficacy of current and past management strategies. As Pacific Reef Wreck is only one resource among an ever-growing inventory of submerged historic vessels in BISC waters (Marano 2015:103), this thesis will contribute further insight to successful submerged site management and the context of underwater cultural heritage in BISC.

A Note on Vocabulary

This thesis uses the term South Florida to refer to the region encompassing Monroe, Collier, and southern Dade counties (excluding Miami). Vernacular in origins, South Florida is a self-identified area which distinguishes itself from larger coastal populations (Miami and further north) and agricultural areas (Lamme and Oldakowski 1982:105; Lamme and Oldakowski 2007). Lamme and Oldakowski (1982:108) trace this geographic vernacular name to a non-Spanish colonial identity associated with and the influx of later 20th century populations.

Chapter 2. Environmental and Historical Background

A shared dependence on marine resources unifies the human history of Biscayne Bay and the Florida Keys across five centuries. While the area's earliest inhabitants relied on natural resources alone, historic accounts indicate maritime salvage became a mainstay of subsistence in the Keys beginning in the 16th century (Escalante Fontaneda 1944). As shipping and travel through Florida waters increased with colonial expansion, so did local wrecking economies. Disparate communities separated by ideology and nationality found a shared practice in wrecking which allowed these communities to evolve and persist despite outsider dissent. As growing infrastructure incorporated the region into the United States (U.S.), however, wrecking again evolved into a heavily regulated and systematic industry. Unfortunately, the infrastructure improvements which expanded wrecking would eventually be the downfall of these maritime communities. As the 20th century dawned, Keys residents abandoned wrecking to pursue marine resource extraction and the burgeoning tourism industry.

While maritime economies have waxed and waned throughout the Florida Keys, historic wrecking and diving practices and an intimate knowledge of marine resources laid the foundation for modern salvage and local treasure hunting ideology. Pacific Reef and its associated wrecks, specifically BISC-029, are exemplary of these continuing maritime traditions. This chapter explores the historic groups (and "anti-groups" created in opposition) which assembled around Pacific Reef Wreck and provides an overview of potential actions the site experienced as indicated by the historic record (Latour 2005:31).

Environmental Background and Prehistory of South Florida

The earliest evidence of human occupation in South Florida comes from the Cutler Fossil Site (8DA2001), located south of Miami on the coast of Biscayne Bay. Radiocarbon dates from

the early Holocene site, which yielded human remains, projectile points, and charred faunal remains, place human occupation at 9,760±120 B.P. (Carr 1986:231). This early settlement would have experienced a much different landscape than that of today; while marine resources were found on site in abundance, lower sea levels suggest that the site was several kilometers inland (Carr 2012:47). Lower precipitation but warm temperatures fostered grasslands and pine forests which provided ample access to small mammals and rodents (Carr 2012:47).

Approximately 7,000 years ago, sea-level rise transformed the lowlands to the east of the Cutler Fossil Site into shallow Biscayne Bay, while the Florida peninsula's coastal corals became an offshore barrier reef spanning 360 miles from the modern St. Lucie Inlet to the Dry Tortugas (National Oceanic and Atmospheric Administration [NOAA] 2017). This tract, comprised of more than 6,000 individual reefs, is collectively referred to as the Florida Reef (Lighty et al. 1978:59). Although the Florida Reef is considered a single ecosystem, individual reefs are classified as hardbottom, patch reefs, or bank reefs due to proximity to shore, depth, species diversity, and formation (University of Florida 2018).

Bordering the Florida Reef are the Florida Keys—oolitic and coral limestone islands covered in tropical hardwood hammock and mangrove forest that formed during the Pleistocene, approximately 125,000 years before present (Goggin 1944:14; Shinn 1988). While no prehistoric archaeological sites have been located on the Lower Keys (Little Duck Key to Key West) due to extensive development and natural weathering (Souza 1998:12–13), Native American habitation sites dating from 1000 B.C.- A.D. 1700 have been located on Key Largo (8MO25), Totten Key (BISC-048), and Sands Key (BISC-043, BISC-049) (Goggin 1944; Carr 1984; Southeast Archeological Center 2009; Parsons et al. 2018). These sites all feature shell middens, various lithic tools, and ceramic sherds identified in the Glades I (900-1100 AD) and Glades II (1100-

1400 AD) ceramic traditions (Carr 1984; SEAC 2009; Parsons et al. 2018). While there is still a poor understanding of these early Keys dwellers (thought to be ancestors of the contact-era Tequesta), the "Totten Key Complex" (BISC-048), located in the southern end of BISC, remains of interest to archaeologists. Surface scatters on the island indicate contact between Spanish mariners and the Tequesta; ballast stones, iron spikes, a silver and gold rosary cross, and Spanish olive jar sherds have been documented among Glades IIIc (1500-1700 AD) pottery fragments (Carr 1984; Biscayne National Park [BISC] 2012; Parsons et al. 2018).

Just offshore from the Keys runs the Gulf Stream. Formed by winds crossing the Gulf of Mexico, the stream carries warm waters through the Straits of Florida (a deep-water channel between the Florida Keys and Cuba) to western Europe. As the waters are funneled through the narrow straits, their speed increases rapidly, averaging 1.3 meters/second (4.8 knots/hour) (Banks et al. 2007:617). While the Gulf Stream would prove valuable for transportation during the colonial period, it likely prevented sustained prehistoric contact between South Florida and the Caribbean (Fitzpatrick 2013:119). Archaeologist Scott Fitzpatrick (2013:120) has argued that despite the proximity of South Florida to Cuba and the Bahamas, the velocity of the Gulf Stream and prevailing wind patterns would increase travel risk and likelihood of missing the target landfall. Computer simulations run by Callaghan (2011:60–61) confirm these findings, suggesting that environmental conditions prevented the establishment of trading networks between the Caribbean and Florida.

European Exploration and Early Wrecking

Juan Ponce de León sailed to Florida from the Bahamas in 1513, encountering a current which was "more powerful than the [great] wind" (Scisco 1913:725). He named the southern tip of Florida *Cabo de Corrientes* (Cape of Currents), "because the water ran so much there that it

had more force than the wind, and it did not permit the vessels to go forward, although they put out all sails" (Scisco 1913:725–726). Travelling south, the line of islands bordering this current were named *Los Martires* (the Martyrs), as "the rocks [appeared] like men that were suffering" (Scisco 1913:728). Inadvertently discovering the Gulf Stream and Florida Keys, Ponce de León's aptly named landmarks would be responsible for strandings, shipwrecks, rescues, and salvage cases over the next five centuries.

Following Ponce de León's expedition, other Spanish explorers continued to visit and document the Keys and their Tequesta inhabitants including Hernando de Escalante Fontaneda (ca. 1550s), Pedro Menédez de Aviles (1570s), and a group of shipwrecked missionaries in 1605 (Goggin 1950:17–18). The associated oral accounts provide a conflicted narrative of Tequesta and Spanish interactions. Menédez petitioned the Spanish Crown in 1573 to enslave the Tequesta as they were "a menace to the Spanish, particularly castaways" (Goggin 1950:17). The later account of the missionaries in 1605, however, suggests amiable relations as the Tequesta "furnished the stranded Spaniards with fresh water, fish, and wood, and aided in freeing the vessel" (Goggin 1950:18).

Regardless of the nature of interactions, ample evidence of late 16th century Native American wrecking practices is provided by Hernando de Escalante Fontaneda (1944:19). A shipwrecked sailor himself, Escalante Fontaneda witnessed "bars of silver and gold, and bags of reals, and much clothing" taken from wrecked Spanish vessels travelling from Mexico (Escalante Fontaneda 1944:19–20). He concludes that "the Indians of the Islands of Guaragunbe [the Tequesta name for the Keys] are rich… from the sea, not from the land" (Escalante Fontaneda 1944:21).

While good will and hostilities between Europeans and Keys inhabitants waxed and waned over the next two centuries, the frequency of wrecks did not. The Straits of Florida remained the primary means of connecting the Gulf of Mexico to northern ports (Dodd 1944:173; Garrison 1998:305). Garrison (1998:306) found that the hazardous Florida Keys, Marquesas, and Dry Tortugas claimed more ships than any other obstacle in the Gulf between the 16th and 20th centuries. The primary danger to mariners was the submerged reef system—sailors could aptly navigate shoals in clear weather; however, the addition of storms, strong wind, and abnormal currents created dangerous sailing conditions (Garrison 1998:307, 308).

In the early 17th century, the Spanish brought divers from the Caribbean, northern Florida, and Africa to salvage valuable cargoes lost off the Florida Keys (Dawson 2006; Viele 2001). Evidence of this early wrecking activity can be found in historic records (Viele 2001), however treasure hunting in the 20th century destroyed archaeological evidence from many of these sites, such as *Atocha* (Mathewson 1977:5).

Whereas the Spanish brought divers to the Straits to salvage wrecks, Bermudan settlers established local wrecking industries in the Bahamas (Viele 2001:15). Initially drawn to the Keys in hopes of expanding the Bahamian mahogany industry, these mariners discovered ample opportunities for turtling and wrecking, albeit no mahogany (Goggin 1950:21). After Spain ceded Florida to Great Britain following the end of the Seven Years' War in 1763, the Spanish government organized a forced emigration of Florida colonists (concentrated in St. Augustine) and Native American groups to Havana, Cuba (Viele 2001:15). Bahamian crews took advantage of this exodus, establishing a wrecking station at Tavernier Harbor in Key Largo (Goggin 1950:21). The station functioned through the 19th century, as demonstrated by Charles Vignoles (1823:118) who writes the wreckers:

> Station themselves a little south of the point, from whence they can with certainty wait for the sight of any ship, that is so unfortunate as to be driven ashore: hence *Key Tavernier* has become for the last fifty years the general rendezvous of the little fleet of small craft, which are annually fitted out for wrecking, …

Sentiments expressed by British Governors of East Florida during the 18th century emphasize the economic importance of the burgeoning Bahamian wrecking industry. Two successive Florida Governors outlawed Bahamian wrecking even though the wreckers were English citizens, stating that Bahamians were "descended from pirates" and any removal of cargo from wrecked vessels disrupted a valuable source of income (Viele 2001:15). In 1766, the colonial Governor commissioned a captain to patrol the Keys, enforcing the anti-Bahamian wrecking laws (Arnade 1955:51). While this patrol did not result in actions taken against Bahamian wreckers, these early accounts are indicative of an English movement to legitimize and control wrecking in the Keys.

By the 1790s, Florida was once again under Spanish control. Despite the changing government and northern population, the Keys remained unaffected. Viele (2001:17) estimates there were at least 37 Bahamian wrecking vessels operating in the Keys, including 23 sloops and 14 schooners. Vignoles (1823:125-126) praises the efficacy of these vessels and crews, stating "for many years, *wrecking* has been reduced to a perfect system." Saved cargoes were routed through Nassau to return to the stream of commerce while government tariffs and partial shares of the salvage boosted the local Bahamian economy (Vignoles 1823:125; Marvin 1858:18; Wright 1915:622). The steadily increasing profit margins associated with the Nassau wrecking

industry drew criticism as accusations of extortion and false lights circulated in seafaring communities. Vignoles (1823:126-127) attempted to dispel these myths, maintaining:

> It must be remarked that much of the abuse which has been thrown upon them is very undeserved, and that where in one instance they are accused of extortion, there are many more where they have been ill treated for their services. The idle tales which have been told of their making false lights on the coast, all who have resided in those parts, assure to be untruths.

While the suspicion of wrecker intentions noted by Vignoles would persist, the appearance of resources devoted to safely navigating the Keys helped to allay fears. In 1772, De Brahm published the first guide for sailors circumnavigating the Keys, *The Atlantic Pilot*, as an informational brochure containing maps, geographical coordinates, points of interest, and regional flora and fauna (Figure 2.1). More importantly, De Brahm (1772:13-25) also included sailing instructions documenting safe passage through the Keys.

Unfortunately for De Brahm, English cartographer Bernard Romans would ridicule the pilot in his own guide published three years later, stating that De Brahm's incorrectly recorded depths and poor instructions appear "as if calculated on purpose to destroy ship, goods and people" (Romans 1962:298). However malicious this review, Romans' critique likely held some truth. He continues, "happy is it for me that our present navigators know the navigation so well, and for the benefit of trade I hope his pamphlet will never serve as a guide to any man that is a novice" (Romans 1962:298). Such sentiments indicate locally held knowledge of the submerged landscape that De Brahm, as an outsider, would not have been able to access.

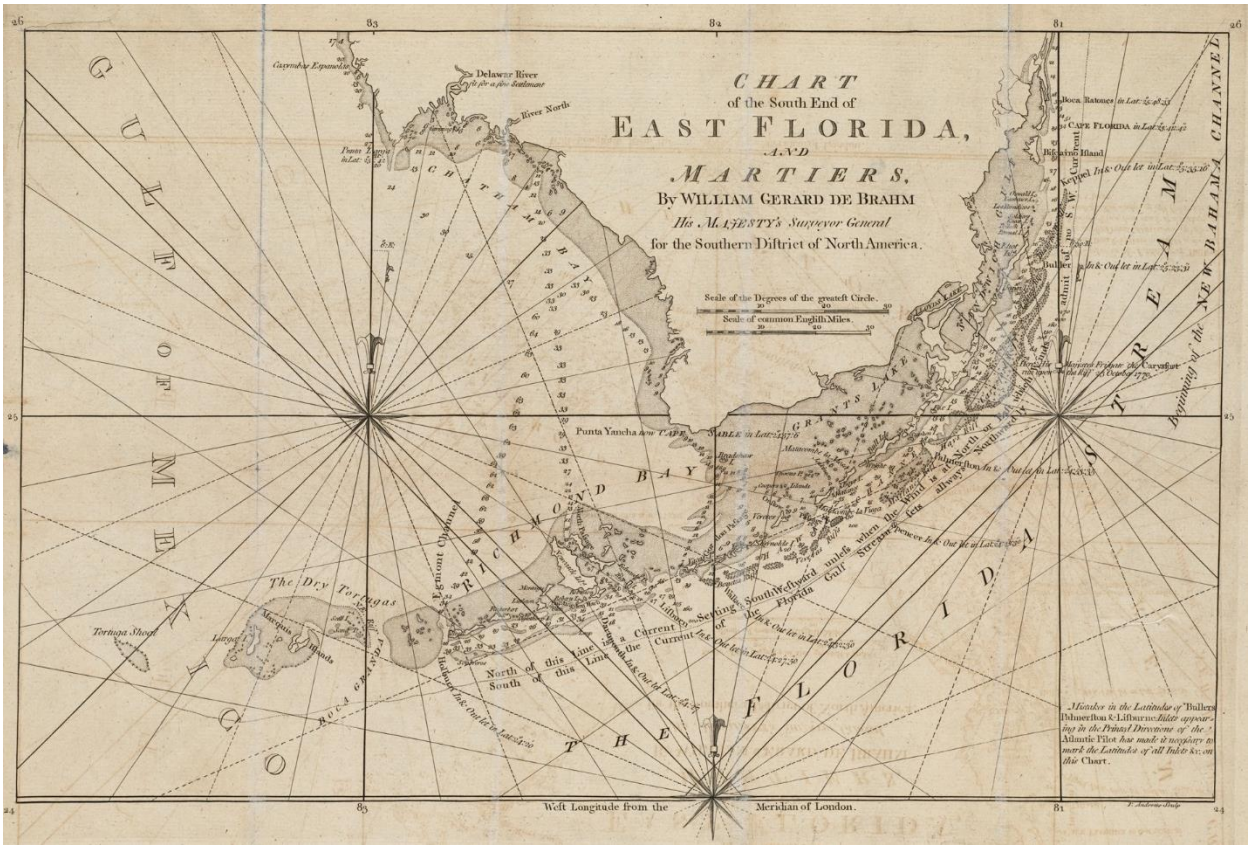

FIGURE 2.1. *Chart of the South End of East Florida and Martiers* from *The Atlantic Pilot*, by William Gerard De Brahm, 1772. (Image from Norman B. Leventhal Map Center at the Boston Public Library, Boston, MA).

Establishment of the American Wrecking Industry

In 1821, Florida became a territory of the United States. As Bahamian wreckers had proven wrecking a commercial success, Key West became an official port of entry in 1822 which drove harbor construction and shipping infrastructure (Marvin 1858:4). Within the next three years, Congress had "passed a law requiring all property salvaged from any wreck occurring on any keys or shoals on the coast of Florida to be brought to a port of entry within the jurisdiction of the United States" (Souza 1998: 26). This territorial wrecking act (signed 4 July 1823) had wide ranging implications throughout the Keys. While it encouraged the establishment of a second wrecking camp on Indian Key further north, it also prohibited Bahamian crews from

bringing goods to Nassau, effectively restricting the wrecking business to those living in the Keys (Dodd 1944:177, 180).

The Key West economy flourished as wreckers brought salvaged goods to the port for re-shipment. In 1828, a congressional act established a superior court in town to handle Admiralty cases, leading to the introduction of licenses and regulations for wrecking vessels (Dodd 1944:184–185). In just under a decade, legislation transformed the once informal wrecking community (which had operated under an internal code of ethics) into a tightly regulated business (Figure 2.2).

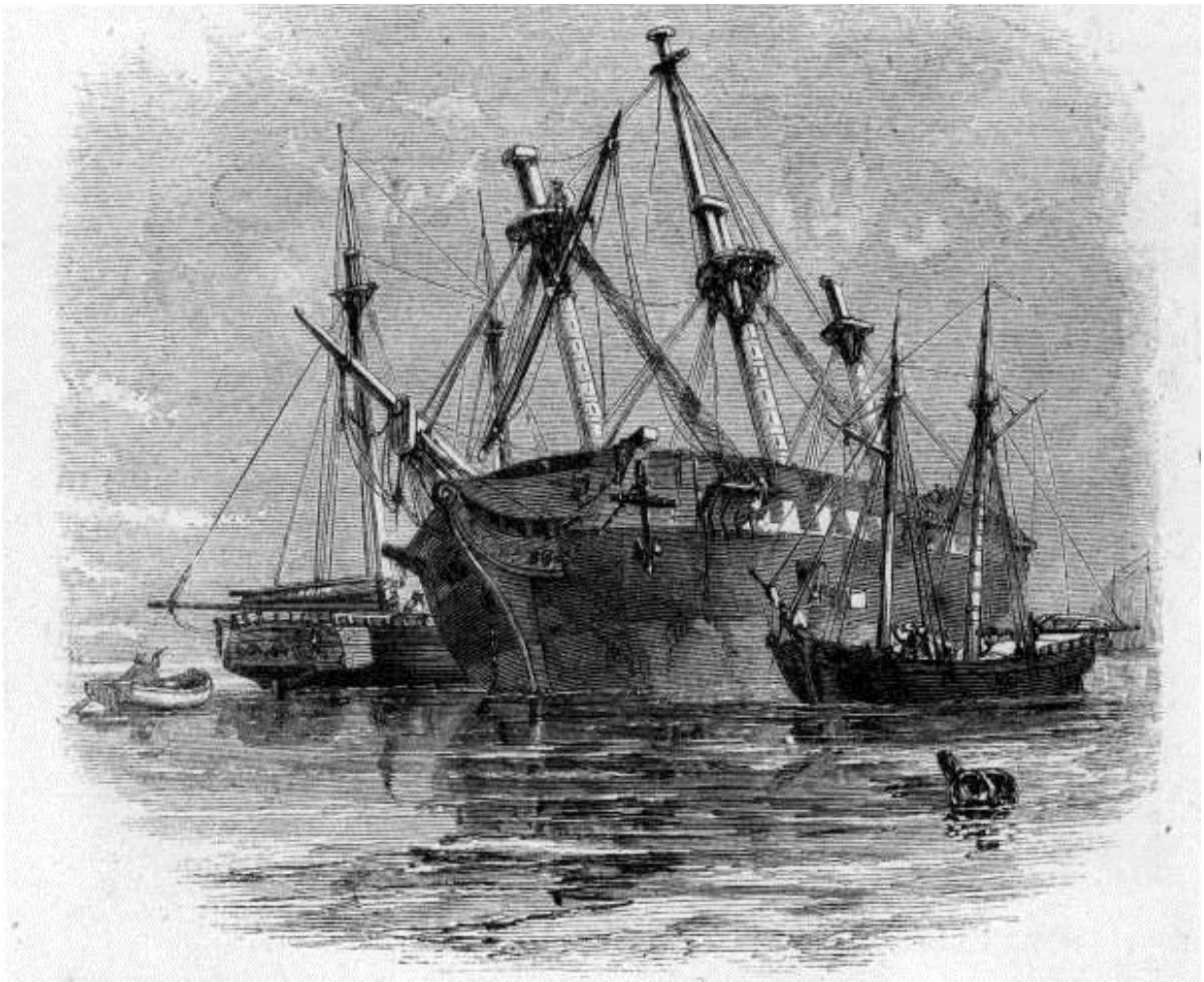

FIGURE 2.2. Wreckers at Work, seen during a voyage through the Florida Keys. *Harper's New Monthly Magazine* published the engraving in 1859. (Image from Florida Archives, number RC01939).

A visiting scholar wrote to his family in 1838, documenting the transition:

> The general opinion entertained of Key West is, that it is a sickly & very immoral place, the former abode of pirates & the present residence of wreckers who are little better. … At present for a small place in the south, it is more moral than any other of its size that I can recollect (Scott and Walker 1946:196).

Dodd (1944) considers Judge William Marvin, who served from 1835 to 1863, as one of the driving forces behind this transition. Aiming to legitimize wrecking and dispel any myths regarding wrecker intentions, Marvin (1858:5) would later write "embezzlement of wrecked goods; voluntarily running a vessel aground under the pretense of piloting her; colluding with the master of a vessel wrecked or in distress; or corrupting him by any unlawful present or promise" all resulted in withheld or revoked licenses.

Despite these assurances, dissent remained in the public sphere. An article published in *The Merchants' Magazine and Commercial Review* in April 1842 sought to reveal the "true" intentions of Key West wreckers. "Small wrecking vessels… anchor inside of the reef, *out of sight* from vessels at sea, because if they were seen by the unfortunate vessel who is making unconsciously too near an approach to the shore, they would apprise her of her danger," the anonymous Floridian (Anon 1842:349-350) wrote. They concluded:

> That the wrecker hails with delight the wreck of a vessel, is not to be wondered at. His gains are enormous; it is his business, and his interests are so much at stake that all the softer feelings of humanity soon die away in his bosom and he hails

> the stranding of the unfortunate vessel with delight. … If a vessel is discovered on shore, and two wreckers descry her at the same time, every stitch of canvass is set, in order to be the first to board her and relieve her; if it is calm, the small-boats are manned, and they pull as if for life. This looks charitable, but the charity begins at home (Anon 1842:350).

Fortunately, the economics and legislation behind the wrecking industry do not support this opinion. The courts never provided remuneration for saving lives, yet wreckers always prioritized shipwrecked passengers and crews (Dodd 1944:191). Even the anonymous Florida critic (1842:350) conceded wreckers would abandon the shipwreck to carry passengers to port, free of charge.

The salvage awards from the mid-19th century, too, indicate wrecking was not always lucrative. While twenty wreckers were operating out of Key West in 1835, total salvage awards were only $17,289, an average of $862 per wrecking vessel (Dodd 1944:186). Dodd (1944:186) further estimates annual wrecking vessel expenses were close to $2,700. Given the discrepancy between these two amounts, Dodd (1944:186) suggests that wrecking vessels required additional sources of income to offset cost of operations.

By 1858, the wrecking industry had experienced some growth in profit. Forty-seven vessels were licensed as wreckers in Key West (Marvin 1858:5). Over the course of the previous decade, these mariners had brought salvaged cargoes from 499 vessels to Key West, totaling $16,266,427. The court awarded wreckers a total sum of $1,153,909 (7% of salvaged cargo proceeds) in these years, averaging $2,455/year per wrecking vessel (Souza 1998:27).

Naturally, salvaged cargoes could turn a profit, albeit not by the wreckers themselves. Key West merchants who bid on the goods for reshipment stood to turn a large profit due to local shipping monopolies as the port's isolation, in conjunction with the loss of the Indian Key wrecking station during the Second Seminole War in 1840, assured all wrecking business operated out of Key West (Anon 1842:351; Dodd 1944:195-196). Unfortunately for wreckers and merchants alike, this monopoly would be short lived. A new threat to the wrecking industry loomed on the horizon.

Aids to Navigation, the Decline of Wrecking, and Federal Management

While wreckers provided a means of rescuing stranded mariners and returning goods to the stream of commerce, dangerous sailing conditions remained an ever-present threat. Shortly after the founding of Key West, U.S. Congress appropriated funds for the construction of lighthouses at Cape Florida and Key West. Contractors would place beacons and buoys at intermediate locations, while a lightship anchored off the Tavernier station marking Carysfort Reef (Dodd 1944:182). In an act of fate (or perhaps irony), the ship carrying lighthouse materials was lost at sea in August 1824, delaying construction until 1826 (Dodd 1944:182). The lightship destined for Carysfort, too, grounded on the Florida Reef, although wreckers rescued and refit the vessel, returning it to service (*Pensacola Gazette* 1825b:3). The same year, however, contractors successfully installed six lit beacons at Cape Florida, Key West, the Dry Tortugas, Bahia Honda, Sand Key, and Looe Key, respectively (*Pensacola Gazette* 1825a:2).

As early as 1826, Florida residents noted the efficacy of aids to navigation (ATONs). The *Pensacola Gazette* (1826:2) reported:

We are gratified to learn that the Light [*sic*] vessel on the Dry Tortugas has been

> of the most essential service in warning vessels of approaching danger. Four ships lately have been entirely indebted to the warnings of the bells of the light vessel. Employment for the wreckers diminishes daily, and some of them have left the wrecking ground.

This early allusion to ATONs ending wrecking would eventually ring true, however ongoing natural disasters and social upheaval would prevent the addition of further safety measures until the 1850s (Dodd 1944:197-198).

In 1836, warring factions destroyed the Cape Florida lighthouse during the Second Seminole War. Just over a decade later, a hurricane demolished the lights at Key West and Sands Key (Dodd 1944:197–198). While the public supported new lighthouse construction, nothing materialized. By the mid-19th century, however, the Straits of Florida continued to be considered one of the most dangerous passages along the American coastline (Anon 1842:349, Bache 1849). Vessels traveling through the Straits were required to carry the same insurance as those rounding Cape Horn, a notorious endeavor where hardened sailors learned "that what they had hitherto called storms, were inconsiderable gales compared with the violence of [the cape's] winds" (Dodd 1944:173; Chambers and Chambers 1854:107). These growing insurance payouts increased shipping costs, impacting merchants and insurance companies alike. In 1845, insurance underwriters, driven by increasing expenses and anger towards the wrecking monopoly, petitioned the U.S. Senate to erect lighthouses along the southwest coast of Florida (28th Congress 1845). They were successful—reconstruction of the Cape Florida light began in 1847 while the U.S. Coast Survey conducted an extensive survey of the Florida Reef in 1849. Using wrecking data, the survey implemented signal poles on reef crests with high wreck potential in

1849 (Bache 1849:46-47,90). Finally, completion of the Carysfort Reef Light in 1852 ushered in a new era of ATON development (Hunt 1850:116; Dodd 1944:198-199).

While engineers began construction of the Carysfort Light, congressmen approved "An Act Making Appropriations for Light House, Light Boats, Buoys, etc." (31st Congress 1850:717). By 1852, further funds were allocated to the U.S. Lighthouse Board, the administrative body created to oversee both construction and maintenance of ATONs (Noble 2014:ix). Over the next few years, the board implemented a new system of reef markers designed by James Totten and Alexander Bache at five reefs within the current BISC boundary—Fowey Rocks, Triumph Reef, Long Reef, Ajax Reef, and Pacific Reef (Figure 2.3). These markers each featured a cast-iron lettered vane close to six feet in height which corresponded to the U.S. Coastal Survey Chart of Florida waters (Bache 1855). Despite the added safety these markers provided, the only lit ATONs remained north and south of the park boundary at Cape Florida and Carysfort, respectively.

ATON construction and development continued unabated across the Florida Reef. The U.S. Lighthouse Board constructed four additional lighthouses throughout the Keys, the last being the Fowey Rocks lighthouse, lit on 15 June 1878 (Hairr 1999:63). The addition of these five lighthouses greatly contributed to the decline of Key West wreckers. When visiting Florida and Cuba on a fishing trip in 1874, British Colonel Frederick Townshend traveled with a former wrecker to popular sponging areas and reefs. Anchored near the Alligator Key lighthouse, constructed the previous year, Townshend (1875:230) recalls " "I wish them d[amne]d lights was sunk below the sea," growled our humane skipper, as he related to us tales of the many ships he had wrecked, and valuable cargoes he had obtained salvage on a few years ago." Bitter about

diminishing returns, later episodes document a shift in wrecking ideology towards illicit wrecking practices.

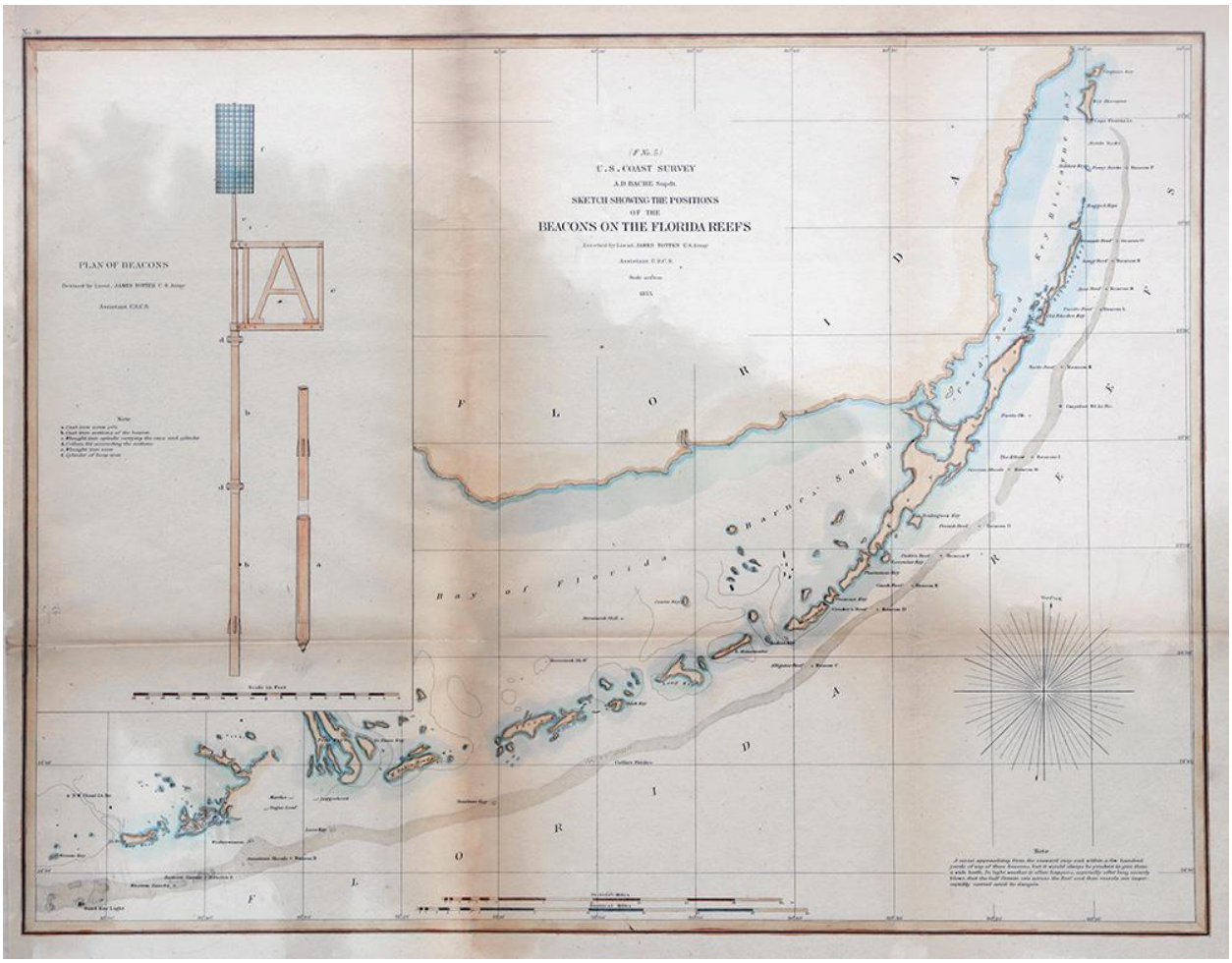

FIGURE 2.3. Sketch Showing the Positions of the Beacons on the Florida Reefs by A.D. Bache, 1855. (Image from NOAA, 2018).

Although the Key West Admiralty Court issued wrecking licenses until 1921, the 1905 salvage of *Alicia* (located in BISC) illustrates the shift in wrecker philosophy (Harding 1911). George Harding, a writer for *Harper's Magazine*, interviewed the Key West wreckers, who told of the Bahamian Black Fleet also arriving at the wreck, "just like a flock of vultures"(Harding 1911:279). Hand-to-hand fighting broke out on deck over salvage rights, resulting in a red-paint line drawn down the deck of *Alicia*, splitting the haul. The wrecker concluded that "not all the

cargo got to Key West, of course… It was very convenient having the Bahama [Fleet] around, after all" (Harding 1911:280). Harding (1911: 281) himself states that by 1911, "the wreckers of Key West, familiar with the reefs of the law and contemptuous of their dangers, often come close to wreck. There is a point where it is difficult to determine between salvage and loot."

Further episodes such as the salvage of *Lugano* in 1913—in which divers were blinded by caustic soda in the cargo and wreckers were short in the delivery of goods—brought a swift end to legal salvage (U.S. Court of Appeals 1914:964–965). The sponge and turtle fisheries, formed in Key West during the mid-19th century, continued to draw mariners from the failing wrecking industry (Shearer 2008:21). Other agricultural enterprises arose throughout the Keys, driven by the construction of the Overseas Railroad between 1905 and 1912 (Viele 1996:99). Viele (1996:100) summarizes the impact of the railroad for the Keys maritime industries, stating "…captains of Keys sailing craft cursed the railroads as the channels connecting the Gulf and Atlantic sides of the Keys were closed and access to sheltered storm anchorages between the Keys was blocked forever." The road soon followed the railroad, opening the Keys to the outside world and drawing the era of wrecking to a close (Viele 1996).

Residential Development and Recreational Use

In the 1920s, Florida underwent a land boom driven by speculation and property investment in the burgeoning cities of Miami, Sarasota, and Ft. Lauderdale (Turner 2015:3). The Keys were not exempt from development as private clubs, resorts, and fishing camps opened their doors to tourists (Turner 2006:20). Remote locations and big game fishing furthered the exclusivity of these locations and contributed to their ongoing popularity.

As the Second World War blossomed across the globe, Florida's mild climate and large population contributed to the ongoing war effort. Military facilities were installed across the state

as training could be held year-round, while agriculture and war industries such as shipbuilding and scrap salvage intensified (Wynne and Moorhead 2011). Following the war, many of the military personnel who trained in Florida returned "for the state's inviting climate and low cost of living" (Turner 2015:4). Another World War II remnant encouraged this second real estate boom in the Keys—the self-contained underwater breathing apparatus (scuba). Marketed to the public in 1948, scuba equipment was both simple to use and safety oriented—features which encouraged recreational use (Dimmock and Cummins 2013:16).

For the second time in a century, Florida residents returned to diving and salvage of shipwrecks. Dr. Eugene Shinn (2013:22-23), a Key West native, describes post-war salvage of wrecks during the mid-1950s, stating:

> With this rig—a converted World War II-vintage landing craft—we would salvage scrap iron from the many turn-of-the-century shipwrecks along the reef line… My job was diving down and placing dynamite charges in strategic places. Iron plating had to be broken into pieces light enough to be lifted aboard. … Today's reader would find it odd that no special permits were required to purchase, blast, and pull up scrap iron from old shipwrecks. Even if permits were required, no one asked.

The freedom of salvage and lure of undiscovered shipwrecks would draw treasure hunters, salvors, and divers to the Keys over the next half-century.

A Brief History of Pacific Reef and Pacific Reef Wreck

The first appearance of 'Pacific Reef' in print is the 1850 coastal survey report (Hunt 1850:116). During the survey, workers constructed a red and white signal pole on '*Pacific Reef*" to alert mariners to the reef crest (Hunt 1850:116). Bache and Totten reconfigured these poles to include unlit beacons in 1855; they assigned Pacific Reef beacon "L" (Figure 2.3) (Bache 1855). Prior to this ATON construction and reef individualization, wreckers refer to the area as an extension of Caesar's Creek, a popular anchorage located six miles inshore on the southern end of Elliott Key (Bache 1849:12; Viele 2001).

An inventory of recorded historic wrecks in the Florida Keys compiled by Halas (1988) indicates that at least 64 known historic wrecks and groundings occurred within the current boundary of BISC between 1733 and 1966. Further research conducted by BISC staff suggest this number is closer to 85 wreckings and groundings (C. Lawson 2016, pers. comm.). Of these, 25 vessels grounded on the Pacific Reef or near Caesar's Creek between 1835 and 1900. A further 14 were total losses (Table 2.1). Comparison of these vessel losses is indicative of 19th century maritime trade in Florida waters; the cargoes were primarily agricultural and industrial goods destined for northeast/British markets and the Gulf, respectively (Table 2.1).

Pacific Reef Wreck's location on the reef crest suggests a catastrophic loss, a trait shared by all vessels documented in Table 2.1. Given the site's shallow depth, it is likely the vessel experienced historic salvage by wreckers operating in the early 19th century. This thesis characterizes wreckers both by their practices and the legal framework which structured their operations. As such, some of the most detailed historic accounts come not from the wreckers themselves, but the Key West court which oversaw their actions. The archaeological record, too, bears evidence of their work—shipwreck sites in the Keys still contain discarded wrecking tools

and machinery deemed worthless during salvage operations (McClarnon et al. 2007:12; C. Lawson 2016, pers. comm.). More frequently, however, it is the absence of specific objects including rigging, deck machinery, and anchors that suggest historic salvage (Key West Admiralty Wrecking Reports [KWADM] 1838, 1851, 1856; Souza 1998; McClarnon et al. 2007; Shefi et al. 2009). The absence of these materials on Pacific Reef Wreck is further evidence that historic salvage did occur. While this salvage would have resulted in economic gain for the wreckers, it also may have been catastrophic for the owners and those on board.

Meylach and Whited (1971: 288) introduce the wreck through its tragedy when discussing their interaction with the site, "one sees the great ship thundering across the rock as wind-driven wave tops explode over the careening rail, and imagines voices shouting unheard in the fury." Disregarding this romanticized shipwreck account, Meylach and Whited's description does bear an element of truth—Pacific Reef Wreck represents extreme economic loss and misfortune for those aboard. Fortunately, as the Keys continued to develop through the 19th century, Pacific Reef experienced intensified survey which resulted in more accurate maps and soundings (Figure 2.4). While the efficacy of these materials is not well documented, there is a noted decline in shipwrecks by the late 1870s within park waters (Halas 1988).

A third wave of reef ATON development swept the Keys in the 1910s and 1920s. At Pacific Reef, the U.S. Coast Guard constructed an automated 45 ft. light tower in 1921 on the reef crest to replace the Totten marker (U.S. Bureau of Light-Houses 1922:43). While they removed the tower in the 1990s due to deterioration, the foundations remain as an archaeological site (BISC-151) documenting human use and interaction with the reefscape.

TABLE 2.1. Vessels Lost on Pacific Reef, Ajax Reef, and Caesar's Creek (1835-1900)

Wreck Date	Vessel Name	Wreck Location	Wrecked?	Vessel Type	Vessel Function	Last Port of Call	Destination	List of Cargo	Salvaged?
11/14/1836	*Ajax*	Ajax Reef/Carysfort	Stranded	Ship	Cargo	New York	Mobile, AL	Assorted	Yes
9/7/1838	*Caroline*	Caesar's Creek Reef	Lost	Schooner	Wrecking	Key West	Florida Keys	N/A	Unknown
9/7/1838	*Export*	Caesar's Creek Reef	Lost	Brig	Cargo	Matanzas, Cuba	Boston, MA	Sugar, Coffee	Yes
9/7/1838	*Triumph*	Caesar's Creek (off)	Lost	Ship	Cargo	Boston	New Orleans	Locomotive, iron, machinery, domestic goods	Unknown
11/28/1851	*Merchant*	Pacific Reef	Lost	Schooner	Cargo	Charleston	Key West	Mail, Rice, Specie, Survey Equipment	Yes
1/3/1856	*Siddons*	Pacific Reef	Lost	Ship	Cargo	London	New Orleans	Ballast	Yes
1/22/1857	*Crown*	Ajax Reef	Lost	Ship	Cargo	New Orleans, LA	Liverpool	Cotton, corn, wheat	Yes
2/8/1858	*Riversmith*	Pacific Reef	Lost	Ship	Cargo	Liverpool	New Orleans	Salt	Yes
8/15/1861	*Sir Walter Raleigh*	Pacific Reef	Lost	Bark	Unknown	Jamaica	Liverpool	Rum, pimentos	Yes
2/6/1862	Unidentified	Pacific Reef	Stranded	Steamer	Unknown	Unknown	Unknown	Unknown	Unknown
1/8/1863	*Sparkling Sea*	Ajax Reef	Other	Ship	Military	Fort Monroe	Unknown	Troops, supplies, 106 horses	Yes
10/26/1867	*Let Her Be*	Caesar's Creek	Other	Brig	Unknown	St. Johns	Havana	Nails	Yes
1/1/1871	DERELICT	Caesar's Creek	N/A	N/A		Unknown	Unknown	77 bars of iron	N/A
11/30/1873	*Cornwall*	Ajax Reef	Stranded	Bark	Cargo	Belize	London	Timber and Coconuts	Yes

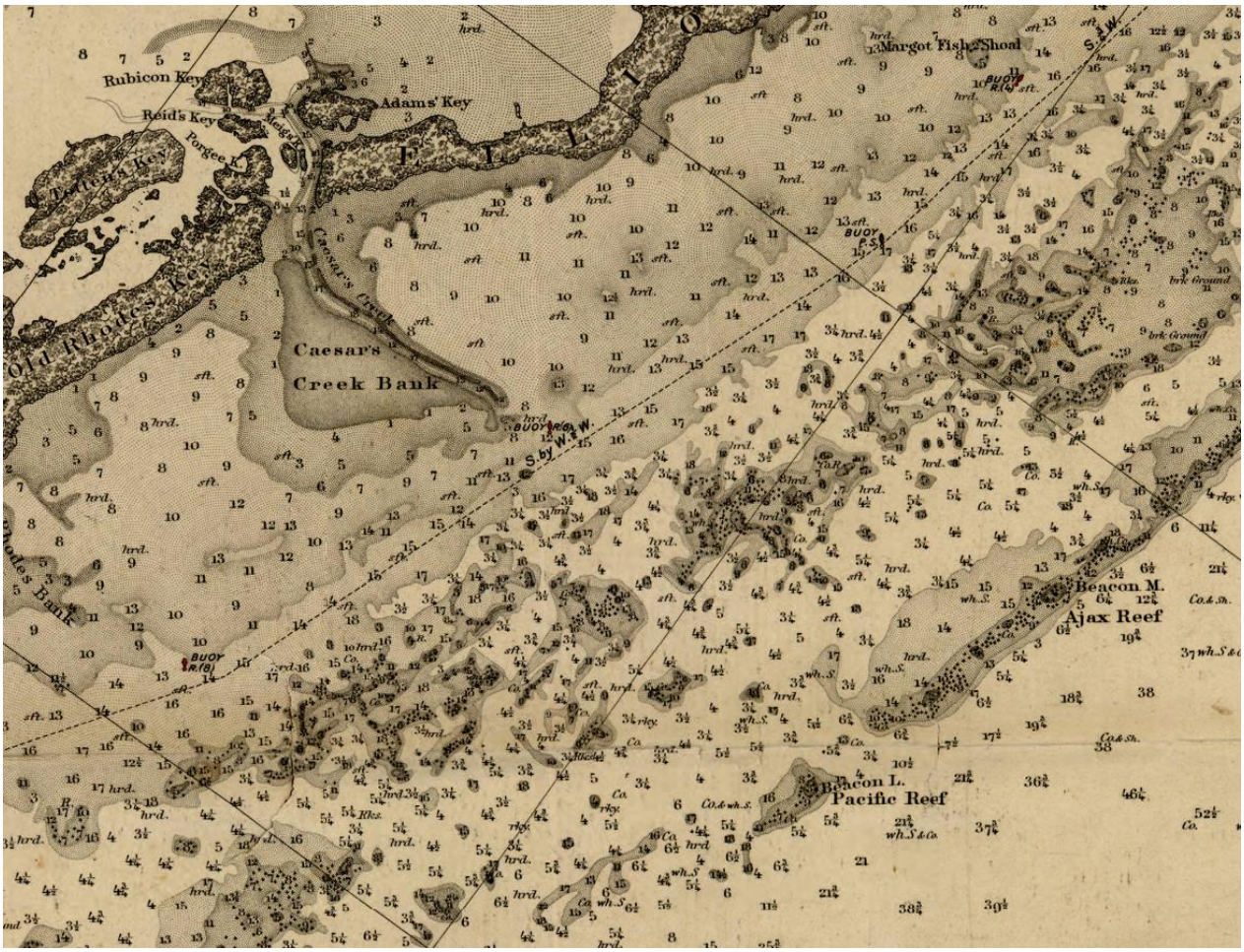

FIGURE 2.4. Detail from *Coast Chart No. 66*, published 1878 by the U.S. Coast Survey. (Image from American Geographical Society Library Digital Map Collection at University of Wisconsin, Milwaukee, WI).

Conclusions

The Florida Keys have a long-standing history of diving and vessel salvage. Since the historic period, Keys settlers maintained maritime practices despite social and political upheavals. As Florida transitioned from colony to state, inhabitants of the Keys remained actively involved with commerce in Florida waters and profited from increased vessel activity. Development of ATONs in state waters led to the decline of wrecking and forced adoption of other maritime industries. The wrecking ideology remained, however, and continued with a new generation of treasure hunters and salvors following WWII.

Chapter 3. Management History

While the past chapter served to identify historic groups and potential interactions with the vessel, this chapter identifies modern groups within Pacific Reef Wreck's network including resource managers, stakeholders, and treasure hunters. This section places emphasis on the interaction of these groups—especially points of contention which have resulted in both actions and objects. Furthermore, investigation of how managers conducted past research illustrates the dissolution of past connections and a strengthening of the network which persists today.

Previous Site Work

Marty Meylach, a local treasure hunter with extensive knowledge of sites located within then Biscayne National Monument, first reported Pacific Reef Wreck to park staff in the early 1970s. Colloquially named 'Pacific Reef Wreck' due to the site's proximity to Pacific Reef, Meylach (Meylach and Whited 1971:288) states "the wreck has been discovered repeatedly by newcomers who treat their find with massive secrecy." Meylach further reported that the site consisted of copper sheathing, bronze fasteners, and ballast which led him to believe the vessel was a schooner (Meylach and Whited 1971: 288). Furthermore, it is evident that the local treasure hunting community knew and interacted with the site as Meylach (Meylach and Whited 1971:288) concludes "in one case, a newly formed treasure group seeking my help in constructing airlift machinery found their hammer and crowbar, which had been left on the wreck, leaning against my home barbecue pit."

Given the preservation of its wooden hull remains and the notoriety of the site among local treasure hunters, NPS Archeologist George Fischer determined Pacific Reef Wreck was of historic cultural significance and assigned the title BISC-UW-29 to the site during his preliminary investigation of cultural resources in 1975 (Wild et al. 1985:22). Following the

transition from monument to park in 1980 (coinciding with the physical expansion of the park boundary), archaeologists from SEAC visited BISC in 1984 to assess submerged cultural resources. Deemed one of ten "significant" submerged sites assessed by SEAC, the archaeologists conducted an in-depth evaluation of the wreck. Initial results from the survey indicated that the site had undergone extensive salvage, as evidenced by the removal of ballast from the main vessel structure. As the area was (and remains) a popular sport diving spot, SEAC determined that the site "mandated extensive documentation" (Wild et al. 1985:11).

Over the course of two days, Wild et al. (1985:22) conducted photo-documentation and a systematic surface collection, delineated the site based on surface remains, placed a permanent datum based on intra-site magnetometer survey, and created a scaled site plan. The resulting report includes a site photograph and the preliminary site map (Figure 3.1), however records associated with the project (BISC Accession (Acc) 675) indicate that researchers did not recover any materials during the systematic surface collection (Wild et al. 1985:22). A note included in Wild et al.'s (1985:22) report states that two carronades dated to 1811 were recovered from Pacific Reef Wreck by Craig Hamilton and Eugene Shinn in 1957; however, personal correspondence with Shinn (as well as a similar description by Meylach and Whited) suggests that the original location of these carronades was farther south in the park[2] (Eugene Shinn 2016, pers. comm.).

Following the initial survey of Pacific Reef Wreck, Wild et al. (1985:22) determined that the site was of "considerable scientific importance" as the vessel represented "one of the few remaining examples" of composite ship construction. Due to these suggestions, resource managers visited the remains every few years with other NPS personnel, including staff from the

[2] Shinn suggests they found these carronade guns on an "English wreck" near Pacific Reef. Meylach (1971) records the same site but places it closer to the southern park boundary. The site in question may be BISC-32, an anomaly identified during the 1984 SEAC survey.

Submerged Cultural Resources Unit (SCRU), today known as the Submerged Resources Center (SRC) (Helmers et al. 1988; Conlin and Seymour 2005).

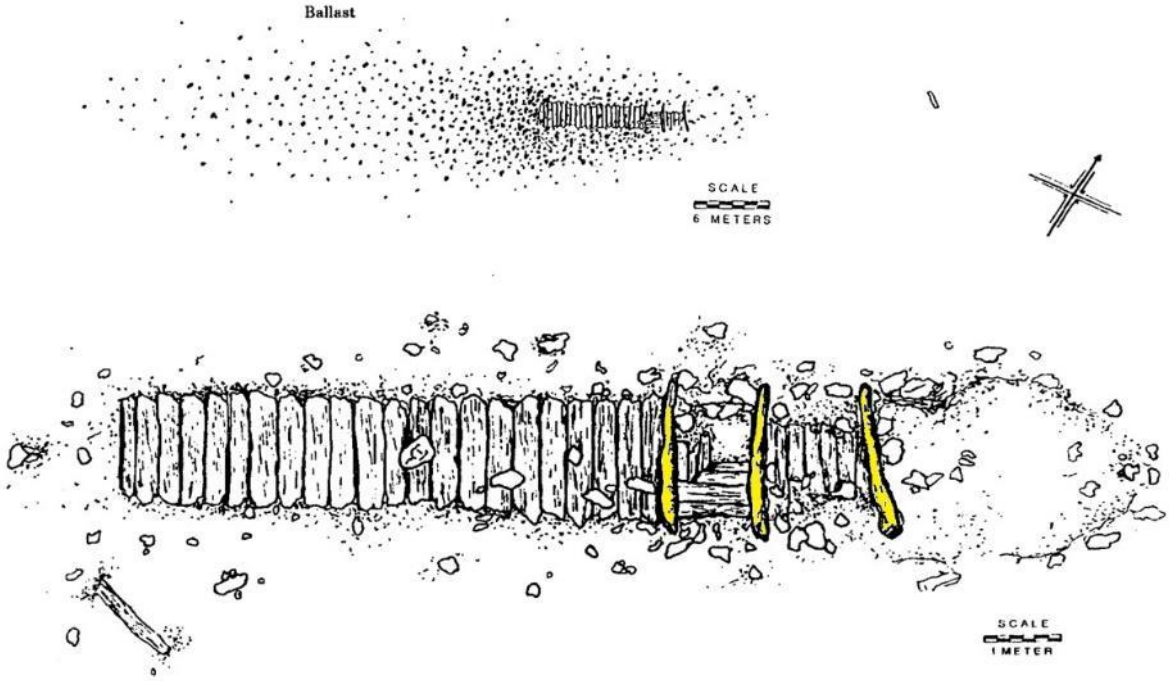

FIGURE 3.1. Map of Pacific Reef Wreck, iron frames are highlighted in yellow. (Image from Wild et al. 1985:23).

Notes from the earliest condition assessment indicate that the site remained largely exposed through the 1980s and at risk from anchoring and recreational dive traffic (Helmers et al. 1988). Staff attempted no mitigation, however, as they believed that the high traffic of the area combined with the history of modern salvage negated any research potential. The report instead suggested that mooring buoys should be installed on site (Helmers et al. 1988).

In August 1992, Hurricane Andrew, a category five storm, struck the park causing substantial damage to cultural resources and the surrounding community (Davis et al. 1992). Pacific Reef Wreck was one of the first sites reassessed by SCRU and SEAC following the storm as it was "located near the storm's centerline track and represents an exposed, shallow site" (Davis et al. 1992:41). Notes from the assessment state that a total of 14 frames were visible,

approximately half of the frames recorded by Wild et al. (1985:22). Four hull planks were visible underneath the ship's structure, which *Teredo navalis* (ships' worms) had severely deteriorated, however there was no damage from bacterial or algal growth (Davis et al. 1992:41). They concluded that the structure had minimal damage from the storm and suggested no short-term recommendations.

Following the post-Hurricane Andrew condition assessment, information contained within subsequent monitoring reports is sparse. In 2003, Archeological Site Management Information System (ASMIS) records evidence of propwash on site, however no written report of this disturbance exists (Charles Lawson 2015, pers. comm.). There is no record of a follow-up to this incident, and staff maintained no paper record of this information. Furthermore, this damage is not mentioned in the 2005 post-hurricane condition assessment, likely due to natural infill (Conlin and Seymour 2005). In the same year, the avocational group Diving With a Purpose (DWP) visited Pacific Reef Wreck to conduct annual dive training. Again, notes taken during the project work give no indication of site change, features, or deterioration (Lazendorf et al. 2005).

In 2010, Charles Lawson became the cultural resource manager at BISC. Lawson re-evaluated all submerged archaeological sites during the 2010 fiscal year. The large quantity of cupreous portable artifacts seen during the survey suggested that BISC-029 was a potential looting target, and Lawson placed the wreck on a yearly assessment cycle (Lawson and Bayliss 2010). Between 2010 and 2015, condition assessments indicate that more of the site was exposed, suggesting overburden had been gradually removed from the site since 1992 (Lawson and Bayliss 2010; Roth and Marano 2015). Further examination of photographic material from the site during the 1980s and 2000s found that the wreck had experienced a dramatic loss of

remaining structure which was not recorded in any of the condition assessments following SEAC's initial site evaluation (Figure 3.2) (Wild et al. 1985; Helmers et al. 1988; Roth and Marano 2015). These findings, coupled with annual assessments reporting the site had not suffered any further deterioration despite a noted loss of overburden, suggested the site remained unstable (Lawson and Bayliss 2010; Roth and Marano 2015).

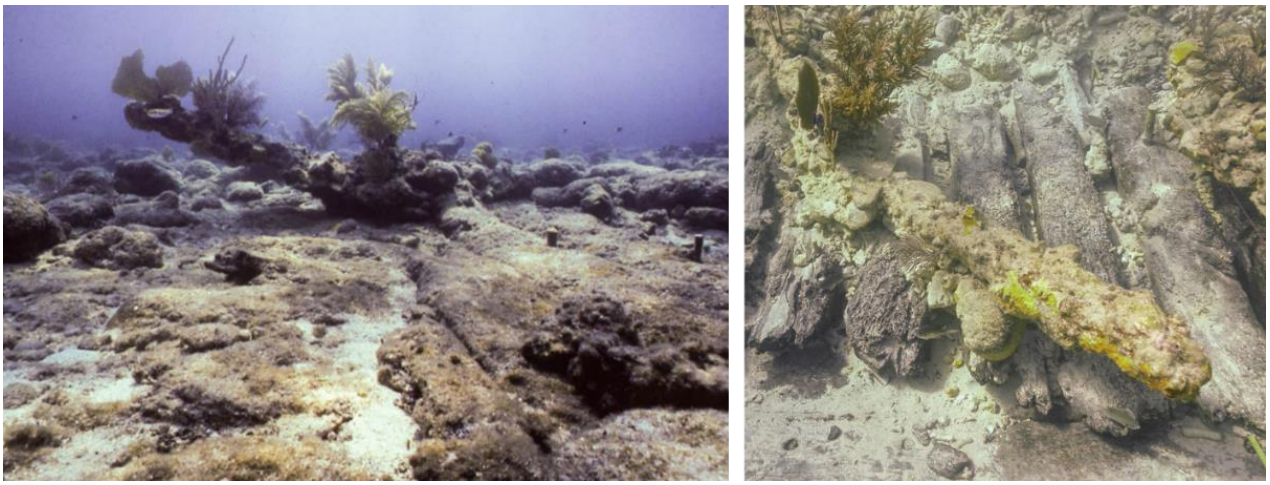

FIGURE 3.2. Image on left shows ceiling planking in-situ as of 1988. Image on right is the same area with the iron frame out of place and ceiling planking missing. Image taken during 2015 field work. (Images courtesy of BISC, 1988 and 2015).

Current Management Strategy

The current aim of cultural resource management within the NPS, as determined by the 1916 Organic Act, is to "conserve…historic objects and… to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations" (NPS 2016). To meet the goal of preserving cultural resources unimpaired, the U.S. Department of the Interior (DOI) published *Management Policies* in 2006 to address three key principles in cultural resource preservation—research, planning, and stewardship (DOI 2006:60). Regarding submerged cultural resources, the DOI (2006:69) treats historic shipwrecks and submerged sites "in the same manner as terrestrial archeological resources. Protection

activities involve inventory, evaluation, monitoring, interpretation, and establishing partnerships."

Of importance to Pacific Reef Wreck are the DOI policies concerning inventory, evaluation, and monitoring which in turn influence stewardship and management strategies. DOI planning policy (2006:63) states:

> Effective planning is based on an understanding of what a park's cultural resources are and why those resources are significant. To gain this understanding, the Service must obtain baseline data on the nature and types of cultural resources, and their (1) disturbance; (2) condition; (3) significance[3]; and (4) local, regional, and national contexts.

As of 2015, the baseline data collected from Pacific Reef Wreck to meet these four criteria was only partially complete. While initial documentation conducted by Wild et al. (1985:22) did address disturbance and condition of the site (criteria 1 and 2), the authors did not establish the two other standards for determining significance— (3) National Register eligibility and (4) cultural context (DOI 2006:62). Whereas park staff have monitored disturbance and site condition continually through semi-annual and annual conditions assessments, no manager has determined overall significance of the site. Furthermore, when BISC resource management discovered the undocumented structural deterioration of the site between 1988 and 2015 mentioned above, it became apparent that the data collected with annual site visitation and rapid visual survey were not accurately addressing changes in baseline disturbance and site condition.

[3] NPS uses National Register eligibility to determine site significance (DOI 2006:62).

In late 2015, BISC resource management determined that, due to incomplete baseline data, they should revisit and re-evaluate the site. DOI management policies of archaeological resources promote stewardship of sites through in-situ conservation and proactive preservation treatments (DOI 2006:68). Due to the presence of cupreous artifacts (potential looting targets) and the ongoing deterioration of vessel structure, the site was further eligible for "proactive measures that protect resources from vandalism and looting" as well as stabilization "using the least intrusive and destructive methods" (DOI 2006:68).

Regarding public interaction with submerged shipwreck sites, BISC Cultural Resource Management (CRM) has classified wrecks as closed to the public, open and unadvertised, or open and advertised. HMS *Fowey* is the only site in the park that is closed to the public—public interaction with all other submerged resources is possible yet not always encouraged due to site stability and presence of portable artifacts (DOI 2006:69, 99). Fortunately, there are sites within the park boundary that are relatively stable and can support visitor use. In 2014, BISC CRM selected six of these sites for the creation of a maritime heritage trail (MHT) following suggestions made by the Florida state archaeologist in the 1970s (Wilson 2015:162). The vessels represent a diverse array of submerged archaeological resources within the park (Wilson 2015:164; BISC 2016), and their geographic coordinates and histories are publicly accessible online and in the BISC visitor's center. While this outreach strategy is comparable to that proposed for Pacific Reef Wreck in 1988, Pacific Reef Wreck's history of looting and illicit salvage has restricted visitor access regarding distribution of site coordinates to preserve remaining cultural heritage and prevent unacceptable risk (DOI 2006:69, 99). As such, Pacific Reef Wreck remains open to the public, however the site, history, and coordinates are unadvertised.

Park Resource Management Staff and Stakeholders

The DOI mandates that cultural resource professionals should evaluate cultural resources and make them available for public understanding (DOI 2006:60, 62). These professionals, defined by those who have a graduate degree in archaeology/anthropology and at least one year's experience working in archaeological research, administration, and management (DOI 2018), are stakeholders interested in the protection and scientific study of submerged resources. Although there were no designated professional archaeologists employed at BISC prior to the mid-1990s, past park superintendents and staff have demonstrated an active interest in studying and understanding submerged cultural resources, although not always through recognized scientific means (Skowronek and Fischer 2009:169). With the hiring of an archaeologist in the 1990s, the use of submerged cultural resources in the park for the study of past peoples has become a key component of BISC CRM.

While Pacific Reef Wreck falls under NPS jurisdiction and is subject to DOI policies, it is a resource first and foremost protected for the enjoyment of this and future generations (NPS 2016). As such, taxpayers and local community members are the primary stakeholders in the preservation and interpretation of the site, which BISC is meant to facilitate (DOI 2006:98). Recent statistics suggest that BISC is visited by approximately 500,000 people annually, 90% of which visit by boat (NPS 2017). In 2003, an ethnographic assessment of BISC was conducted to identify park user groups and activities (EDAW 2003:1–1). The findings of the study suggested that fishing and recreational boating (including diving, swimming, and snorkeling) were the primary visitor uses of the park. An estimated 50,000 boats visited the park annually, over 90% of which originated in Miami-Dade County (EDAW 2003:4-10). These visitors were ethnically diverse and representative of Miami and South Florida's multicultural heritage. Similarly,

another group of stakeholders (10% of park users) were tourists from a wide variety of backgrounds. Although tourism was not identified as the park's primary use, park resources do cater to South Florida tourism culture which is historically linked to the establishment of the Overseas Railroad (EDAW 2003: 3-1).

The diving subset of visitors did not represent the same ethnic diversity as boating populations. The survey identified 80% of divers to be local, white, middle-class men (EDAW 2003:5-28). Researchers also documented a correlation between diving practices and "old family," a "self-explanatory descriptor of residents with a family history of multiple generations in the Miami area" (EDAW 2003:5-32). Many of the Miami old family are descendants of long-term residents who owned property in the uppermost Keys prior to the establishment of BISC. These individuals maintain an active interest in utilizing park resources and identified diving as a generational/familial activity. Furthermore, some old family have expressed frustration that BISC is not cultivating "a sense of ownership" of the park's cultural resources (EDAW 2003: 5-33). This personal attachment to cultural resources, and especially shipwrecks, has been documented elsewhere in the park; a concrete marker with the words "TQ's Wreck" (spelled in historic glass bottle shards) was discovered on one of shipwreck sites and was likely placed to denote ownership (Marano 2015:109). Historic artifacts from vessels, too, have returned to the park from donors again demonstrating community interaction with historic resources.

Treasure Hunting in BISC

The most contentious aspect of Pacific Reef Wreck's heritage is the site's association with the local treasure hunting community[4], a relationship which began during the 1960s if not earlier (Meylach and Whited 1971:288). There have been a plethora of publications (Paull 1994;

[4] Treasure hunting is hereby defined following Price (2015:265) and Hall (2007) as the organized exploration and removal of artifacts for profit. It should also be noted that although Meylach (1971:288) identifies other treasure hunters on site, he himself was a licensed salvor.

Throckmorton 1998; Cockrell 1998; Hall 2007; Price 2015) addressing the impact treasure hunters have on submerged cultural resources—all of which conclude that treasure hunting is inherently destructive. While the same can be said of archaeology, there is a distinction made between treasure hunting and archaeology by these authors. Hall (2007:4) argues that archaeology differs from treasure hunting through its use of professionally trained staff who adhere to scientific principles and data collection techniques. These professionals also aim to make data and collections publicly accessible (Hall 2007:4). Throckmorton (1998:79) agrees, further stating "Florida treasure hunting sprang from a booming get-rich-quick society that has little historical past… Today's salvors are no more aware of the cultural material they destroy that the peasant farmers who rob tombs."

Such statements are frequent within literature surrounding the treasure hunting debate—authors present them to invalidate treasure hunting interests by setting the archaeologist in moral opposition to these communities. Certainly, there is ample evidence demonstrating quantifiable data loss associated with the Florida treasure salvor industry of the 1960s and 1970s (Price 2013:163), however the assumption that treasure hunters are uninterested in local history or that they have no scholarly understanding of submerged cultural sites is not evident in the history of Pacific Reef Wreck. Meylach's (1971:288) description of Pacific Reef Wreck, a schooner which was "copper sheathed, bronze spike-fastened and ballasted with pebble, quarry and egg rock," indicates he was at least somewhat familiar with ship classification and construction. His memoir (Meylach and Whited 1971) further suggests an interest in understanding and interacting with submerged cultural heritage, as well as documenting their stories, a trait which Hall (2007:4) identifies as a key component of "doing archaeology." This of course, is not meant to legitimize Meylach's actions or condone the destruction of historic resources for personal gain and

enjoyment, but rather identify that treasure hunters did have valid interests in interacting with submerged cultural resources, albeit through illegitimate means. The history of their work on submerged resources within BISC is a crucial component of understanding site significance and the communities to which these resources are important.

Critiques: In-situ Preservation and the Current Management Strategy

One of the strongest critiques against archaeologists by treasure hunters is that they "seek to prohibit public access to underwater cultural heritage" (Hall 2007:5). Hall (2007:5) counters this by stating agencies, including the NPS, have encouraged access to underwater cultural resources through research, education, and other uses while preserving sites through protection. Unfortunately, in the case of Pacific Reef Wreck, BISC has fallen short of this goal by protecting a resource without interpreting it for stakeholders, or even fully understanding its significance[5]. Furthermore, the current NPS management strategy of in-situ preservation does not guarantee protection indefinitely. "From the moment a site is uncovered it is degrading, often rapidly, and it requires active, sustained, physical intervention [to] be preserved in situ. Yet actual preservation remains unlikely, and intervention can only hope to change the rate of decay" (Ransley 2007:223). Archaeologist Martijn Manders agrees, stating the purpose of in-situ preservation is the creation of an accessible underwater archive which can be used for future enjoyment and research, managed "until excavation becomes necessary" (Manders 2008:32). Manders (2008:33-34) concludes that in-situ preservation is a means of maintaining stability while resource managers balance problems of cost, funding, site significance, and threats. Thus, in-situ preservation itself is not meant to maintain resources in perpetuity for future generations, but to delay destruction long enough for resource managers to decide which sites are of

[5] BISC-029 is not alone in this regard—the majority of submerged shipwrecks in BISC have yet to be interpreted or understood. Prior to 2010, BISC CRM avoided excavation as it was deemed too destructive. This belief stemmed from prior archaeological training, not NPS policy (C. Lawson 2018, pers. comm.).

importance and deserve archaeological attention (Manders 2008:34). While this in turn raises questions of what is deemed significant and by who, it is evident that in-situ preservation is only a temporary measure with (at present) no better alternative.

Taken together, these arguments against the current management strategy are not meant to validate treasure hunter beliefs and actions, but instead suggest the need to re-evaluate the success of preservation efforts and future scientific endeavors against the inevitable reality that submerged resources can, and will, break down. Jesse Ransley (2007:226) summarizes the core of this argument by asking:

> Are those ship hulls in themselves the heritage we are trying to preserve for future generations? In the end, and most fundamentally, we need to determine whether we are interested solely in those physical remains or whether it is the information they yield, and the potential for new interpretation and further insights into past communities and past lives, that is of importance.

Regarding threatened sites managed by NPS, proactive protection and stabilization cannot involve in-situ preservation alone, as in-situ preservation will not preserve resources un-impaired. There is a need to understand these sites, to slow their degradation for the enjoyment and education of others, and to re-evaluate how to maintain their significance and archaeological data in perpetuity.

Similar Archaeological Work and Management Strategies

Submerged historic archaeology has a long history the Florida Keys. Early-European vessels of Atlantic exploration have been frequent choices for archaeological work conducted in

South Florida (both within and outside the park), although recent BISC fieldwork has emphasized later periods of development and technology (BISC 2016). Within the past decade, there too has been a renewed interest in documenting and stabilizing previously disturbed sites within the park.

In 2012, BISC CRM staff excavated Soldier Key Wreck (8Da416, BISC-022), a mid-18th century vessel which had been previously disturbed by treasure hunters and a professor at the University of Miami in the 1980s (Wilson 2015:3). The previous excavations had removed a heavy layer of once-protective ballast stones from above the wreck and deposited them adjacent, leaving the wooden structure exposed to the elements. The aim of the BISC CRM fieldwork was to remove sand overburden from the shipwreck remains to document the vessel structure. Following excavation and documentation, project personnel reburied the site with the previously removed ballast and sand to restore the anaerobic environment necessary for the current accepted in-situ preservation methodology (Gregory et al. 2012:145; Wilson 2015:4,146). To date, the reburial has been very successful as the site remains undisturbed and has been recolonized by aquatic vegetation which has begun to anchor substrate on site (Marano et al. 2017b). Furthermore, the excavation and documentation of vessel structure and associated artifacts provided ample data for vessel nationality, purpose, and age which have led to new insights regarding park water usage during the 18th century (Wilson 2015:160).

The success of the Soldier Key Wreck reburial (as evidenced by vegetation growth and no decrease in overburden) suggested to park managers that re-establishing a protective covering of overburden was an appropriate means of stabilizing archaeological sites and slowing their degradation in the interim (Gregory et al. 2012:S145). Coupled with excavation, documentation, and analysis, the 2012 fieldwork further helped BISC CRM meet site interpretation mandates by

establishing site context and significance. Due to these factors, staff again decided in 2014 to conduct a similar documentation project on HMS *Fowey*, a 5th rate British vessel sunk in 1748 and uncovered several times by looting and intense weather events (Skowronek et al. 1987; Marano 2015).

The 2014 fieldwork on HMS *Fowey* included extensive documentation of exposed vessel structure and reburial using 13,580 biodegradable bags filled with sand (Marano 2015:97). As pig iron formed the original ballast, past reburial efforts have been ineffective in creating a protective sediment layer, as no structure on site serves as a sediment trap (Wilson 2015:150). Even with the addition of the bags to facilitate sand retention, the 2014 project was only moderately successful as limited vegetation recolonization and increased storm activity in 2017 have again uncovered portions of the site (Joshua Marano 2018, pers. comm.).

While the stabilization of HMS *Fowey* did not produce the same success as stabilization of the Soldier Key Wreck, controlled excavation of both sites offered a much broader understanding of the functions and construction of these vessels, as well as larger maritime usage themes in park waters. As a result, museum displays in the Dante Fascell visitor center at BISC offer visitors the opportunity to interact with artifacts from HMS *Fowey* while a video of the site and excavation is available both in the center and online, making the project accessible to the public (Marano 2015:105, 108-111). While the site is effectively closed to the public (and has been for several decades), these avenues have increased site accessibility, especially to non-divers.

In counterpoint to ongoing Park research is work conducted in the Florida Keys National Marine Sanctuary (FKNMS), BISC's southern neighbor. The Rib Wreck and the Bronze Pin Wreck (McClarnon et al. 2007; Shefi et al. 2009) are two sites located in FKNMS which share

similar architectural features with Pacific Reef Wreck. The Florida Bureau of Archaeological Research (BAR), a state funded organization which works in conjunction with FKNMS to survey sites but is not responsible for site management within the FKNMS boundary, conducted the archaeological research on both sites.

The Rib Wreck features iron reinforcing frames which protrude from a sandy bottom, and very deteriorated wooden structure (McClarnon et al. 2007:6). As a treasure salvor first reported the site, it has likely been salvaged. McClarnon et al. (2007: 14) do note that substantial wooden hull remains are preserved below the sand. Similarly, the Bronze Pin Wreck features exposed iron frames, copper pins, and hull remains. Dated to the early 19th century, Shefi et al. (2009:7) hypothesize that the owners re-fit the vessel with iron frames and copper alloy fasteners. These attached to the floors and ran to the turn of the bilge. Unfortunately, both of these sites remain in a state of disequilibrium with the environment as biological and mechanical factors heavily degraded exposed structure (McClarnon et al. 2007:6; Shefi et al. 2009:6). This deterioration prevented researchers from taking accurate measurements and, as these sites remain unexcavated, there is not enough adequate data to determine the construction of the Rib Wreck or the Bronze Pin Wreck.

While full site reports are forthcoming (as noted by authors), the data contained within site reports published to date is limited. This lack of detailed site investigation and information is part of the larger issue of resource management in FKNMS. As of the last updated management plan, FKNMS had no Maritime Heritage Resources (MHR) Field Unit to conduct field research and had not met the MHR management plan aims of establishing an MHR inventory which would determine significance (Florida Keys National Marine Sanctuary [FKNMS] 2007:135). As such, sites have undergone initial documentation but are not understood in their respective

historic or cultural contexts. Thus, the initial baseline documentation conducted by BAR and facilitated by FKNMS has provided little information for outreach, education, or determining significance and is not an effective comparative management strategy despite the similarity of managed resources.

Results: 2016 Fieldwork, Education, and Outreach

To meet the NPS goals of proactive site protection and stabilization, BISC CRM staff decided to excavate and stabilize Pacific Reef Wreck during the 2016 field season. Similar to previous work on the Soldier Key Wreck, the goal was to expose and document as much of the wreck as possible, and then stabilize the site via reburial using the ballast and rubble previously dislocated by looters.

For the course of the fieldwork, grants from the NPS Latino Heritage Internship Program and the NPS Cultural Resources Diversity Internship Program secured funding for interns to participate in the site excavation, recording, and reburial. While initial project aims were to archaeologically investigate and stabilize the site, these grants made the excavation and evaluation of the Pacific Reef Wreck a valuable archaeology training tool to help students from underrepresented backgrounds in their professional development.

Similarly, one of the requisites for these internships is a project with a tangible final product. Working with the interns, staff created digital media including a 3-D model, video, and write-up associated with the site work. BISC CRM developed these materials to increase public outreach and understanding of the importance of the site and archaeology in the park. Staff posted the video on the park's Facebook® feed in late August 2016 and received 3,900 views and 79 shares by the end of the 2016. While this number is modest, it indicates that the video

resonated with at least a small number of park visitors. Furthermore, the video offers a means of experiencing the site—it captures and presents the site, unimpaired, for future generations.

Conclusions and Recommendations

The remains of Pacific Reef wreck are significant to understanding the history of South Florida—the vessel is part of the narrative of commerce and transportation during the 19th century and ties into the larger historical context of park waters. Contrary to the 1988 assessment, the site has a continued research potential despite a long history of salvage and looting. More importantly, the production of objects (including digital outreach materials) by resource managers has created new avenues for public outreach and the education of a new generation of cultural resource stewards. Resource managers undertook this stabilization project, the third since 2012, to meet the management goals of BISC (DOI 2006).

Over the past decade, park CRM have found that while the current management strategy of annual condition assessments monitors sites for threats and changing environmental conditions, it fails to address the historic and cultural significance of sites to groups which have demonstrated an interest in submerged heritage including the local community, local stakeholders, and the taxpayers for whom these resources are chosen to be preserved. Both anthropogenic impacts and natural forces will continue to disrupt these sites, however without focused site investigation and research, this data will be lost. To successfully manage and interpret the park's material record in the future, it is important to re-evaluate how research is conducted—the sites studied, their significance, and their research potential.

Past management actions have restricted sites in the park from visitor use without adequately protecting or understanding their histories. As the number of archaeological sites grows each year with further survey and preliminary documentation, there is an inevitable

reduction in annual site visits conducted by park staff (Joshua Marano 2018, pers. comm.). While the Organic Act sets a precedent to conserve cultural resources "unimpaired," the unfortunate truth is that resource limitations prevent the monitoring and protection of all sites in the park. Submerged cultural heritage will continue to deteriorate, however, with active intervention, the data-loss from deterioration can be offset by data collection from site excavation and investigation. While this unfortunately means that some sites must be deemed more significant than others to warrant resource expenditure (raising questions of what is deemed significant and by whom), the ongoing excavation and stabilization of sites within the park has indicated that despite histories of looting and illicit salvage, there is still much to be learned from previously disrupted sites.

Excavation is a powerful management tool that can aid in meeting NPS agency mandates. The process of excavating Pacific Reef Wreck introduced new avenues of outreach and education and offered greater insight than condition assessments alone can offer. Finally, the stabilization of the site will hopefully slow deterioration, thus extending research potential. As Pacific Reef Wreck is only one site among many which lay exposed within park waters and beyond, this management strategy has a much wider application for understanding and protecting Florida's submerged cultural heritage.

Chapter 4. Material Culture Analysis

Objects are at the core of understanding ANT as they, taken as an assemblage, form "a momentary association which is characterized by the way it gathers together" (Latour 2005:65). Context, for objects, is part of their identity; a vessel bilged on a reef draws a much different reaction than one sailing alongside despite shared material features. The difference between two materially identical objects is "the state of affairs", their ability to influence the course of another actor's actions (Latour 2005:71). Certainly the "absence" of objects at BISC-029 has influenced past management groups and their actions while the presence of these same objects has provided data that allows for analysis in the next two chapters.

For an object to act, Latour (2005:79) cautions that it first has "…to enter into accounts. If no trace is produced, they offer no information to the observer and will have no visible effect on other agents." As many of the objects discussed herein were not accountable until the 2016 fieldwork—having no prior documentation in historic wrecking accounts or tales of treasure hunting—the associations traced between objects, groups, and actors within the network are limited. While specific objects may be the product of group actions, created using a specific technology or bearing an identification mark for example, actors did not sustain these relationships past the initial wrecking event; instead, they only re-formed following the 2016 site work. The resurrection of forgotten objects into present networks is often associated with an additional context—the use of objects by groups as mediators between past and present (Latour 2003:81).

"Object as mediator" is a succinct description of the material culture analysis of BISC-029. As this study remains anthropological in origins, the next two chapters emphasize tracing associations between material objects and human actors, both past and present.

Artifact Cataloging

During the 2016 fieldwork, staff recovered 930 individual artifacts from Pacific Reef Wreck for documentation. Three sediment samples were collected and analyzed separately (and did not include in artifact counts, see below). The resulting artifact catalog contains 179 entries created through grouping or separating artifacts into single objects. NPS collections guidelines group each catalog entry by material composition—glass, ceramic, bone, wood, metal, etc. (Table 4.1) (NPS 1990; Finch and Wilson 2001).

Resource managers reburied a total of 651 artifacts. Two further artifacts—a modern beer bottle and fishing weight with line attached—were discarded as they were deemed intrusive. Staff assigned FS and log numbers to the 651 historic artifacts (one concretion and 650 metal fragments) and created a catalog entry for each. These artifacts were also photographed and weighed before being returned to site. The artifact analysis below discusses these artifacts as part of the general material counts, however they do not have catalog numbers.

TABLE 4.1. Artifacts recovered from site by material

Material	Entry Count	Artifact Count
Bone	1	1
Ceramic	4	4
Coal	3	11
Composite	7	12
Fiber	1	1
Glass	63	121
Metal	98	778
Stone	1	1
Wood	1	1
Total	179	930

NPS cataloging protocol also assigns every artifact a functional classification category based on Robert Chenhall's system of classifying human made objects (Chenhall 1978; NPS 1990; Blackaby et al. 1995). The classification system divides artifacts into ten categories including (1) structure, (2) furnishings, (3) personal artifacts, (4) tools and equipment (T&E) for

materials, (5) T&E for science and technology, (6) T&E for communication, (7) distribution and transportation artifacts, (8) communication artifacts, (9) recreational artifacts, and (10) unclassifiable artifacts (Finch and Wilson 2001:111–113). Chenhall's classification system further includes sub-categories; Table 4.2 illustrates the sub-classification of artifacts from BISC-029.

TABLE 4.2. BISC-029 Catalog Entries by Functional Classification

Sub-classification Category	Entry Count	Artifact Count
Armament—Ammunition	1	1
Artifact Remnant	55	88
Food Service T&E	12	32
Food T&E	1	1
Game	1	1
Lighting Device	2	3
Maintenance T&E	1	1
Recreational Device	3	3
Thermal T&E	3	11
Water Transportation—Accessory	94	776
Window or Door Covering	5	13
Total	179	930

Unsurprisingly, water transportation artifacts dominate the assemblage (approximately 83% of the collection), and it could be argued that every artifact found on site be classified as a water transportation artifact. Several of the remaining categories, however, are indicative of larger trends in the 19th century that transcend maritime culture. The discussion of artifacts is thus structured below by both material and, in some cases, functional classification. Due to the breadth of artifacts and organic samples discussed, the next chapter addresses specific water transportation artifacts and accessories.

Organics (Bone, Fiber, and Wood)

Three organic artifacts recovered from the site include animal bone, felt, and one fragment of shaped wood. The animal bone split into six fragments during conservation (Figure 4.1). These fragments are likely part of a singular rib. While the species has not been positively

identified, the width of the largest fragment (3.86 cm/1.5 in.) is consistent with bovine rib size (Genus *Bos*) (Adams and Crabtree 2011:416). One fragment also appears to display cut marks which suggest butchering. Beef has long been a food staple on vessels in fresh and salted forms and would have been a common victual on historic merchant vessels (Dana 1842:40; Rodger 1988:83; Macdonald 2014:22). For example, American sailor Richard Henry Dana Jr. (Dana 1842:14,40,332) fondly recalls eating salt beef with ship's biscuit during his 1834 voyage on the Boston brig *Pilgrim*; "our chief article of food was the beef. A mess, consisting of six men had a large wooden kid piled up with beef steaks, cut thick, and fried in fat, with the grease poured over them" (Dana 1842:331–332).

FIGURE 4.1. Animal bone (FS 11.1). (Image from NPS, 2016).

Divers recovered one strip of felt measuring 1.5 × 41 cm (0.6 × 16 in.) in Area II, and observed several other strips under wooden frames on site. Upon cleaning, lab staff determined the piece was animal skin, although they could not determine species.

By the second quarter of the 19th century, shipbuilders added felt under sacrificial wood sheathing as additional protection against ships' worms (Morgan and Creuze 1827:273). The felting process, first used on the British vessel *Dorothea* during its voyage to the Arctic in 1818, proved its worth when pack ice trapped the ship and the vessel survived the return trip. Naval papers recorded the event, crediting that "the felt had saved the ship" (Morgan and Creuze 1827:273; Willcox 1838:228). By the 1820s, felting was "being introduced into all maritime countries. Our active and intelligent neighbors, the French, are also beginning its use" (Morgan and Creuze 1827:273). Knowledge of felting in New World shipbuilding is apparent in an 1838 article from Pensacola, Florida which references the use of felt's predecessor, tarred paper, in the Royal Dockyards at Portsmouth, England despite the waterproofing benefits of felt (Willcox 1838:229).

The single wood fragment recovered from the site, weighing 5.9 grams, is heavily worn, making the original form and function indeterminable. Project personnel did not conduct species identification due to artifact size. As such, further investigation is needed before function can be determined.

Ceramics

The term *ceramic* refers to all artifacts made of fired clay. Dredging operations revealed four ceramic artifacts, including one red brick fragment and one clay marble in Area II, and two ceramic sherds in Area I.

Brick

The brick recovered from site is handmade and incomplete, weighing 206.4g and measuring 5 × 3.5 × 8 cm (2 × 1.4 × 3.2 in.) (Figure 4.2). There is no evidence of mortar, burning, or a maker's mark on the brick's exterior, although the red paste and general dimensions suggest British or American origins (Hume 2001:82–83). Unfortunately, further differentiation between products of these nations is difficult as the North American brick industry developed soon after colonization and remained in competition with British imports through the 19th century (Gurcke 1987:40).

FIGURE 4.2. Brick (FS 11.9). (Image from NPS, 2016).

Red bricks are common finds on shipwreck sites throughout the park (Wild et al. 1985:v, 17; Skowronek et al. 1987:318; Wilson 2015). The small quantity of brick observed on Pacific Reef Wreck limits interpretation, however the most likely function of the brick was ballast (South 1964:67; Kane et al. 2002:54–60; Forte et al. 2004). While builders used brick for

firehearth (and later stove) construction on vessels throughout the 17th and early 18th centuries (Lavery 1987:196–197; Horrell 2017:375; Ray 2017:280–281), iron replaced brick in stove construction by the 1750s due to its decreased weight (Lavery 1987:197; Horrell 2017:375). Small and large vessels alike adopted cast irons stoves by the early 19th century (Lavery 1987:197; Ray 2017:375) which makes a brick hearth unlikely for Pacific Reef Wreck.

Coarse Earthenware Marble

Excavation of Area II yielded one coarse earthenware marble—the sole "small find" (a miscellaneous object not found in large quantities) representative of personal ownership associated with the site (Samford 2002). The marble measures 1.5 cm (0.6 in.) in diameter and is dark brown in appearance (Figure 4.3). Marbles are categorized by manufacture and material, which includes glass, stone, wood, metal, and ceramic (Randall 1971:102). Coarse earthenware ceramic marbles are low-fired, not glazed, and, prior to 1884, were not commercially produced or imported in the U.S. (Randall 1971:103; Carskadden and Gartley 1990:56). While marbles have been classified as toys in archaeological contexts (Hume 2001:313, 320), it is not necessarily an indicator of a child or children on board (Carskadden and Gartley 1990:55).

FIGURE 4.3. Clay marble (FS 2.13). (Image from NPS, 2016).

Pearlware

Two fragments of coarse refined earthenware were found on site in Area I. Fired at a lower temperature than stoneware and porcelains, coarse refined earthenware are water permeable and must be glazed to create a watertight seal (Deetz 1996:69). The first ceramic is a fragment of pearlware, a cream bodied earthenware featuring a transparent blue glaze developed in the late 18th century as an imitation of Chinese porcelain (Hume 2001:109). While English and Dutch potters began mimicking Chinese tableware with *chinoiserie* (designs imitating Chinese imagery) and pseudo-Chinese motifs in the early 17th century, the European ceramic bodies did not hold up as well as their Chinese counterparts. Throughout the 18th century, competing Staffordshire potters sought new methods of creating an English porcelain to compete with Chinese imports in both decoration and structure (Hume 2001:109-111; Miller and Hunter 2001). Josiah Wedgwood introduced "Pearl White" wares in 1779, which had a refined creamware body with blue-green tinted glazing (Hume 2001:128). In less than a decade, competing British factories had all adopted the style and were producing blue "china glaze" wares, or pearlwares, for large scale consumption (Miller and Hunter 2001; Hume 2001:128).

The growing demand for pearlware increased the frequency of transfer-printed motifs on tableware. Transfer-printing, created by inking a copper engraving and transferring to the ceramic surface via tissue paper, was developed by Liverpool potters in the mid-18th century for use with creamware, pearlware's precursor (Hume 2001:129). As pearlware consumption increased, blue underglaze printing of pseudo-Chinese motifs and *chinoiseries* became the prevalent decoration style (Hume 2001:130). Pearlware remained in vogue through the turn of the 19th century, when whiteware and Ironstone China superseded it in the 1820s (Hume 2001:131).

Only one of the fragments is painted, featuring a blue on white *chinoiserie* transfer-printed motif (Figure 4.4). While the pattern cannot be determined due to fragment size, the transfer printing process dates to the late 1700s and is frequently associated with early 19th century sites (Hume 2001:131).

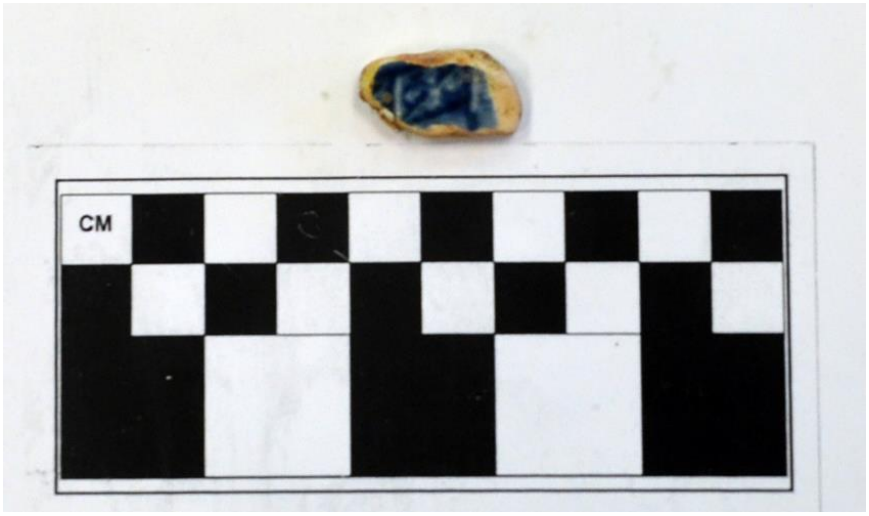

FIGURE 4.4. Pearlware Fragment (FS 12.2). (Image from NPS, 2016).

The other recovered fragment is sprig molded with a floral motif (Figure 4.5) and thought to be whiteware due to the lack of green pooling around the molding. Pearlware's successor,

FIGURE 4.5. Possible whiteware (FS18.6). (Image from NPS, 2016).

whiteware was popularized in the 1820s (Hume 2001:130) and featured a whiter paste and glaze. While Hume (2001:131) notes whitewares are difficult to date, Samford (2015) writes the sprig molding is particularly diagnostic of ceramics produced in the 19th century. Based on the curvature of the sherd, the original form is likely a container or type of tableware.

Composite

Divers recovered eleven composite artifacts from site, including two modern fishing weights, two concretions, six copper alloy spikes embedded in wood, and one leather fragment with iron fastener remnants. The fishing weights are discussed below, in *intrusive artifacts*, while the spikes will be discussed in the next chapter.

Of the two concretions recovered from site, one was immediately discarded as its small size indicated it contained no artifacts or artifact remnants. The other concretion is cupreous as determined by verdigris in the concretion product. Unfortunately, during conservation the concretion proved to contain no artifacts or metal, leading to its discard.

The remaining composite artifact recovered from site was a leather fragment with embedded iron fasteners. Upon further investigation of the fragment, a ring of circular indentations was present on the concave surface as seen in Figure 4.6. The leather fragment is incomplete, thus making original form indeterminate. Project staff discussed several functions for the leather including its use as a one-way valve to control water flow in a tube or its incorporation into a shoe. Unfortunately, the ring pattern does not match the grating observed on the lead pipe discussed in the next chapter, suggesting further research to determine function is necessary.

FIGURE 4.6. Leather (FS 1.1) with circular indentations on surface. (Image from NPS, 2016).

Glass

After metal artifacts, glass was the second largest artifact class recorded on site. Dredging recovered a total of 115 glass fragments (12.4% of the total collection) for documentation (Table 4.3). For the purposes of this analysis, glass was grouped by both color and form. While Jones and Sullivan (1989:12) caution against the use of color as a classification device due to the separation between color and manufacturing technology/vessel form, Lindsey (2018) states that color "is still an important descriptive element" and, when observed infrequently, can be indicative of a distinct vessel type. In many cases, the fragments recovered from Pacific Reef

Wreck were too small to determine original vessel form or function. Thus, color (while not ideal) is used here to classify glass shards.

TABLE 4.3. Historic Glass Recovered from Site (n=artifact count)

Color	Vessel Type			Total
	Container	Flat	Indefinite	
Blue, Light	0	0	1	1
Blue-green, Light	1	0	3	4
Colorless	1	51	10	62
Copper-green, Dark	19	0	16	35
Copper-green, Light	5	0	5	10
Green, Light	2	0	0	2
Purple, Light	0	0	1	1
Total	28	51	36	115

Colorless Glass

Glass with no color was characterized as colorless, rather than "clear," following NPS classification standards (Finch and Wilson 2001). Manufactured from silica with a low iron content, colorless glass can have a faint tint due to the presence of trace metals (Lindsey 2018). Of the glass recovered from site, close to half of the shards (54 fragments) were characterized as colorless flat glass, weighing a total of 137.5g. While some of these fragments were thought to be leaded, analysis to determine the presence of lead content was not undertaken. The glass fragments varied in size and thickness, the largest was identified as a partial pane (weighing 17.3g) measuring 9 × 5.3 cm (3.5 × 2.1 in.) (Figure 4.7A). Flat glass was used to manufacture both leaded window panes and lanterns throughout the 1800s (Jones and Sullivan 1989:172; Hume 2001:235). Both of these lighting features are common on historic vessels and cannot be assigned a specific date range without measurements of a full pane (Hume 2001:235).

One fragment of colorless flat glass featured striations in the form of lines running perpendicular to the sides of the glass (Figure 4.7B). Jones and Sullivan (1989:15) identify these

marks as part of the manufacturing process. While flat, the inner and outer curve of the glass suggest it was circular. Function and original form have not been determined.

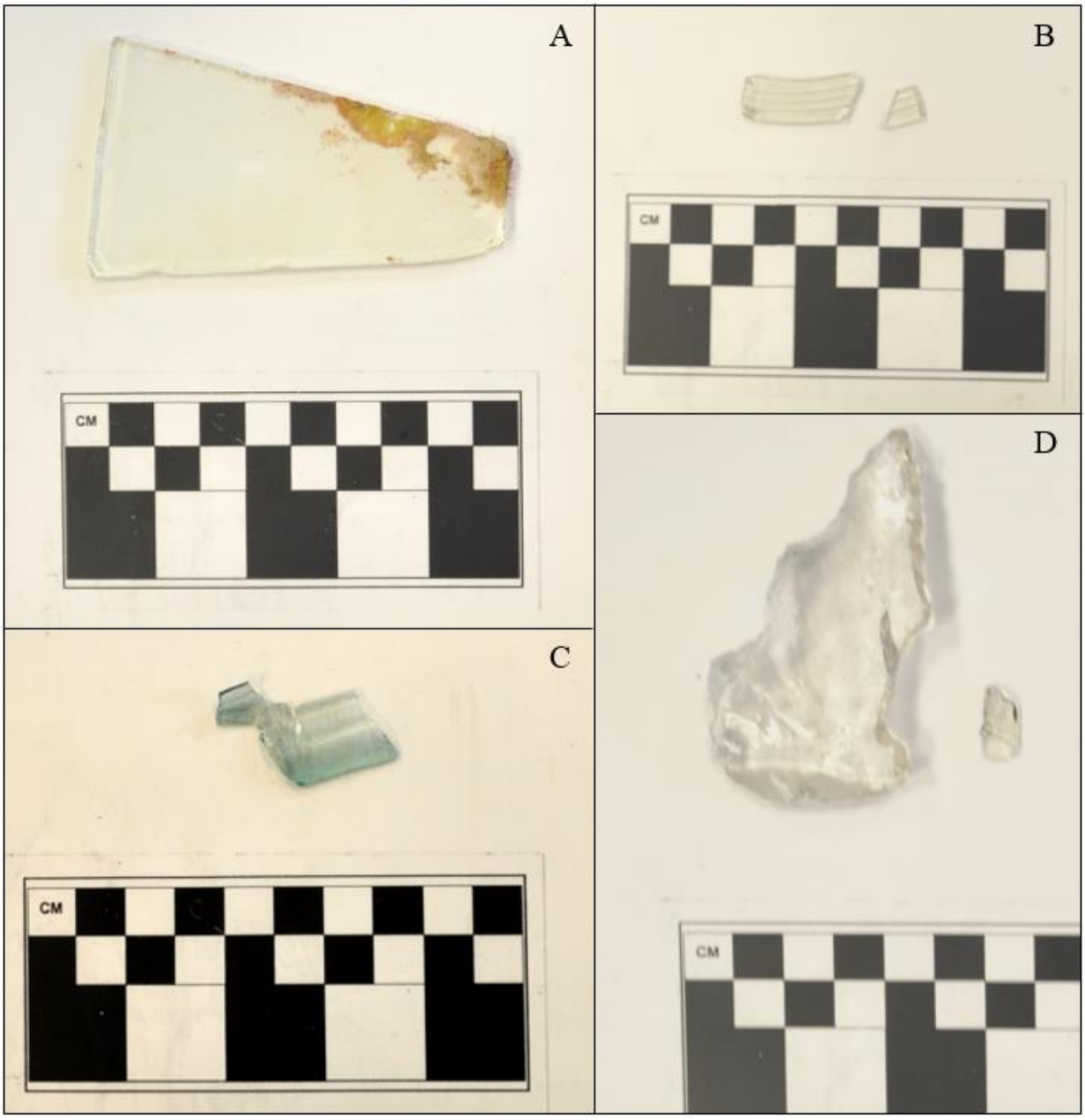

FIGURE 4.7. Colorless glass recovered from site. Top left (A): pane fragment (FS 17.1), top right (B): striated glass (FS 2.12), bottom left (C): thin container glass (FS 14.8), bottom right (D): possible flaked glass (FS 2.16). (Images from NPS, 2016).

One potential fragment of container glass was identified in the assemblage (Figure 4.7C). Thinner than the window glass and featuring a slight blue tint, the face of the glass is concave

and features part of a square corner. At present, it is thought that the glass is part of a square bodied container however further identification is difficult due to shard size.

Eleven other colorless glass fragments weighing a total of 236.6g were found on site. They were categorized as having indeterminate form and function due to fragment size. Of these fragments, however, there are some that, with further investigation, may offer future insights into the vessel. Two fragments of colorless glass, for example, appeared fractured but also may have been purposefully flaked (Figure 4.7D). While there have been historic accounts of glass repurposed into tools by indigenous, slave, and maroon communities (Sayers 2007:147; Porter 2015), the presence of this glass cannot be associated with an individual or group without further evidence. Another possibility is that the glass flaked under high stress and may be part of a larger glass artifact.

Deck Prism

During the 2017 post-hurricane assessment, cultural resource staff documented a partial deck prism on site which had become exposed during the storm (Figure 4.8). Deck prisms, also called deck lights and deck glasses, are thick pieces of glass set into a vessel's upper deck to increase light below (Vlierman 1994:319). Deck prisms required a wooden or metal frame which could be waterproofed to prevent leakage through the light (Quinn 1997:142). Although they varied in form from convex cylinders to rectangular prisms, one historic source indicates prismatic lights were preferred as they were stronger and shed light more evenly below decks (Vlierman 1994:319).

The partial deck prism seen during the 2017 condition assessment is characteristic of the rectangular prism shape. Two other potential prism fragments were recovered during the 2016 field work—they are part of the count for indeterminate glass presented above. One fragment

appears to be part of the triangular lower section of a rectangular prism, with the incomplete base of the triangle measuring 4 × 1.65 cm, and a prism depth of 2 cm (1.57 × 0.65 × 0.79 in.). The third possible prism fragment is molded with a checkered appearance (Figure 4.9) and is incomplete. The depth of the glass and coarse molding suggest this is not a container fragment. Furthermore, Vlierman (1994:320–321) records a similar pattern on a circular prism recovered from a 19th century Dutch merchant vessel indicating there was experimentation with deck light form.

FIGURE 4.8. Partial deck prism observed during 2017 post-hurricane condition assessment. (Image from NPS, 2017).

FIGURE 4.9. Checked glass shard (FS 11.10). (Image from NPS, 2016).

Quinn (1997:144, 146) dates deck light use on merchant vessels to the second half of the 19th century (ca. 1840) associated with examples found on the vessel *Charles W. Morgan*. Vlierman (1994:320), too, states that while descriptions of deck lights suggest their use was known by merchant mariners in the second quarter of the 19th century, there is no archaeological evidence of their use in the Netherlands prior to 1850.

Finally, a sole fragment of amethyst glass is also grouped with the colorless glass as its coloration is the result of ultraviolet radiation (Figure 4.10) (Jones and Sullivan 1989:13; Lindsey 2018). Originally colorless, manganese dioxide inclusions in the glass changed color when exposed to UV rays. Jones and Sullivan (1989:13) state amethyst glass was popular between 1875 and 1900, however it can be found on earlier sites. The original form of this glass fragment is indeterminate.

FIGURE 4.10. Amethyst glass (FS 15.8). (Image from NPS, 2016).

Copper-green Glass

A total of 29 fragments of container glass (247.1g) were recovered from site. Of these, 24 shards (weighing 231.6g) were light or dark copper-green, colors created with the addition of iron oxides (Lindsey 2018). While various containers were manufactured in copper-greens during the 19th century, the most prominent vessel form is the wine or beer bottle (Lindsey 2018). The majority of copper-green shards found on site are from container bodies. As there is no indication of decoration or molding, they are likely associated with wine and beer bottles (Lindsey 2018). One fragment, however, included part of the bottle neck, shoulder, and lip.

The neck features a mold seam which ends at the lip. The mouth of the bottle features a two part finish referred to as double collar (Figure 4.11) (Schulz et al. 2016:303,312; Lindsey 2018). Lindsey (2018) states “this finish style appears to have originated in the 1820s with its most frequent use from the 1840s into the 1880s.”

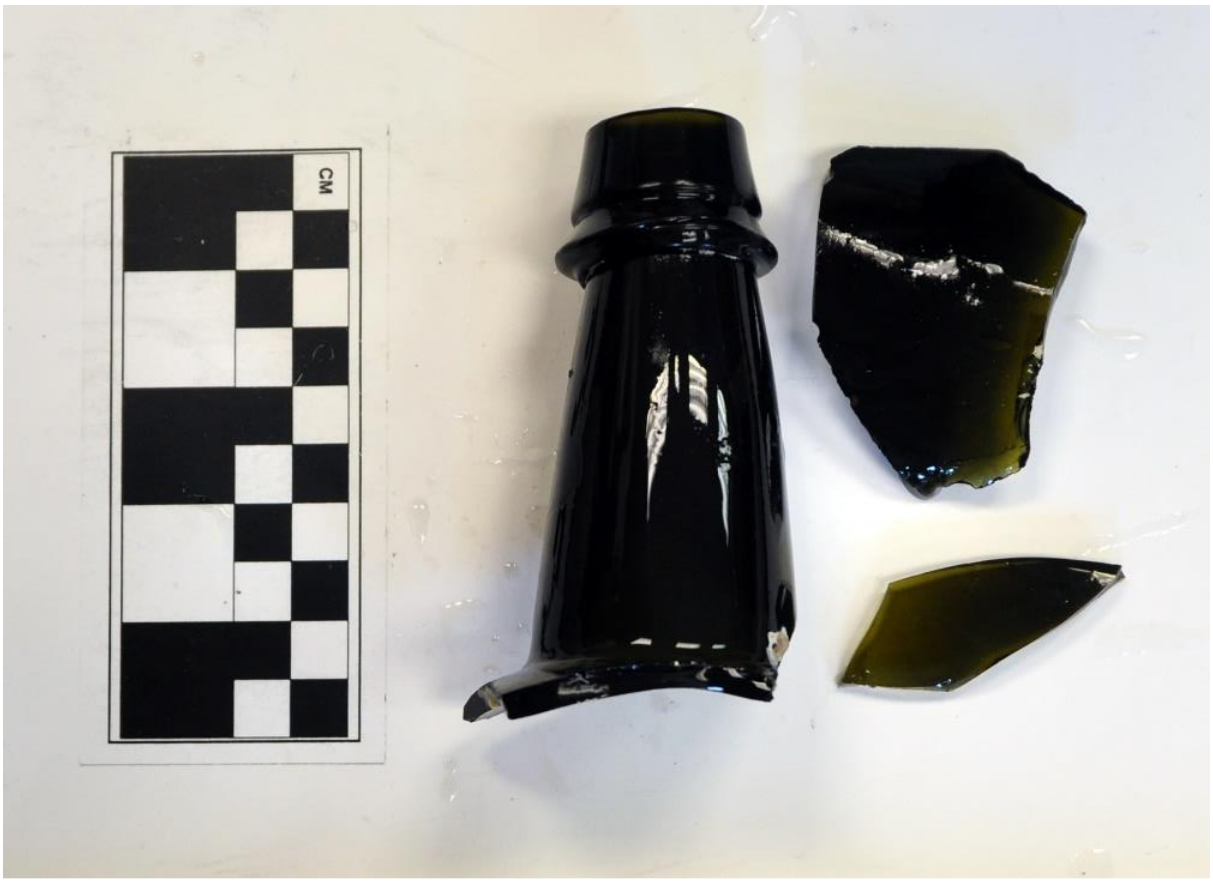

FIGURE 4.11. Bottle neck with double collar two-part finish (FS 17.5). (Image from NPS, 2016).

A partial body and heel fragment also recovered was too small to determine shape of the kick (domed base of the bottle) (Lindsey 2018). Finally, one bottle kick was recovered, measuring approximately 2 cm in diameter (1 in.). Deterioration of the fragment, however, made it difficult to determine if a pontil scar[6] existed. Similarly, various other copper green fragments were recovered from site (44 shards weighing 131.3g) but are too fragmented to determine original form.

Blue, Green, and Aquamarine Glass

Light blue-green glass, referred to as Aquamarine glass by Lindsey (2018), is the result of iron impurities in the sand used in manufacture (Lindsey 2018). Four fragments of light blue-

[6] Pontil scars are remnants of the glass blowing process found on the bottom of historic bottles. The shape of the mark or scar can be indicative of manufacturing date and technology (Lindsey 2018).

green glass were recovered from site (5.2g), one of which was curved, suggesting it was part of a container. Lindsey (2018) states that aqua glass was a popular choice for utilitarian food bottles from the 1850s-1920s, although earlier examples exist.

One additional light blue and two light green fragments were recovered from site. The light blue shard is similar to sapphire blue bottles described by Lindsey (2018). This bottle color was less popular than greener hues but was a frequent choice for soda and mineral bottles manufactured from the 1840s-1900s (Lindsey 2018). The light green glass is thin and curved, likely part of a container. Lindsey (2018) dates the color to the 19th century and states it was primarily used with mineral water bottles.

Metal

Of the 777 historic metal artifacts recovered from site, 767 (82.3% of total assemblage) relate to ship construction and are discussed in the next chapter. The remaining ten artifacts are varied—two of these are highly fragmented copper and iron of no discernable form while a further three metal artifacts weighing a total of 5.9g are wire artifacts. Two of these are small, likely modern, wire pieces (total weight was 0.3g). The third is possibly historic, with no function yet determined (Figure 4.12).

FIGURE 4.12. Concreted wire fragment (FS 6.10). (Image from NPS, 2016).

The remaining metal artifacts include one partial lead strap and four cupreous mechanism fragments. The lead strap, measuring approximately 2.4 × 2.4 cm (1 × 1 in.) is incomplete, and original function cannot be determined. The four cupreous mechanism fragments, however, are the most diagnostic artifact recovered from site and have been determined to be part of a door lock.

Lock

Found adjacent to Area II near several large fragments of copper sheathing, four cupreous mechanism fragments weighing a total of 146.2g were recovered for conservation. Following treatment, small lettering was identified on the underside of the larger strap which read "EN & BROAD NEW YORK". Further investigation identified the mechanism fragments as belonging to a lock manufactured by Green & Broad, locksmiths working in New York City between 1838 and 1845 (Longworth 1838:284; Doggett 1845:152). City directories prior to 1840 list the company as "Green, Broad & Co." located at 279 Second Street, while the 1841 directory states the name "Green & Broad" was located at the corner of 3rd Street and Avenue C. (Longworth 1839:293; Longworth 1841:314). These changes in the company further suggest the lock was manufactured after 1839 as it reflects the latter name of the business.

Several Green & Broad locks were identified on doors at the Martin Van Buren Historic Site during an inventory of historic architectural features (Howell 1985:159, 339). The locks measured 6 × 3.8 × 0.81 in. (15 × 10 × 2 cm) and were all identified as two-bolt rim locks with a lower sliding latch and upper dead bolt (Howell 1985:339). Rim locks are set into a door's surface and have been characterized archaeologically by material and function (Priess 2000:78, 84). Cast brass inner components were first used in the 19th century and the associated housing

was either cast iron or brass. Priess (2000:88) also notes that 19th century American manufactured locks differed from English locks in that the latch bolt was below the lock bolt.

Comparison of similar 19th century American rim locks suggests the four mechanism components are the lower sliding latch bolt, upper dead bolt, pivot which sat against the cam (mechanism through which the door knob passed), and the lever tumbler (Figure 4.13) from a rim lock (Streeter 1973:14, 17; 1974:51). The copper alloy material type further supports this hypothesis (Streeter 1973:14).

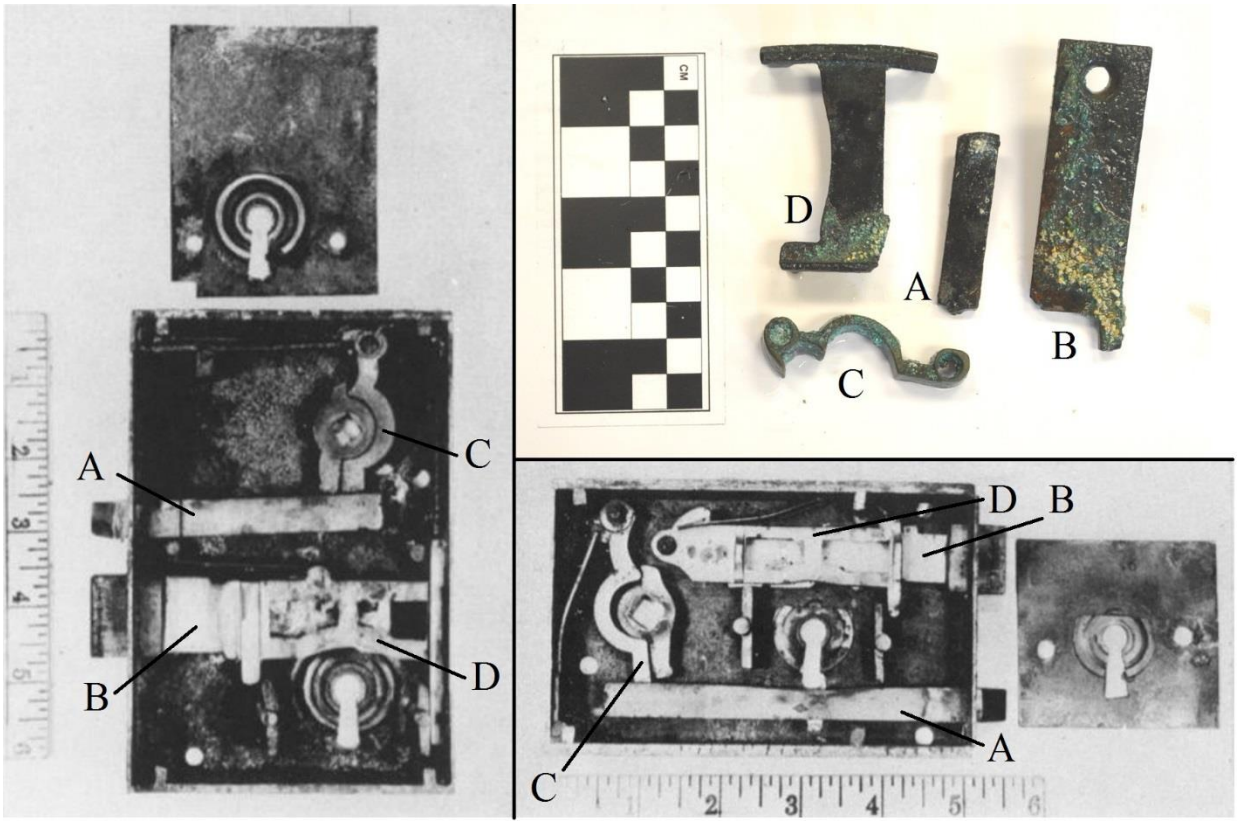

FIGURE 4.13. Comparison of rim locks. Mechanisms recovered from Pacific Reef are in the upper right (FS 22.11) and consist of: A. lower sliding latch bolt, B. upper dead bolt, C. pivot, and D. lever tumbler. The same mechanisms are labeled on a Searing lock, bottom right, manufactured in New York and a vertical Mackrell & Richardson lock, left, also manufacture in New York. (Upper right image courtesy of NPS, 2016; bottom right and left images from Streeter (1973:17, 14)).

Mineral (Coal and Stone)

Eleven coal fragments (weighing a total of 8.1g) were recovered from site along with one incomplete worked stone, identified as a whetstone. While coal is associated with the advent of steamships, it is not indicative of a steam engine on site. Anthracite coal became a major English export in the late 1820s and was imported to the U.S. as blast furnace and stove fuel (Parker 1919:570). The presence of coal may suggest its use as a fuel onboard, a documented 19th century practice (Greenhill and Gifford 1972: 44).

The incomplete whetstone recovered from site measures 4.37 × 2.1 cm in length, and approximately 1 cm in depth (1.7 × 0.8 × 0.4 in.). Used for sharpening blades, whetstones are tools frequently found on sites in BISC—four alone were recovered from HMS *Fowey* (Skowronek and Fischer 2009:135).

Intrusive Artifacts

Two modern fishing weights attached to synthetic line were recovered from site during excavation. One of the weights, found early in the project within EU 5, Level 2, became a key indicator that site disruption from human and natural activity was greater than initially anticipated. As excavation progressed, further intrusive artifacts were found on site including a metal "necklace" from a boat fuel cap concreted to the filling chock between timbers T36 and T37 in Area II, a crushed coffee can between timbers T41 and T42 in Area II, and a heavily degraded bullet with shell casing. While the fuel cap necklace and coffee can were left in place due to concretion product present, the bullet and weights were recovered as they are both indicators of continued human interaction with the site.

Modern glass was also found on site including five amber glass shards and one green glass shard. These fragments were all considered modern beer bottle fragments—molding on one

of the amber neck fragments as well as general condition and clarity of the glass supported this conclusion. Like the weights, the presence of modern bottle glass speaks to the popularity of the reef crest as a recreational area. The bullet, a component of powerhead spearfishing equipment, may represent solely recreational activity and conflict between human and non-human species. The history of South Florida treasure hunting, however, presents another possibility.

In 1968, Treasure salvor Bob "frogfoot" Weller was in the process of salvaging the Spanish ship *San Jose* when an unwelcomed visitor arrived on site (Weller 1990:49). Unsure if the wreck fell under state jurisdiction, one of the Florida state archaeologists came out to investigate the salvage vessel. Refusing his request, the treasure hunting crew pulled out guns onboard and fired shots over his head (Weller 1990:49). The following day, U.S. Coast Guard officials arrived at the salvage vessel and "with guns drawn and ready, they boarded" (Weller 1990:49). While this incident fortunately resulted in no injuries, it illustrates that conflict existed between stakeholders and demonstrates that these factions would go to extreme lengths to protect their interest in submerged cultural heritage.

The intrusive artifacts on site provide evidence of forgotten but experienced secondary use in the mid-20th century. While the true extent of activities and changes to the site may never be known, the presence of modern materials associated with both recreation and conflict speaks to stakeholder interests and past actions.

Sediment Samples

During the fieldwork, three sediment samples were taken between frames in excavation units five (FS 4) and six (FS 7 and FS 20). The samples were identified as a mixture of naval stores and macrobotanicals. Each sample was screened through a series of geological screens varying in size, from 0.046 to 0.5 in. (0.12-12.7 cm). One sample, FS 20 from EU6 between

timbers T28 and T29, was split into three parts to determine if a solvent would aid in breaking down the pine resin. One part of the sample was processed with water, one part was processed with acetone, and one part was processed with turpentine. The resulting sediments found in each screen level were packaged and kept for analysis. All samples were processed by hand at Rhodes College under the guidance of Dr. Kimberly Kasper (Kimberly Kasper 2017, pers. comm.).

Over five kilograms (kg) of sediment were recovered and included in FS 20. This specimen was further split into nine catalog entries due to sieve size and processing agent. Much of the sediment found in larger sieves could not be broken down due to low water solubility of the tar (discussed below). All of FS 20.1, sieved through 0.5 in. (1.27 cm) mesh was processed as it largely consisted of wood fragments. Of the remaining samples, a subsample of FS 20.9 was chosen for species identification due to the small sediment size in the sieve. The subsample, weighing approximately 100g (of the 2,272g collected in 0.046 in. (0.12 cm) sieves), was used for analysis. As the primary goal of the processing was to identify the macrobotanicals which were observed embedded in the sediment on site, processing of the sediment stopped when the macrobotanical count of any one specimen type reached 500 (Kimberly Kasper 2017, pers. comm.). Certainly, further investigation may yield richer insight into the botanical samples and origins of the naval stores, however it is outside the scope of this thesis[7].

Naval Stores

When recovering FS 20, researchers found a strong decaying pine odor associated with the sample of sticky black residue. Researchers further determined that the sediment consisted of naval stores, a group of materials manufactured from pine species including tar, rosin, pitch, and turpentine (Outland 2001:311). Although collectively known as naval stores, only pitch and tar

[7] Due to time constraints, a paraffin treatment was not undertaken but may prove a better solvent in removing sediment from specimens. A sediment sample remains part of BISC Acc531 and may be available upon request.

have a true marine history as they were used to caulk hulls and to slow decay of rigging on wooden vessels (Bond 1987:187). Turpentine and rosin are products created from the distillation of pine resin taken from a living tree, while tar (called black pitch in its concentrated form) was obtained by heating resin collected from harvested timber (Perry 1968:511).

Both New England and the Carolina colonies produced naval stores historically for local consumption. In the early 18th century, England began importing naval stores from its colonies to reduce reliance on Baltic resources. This increased demand was met with an overproduction of naval stores and the eventual adoption of other cash crops in northern states (Perry 1968:511). Production continued in southern states, however, fueled by an abundance of longleaf pines and an enslaved workforce (Perry 1968:512; Outland 2001). North Carolina, in particular, became a major naval stores production center due to poor soil quality (Perry 1968:512). While this early industry primarily manufactured pitch and tar, technological innovation in the 1830s demanded a shift towards rosin and turpentine production for the manufacture of soaps, rubber solvents, and lamp fuel (Perry 1968:514; Bond 1987:187). By 1840, close to 620,000 barrels of naval stores were produced annually in the U.S., with North Carolina accounting for 95.8% of overall production (Perry 1968:515).

Following initial naval stores processing at kiln sites, tar and pitch were stored in barrels and transported to coastal ports (Gamble 1921:31). Coastal cities including Charleston, South Carolina and Wilmington, North Carolina both became prominent southern “naval stores emporiums” in the mid-19th century, facilitating the reshipment of stores to both American and European ports (Gamble 1921:35). Deforestation and loss of virgin longleaf pine stands led to the decline of the North Carolina naval stores industry in the late 19th century. Florida, Georgia,

and South Carolina all rose in prominence as naval stores centers and continued production through the early 20th century (Bond 1987).

Tar and black pitch have both been characterized by Loewen (2005:240), who suggests that while both are black resinous paying materials, tar is more fluid. Tar and black pitch have been recovered in copious quantities from French shipwrecks (Loewen 2005:247); samples recovered from La Natière 1 (dated 1700AD), included "a lustrous black" paying substance which had "settled as a mass between frame timbers" (Loewen 2005:247). Upon recovery, the Pacific Reef Wreck sample remained sticky and did not dehydrate. The uneven texture further lead researchers to suggest it was the remains of a tar and pitch mixture (Loewen 2005:247). The description provided by Loewen (2005:247) of the tar/pitch recovered from La Natière 1 is similar to the naval stores in FS 20 as they exhibited a semi-solid texture, had a low water solubility, and were dark in color. It is presumed that the naval stores observed between frames and recovered from site consist of pitch mixed with tar. Further laboratory analysis may indicate other additions and chemical composition (Loewen 2005:240).

Macrobotanicals

Project personnel processed four sediment samples for macrobotanical identification from the site—FS 4, FS 7, and FS 20.1, and the representative sample of FS 20.9. They identified a total of four different macrobotanical specimens embedded within the naval stores. These were all recovered from FS 4, representing four different taxa. They are discussed here by sample size, from least to greatest.

Laboratory analysis discovered one partial organic macrobotanical specimen measuring 2.5 cm (1 in.) in diameter in FS 4 (Figure 4.14). Due to the level of deterioration, species was not

determined. However, the specimen may be a fruit or legume skin (Kimberly Kasper 2017, pers. comm.).

One complete and three incomplete specimens were tentatively identified as *Polycnemum majus* within FS 4 (Figure 4.14) (eFloras 2018). *Polycnemum majus*, common name giant needle leaf, is an herbaceous annual plant native to Europe. Introduced to North America, today species distribution is rare due to loss of habitat (eFloras 2018; U.S. Department of Agriculture [USDA] 2018). The species currently survives in New England, Canada, Maryland, and Illinois, however its historic range was likely larger (USDA 2018). There are no associated historic uses of the plant, suggesting vessel occupants unintentionally brought the seed on board or it was trapped in the naval stores.

Eight examples of a third seed specimen were also recovered from FS 4. Measuring approximately 0.4 cm (0.15 in.) in length, the seed species has not been identified (Figure 4.14). The seed form is similar to that of flax (*Linum* sp.), however further analysis is needed before species identification can be confirmed.

The final specimen type was found in all sediment samples but varied in quantity; FS 4 contained 9 specimens, FS 7 contained 42, FS 20.1 contained 12, and the subsample from FS 20.9 contained 500 specimens. As this sample was only 4.4% of FS 20.9, the total specimen count for FS 20.9 exceeds 12,500. The specimens, which measure approximately 0.8 cm in length and 0.2 cm in width (0.31 × 0.08 in.) were determined to be the outer hull of *Oryza* sp., common name rice (Figure 4.15) (Kimberly Kasper 2018, pers. comm.). Given the large quantity of specimens recovered, it is currently hypothesized that Pacific Reef Wreck carried rice as part of the cargo.

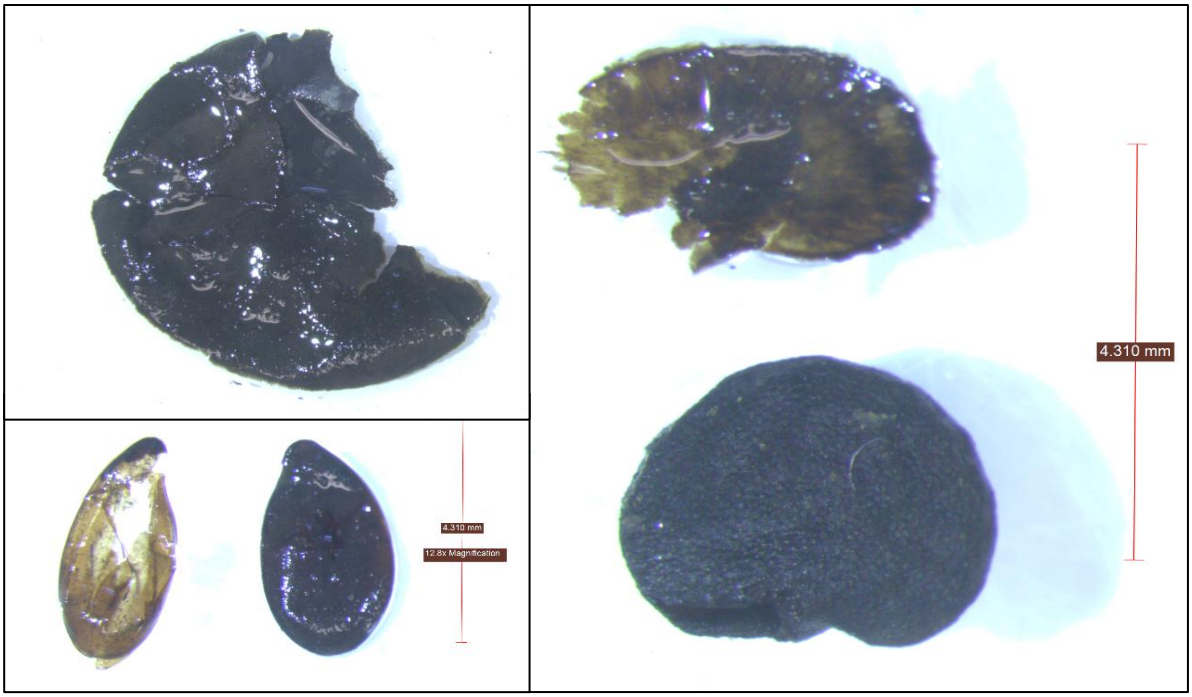

FIGURE 4.14. Macrobotanical samples recovered from FS 4. Clockwise from top left: unidentified sample, tentative *P. majus* seed, unidentified seed (tentatively flax). Scales both measure 4.3 mm. (Images by author, 2017).

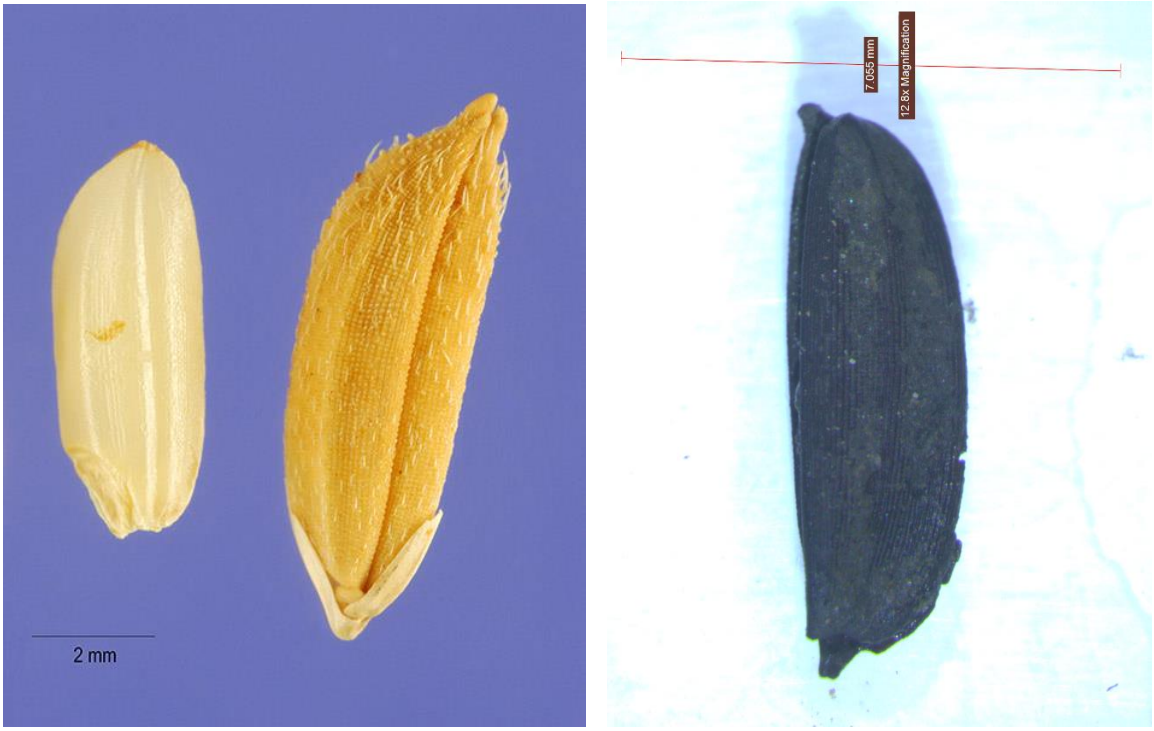

FIGURE 4.15. Rice (*O. sativa*) specimens. (Image on left by Steve Hurst, USDA 2018). Image on right represents a sample of specimens recovered from FS4. Red line measures 0.7 cm (0.27 in.). (Right image by author, 2017).

Plantations in southern states cultivated rice from the late 17th century to early 20th, with South Carolina plantations dominating American rice production from 1700-1860 (Haughton 1980:332). Introduced from Africa during the 17th century, rice required manual cultivation; in southern states the enslaved African diaspora was responsible for its production (Clifton 1981:266, 273). The plants also required soil with high water content—they were primarily grown in tidewater and low country swamps during the historic period (Clifton 1981:276; Haughton 1980).

Planters cultivated American rice to feed local slave populations and as an export product destined for European markets. By the early 1800s, however, European colonial expansion into South Asia led to a decrease in American rice imports, despite growing rice consumption (Sharma 2010:420). Between 1800 and 1860, American rice producers targeted new markets including domestic consumption—spurred by westward expansion and the American gold rush—and the Caribbean, notably Cuba due to its large slave population (Coclanis 1991:136; Sharma 2010:420). For example, in the 1850s, approximately 49.5% of American rice remained in country while growers exported a further 26.9% solely for Cuban consumption (Coclanis 1991:282). While rice exports remained steady through the 1850s, the Civil War drastically impacted the industry which did not rebound until the early 20th century (Coclanis 1991:137; Sharma 2010:420).

The rice specimens recovered from sediment samples taken from Pacific Reef Wreck were highly degraded, and in many instances only the outer husk remained. While today the husk is separated from the grain, Clifton (1981:272) notes that it was not a customary practice to husk Carolina rice before exporting it. As such, the un-husked rice seen on site is considered part of the cargo.

Following the threshing and drying of rice stalks, the grains were transported to larger markets and town centers for shipment (Clifton 1981:274). While discussing the stowage requirements of various goods, Robert Stevens (1858:112) notes that "rice requires little or no ballast," however, casks should be placed in a hold with 14 inches of dunnage in the bilge. Furthermore, they should be carefully chocked to prevent movement while on board (Stevens 1858:112). A later edition of his work further cautioned that rice would expand and generate heat and noxious gasses when exposed to bilge water. "Some masters consider that when a cargo becomes very wet, the ship is liable to burst, from the peculiar and well-known swelling property of rice" (Stevens 1863:194). Stevens (1863:193) concludes "ventilation is absolutely necessary," although he gives no mention of modifications which might aid in air circulation.

As no stave or nail fragments were recovered in the naval stores sample, method of rice stowage on board Pacific Reef Wreck remains conjecture. Records from *John C. Calhoun*, a brig with a rice cargo wrecked in 1842 in the northern part of the park, state that casks and bags contained the cargo (KWADM 1842:111). It is possible, therefore, that the rice was packaged in bags or was loose at the time of sinking.

Conclusions and Datable Evidence

The artifacts recovered from Pacific Reef Wreck form a utilitarian assemblage; most artifacts including the glass, the brick, and the lock components emphasize function, safety, and security over decoration. While there are decorative and recreational objects in the assemblage, such as the ceramic sherds and marble, these still served a practical purpose on board and are likely associated with entertainment—both gaming and food presentation. As past human actors both looted and salvaged the site, it is assumed that this assemblage is representative of materials deemed insignificant to salvors and treasure hunters and may not be characteristic of life on

board. This in and of itself speaks to the mindset of past actors who engaged with, and likely altered, the material assemblage. Past park staff used this same alteration to dismiss long term site management (Helmers et al. 1998), however the above analysis of material culture suggests the opposite—the study of the remaining artifact assemblage yielded new information on site origins.

The sediment samples were the singular most important find of the 2016 field season as they provided compelling evidence for establishing the potential cargo and materials carried by the vessel. Additional artifacts, such as the lock components and copper-green bottle glass provided a reliable wrecking terminus post quem (TPQ) date of the late 1830s. While the artifact sample size discussed thus far remains small, the addition of maritime transportation artifacts (presented in the following chapter) expands the data set and offers further insight into associated vessel usage and dates.

Chapter 5. Water Transportation: The Vessel and Artifacts

As discussed above, the large quantity of water transportation artifacts, i.e. artifacts related to ship construction including the vessel structure, associated with Pacific Reef Wreck necessitated a second chapter devoted to material culture. The following chapter addresses evidence of shipbuilding practices, vessel timbers recorded on site, and the water transportation artifacts recovered for analysis. In addition, it includes results from wood samples.

Timber Scantlings and Analysis

Divers recorded two concentrations of timbers on site during the 2016 field season. The first group of disarticulated timber fragments was termed "Area I", while the portion of hull structure previously recorded in the 1984 work was designated "Area II" (Figure 5.1). During the 2016 excavation, it was assumed that both groups of timbers belonged to the same vessel. While project staff considered the possibility that the two areas represented distinct and separate vessels, the prevalence of similar fasteners, ballast, artifacts, and sheathing suggested a shared date range and construction technique. Following the field work, analysis of the timbers and wood samples (discussed below) further supported the assumption that both timber groupings came from the same vessel and, as such, should be studied as components of a singular vessel.

The site was recorded using metric tapes following NPS guidelines, however the timber scantlings and suggested vessel dimensions (Appendix B) are presented in both feet and meters as the measurements of the timbers recorded on site fit the standard 19th century English imperial foot, designated in 1824 (Anon 1905:9). For the purposes of this chapter, timbers were numbered sequentially beginning in Area I and continuing through Area II, as can be seen in Figures 5.2 and 5.3. All timbers will be referred to as Tn, with the prefix T denoting timber followed by the assigned number, n.

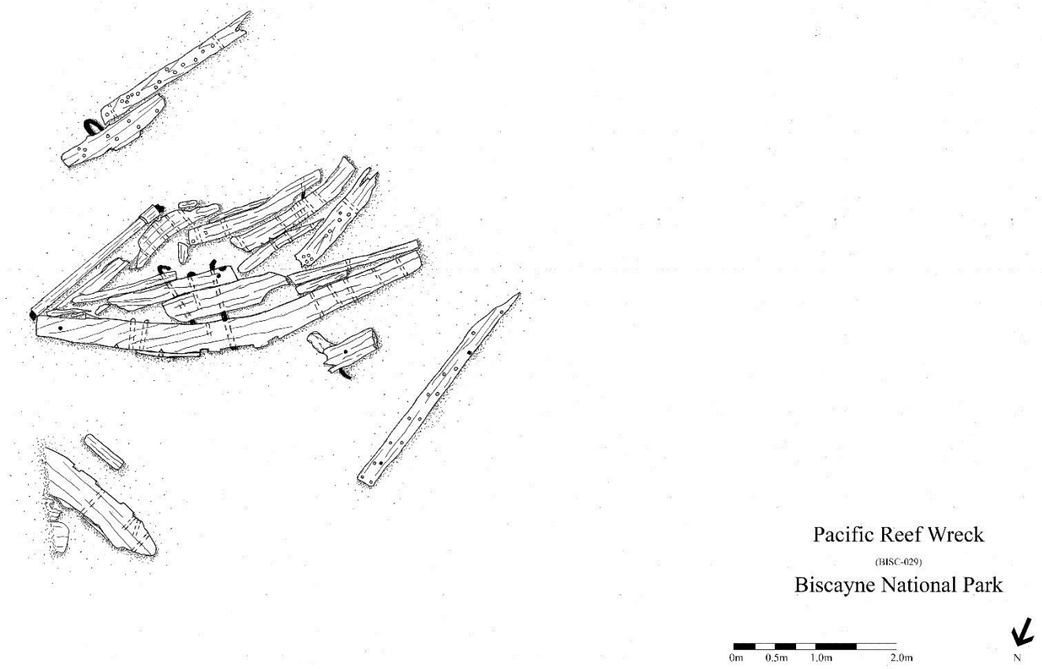

FIGURE 5.1. Full Site Plan. Areas I and II are on the left and right sides of the page, respectively. (Image by author, 2018).

Overview of Area I

Situated in a shallow depression adjacent to a coral patch reef, the timbers in Area I are spread over an area measuring approximately 6 × 8 m (20 × 26 ft.). Within Area I, there is only one cluster of timbers (four timbers total) which are still attached to each other via fasteners (Figure 5.2). The remaining nine larger timbers and various timber fragments in Area I are no longer in-situ as evidenced by their fastener patterns and location on site. As excavation progressed, divers discovered that any wood below the first few centimeters of sediment in Area I was highly friable and severely deteriorated. Staff determined that continued sediment disruption would not result in the collection of useful data. As such, excavation did not progress past level one (approximately 10 cm (4 in.) below surface) in Area I.

The disarticulated timbers and partial timbers recorded in Area I were difficult to distinguish, as many were highly degraded and no longer in-situ. Nevertheless, floor timbers and a deck stanchion were readily identified (T1, T5, and T13 in Figure 5.2). The four fastened timbers (T1-T4) are possibly associated with the keelson assembly, due to the through fastening of T1 and the results of the wood samples (discussed below). Area I may be associated with the initial wrecking process or may be evidence of continued site disruption from salvage and looting activities.

Overview of Area II

The total length of the surviving hull structure in Area II measured approximately 42.8 ft. (13.05 m) in length and 10.3 ft. (3.15 m) in width. The structure is oriented at approximately 70° NE/250° SW and is situated in a shallow depression. The fragmented hull consisted of 34 partial frames (in 17 frame pairs) fastened to 7 outer hull strakes. Also present on the sided interior of

three partial frames are three iron framing elements (thought to be knees or riders) attached vertically with copper alloy fasteners (Figure 5.3).

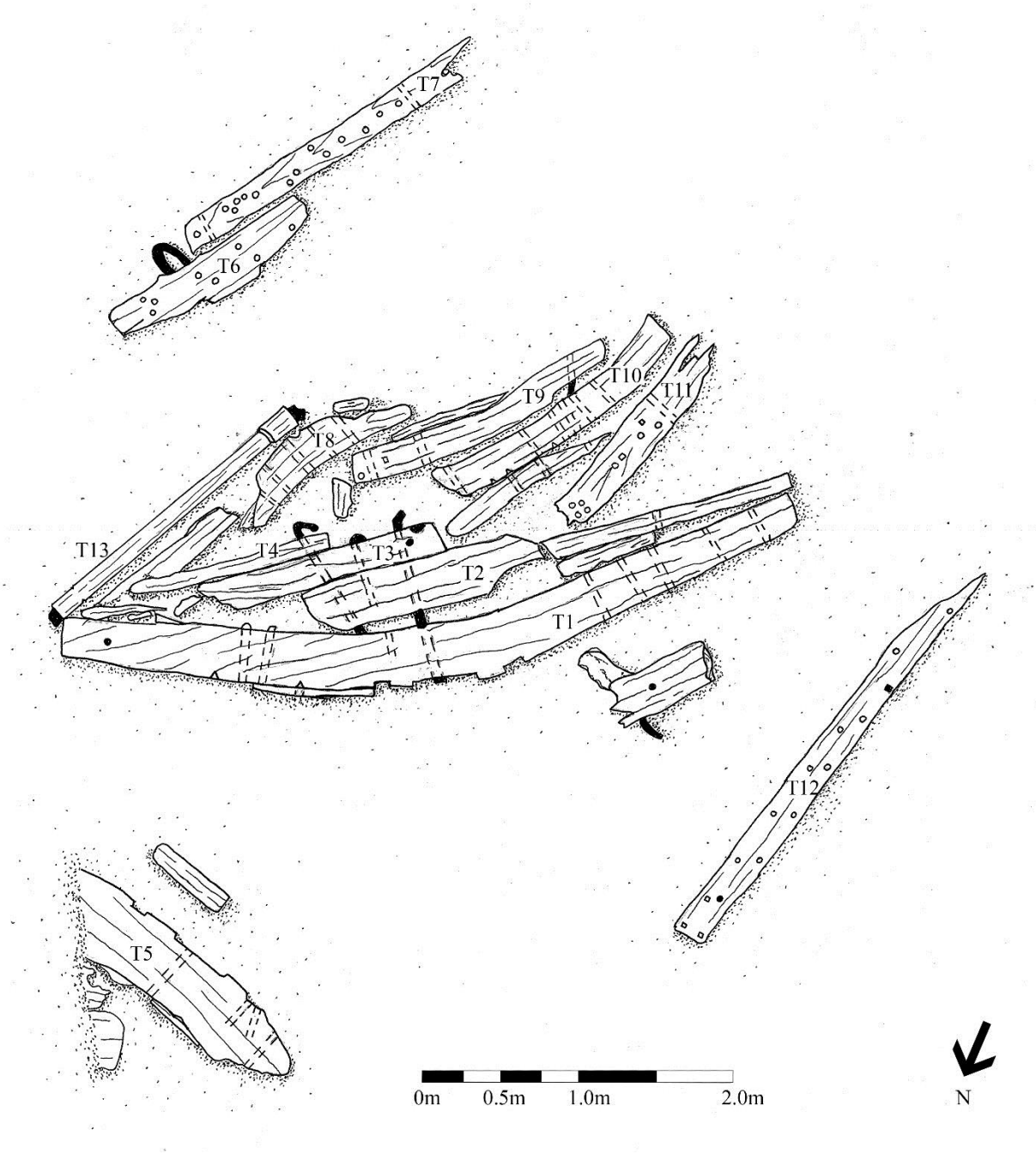

FIGURE 5.2. Detail of Area I. (Image by author, 2018).

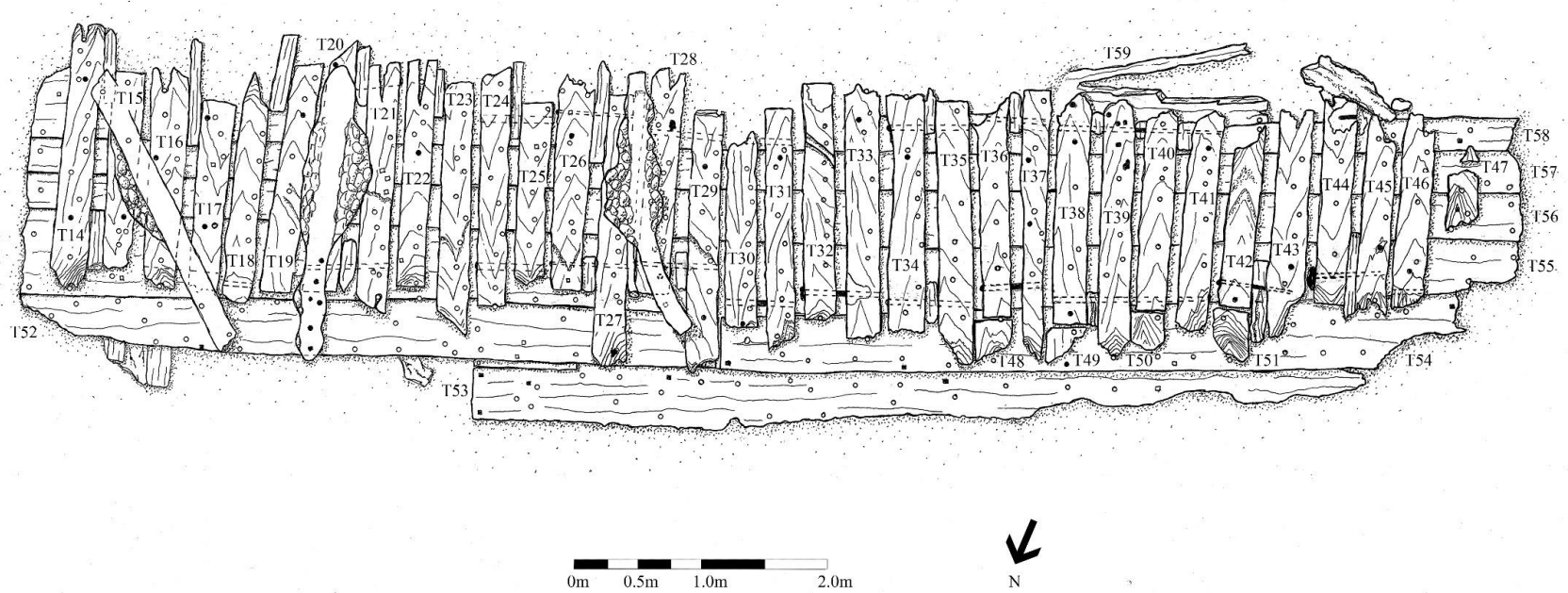

FIGURE 5.3. Detail of Area II. (Image by author, 2018).

Iron, copper alloy, and wooden fasteners were found in both timber concentrations along with copper sheathing fragments and copper sheathing tacks. The following discussion presents each of the structural features noted on site, along with structural artifacts and the results of timber sampling.

Floors and Frames

Two floor timbers were found in Area I; T1 was complete and measured 15 ft. 9.5 in. (4.81 m) in length, and 16.5 in. (42 cm) molded at the widest point (Figure 5.2). Unfortunately, the sided dimension is incomplete but measures approximately 10 in (25 cm). The second floor timber, T5, was only partially complete, measuring 5.5 ft. (1.72 m) in length and 12.8 in. (32.5 cm) molded. Due to the position of the timber, the sided dimension could not be taken. Each floor featured two limber holes, measuring 1.37 in. (3.5 cm) by 4 in. (10 cm) and a keel step, measuring approximately 16.5 in. (42 cm) by 1.38 in. (3.5 cm) cut at a 90° angle. The complete floor does not feature a long and short arm, but two arms of equal length. At the end of each arm, the molded dimensions tapered to 8.67 in. (22 cm).

While no floors were present in Area II, 34 frames in 17 frame pairs were recorded. Each of these frame pairs was comprised of two futtocks fastened laterally with iron through bolts. Due to the concretion product present, no diameter measurements of the bolts were taken. The additional fasteners used to attach frames to the outer hull planking are discussed below.

The room and space of the frames in Area II was 25 in. (63.5 cm), with 2 in. (5 cm) between frame pairs, and 4 in. (10 cm) between frames in the same frame pair. Each futtock measured between 5.5 and 12 in. molded (14-30 cm), depending on level of degradation, and approximately 9.5 in. (24 cm) sided. Unfortunately, degradation on site has resulted in no complete length dimensions of any futtock; all futtocks measured between 57 and 84 in. (145-

213 cm) in length. A continuous limber was recorded running throughout the frame pairs, as seen in Figure 5.4. The limber holes measured 3.15 × 2 in. (8 × 5 cm) and appeared rounded (Figure 5.5).

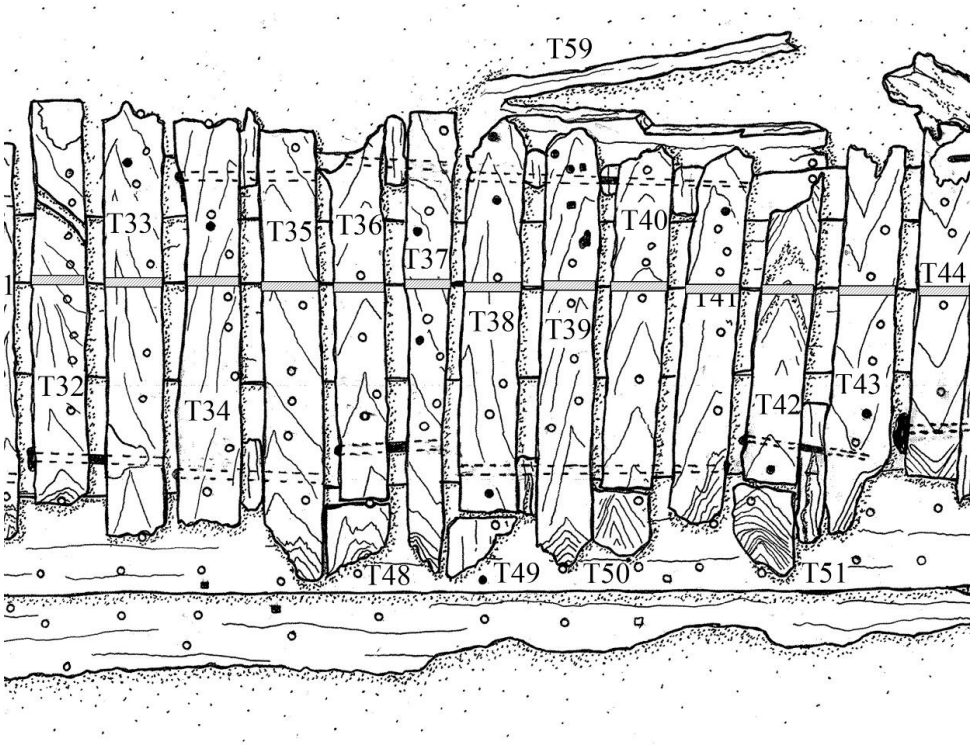

FIGURE 5.4. Detail of Area II with limber added in gray. (Image by author, 2018).

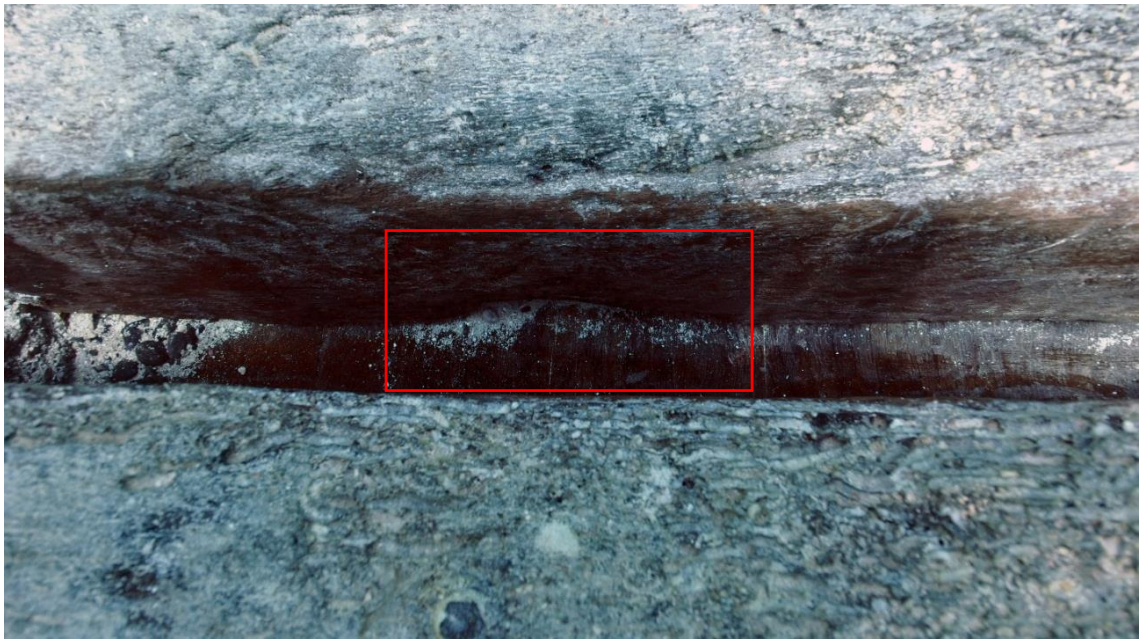

FIGURE 5.5. Limber Hole cut into underside of frames. (Image from NPS, 2016).

The futtock ends are squared to butt against other timbers in the frame. As the squared ends found on site are not adjacent in each frame pair, the futtock and floor spacing was hypothesized to alternate. On the western end of the site, second timbers (T48-T51) with a larger sided dimension (11.8 in./30 cm) were identified butt joined to the frame timbers T36, T38, T40, and T42 (see Figure 5.4 and Figure 5.6).

FIGURE 5.6. Additional futtocks (T48 and T49) with squared butt joins. Scale is 15 in. (38 cm) and in line with T39. (Image from NPS, 2016).

Placed between each frame in the pair (adjacent to one frame's butt joints) were filler chocks which measured 4 in. (10 cm) sided, 7.87 in. (20 cm) molded, and 27.5 in. (70 cm) in length. These filler chocks were laterally fastened with the frame pair, suggesting they were placed before the frames were erected on the keel, and not as a later modification (Figures 5.7 and 5.8) (Desmond 1919:88–89). Filling chocks were used, as their name suggests, to fill spaces between frames, increasing the longitudinal strength of the hull and offsetting the potential of the hull to hog (flex upward in the center of the vessel while sagging at the bow and stern) (Campbell 1974:62). Greenhill (1988:115) writes that chocks were placed between frame pairs "(but never between the floors and first futtocks, which were bolted hard against one another), to keep them a little apart so that the air could circulate freely."

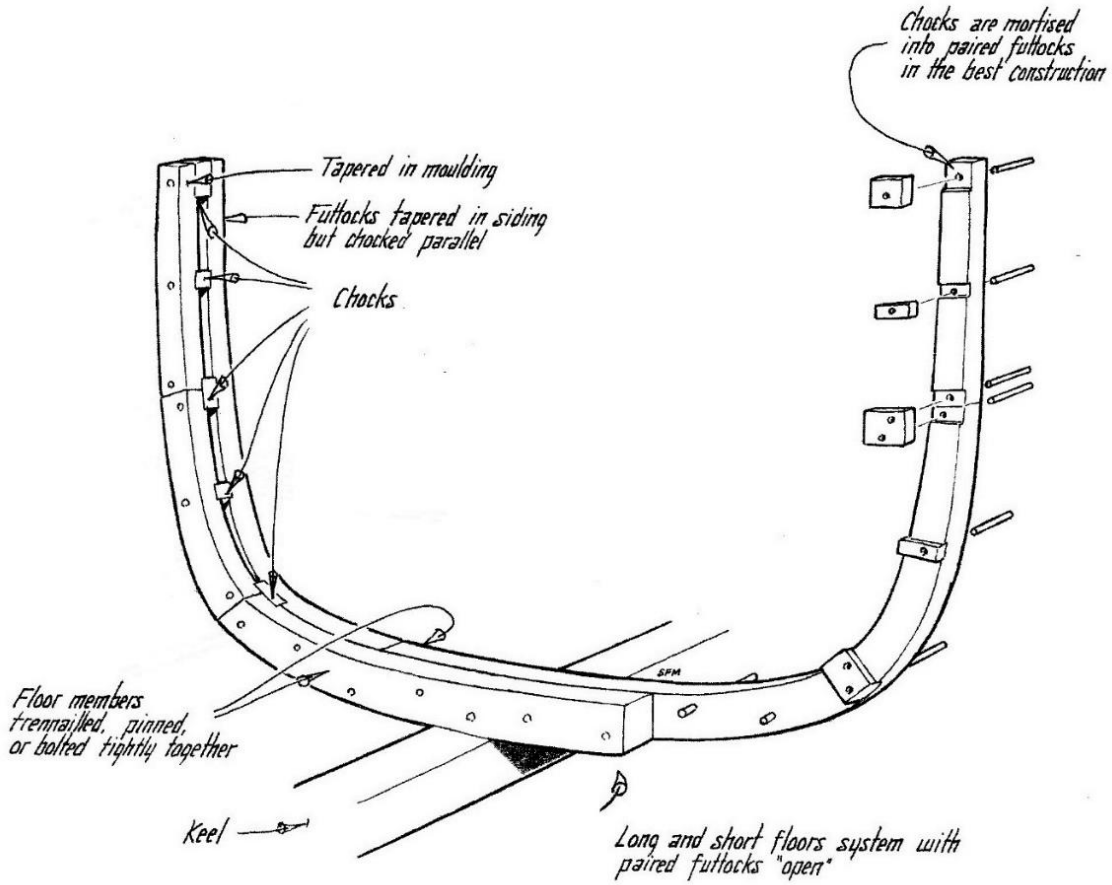

FIGURE 5.7. Frame construction featuring filler chocks. (Image from Greenhill (1988:114) and modified by author).

FIGURE 5.8. Example of filling chock seen on site. (Image from NPS, 2016).

T1 features arms of two equal length, a characteristic of "simple double floor construction" (Greenhill 1988:7) where each frame pair is comprised of a single floor laterally fastened to two first futtocks. The subsequent second and third futtocks were laterally fastened in an alternating pattern, with filler chocks included to strengthen each butt joint. Campbell (1974:64) illustrates this framing pattern (Figure 5.9), noting that while frequent in British 19th century shipbuilding, contemporary American vessels did not frequently use filler chocks and instead used double frames with flush set futtocks.

Keel

While no wooden remains of a keel were found on site, a hypothetical keel dimension was reconstructed from the keel steps present in the two floors in Area I (Figure 5.10). Given the TPQ of 1838 for the vessel's loss, contemporary shipbuilding treatises from the 19th century were consulted to identify similar keel measurements for a sided dimension of 16.5 in. (42 cm). Due to the paucity of North American shipbuilding treatises from the 19th century, the best

comparison of keel dimensions came from contemporary British treatises including Steel's 1805 *The Shipwright's Vade-Mecum*, which addresses the construction of British warships, and De Chapman's Swedish merchant shipbuilding treatise translated for British use.

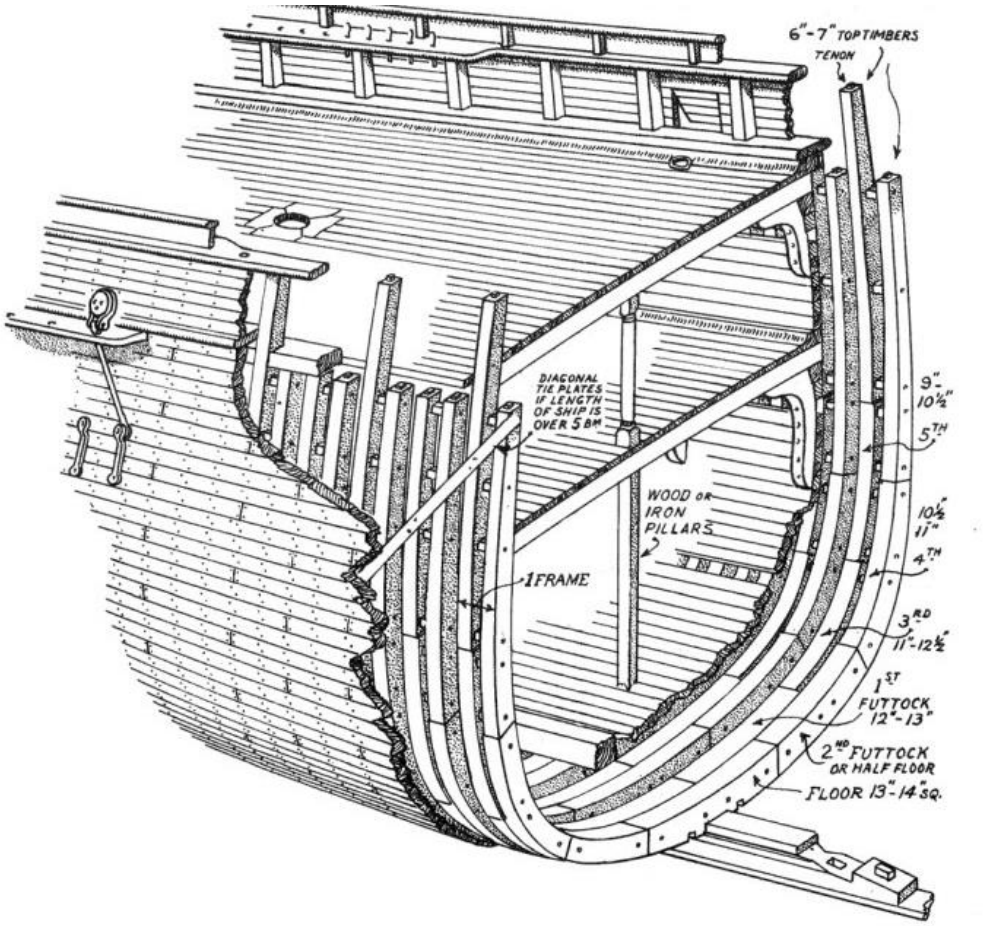

FIGURE 5.9. Simple double frame pattern characteristic of 19th century British shipbuilding. (Image from Campbell (1974: Figure 20) and modified by author).

While 19th century warship construction featured a narrower hull than those of merchant vessels, the frame first construction principles were the same (Walker 2006). As such, Steel's warship measurements are a broad indicator of overall vessel size and dimensions. Steel (1805:275–276) records a 16 in. (41 cm) sided keel as belonging to a 74 gun vessel with a keel

length of 145 feet. De Chapman (1820:116) documents the same keel scantlings on a slightly shorter vessel; a 16.5 in. sided keel was used on merchant ships of 140 ft. (42.7 m).

FIGURE 5.10. Keel step in T1, scale bar is 15 in. (38 cm). (Image from NPS, 2016).

One final clue to understanding the keel (and potential wrecking process) came during the metal detecting survey. Four large copper through bolts were observed on site, all of which showed evidence of undergoing extreme force (Figure 5.11).

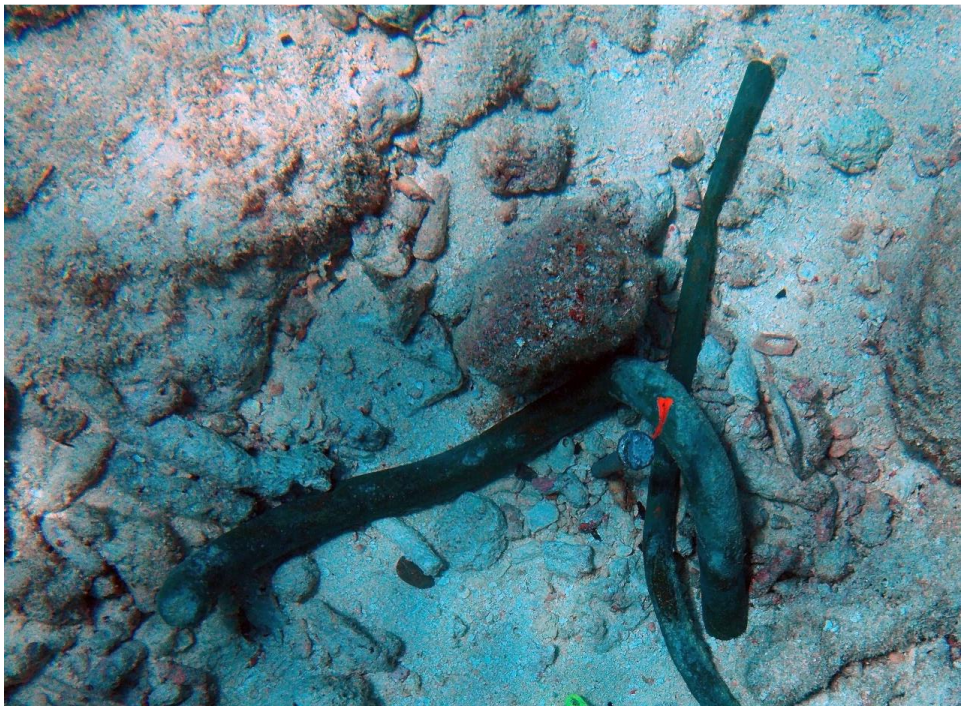

FIGURE 5.11. Copper drift pins located during metal detection survey. (Image from NPS, 2016).

These bolts, which measured 1 in. (2.5 cm) in diameter and over 2 ft. (61 cm) in length, were thought to be through bolts which joined the frames and keel. Their locations on site and general form lead researchers to hypothesize that the site experienced a violent wrecking or salvage event.

Outer Hull Planking

The frames in Area II are attached to seven outer hull strakes of varying length (the maximum being 21.3 ft. (6.5 m)) via wooden trunnels[8] and iron bolts, approximately 1.5 in. (4 cm) in diameter (Figure 5.3). Outer hull planks T52 and T53 further showed that square-headed copper dump bolts (spikes) were once present, driven from the exterior of the hull strakes into the frames below. The average width of the planks was 13 in. (33 cm), with the widest plank measuring 20.5 in. (52 cm). The average thickness of each plank was 3.15 in. (8 cm).

The strake fastening pattern was not uniform throughout Area II. Many of the frames demonstrated alternate trunnel fastening, or the alternating single and double trunnel fastening pattern described by Charles Desmond (1919:59). Some frames, however, featured gaps in their fastener patterns or trunnels which were doubled. While site degradation made it difficult to differentiate trunnels from biological deterioration, it is also possible that the "missing trunnels" were not used due to the presence of knees and riders, as shipwrights would reduce fastener numbers to maintain frame strength (Desmond 1919:59). Similarly, additional trunnels may have been added to strengthen the hull.

There is one joint (between T52 and T54) and one partial joint (eastern end of T53) of the outer hull planking present on site (Figure 5.3). One of the joints also features a repair, measuring 29 × 2.25 in. (75 × 5.7 cm) (Figure 5.12). Each plank in the joint was originally

[8] Trunnels, from "tree nail", are cylindrical wooden pins used to fasten timbers in wooden vessels (McCarthy 2005: 26). They are a prevalent fastener type as, when immersed, the wood swells creating a tighter hold.

fastened to the underlying frame via two copper spikes. Wooden trunnels were then driven through the adjacent frame. Desmond (1919:60) documents a similar practice in ship construction—butt joints were fastened with a trunnel and copper "short bolt" while an iron through bolt was driven into the adjacent frame (Figure 4.13).

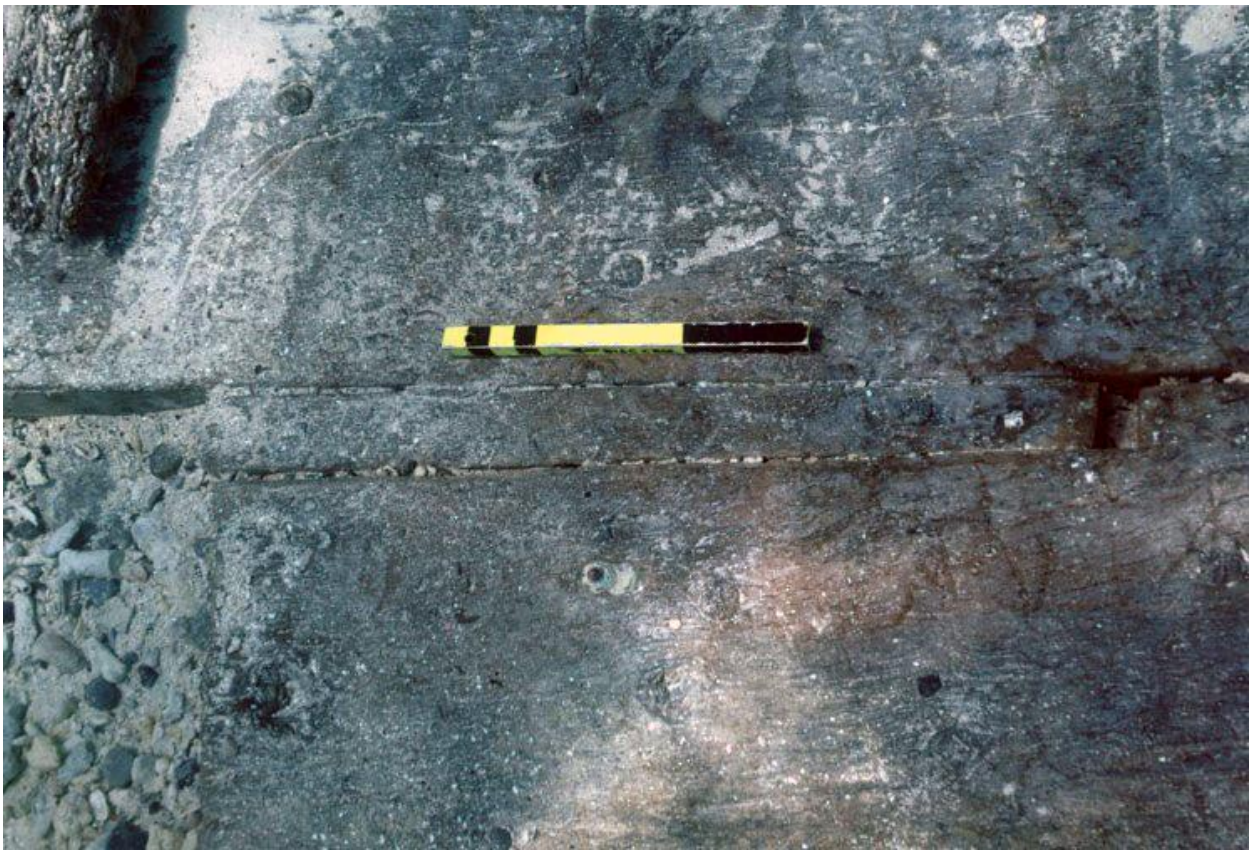

FIGURE 5.12. Repaired Outer Hull Planking. Scale is 12 in. (30 cm). (Image from NPS, 2016).

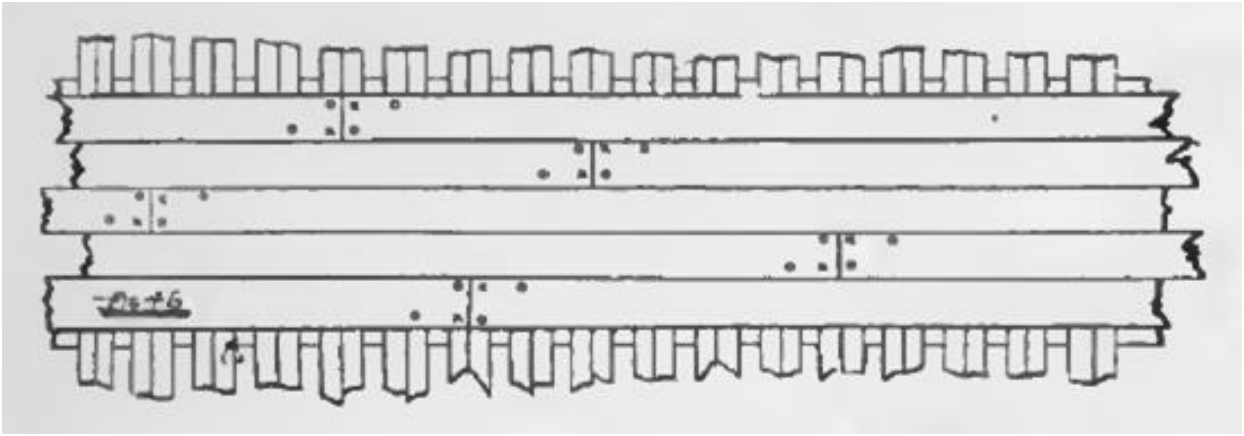

FIGURE 5.13. Butt joints in outer hull planking documented by Desmond (1919:60).

Ceiling

While ceiling planking was recorded on site in Area II during the 1984 work, no ceiling was present during the 2016 fieldwork. Images taken during the 1988 condition assessment indicate that the ceiling measured between 13 and 14 in. (33 and 36 cm) in width and ran between the iron framing elements adjacent to T20 and T27 (Figure 5.14). A profile photo of the ceiling planking (also taken in 1988) provides evidence that the planks were an estimated 3.04 in. (7.5-10 cm) in depth and through fastened (Figure 5.15).

FIGURE 5.14. Ceiling visible during the 1988 survey. (Image from NPS, 1988).

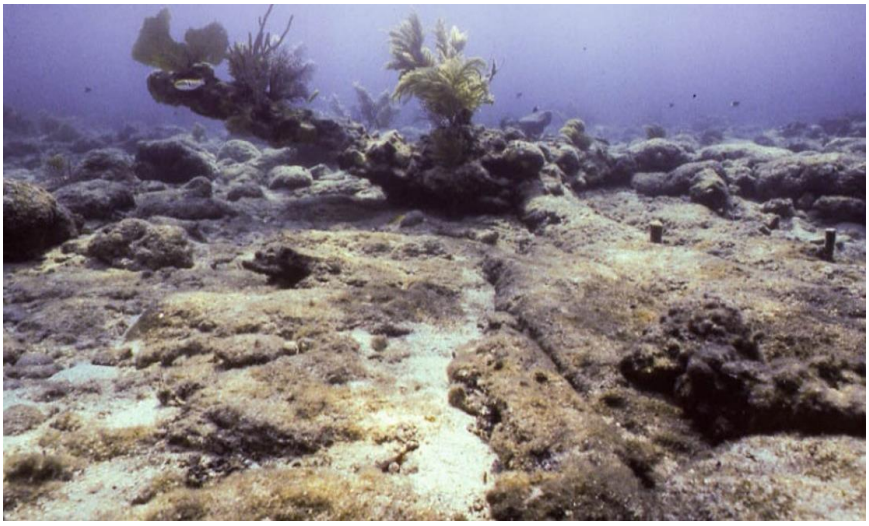

FIGURE 5.15. Ceiling running between iron framing elements. (Image from NPS, 1988).

Remaining Timbers and Construction Elements Observed on Site

Within Area I, various other timbers were observed including two planks and a futtock (Timbers T7, T12, and T6 in Figure 5.2, respectively). Their dimensions are consistent with the hull planks and futtocks in Area II. Timber T2, which is through fastened to floor T1, is hypothesized to be part of the keelson assembly. A further two timbers, T3 and T4, are also attached and thought to be rider keelsons. In its current position, the grain of the possible keelson timber is inconsistent with that of a timber running longitudinally down the vessel. As such, if the timber is part of the keelson, it likely pivoted on the through bolt and flattened. Many of the other timbers surrounding the floor assembly were heavily deteriorated and difficult to assess; the shape of timbers T8, T9, and T10 suggest they may have been part of the deadwood/post assembly in the stem or stern (Figure 5.2).

The final distinguishable timber found in Area I was a complete stanchion post (T13) Measuring 11 ft (3.35 m) in length and 5.1 in. (13 cm) in width, the post is finished and has been embellished at either end with a simple turned decoration (Figure 5.16). There is also concretion product at either end where the post attached to the deck. Given the refined finish, it was hypothesized that the post would have not have been placed in the bilge but on an upper deck. Illustrations of contemporary merchant vessel cross sections show a clear distinction in stanchion manufacture between those located in the bilge and upper deck (Figure 5.9).

Various timber fragments were also found scattered throughout Area II but were too fragmented to determine function. Several were located under the hull structure and thus may be associated with the initial wrecking event. Of interest to staff were two additional construction features—the remnants of a lead tube and the iron framing elements.

FIGURE 5.16. Stanchion post with finished decoration. (Image from NPS, 2016).

Lead Tube

A lead tube measuring 4.75 ft. in length and 2.25 in. in diameter (1.61 m × 5.7 cm) was uncovered between T7 and T8. While the southern end of the tube remains crushed but open (Figure 5.17), the northern end is folded over and features seven holes punched in its end (Figure 5.18). It is hypothesized that the northern end of the tube is the output as the holes would prevent large sediment from being deposited in the bilge. Oertling (1996:53) documents the use of lead

FIGURE 5.17. Southern end of lead tube. (Image from NPS, 2016).

FIGURE 5.18. Northern end of lead tube. (Image from NPS, 2016).

tubes in late 18th and early 19th century vessels emptying into the hull to flush out stagnant bilge water. The tubes recorded by Oertling (1996:53) fed into a well or directly into the ship's pump from a hole cut just below the waterline. As the tube on site has both ends exposed, it is likely incomplete in its current form.

Iron Frames

Three iron framing elements measuring 6 in. sided and 3 in. molded (15 × 7.5 cm) were recorded on site. With lengths varying between 8 ft. 6 in. and 7 ft. 2 in. (2.55-2.2 m). These framing elements are through fastened to the timbers underneath although all the fasteners are too heavily encrusted to determine original size. The overall form of each framing element is an arc with a deliberate bend in the structure (Figure 5.19). Two of the iron framing elements sit parallel with the wooden frames underneath. The third was also parallel but pivoted during site work.

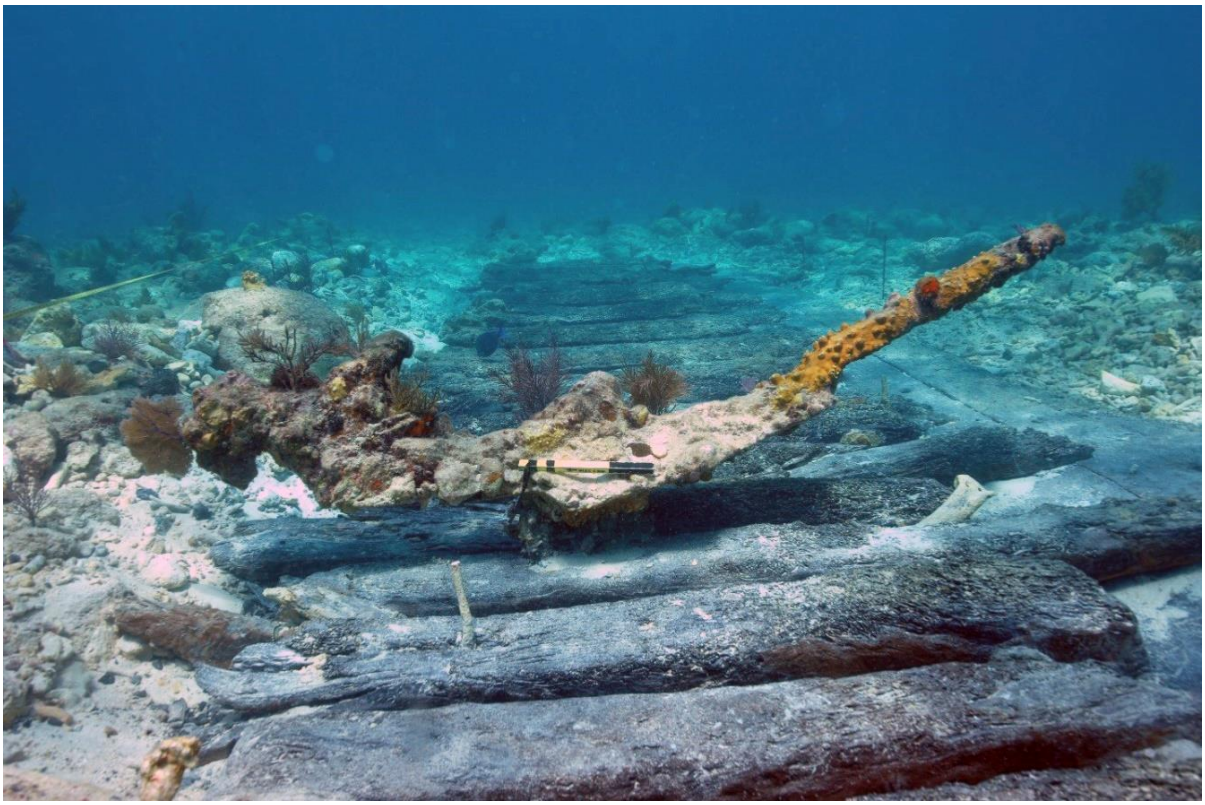

FIGURE 5.19. Western framing element. Note arc and deliberate bend. (Image from NPS, 2016).

Iron has long been used in vessel construction as a fastener material, however the incorporation of iron structural elements replacing or reinforcing wood timbers was first recorded on a British vessel in 1670 (Goodwin 1998:26). Goodwin (1998:27) proposes that despite this early use, iron was not generally adopted by British shipbuilders due to the inferior quality of wrought British iron and the high cost of foreign iron imports. As the 18th century progressed, however, continued shipbuilding activities reduced the quantity and quality of compass timbers available in England. Following advances in iron technology and a reduction in timber imports during the American War of Independence, the British East India Company (EIC) incorporated "iron knees, riders, and braces" into ship construction in the 1780s to strengthen wooden framing elements in vessels (Goodwin 1998:30).

In the early 1800s, Robert Seppings, Master Shipwright at the Chatham Navy Dockyard, proposed a new iron framing system for British warships inspired by the EIC design and implemented to reduce reliance on oak (Seppings 1814:286; Wright 1981:55; Goodwin 1998:31). The Seppings method used iron diagonal cross braces, iron knees, and filler frames to increase longitudinal hull strength (Seppings 1814:290, 292; Wright 1981:57). The basic tenets of this construction continued to be used by British, and later American, shipwrights as suitable timber stocks dwindled. By the 1830s, iron framing components including knees and diagonal riders were incorporated into British merchant vessels (Stammers 2001:115). In a study of Canadian shipbuilding conducted by Sager and Panting (1996:67), the authors found that vessels built in the 1820s and 1830s were coppered and fitted with iron knees to increase their working lives. The coppering and addition of iron knees was "often done in England," however, changes to the Lloyd's vessel classification standards in 1830s stated that:

> Ships built in the British North American colonies of 300 tons and above, shall, in order to entitle them to stand on the first description of the first class… be secured in their bilges by the application of iron riders to cover the joints of the floor and f[utt]ock heads, to extend from the height of the hold beams to the floors (*Lloyd's Register* 1839:104).

These standards were only necessary if the vessel was registered in England with Lloyd's. Nevertheless, the changes in classification are indicative of changing British sentiment towards iron use in vessel construction.

Stammers (2001:116) documents a paucity of iron components in American-built vessels from the mid-19th century, however this may be linked to the overall paucity of American shipbuilding resources as Sager and Panting (1996:67) note iron use in contemporary Canadian vessels. As the iron framing elements recorded on site do not feature the characteristic 90° bend of iron ship's knees, it is currently hypothesized that the framing elements are modified iron riders used to strengthen the lower hull (Stammers 2001:117-118).

Fasteners in-situ

All fasteners recorded in-situ are visible in Figures 5.2 and 5.3. Metal fasteners are denoted by filled black circles (representing bolts) or squares (representing spikes). Trunnels are represented by the unfilled circles whereas unfilled squares indicate missing spikes. All through fasteners not visible are represented by dashed lines.

Trunnels were the predominate fasteners observed on site. The trunnels were observed in Areas I and II in the outer hull planking, frames, and associated timbers. All trunnels were uniform in size, with a diameter of 3.8 cm (1.5 in.). No trunnel pegs or wedges were observed.

Copper alloy through bolts (discussed above) were also found scattered on site and were present in T2-T4, in Area I. Larger than the iron through bolts observed in the frames (also discussed above and below), the copper alloy bolts are hypothesized to be used as vertical fasteners, bolted through the hull. Copper alloy clench bolts with rings (Figure 5.20) were observed in the frames in Area II and are visible fastening the frames to the ceiling planking in Figure 5.15.

FIGURE 5.20. Copper alloy bolt with clench rings in T19. (Image from NPS, 2016).

Spikes were visible in the outer hull planking (as discussed above) and were recorded in the bottom of the floors and a frame in Area I. Staff were able to differentiate the past placement of spikes due to the characteristic square holes seen in some of the outer hull planking (see Figures 5.2 and 5.3).

Ballast

During excavation, divers removed little ballast from the vessel structure; the majority having been disarticulated by treasure hunters. The larger ballast fragments were visually similar to a red sandstone and granite while the smaller pebble (or shingle) ballast (the majority of that seen on site) consisted of flint and small river cobbles (Figure 5.21).

FIGURE 5.21. Sample of ballast recovered from site. (Image by author, 2018).

Metal Ship Construction Artifacts

Of the 903 artifacts recovered during excavation, 767 were metal artifacts related to ship construction. These constituted approximately 83% of the collection by count and 66% of the collection by weight (3,684.7g metal/5,603.7g total). The metal ship construction artifacts could further be refined into two broad categories—sheathing and fasteners.

Sheathing

Cupreous or yellow metal sheathing fragments were the largest category of metal artifacts found on site as 579 individual pieces weighing 1,778.8g were recovered. The copper content in the sheathing was not measured and, as such, the sheathing can only be classified as "yellow metal" or cupreous. While the recovered portions were often small, one sizeable partial sheet measuring 4.8 by 10 in. (12.3 × 25.3 cm) underwent conservation and was examined for evidence of a trademark, although none was found.

In addition to the sheathing recovered from site, one additional sheathing concentration termed EU 14 was found two meters due west of Area II. Within this excavation unit, six larger sheathing pieces were observed with some smaller fragmentary wood. While these were not recovered, all were mapped in-situ. No wooden structure was found within the excavation unit. Further sheathing fragments were also observed on site under the wooden structure in Area II (Figure 5.22).

Experimentation with copper sheathing began in 1759, when sheets were added to the keels and stern-posts of smaller 5th and 6th rate British Royal Navy (RN) warships. While the coppering helped protect vessel bottoms, galvanic action caused increased rates of erosion in iron fasteners (McCarthy 2005:103). Undeterred, chemists and shipwrights continued to experiment with copper alloys, copper fasteners, and sheathing density over the next three decades (Morgan

and Creuze 1827:270). In 1783, the first of many copper ships' bolts was patented and soon after were incorporated into RN vessel construction (McCarthy 2005:106).

FIGURE 5.22. Sheathing seen on site adjacent to southern end of T57. (Image from NPS, 2016).

While copper sheathing and fasteners became commonplace on British Naval vessels, coppering remained cost prohibitive for merchants and was not common practice in American shipbuilding at the end of the 18th century (McCarthy 2005:108). Experimentation continued, however, and copper sheathing became more predominant in merchant ship construction. In 1832, George Muntz patented "Muntz metal" (also referred to as yellow metal), a copper alloy comprised of a 60:40 copper to zinc ratio (McCarthy 2005:116). Stronger, cheaper, and more durable than other copper alloy sheathing, Muntz metal dominated the market and lead to numerous yellow metal patents and imitators over the next decade (McCarthy 2005:114).

The copper sheet production process was solely found in Europe at the beginning of the

19th century. American shipbuilders relied on imported rolls of copper to sheath vessels (Ronnberg 1980:125). Ronnberg (1980:125) estimates that in the 1849 fiscal year, over 588 vessels were sheathed with imported copper. Furthermore, as copper sheathing imports began in the early 1830s, Ronnberg (1980:125) establishes that a coppering tradition in American shipbuilding was present during the early 19th century.

Regarding the sheathing found on Pacific Reef Wreck, copper content was not measured[9], nor was a trademark observed on the recovered samples. As Muntz was careful to stamp the yellow metal sheets with his trademark (McCarthy 2005:115), it is likely that the sheathing on site is not true Muntz metal but a copper alloy imitator.

Fasteners

Sheathing tacks and nails were the most plentiful fastener found on site—over 158 tacks, nails, or partial fragments were recovered, weighing a total of 193.4g. The tacks and nails are all machine cut, made of copper or copper alloy. Individual tacks, used for attaching copper sheathing, measured approximately 1 in. (2.5 cm) in length. They also featured a rounded head which measures roughly 0.2 in. (0.55 cm) in diameter. The sheathing nails, which were used to attach sacrificial wood sheathing, also measure 1 in. (2.5 cm) in length and can be distinguished from tacks by lack of a head and curved body (Figure 5.23). McCarthy (2005:90) dates these characteristics to the early 19th century, between 1820 and 1850.

A total of four copper alloy clinch rings were recovered from site. While their associated fasteners were not found, "clinch rings were generally made of the same metal used for the fastenings" (McCarthy 2005:91) suggesting they would have been used with copper bolts. The inner diameter of the rings varied between is 0.65-0.88 in. (1.66-2.24 cm) and their outer

[9] X-Ray Fluorescence (XRF) was not conducted on samples of sheathing recovered from Pacific Reef Wreck due to delays in accessioning and conserving artifacts from BISC Acc531. XRF would present researchers with copper content of the sheathing and remains an avenue of future inquiry.

diameter varied between 1.29-1.43 in. (3.29-3.6 cm). Used to secure a through bolt, the ring sat flush against the wood. The end of the bolt would then be clinched, or hammered, over the ring. As clinching the head of a bolt would cause the bolt to thicken in the clench ring, a uniform ring diameter was not required (McCarthy 2005:71).

FIGURE 5.23. Sheathing nails and tacks (FS 22.7) recovered from site. Note variations in size and degree of deterioration. (Image from NPS, 2016).

One copper bolt without the copper clench ring was recovered from site (Figure 5.24). The diameter of the bolt was 0.75 in. (1.96 cm), while the overall length was approximately 10 in. (25 cm). The bolt tapers at one end and is incomplete. This taper is characteristic of "drift bolts" (McCarthy 1983:20) which were engineered to drive more smoothly through the hull during vessel construction.

Thirty spikes were recovered from the site during the 2016 survey. All of the spikes are square bodied and end in a chiseled point. Used to attach thick planking to beams and frames, spikes varied in size—McCarthy (1983:11–13) cites average length between 3 and 12 in. (7.6-30

cm). Most spikes had no distinguishable head, however a handful featured squared or rounded heads (Figure 5.25).

FIGURE 5.24. Copper bolt. (Image from NPS, 2016).

FIGURE 5.25. Spike (FS 11.5) recovered from site. (Image from NPS, 2016).

Wood Samples and Speciation

A total of six timber samples were taken during the 2016 fieldwork using a hand chisel and saw. Three samples were taken in each area and are summarized with images in Appendix C. The timber samples were kept in de-ionized water and analyzed at Rhodes College by Dr. Kimberly Kasper and the author. The sampling methodology followed that proposed by Hoadley (1990). All species identifications were made using the dichotomous key created by Brown et al. (1970) and were further checked against collections held at Rhodes College or available online. Each timber sample is discussed below.

Timber Sample (TS-) 1 (FS 23.1)

TS-1 was collected from floor timber T1 in Area I. The wood is a ring porous hardwood with evident parenchyma banding (where alternating bands of similar sized cells are present in the end grain of the wood). There is a clear differentiation between the early and late wood, and the late wood has few to no visible pores. Rays are present and vary in size. Due to these characteristics, the species was identified as *Carya*, common name Hickory. Genus could not be established.

Hickories are native to eastern North America, Mexico, and southeast Asia (Brockman 2001:96). The heartwood is characterized as dense, with both high tenacity and strength. Various historic accounts caution against the use of hickory in shipbuilding as it is prone to weathering and decay from insect activity (Storke 1859:207; Bigelow 1863:102; Spon 1889:134; Forest Products Laboratory 1945:42). Other firsthand narratives and reports from the 19th century do indicate, however, that hickory was used in the construction of American built vessels. In describing North American forests and associated economic activities, Michaux (1819:186) writes:

> The wood of the Shellbark Hickory possesses all the characteristic properties of the Hickories, being strong, elastic, and tenacious. It has also their common defects of soon decaying and being eaten by worms. As this tree stretches up to a great height with nearly a uniform diameter, it is sometimes employed at New York and Philadelphia for the keels of vessels; but it is not seldom used for this purpose, most of the large trees near the seaports being already consumed.

Similar agricultural reports from later in the century shed further light on the use of hickory for ship timbers. The commissioner of agriculture's 1866 report makes a clear distinction between naval and merchant ships; while the U.S. Navy only used hickory for non-structural elements such as capstans and handspikes, merchant vessels used hickory for "keels or other parts of bottom" (Newton 1867:474). These contradicting statements concerning hickory use are perhaps best explained by Silliman and Goodrich (1854:97) who state that "the wood is [liable] to warp and shrink, and to be attacked by worms, unless in salt water, where it is very durable."

In an 1894 report detailing American lumber exports to foreign markets, the authors note that hickory was only exported to a small number of countries as it was expensive and often carried higher taxes than other tree species (U.S. Bureau of Statistics 1894:114). While this report likely dates later than Pacific Reef Wreck, it suggests that there was no precedent set for hickory exports earlier in the century.

TS-2 (FS 24.1) and FS 7.2

TS-2 was taken from T2, tentatively identified as the keelson, in Area I. Akin to TS-1, the timber sample is a ring porous hardwood. While the parenchyma is less evident, the clear distinction between early and late wood remains. Tyloses are present, as are rays which differ in size. These characteristics suggest the timber is *Quercus alba*, common name White Oak.

Although only six wood samples were intentionally taken, one further wood fragment was found in the tar removed from the space between T28 and T29. Given the state of preservation, species identification was undertaken. The fragment was determined to be a ring porous hardwood with no parenchyma evident. Pores are spread throughout the entire wood structure and there is a solid demarcation between early and late wood. Tyloses and rays are

present, and the rays do not vary in size. Given these traits, the fragment was determined to belong to species *Quercus*, with a possible genus of *alba* (White Oak).

Oak species are found throughout North America although White Oak only grows east of the Rocky Mountains (Brockman 2001:120). Due to oak's strength and natural rot resistance, it became a preferred timber for both North American and European shipbuilding with export beginning in the late 17th century (Fairburn 1947:241, 245). Following close to two centuries of use, however, white oak became a scarce commodity in New England by 1835 (Hall 1884:87). As such, Hall (1884:87) records northern shipyards importing "southern timbers" (including live oak) circa 1830. While white oak use continued for keels, frames, and associated longitudinal timbers, non-traditional shipbuilding species including maple, spruce, and hackmatack became mainstays in New England shipbuilding traditions (Hall 1884:87-88).

TS-3 (FS 25.1)

The final timber sample from Area I was taken from T8 in Figure 5.2. Due to the density of the wood, characteristics within the sample were difficult to distinguish. Though definitely a hardwood, researchers were unable to determine if the wood was semi-ring porous or ring porous. Some parenchyma is evident, but latewood pores are not as distinct as other samples. Rays are also present. Researchers concluded that this sample may belong to species *Quercus,* and is possibly *Q. virginiana* (Live Oak) due to the un-even radial pore distribution and the density of the wood (Brown et al. 1970:540).

Live Oak was a popular timber choice for North American shipbuilding following the Revolutionary War (Fairburn 1947:249). Found in southeastern states along the coast, Live Oak was considered more durable than northern White Oak and became the mainstay of the burgeoning American naval industry (Desmond 1919:14; Fairburn 1947:249). By the 1830s it

was found in shipyards across the Eastern seaboard due to diminishing White Oak stocks. Incredibly strong and durable, live oak was used for frames, keels, and masts (Hall 1884:87).

TS-4 (FS 26.1)

TS-4 was taken from the outer hull planking T53 in Area II. The wood is a diffuse porous hardwood. Parenchyma is not evident in the sample. The pores have tyloses present, and rays alternate between very fine and large. These characteristics are suggestive of an *Acer* species, commonly referred to as hard or rock maple in ship construction (Crothers 1997:24–35).

Maple is a structurally strong but dense timber that can be found in northern states east of the Mississippi River (Crothers 1997:24; Brockman 2001:210). Historically, maple's density made it an ideal timber for keel and frame construction in North American shipyards (Bates 1867:474). An American shipbuilding report from 1866 cites hard maple use for keels or "in plank from keel to light water-mark" (Bates 1867:474). Like hickory, Desmond (1919:15) suggests that maple is only durable when kept in contact with water while Crothers (1997:25) states it has a high resistance to rot.

TS-5 (FS 27.1)

TS-5 was collected from T27 in Area II. The sample is from a ring porous hardwood with evident parenchyma banding. There is a clear differentiation between early and late wood and the late wood has few to no visible pores. Rays are present and vary in size. Given these characteristics, the sample was identified as a *Carya* species. Furthermore, the similarities in defining characteristics between TS-5 and TS-1 suggest both wood samples are from the same hickory species. While not definitive proof, these similarities provided enough evidence to suggest that Areas I and II contained timbers from the same vessel.

TS-6 (FS 28.1)

TS-6 was a sample taken from the filler chock between T24 and T25. Unlike the other samples, the wood has large resin canals present and is a softwood. The cell structure and rings are clearly visible, even under low magnification. Given these traits, the species was identified as *Pinus strobus*, or Eastern White Pine.

New England White Pine stocks became a main timber source for North American and European shipbuilding industries as early as the 17th century (Fairburn 1947:241). The specie's natural resilience to rot, resistance to warping, and general size made it ideal for rigging elements such as masts and spars (Desmond 1919:16; Fairburn 1947:244). The British Royal Navy, having depleted England's virgin timber stocks, turned to North American pine forests for their masts, and bowsprits in the late 17th century. By the early 18th century, legislation had been passed condemning the felling of any New England grown White Pine without license from the crown to preserve the largest trunks for warship construction (Fairburn 1947:244). Despite these restrictions, the sheer quantity of White Pine exports to England greatly reduced reforestation efforts (Fairburn 1947:250). By the 19th century, west coast pine species were preferred in the masting of American built vessels while Eastern White Pine was used for hull planking and "joinerwork" (Desmond 1919:16).

Conclusions and Vessel Orientation

To date, the orientation of Pacific Reef Wreck is still unclear. Various ship construction elements are contradictory, muddling interpretation of vessel remains. For example, the partial frame timbers T48-T51 have larger sided dimensions but are still sitting flush with filler chocks, suggesting they are the remnants of first futtocks. This logic, however, would also place the limber holes in Area II in the second and third futtocks, close to the presumed turn of the bilge.

This limber placement has been observed on ancient vessels but is not frequently seen in 19th century wooden ship construction (Mor and Kahanov 2006:276; Barkai and Kahanov 2007:23). One possibility is presented by David Campbell (1974:62), who suggests that solid bottomed framing as seen in Figure 5.9 resulted in bilge water sitting on top of the timbers, so "drainage holes were not required in the lower surface of the frames." While limber holes were cut in the floor timbers in Area I, a solid bottomed hull may have required secondary limbers to increase bilge water movement. Campbell (1974:62) also notes that some frames were intentionally gouged and filled with salt to prevent growth. While there is no detailed account of this practice, this may have been the function of the secondary "limbers." One final possibility is that the limbers were added to increase ventilation throughout the hold. While a later treatise records additional limbers "also cut into other places to give ventilation in the inner bottom through floors, longitudinals, etc." (Anon 1917:98), it is possible this practice was employed earlier, especially when dealing with agricultural cargoes (fruit, grain, rice, etc.) (Stevens 1863:278).

The alternate hypothesis is that the limber holes seen in Area II are running through the remains of floor timbers and first futtocks. This scenario is also riddled with problems, as it would suggest that the filler chocks were placed between floors and first futtocks, a practice which Greenhill (1988:115) emphatically states did not occur. Furthermore, this scenario does not explain why the partial frame timbers T47-T50 would increase in sided dimension.

Regarding both of these scenarios, it is apparent that further research into 19th century shipbuilding and comparative studies are needed. Fortunately, investigation of the vessel did offer insight while generating more areas of inquiry. Taken together, the wood samples indicate that Pacific Reef Wreck was likely a North American built vessel with Northeast timber origins. The presence of the hickory and maple further suggest vernacular construction as these species

were not widely used outside of North American shipyards. The other construction practices seen in the vessel, including the large keel, close frame spacing, and presence of filler chocks, are all indicators of the shipwright's concerns with longitudinal strength and hogging. The next chapter further explores these concepts to build the context behind Pacific Reef Wreck.

Chapter 6. Context of Pacific Reef Wreck

The previous two chapters discussed the material remains of Pacific Reef Wreck—objects including the vessel itself and the associated material culture. This chapter addresses the construction of Pacific Reef Wreck—not only the architectural features, but the practices and ideologies necessary to transform the vessel from a conceptual to material existence (Latour 2005:89). This discussion results in a re-examination of the historic record and the potential identification of Pacific Reef Wreck.

19th Century Shipbuilding in the Americas

Wooden ships dictated trade and commerce in the New World from European arrival until the mid-19th century. As ships facilitated all communication and trade between European colonies and the motherland, governments placed significant emphasis on harvesting plentiful timber stocks for shipbuilding in colonial America (Carroll 1981:213). Encouraged by the British Navigation Acts, Boston became a major shipbuilding center in the 17th century, followed by New York, Philadelphia, Maryland, and Delaware in the 18th century, and Maine in 19th century (Carroll 1981:213). A secondary business of timber exportation to Europe was created in each of these ports due to their access to timber stocks and navigable waterways (Fairburn 1947:250).

Carroll (1981:214) states there was little experimentation in vessel form during the early colonial period—most shipbuilders patterned vessels after English and Dutch types. As global trade increased throughout the 18th century, however, new trade routes, cargoes, markets, and timetables demanded an expansion in vessel types and building methodologies (Carroll 1981:214). Both American and British vessels rapidly increased in length during the early 19th century, challenging the skill of the shipwright (Crothers 1997:503). As merchant vessels

approached the 200 ft. (61 m) mark, new methods of ship construction became necessary less merchant shipping lose its forward momentum (Crothers 1996).

English sailing craft were already diverging from previous forms at the turn of the 19th century as deforestation had created a heavy reliance on imported timbers. Iron substitutions for wooden knees became commonplace, "done on a principle of mere economy" (House of Commons 1836:10). Iron would become the primary material for constructing rigging, frames, and eventually ships themselves by the mid-1800s (Crothers 1997:503). American shipwrights, however, were less willing to adopt iron, as timber was still widely available at significantly lower cost (Crothers 1997:204; Carroll 1981:215). To meet an increased need for transportation speed and cargo capacity, highly specialized vessel forms including schooners, clippers, and bulk carriers came to dominate American shipbuilding (Crothers 1997:204). Each of these vessels required a change in hull shape facilitated by construction features and timber species (Campbell 1974:65; Crothers 2007:55). While iron did not become a primary construction material, shipbuilders used it for framing and fastening, as discussed in Chapter 5.

By the 1870s, increasing timber prices and shrinking lumber stocks finally led to an adoption of iron and steel technologies (Carroll 1981:215). Composite ships with iron frames and wooden hulls were soon followed by those built entirely of steel. While wooden ships would remain in use through the end of the century, they were no longer the norm in American shipbuilding.

Construction Features and Vessel Investment

The principle dimensions of the Pacific Reef Wreck (Appendix B) indicate that the vessel was large for the early 19th century. Table 6.1 presents a comparison of timber scantlings from contemporary shipbuilding documents. The three sources chosen—*Lloyd's Register* (1834)

(McCulloch 1844:1114), Hedderwick (1830), and Desmond (1919)—were all written to address the construction of wooden merchant vessels. While Hedderwick and *Lloyd's Register* solely address British vessels, Desmond's work, albeit dating to the early 20th century, is representative of refined Lloyd's measurements used in American shipbuilding by the end of the 19th century.

TABLE 6.1. Comparison of Pacific Reef with Contemporary Shipbuilding Scantlings and Associated Tonnage. Measurements are in inches. Sided and molded are indicated by (s.) and (m.). Scantling and tonnage are abbreviated scant. and ton., respectively.

Timber	BISC-029	Lloyd's (1834)		Hedderwick (1830)		Desmond (1919)	
	Scant.	Scant.	Ton.	Scant.	Ton.	Scant.	Ton.
Frame (s.)	9.5	11	500	9.5	347	10	400
Room & Space	25	30	500	N/A	N/A	24.5	300
Floor (m.)	16.5	13	500	15	503	15.75	1500
Keel (s.)	16.5	13	500	14	503	16.5	1500
Keelson (m.)	13	14	500	15	503	15	500
Strake (depth)	3.5	3.5	500	3	347	3.75	400
Average Tonnage			500		440		767

Comparison of the sources in Table 6.1 suggest the vessel ranged from 300 to 1500 tons, averaging 560 tons between the three authors. While these sources indicate that Pacific Reef Wreck was large for the 1840s (more than 500 tons), they may be misleading as to the actual tonnage of the vessel. All dimensions presented in Table 6.1 are minimum dimensions necessary to maintain the associated tonnage. As such, actual vessel tonnage may be lower than that associated with the scantlings in the table. Furthermore, *Lloyd's Register* was only applicable to insured vessels and is not representative of unrated craft including those built using vernacular traditions and used in insular conditions (Souza 1998:116).

Campbell (1974:65) furthers this discussion through a comparison of American and British scantlings taken from 19th century merchant vessels. American ships, for example, often featured wider hull planks due to the shipwright's use of comparatively softer timbers. Reliance on non-traditional timber species also resulted in the shipwright emphasizing longitudinal

strength through the use of rider and sister keelsons, diagonal iron braces, and larger ceiling frames (Campbell 1974:65). Crothers (1997:155), too, suggests that American shipwrights would increase scantlings of the principal structural members such as the keel and keelsons as countermeasures to hogging. Additional measures included incorporation of filler chocks between frames and the installation of iron framing elements such as riders and knees (Crothers 1997:155).

Taking these American shipbuilding traditions into consideration, it is likely that the non-traditional woods used in Pacific Reef Wreck necessitated larger scantlings. While Pacific Reef Wreck may have had a carrying capacity greater than 500 tons, it is also possible the vessel was under this tonnage.

A comparison of shipbuilding materials addresses a secondary argument regarding the construction of Pacific Reef Wreck—that of cost. The presence of iron knees, iron and copper alloy fasteners, copper alloy sheathing, and larger scantlings suggests that the vessel's owner(s) made a significant investment in its construction. If the vessel was rated by insurers, the presumed cargo of rice would have required a first class insurance rating necessary to carry dry stores (McCulloch 1844:1118). This rating, too, required significant vessel investment.

In studying the incorporation of iron into 19th century American built vessels, Sechrest (1998:20) found that increasing iron tariffs restricted iron use on board without significant financial investment. Owners building merchant vessels in the mid-19th century were paying five times what their counterparts were paying thirty years prior (Sechrest 1998:20). Furthermore, as American blacksmiths did not produce iron frames until the second half of the century, their presence indicates they were either imported or the owner had an additional cost of sending the vessel to Europe for iron frame installation.

Coppering, too, was a costly endeavor. Ronnberg (1980:125) estimates that American vessels of 500 tons in 1850 required over 1200 copper plates, an additional cost of $1,700. Furthermore, as it was necessary to re-sheath as copper degraded, this sum only represents the initial investment (Pastron and Delgado 1991:69).While shipbuilding costs varied, it was not unusual for a buyer to pay $15,000-20,000 for a 500 ton vessel in 1840 (Sechrest 1998:9; Burns 2003:16). As coppering initially increased the overall budget by 10%, and was only guaranteed to last for the first six years, it represented a significant financial commitment which would last the working life of the vessel (Pastron and Delgado 1991:69).

The architectural features observed on Pacific Reef Wreck, including the large scantlings, iron framing elements, and copper sheathing, suggest the vessel's owner did not undertake its construction lightly—the vessel required substantial capital and investment from its owner. The paucity of North American shipbuilding records prior to the establishment of the *New-York Marine Register* in 1857 and *The Original American Lloyd's Register of American and Foreign Shipping* in 1859 make it difficult to assess trends in North American shipbuilding in the early 19th century, such as the popularity of iron frames and copper sheathing. While the written accounts above refer to generalized construction trends, resource managers have not observed many of the 19th century shipbuilding practices discussed here on other sites in BISC. For this reason, the next section presents comparable archaeological sites from Florida.

A Comparison of Similar Archaeological Sites

While there are a number of 19th century merchant vessels recorded throughout Florida, the below examples were chosen due to their proximity to the Florida Keys and Gulf Stream. It is presumed these vessels were engaged with the transport of goods through the Florida Keys and experienced similar interactions with the wrecking system and ATONs.

Brick Wreck (8MO1881)

In 2006, BAR recorded the remains of a wooden shipwreck near Vaca Key, so named for the cargo of red bricks it was carrying (Smith et al. 2006:1–2). The site dates to the mid-19th century and is the remains of a merchant vessel approximately 75 ft. (23 m) in length. While the keel is smaller than that associated with Pacific Reef (12 versus 16.5 in. (30 versus 42 cm)), the framing of Brick Wreck is very similar to BISC-029. Average sided dimensions of frames from Brick Wreck were 10.5 in. (27 cm), with approximately 1 in. (2.5 cm) of spacing between frames (Smith et al. 2006:14). Spacing between frame pairs ranged between 0.75 and 1.75 in. (2-4.5 cm). Species identification was also undertaken as part of the study—the frames were identified as *Quercus* and *Acer* while the outer hull planking was solely *Acer* (Smith et al. 2006:19).

The closely spaced framing system observed on Brick Wreck would have resulted in "the whole bottom and bilges of a vessel [made] one solid mass of wood" (Desmond 1919:53). While heavy, Desmond (1919:53) suggests the solid hull provided stability for transportation of cargo. The similar room and space observed on BISC-029 suggests a vessel built with the same solid hull structure in mind. The shared hull materials, too, may suggest the closely spaced frames were a construction technique adapted for North American timber species.

Rib Wreck (8MO1880)

BAR investigated another shipwreck, the Rib Wreck, during the 2007 field season. Located near Brick Wreck adjacent to Vaca Key, the vessel was named for the iron "reinforcing frames" which protrude from the sand on site (McClarnon et al. 2007:7). A total of 12 frames were visible. Their curvature profiles are also included in the report (McClarnon et al. 2007:17–24). The frames are not situated adjacent to the keelson but offset approximately 13 ft. (4 m) to

the northwest. The report further concludes that the vessel was a "heavily laden composite vessel" which wrecked during the beginning of the 20th century (McClarnon et al. 2007:12).

The frames observed on the Rib Wreck share the same dimensions and form as those recorded on Pacific Reef Wreck. While the curvature of several frames from the Rib Wreck is more extreme than that recorded on BISC-029, this may be a result of site formation processes. To date, no excavation has been conducted on Rib Wreck making further comparison of construction techniques difficult. The offset dimensions of the frames from the keel assembly, however, suggest that frame attachment began after the floor/first futtock timbers.

Bronze Pin Wreck (8MO1879)

Located just offshore of Grassy Key, the Bronze Pin Wreck was investigated by BAR during the 2008 field season (Shefi et al. 2009). Presumed to be the wreckage of a 19th century sailing vessel, BAR estimated that the vessel was salvaged by local wreckers (Shefi et al. 2009:4). Of the three BAR investigations discussed here, the Bronze Pin Wreck shares the largest number of construction similarities with Pacific Reef Wreck, including presence of copper alloy fasteners, iron reinforcing frames, 10 in. (25 cm) sided floor timbers, and copper sheathing (Shefi et al. 2009:7–9). Similar to Rib Wreck, the iron reinforcing frames are not located at the presumed keel of the vessel but offset by approximately 8 ft. (2.4 m). Shefi et al. (2009:14) conclude that the iron reinforcing frames and copper alloy bolts were both inserted after initial construction of the vessel. As BAR did not excavate, there is still some question as to how the iron frames attached to the hull.

While working on BISC-029, project staff often had difficulty reconciling construction features with hypothesized vessel orientation. Staff first believed the iron frames were vernacular structures as they only appear on a handful of sites in the park, and never attached directly to

wooden frames. Comparison of features with other archaeological sites, however, suggests that that Pacific Reef Wreck shares many more "common" 19th century American shipbuilding features than previously thought.

Potential Identity of BISC-029

Chapter 2 presented a brief history of wrecking in the Keys and introduced some of the historic vessels lost on Pacific Reef. A re-examination of Table 2.1 in light of the excavation results (Table 6.2) discussed in chapters 4 and 5 further limits the potential identity of Pacific Reef Wreck to four vessels—*Export* (1820s-1838), *Triumph* (1837/8-1838), *Merchant* (1840s-1851), and *Siddons* (1837-1856). While there is always the possibility that a vessel wrecked on Pacific Reef without undergoing salvage, the shallow depth of the wreck site and visibility on the reef makes this highly unlikely. The below section discusses each potential vessel candidate.

Export and *Triumph*

In September 1838, a hurricane swept through the northern Florida Keys and Bahama Bank, leaving a trail of shipwrecks in its wake. *Niles' National Register* (1838:103) records "between thirty and forty vessels" lost on the Bahama Banks, however only three are attributed to southern BISC waters—the bark *Export*, ship *Triumph*, and wrecking schooner *Caroline*.

The Key West Admiralty Wrecking Reports chronicle the salvage of *Export*. The wrecking schooner *Globe* was scouring the Florida Coast for hurricane survivors when it came across "a vessel on shore on the reef bearing about East from Caesar's Creek" (KWADM 1838:184). Reaching the stranded vessel, the wreckers "discovered her to be the brig *Export* of Kennebunk, captained by C.M. Morrill" (KWADM 1838:184). Destined for Boston, MA with a cargo of sugar from Matanzas, Cuba, the vessel had wrecked during the hurricane. The crew and master waited out the storm, and returned the next morning to salvage materials from the brig

"which had gone to pieces" (KWADM 1838:185). The Wrecking Report paints a grim picture of the destroyed vessel— the master and crew "found her bilged and broken into, and the water flowing through her" (KWADM 1838:185). Setting out in *Export's* boat to locate help, wreckers spotted the vessel and were soon in the midst of cutting through the decks to salvage the cargo and material on board including anchors, stores, and boxes of sugar (KWADM 1838:185,186).

The testimony of Morrill at the Admiralty Court in Key West refers to a second larger vessel which, "…about an hour previous to our striking, [struck] very near us—all hands had left the ship and are probably lost. She went to pieces" (*The Floridian* 1838). First identified incorrectly by rescuers as *Thracian*, the vessel was later confirmed to be *Triumph* (*Boston Courier* 1838:3), a newly built ship from Boston loaded with "domestic goods, bar, and tire iron, a carriage, saddles and harness, nails and machinery, [and] a locomotive engine named 'Camden,' directed to Hyde & Comstock, New Orleans" (*Niles' National Register* 1838:103).

Vessel registration records for *Export* and *Triumph* are not present in the 1837/1838 *Lloyd's Register of Ships*, suggesting insurance adjusters did not survey the vessels. *Triumph* was recorded as a "new ship," likely built in 1837 or 1838 in Plymouth, MA (*Boston Courier* 1838:103; *The Floridian* 1838). *Export* is likely an earlier vessel as records first appear in the early 1820s referencing trips from Portland, ME to the West Indies and New Orleans (*The National Advocate* 1823; 1824). Tonnage and materials are not included in these descriptions, making it difficult to estimate size and construction of these vessels.

TABLE 6.2. Vessels Excluded from Search for Identity of Pacific Reef Wreck

Vessel Name	Wreck Date	Reason for Exclusion	Evidence	Citation
Ajax	11/14/1836	Pre-dates TPQ for wrecking event	Green & Broad lock manufactured after Ajax wrecked.	Howell (1985)
Caroline	9/7/1838	Vessel size too small.	Caroline was a wrecking vessel from Key West. Tonnage is significantly smaller than Pacific Reef Wreck. No cargo.	*Niles' National Register* (1838:103)
Crown	1/22/1857	Location of wreck is not at Pacific Reef.	Wreck is placed by wreckers on "Ajax Reef." As reefs were marked at time of wrecking, location is likely correct. Site also caught fire, but no evidence of burning was found at Pacific Reef Wreck.	KWADM (1857:667)
Riversmith	2/8/1858	Location of wreck is not at Pacific Reef.	Wreckers and Captain were within sight of Carysfort Light and place wreck at "6 miles north of light."	KWADM (1858:47)
Sir Walter Raleigh	8/15/1861	British Built (wrong nationality for timber speciation).	Vessel was British built at Sunderland.	Lloyd's of London (1860:no.487)
Unidentified	2/6/1862	Wrong vessel type.	Halas cites the unidentified vessel as a steamer. No steam machinery was observed on site.	Halas (1988:14)
Sparkling Sea	1/8/1863	British Built (wrong nationality for timber speciation).	Vessel was British built at Bristol.	American Lloyd's (1862:96)
Let Her Be	10/26/1867	Wrong location on reef.	Wreckers state they "allowed her to drift ashore on [the] inner reef" to facilitate salvage.	KWADM (1867:386)
DERELICT	1/1/1871	No associated vessel.	Wreckers discovered the rail ties along on the reef-- no vessel present.	KWADM (1871:118)
Cornwall	11/30/1873	British Built (wrong nationality for timber speciation).	Vessel was British built at Bathurst.	Lloyd's of London (1870:790)

While both vessels are presumed to have been built in the northeastern U.S., the 1838 wrecking date does not support either vessel as a candidate for Pacific Reef Wreck. The Green & Broad rim lock likely postdates these vessels while the listed cargoes are inconsistent with that located on site. While salvage and looting may have removed evidence that suggested Pacific Reef was one of the vessels, the current interpretation of the material culture recovered cannot support this hypothesis.

Merchant

Merchant was a schooner that operated out of Charleston, South Carolina between 1846 and 1851 (*The Charleston Mercury* 1846:2, 1851:2). Owned by Moses Cohen Mordecai (a prominent Charleston businessman and shipping tycoon), *Merchant* was a transport packet which carried agricultural goods, including sugar, fruit, coffee, and rice (*The Charleston Mercury* 1846a:2, 1846b:2, 1850:3, 1851:2; Jewish Historical Society of South Carolina 2002:129). The major ports of call the schooner visited included Matanzas and Havana, Cuba; Key West, Florida; Savannah, Georgia; and Kingston, Jamaica (*The Charleston Mercury* 1846a, 1848:2, 1851:2). As Mordecai held the U.S. Government mail contract for service to Cuba, twice a year *Merchant* would take over the run between Charleston and Havana (Mordecai 1874:1; McKay 1971:245).

In 1851, *Merchant* was lost on Pacific Reef (KWADM 1851:541; *The Charleston Mercury* 1851:2). Totaling 119 tons, *Merchant* had six crew on board for the journey (KWADM 1851:541). In late November, the schooner was traveling south from Charleston to Havana laden with a cargo of rice, U.S. mail, and approximately $8,000 in specie (KWADM 1851:541). Four passengers were on board with their luggage; one of these passengers, Mr. J. Totten of the U.S.

Coast Survey, was also traveling with three boxes of survey equipment[10]. The vessel struck Pacific reef on November 27th and bilged soon after (KWADM 1851, *The Charleston Mercury* 1851). The following morning, wreckers discovered the vessel, "her colors union down" indicating distress, and proceeded to transport the passengers, surveying equipment, and specie to Key West (KWADM 1851:541,544). Over the next few days, 157 tierces of rice (approximately 6,590 gallons) were recovered from the wreck along with the specie, survey equipment, and other "materials of the vessel" (KWADM 1851:541,544).

Given the cargo *Merchant* was carrying[11], as well as the presumed construction features necessary to carry a cargo of dry goods, the schooner is the most likely candidate for Pacific Reef Wreck. While the tonnage of *Merchant* is significantly less than the suggested carrying capacity of Pacific Reef Wreck, *Merchant*'s North American origins may have resulted in exaggerated timber scantlings. While the schooner's builder remains unknown, New England wood species could easily have been used in its construction as timbers were transported along the U.S. east coast[12]. Further regarding liability and vessel construction, Mordecai faced severe repercussions if any mail was found damaged (Huger and Modecai 1851:260). As such, *Merchant* likely carried the highest insurance classification (also a necessity for carrying dry goods) and required significant vessel investment. Charleston, too, was a naval stores emporium, suggesting that the other "materials" *Merchant* was carrying may have included naval stores.

[10] As of September 1851, Lt. James Totten (U.S. Army and assistant in Coast Survey) was directed by A.D. Bache to "insure success in getting a number of screw-piles and signal-poles fixed along the Florida reef, at certain important points connected with the triangulation thereof" (Totten 1852:97). The survey, which began in 1852, was conducted by James Totten and another Lieutenant (and possible relation), Joseph S. Totten. It was this survey which resulted in Pacific Reef receiving the "L" beacon designation (see Figure 2.3) and the later 1855 installation of iron signal poles along the reef. While the reasoning behind beacon placement is scarce in subsequent reports, Pacific Reef's beacon placement was likely inspired by one of the Totten's experiences as a shipwrecked passenger aboard *Merchant.*

[11] *Merchant* is the only vessel with a rice cargo which wrecked on Pacific Reef during the 19th century (Table 2.1).

[12] Mordecai also owned steam vessels which operated between Charleston and New York (McKay 1971:245). This may explain the presence of the Green & Broad lock on board.

Siddons

Launched in 1837, the ship *Siddons* was built by Brown & Bell for the E.K. Collins' Dramatic Line of sailing packets (*New-York Spectator* 1837). Running from Liverpool to New York, Collins packets sailed on fixed dates each month from the same port, a practice which guaranteed arrival of shipped goods within a specific time frame (Greenhill and Giffard 1972:21). Curious sightseers published their first impressions of *Siddons* in dock at New York in 1837 (*New-York Spectator* 1837):

> We stepped down to the wharf at the foot of Wall street [*sic*], to take a look at this paragon of aquatic beauty. From the size of the ship, and the manner in which she is painted, a person would be very excusable in mistaking her for a frigate instead of a packet ship. The cabin is intended for the accommodation of thirty-six passengers, and is an elegant room, richly furnished and decorated with the most consummate taste. The stern windows or ornamented glass have a peculiarly fine effect and shed a rich and mellow light.

At the time of construction, *Siddons* was recorded as one of "the largest merchant ships ever built in the United States"(Gleason 1851:336), measuring "160ft. on deck, with 35.5ft. breadth of beam, 21.5 ft. depth of hold, and 900 tons burthen" (*New-York Spectator* 1837).

Siddons was retired from passenger service in 1854 and proceeded to transport cargo under a new master. While traveling to New Orleans from London in early January 1856 with a load of ballast, the vessel ran ashore on Pacific Reef "with about six feet water in her hold" (KWADM 1856:452). Passing wreckers stopped to assist the vessel but were unable to refloat

the ship. *Siddons* was then stripped of the rigging and sails, and all materials were transported to Key West with the crew (KWADM 1856:453).

The tonnage of *Siddons* is larger than the presumed tonnage of BISC-029. Nevertheless, *Siddons* is a potential candidate, albeit secondary to *Merchant*. A vessel of 900 tons would require the scantlings observed on Pacific Reef Wreck. There is also the likelihood that *Siddons* was coppered, as reported in an 1848 advertisement (Irish Emigration Database 2012). There is no record of *Siddons* in *Lloyd's Register*, however, records from another 1837 Dramatic Line packet indicate that Bell & Brown used oak and live oak timbers, and copper and iron fasteners (Root, Anthony & Co. 1857:61).

The cargo of *Siddons*, however, does not match that observed on site. While ballast rock was present, the majority seen on site was small pebble rock. As the ballast-cargo from *Siddons* was not recovered during salvage, it is presumed to still be present on site. The quantity of ballast rock at Pacific Reef Wreck is inconsistent with the amount necessary to be carried by *Siddons*.

Conclusions

An examination of the construction of Pacific Reef Wreck suggests the site represents the remnants of a heavily built, mid-19th century merchant vessel. Further re-evaluation of the historical record suggests Pacific Reef Wreck may be the remains of *Merchant*, a 119 ton schooner transporting rice and passengers to Cuba (see Appendix D for full transcript of wrecking report). While this conclusion is preliminary, it is supported by trends in 19th century shipbuilding and commercial transportation. The next chapter addresses the significance of this conclusion and summarizes the findings of this thesis.

Chapter 7. Conclusions

This thesis set out to analyze the material culture and structure of Pacific Reef Wreck by tracing the network surrounding it. By drawing on the historical and archaeological record, this work identified actors and their actions, assessed objects, and challenged fact to understand Pacific Reef Wreck within a larger maritime and archaeological context.

First and foremost, analysis of the archaeological record identified Pacific Reef Wreck as a North American-built vessel. Shipbuilders sourced the timbers used in its construction from the east coast of the U.S., while the timber scantlings suggest the vessel was anywhere from 300-500 tons. A study of the material culture associated with the site further identified the vessel as a merchantman. Remnants of the cargo include naval stores and rice, both materials that were harvested and produced in southern states. Naval stores were necessary for the maintenance of wooden vessels while rice was important for feeding growing, non-agricultural populations. A comparison of vessels stranded or wrecked in South Florida waters indicates that agricultural commodities were frequent cargoes during the 19th century (Halas 1988).

Turning to the historic record to identify a possible vessel candidate, it was discovered that both the scope and skill of the recorder limit historic records. Nevertheless, this thesis produced a list of vessel candidates with a shared generalized wrecking location. Through a process of elimination based on criteria documented in the historic record, this research identified four potential vessel candidates. Of these, only the American schooner *Merchant* shares the same cargo as Pacific Reef Wreck. While there are still discrepancies between *Merchant* and Pacific Reef Wreck, it remains the most viable candidate of those identified.

Datable artifacts and the historic record both suggest BISC-029 was traveling through Florida waters at the height of the Florida Keys wrecking industry during an era of increased

shipping control and regulation. The Gulf Stream, already a major shipping route, posed a threat to burgeoning American commerce in the South. As such, insurers needed assurances that vessels could safely travel around the Florida coast to reach their destinations. By the 1840s, wreckers and ATONs were both well established, guaranteeing that natural disasters and human errors in navigation would not impede shipping and commerce.

The construction features observed on Pacific Reef Wreck are homologous to those seen on other wrecked merchant vessels in the Keys. The similarity in timber scantlings and placement, as well as presence of iron "framing elements" on these sites, suggests that the vernacular features seen on Pacific Reef are shared by a number of vessels, and may be indicative of larger trends in 19th century American shipbuilding. Certainly, further research and excavation of known sites is necessary to correlate these findings.

Regarding site management, BISC staff have visited Pacific Reef Wreck intermittently since the 1980s. Preliminary documentation of the site resulted in a site plan and a "significant" designation based on the presence of iron framing elements. The past association with treasure hunting and the popularity of the reef as a recreation site, however, did not result in recovery efforts during the 1980s. While staff continued to monitor the site, the first mitigation was the 2016 fieldwork.

Today, taxpayers, local community members, and park research staff are the primary stakeholders in the preservation and interpretation of Pacific Reef Wreck. Park visitors and residents utilize the site for recreational activities. Modern material culture from these activities is present on site but does not indicate any recent attempts at site disturbance. Many stakeholders, however, are unable to visit or interact with the site. As such, park staff excavated and stabilized the site in 2016 to increase outreach potential and slow site degradation from

environmental factors. While in-situ preservation will not stop site decay, it will hopefully slow it, so the site remains a viable research opportunity in the future. More importantly, the ongoing conservation of artifacts and publication of materials such as this thesis will increase public interaction with the site while maintaining its integrity.

Excavation and in-situ stabilization were chosen as a management strategy for Pacific Reef Wreck following past successes at two sites in the park, Soldier Key Wreck (BISC-022) and HMS *Fowey* (BISC-020). To date, this strategy has been successful in reducing visibility of the site and furthering understanding of the vessel's historic context, including cargo, construction technique, and potential identity. While the 2017 hurricane season did impact the site, proactive excavation and data recovery aided park resource staff in meeting management mandates and preventing further data loss. As such, the chosen management strategy of excavation emphasizing data recovery and in-situ structural stabilization is still considered a success.

Shortcomings, Limitations, and Future Avenues of Inquiry

As with any archaeological and historical research, this thesis was, in part, structured by various limitations. This thesis presents a construction of facts (Latour 2005:90); however, inability to access records, inaccuracies in historic sources, and failure to account for past data loss (such as that noted in past site condition assessments) were all shortcomings in the research conducted. While an effort was made to counter for these potential sources of error, it is possible that the "facts" presented here will be challenged and redefined with future research. As the challenging of fact is at the core of ANT, it is hoped that other researchers will be inspired to trace the network for themselves, expand it, and even arrive at other conclusions (Latour 2005:94).

The relationships traced in this work were, in some ways, self-limiting; the cattle and farm which grew the leather (FS 1.1) will likely never be identified, nor will the woodcutter who harvested timbers for the vessel's construction. Research indicates that these relationships were not sustained with the vessel past the wrecking event. Nevertheless, there are various other avenues which were not investigated that may yield further results in determining site significance and expanding the network. This thesis only conducted preliminary study of the naval stores and macrobotanicals—there is still much to be learned from studying the cargo on board. Oral histories addressing treasure hunting in BISC waters are a potential area of future research too, as their study may illuminate the effects of treasure hunting and modern salvage. Similarly, while this work advocates for excavation of comparable sites, only further fieldwork will determine the efficacy of excavation as a management tool. Finally, while the suggested products of this thesis include public outreach materials—Appendix E was created for interpretive staff in BISC—it is not within the scope of this thesis to address the efficacy of these products. It will be suggested to park interpretation staff, however, that the efficacy of these products with park visitors and stakeholders should be studied for future use.

Use of Actor-Network-Theory

This thesis used an actor-network theoretical approach to investigate Pacific Reef Wreck. While ANT incorporates agency and materiality, it was chosen over similar agency-based theoretical approaches due to ANT's treatment of oppositions. The arguments which the NPS and other stakeholders have used to define Pacific Reef Wreck—treasure hunter versus scientist, historic versus modern, significant versus not—ANT removed and replaced with a network of actors. Figure 7.1 was generated to depict the major actors identified in this thesis.

It also includes a graphic representation of the relationships between actors found in the historical and archaeological records which are discussed throughout this work. The number of connections or relationships each actor established and maintained is also evident in Figure 7.1.

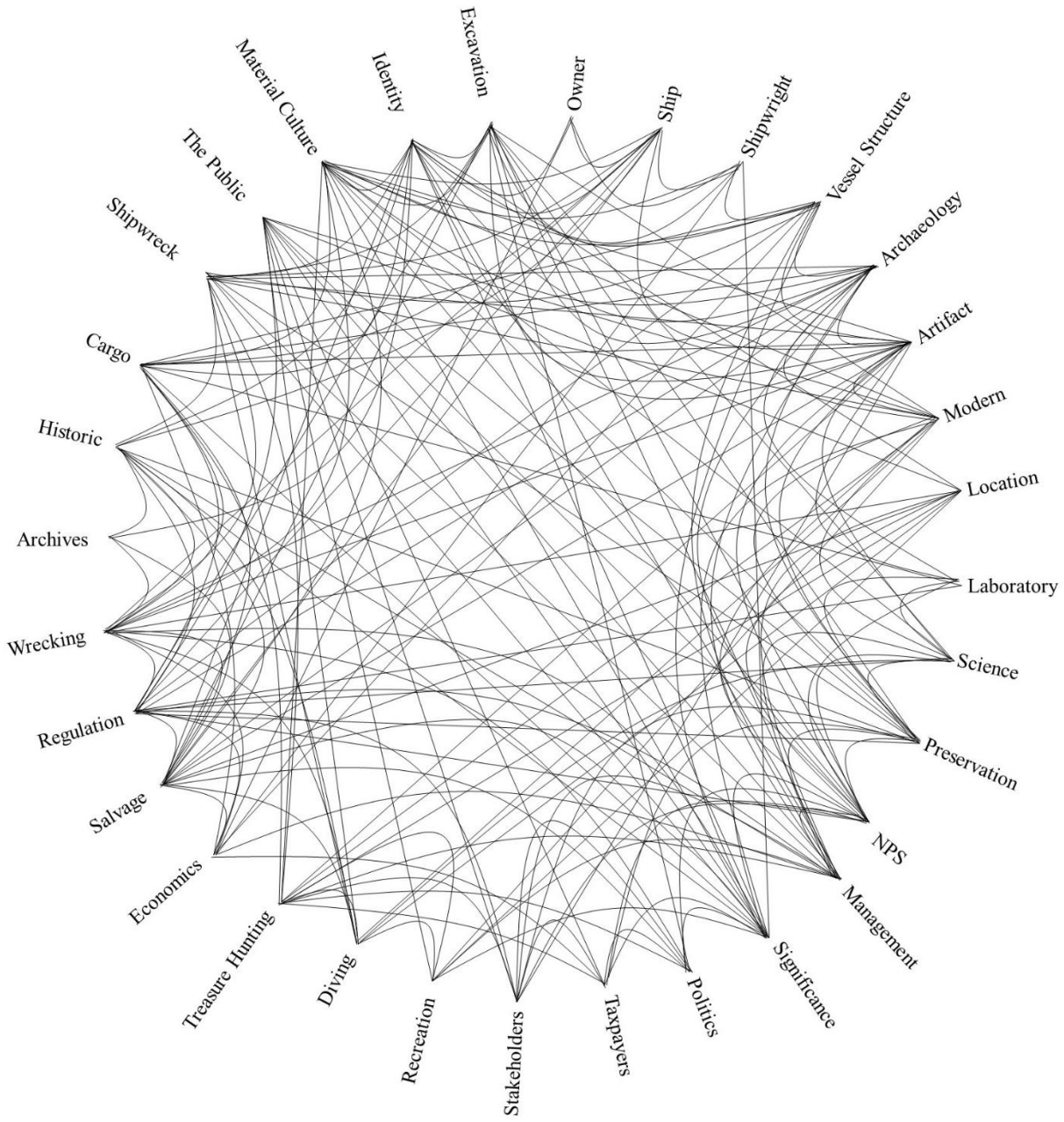

FIGURE 7.1. Pacific Reef Wreck as an actor-network. Relationships are those discussed in this work, while actors have been limited for the sake of simplicity. (Image by author, 2018).

The actors with the most connections—significance, management, material culture, artifacts, wrecking, regulation, and salvage—are those which are driving current expansion of the network. Many of these (significance, management, regulation) reappear throughout this text because of their relationship with the current managing actor, the NPS. The others—material culture, artifacts, wrecking, and salvage—are actors who have maintained their associations across time and space. Historic records indicate their importance to other actors, a significance which remains relevant today. The caveat to all this is that the actors chosen to be part of the network diagram are subjective; another researcher may identify different actors driving future possibilities. Far from diminishing the value of ANT or this research, however, such a study would confirm that this network represents a heterogenous site identity—a multiplicity of meanings. Pacific Reef Wreck is no longer solely a shipwreck, a relic, or an object to be managed. The actor-network demonstrates that every actor experiences Pacific Reef Wreck within their own context. Investigation of relationships between actors reveals new meanings and complexities that traditional oppositions ignore. While this thesis concludes that Pacific Reef Wreck remains bounded by very real constraints—e.g. budget, federal standards, illicit looting—the actors driving expansion discussed above fall within NPS purview. Their actions, as such, have the possibility to influence future South Florida CRM trajectories. The most important new revelation from this network is the determination of historic significance, discussed below.

Finally, for those wishing to undertake similar studies, ANT is not radically different from archaeological methodologies already in use. Archaeologists trace relationships between the past and present, objects and people, thought and action. ANT's contribution to this process is the removal of barriers inhibiting contextualization of archaeological sites. Actors such as

time, degradation, and looting no longer prevent or degrade site study but enhance understanding of site processes and experiences.

Historic Significance

Wild et al. (1985) suggested that Pacific Reef Wreck was a significant park resource, as it was exemplary of "composite shipbuilding" due to the presence of the iron framing elements. While the frames investigated during the 2016 fieldwork were not determined to be associated with the composite shipbuilding technique (McCarthy 2005:118–119), the question of site significance, determined by National Register eligibility, remains (DOI 2006:63).

Sites eligible for the National Register must meet at least one of four criteria; they must be (A) associated with events that have made a significant contribution to our history, (B) be associated with significant persons in our past, (C) embody distinctive characteristics of a type, period, or method of construction, or (D) have yielded information important in history (Potter 1998:421). While Wild et al. (1985) advocated for criterion C, it is argued that the site is eligible and should be nominated under criterion A. In a 1990 article (revised in 1998), historical archaeologist Parker Potter (1998) encouraged underwater archaeologists to re-assess the National Register criteria for determining significance by placing sites within a larger historical context. Shipwrecks are often nominated under criterion C as "the best example" of a construction feature, vessel type, etc. This becomes a problem, however, when a larger, older, or better-preserved site is discovered as it suggests the initial nomination is less significant (Potter 1998:421). Under criterion A, further discovery of associated sites only enhances the historical context and strengthens the nomination (Potter 1998:422).

For Pacific Reef Wreck, significance of the site unfolds within the dynamic Florida coastal history of wrecking, transportation, and commerce. At the height of the wrecking

industry, close to 200 vessels operated along the Florida Keys, aiding those stranded on the reef (National Archives and Records Association 1987). Given the shallow water in which the Pacific Reef wreck site is deposited and the proximity to Caesar's Creek, a local anchorage known to wreckers working the Northern Keys (Viele 2001), it is assumed that wreckers salvaged the site shortly after its sinking. A comparison of vessels in the historic and archaeological records which underwent salvage further sheds light on the construction features of Pacific Reef Wreck, indicating the vessel was likely the product of 19th century American shipbuilders and changing trends in vessel design and construction. The presence of coppering and iron technologies (associated with dated and measurable advances in shipbuilding), suggests a willing investment in the vessel's construction. These advances in shipbuilding technologies, too, correspond with the addition of aids to navigation along the reef tract—both actions were intended to extend the working life of vessels and were key components in a rapidly modernizing transit system (Bingeman et al. 2000, Viele 2001).

Pacific Reef Wreck was part of the maritime cultural landscape which wreckers created, understood, and with which they actively engaged. The site itself took on a new role after sinking as the wrecking community did not forget but integrated the vessel into their collective knowledge. Similarly, when amateur treasure hunters discovered the site "repeatedly" (Meylach and Whited 1971:288) following the advent of recreational scuba in the Florida Keys, it again became part of the collective history and traditions shared by like-minded individuals. As such, the wreckage itself has played an important role in bringing together people across time and space—first as a working vessel, then as an economic subsistence strategy, a form of recreation, and finally a means of carrying out federal legislation and scientific research. These associations,

as Latour (2005) would call them, place Pacific Reef Wreck in an ever-evolving historic context as a stabilizing concept (Clegg and Haugaard 2009).

Past human actors demonstrated a willingness to interact with and understand Pacific Reef Wreck. Today this intellectual interest remains as expressed by both park visitors and local community members. As BISC-029 currently falls under NPS jurisdiction, park resource managers have both an opportunity and a responsibility to maintain relationships between the site and the community with which it is intricately associated.

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Appendix A. Results from Metal Detecting Survey and Trilateration

Side of Baseline	Point ID	Distance Clip 1 (m)	Distance Clip 2 (m)	Clip 1 Location	Clip 2 Location	Description
R	MD 09	3.1	3.44	0.3	2.9	Copper Sheathing
R	MD 11	1.72	1.82	1	3	Copper Sheathing
R	MD 28	7.28	7.96	0	4	Copper Pin
R	MD 05	3.52	3.4	2	5	Unidentified anomaly
R	MD 07	7.15	6.38	3	7	Unidentified anomaly
R	MD 23	6.05	5.4	4	9	Copper
R	MD 19	5.4	5.26	5	11	Copper Pin
R	MD 27	6.4	6.06	8	15	Unidentified anomaly
R	MD 22	4.65	4.25	9	15	Unidentified anomaly
R	MD 08	5.83	5.4	12	18	Unidentified anomaly
R	MD 03	7.73	8.8	13	22	Unidentified anomaly
R	MD 13	3.66	2.88	18	22	Iron fragment
R	MD 32	8.87	9.22	25	33	Copper fastener, broken
R	MD 31	7.1	7.34	29	36	Copper fastener
R	MD 24	4.35	4.53	31	36	Iron fragment
R	MD 18	6.5	6.11	33	40	Two copper fasteners
R	MD 02	4.35	4.65	33	40	Copper sheathing
R	MD 30	6.08	5.16	33	40	Copper sheathing
R	MD 15	5.1	4.6	36	40	Unidentified anomaly
R	MD 35	6.4	6	39	42	Iron fragment
R	MD 10	6.8	6.2	41	45	Copper fastener
R	MD 29	6.4	5.75	43	45.5	Iron bar fragment
R	MD 26	2.7	3	45.5	43	Unidentified anomaly
L	MD 17	4.6	5.65	45.5	43	Large iron fragment
L	MD 06	4.9	7.1	43	39	Iron fragment
L	MD 12	3.7	3	37	34	Possible mast hoop?
L	MD 33	6.25	4.4	37	31	Unidentified anomaly
L	MD 20	2.54	2.5	25	23	Iron bar
L	MD 14	5.25	5.4	25	20	Unidentified anomaly
L	MD 16	7.4	7.47	22	18	Copper fastener
L	MD 01	0.87	0.8	16	15	Copper fastener

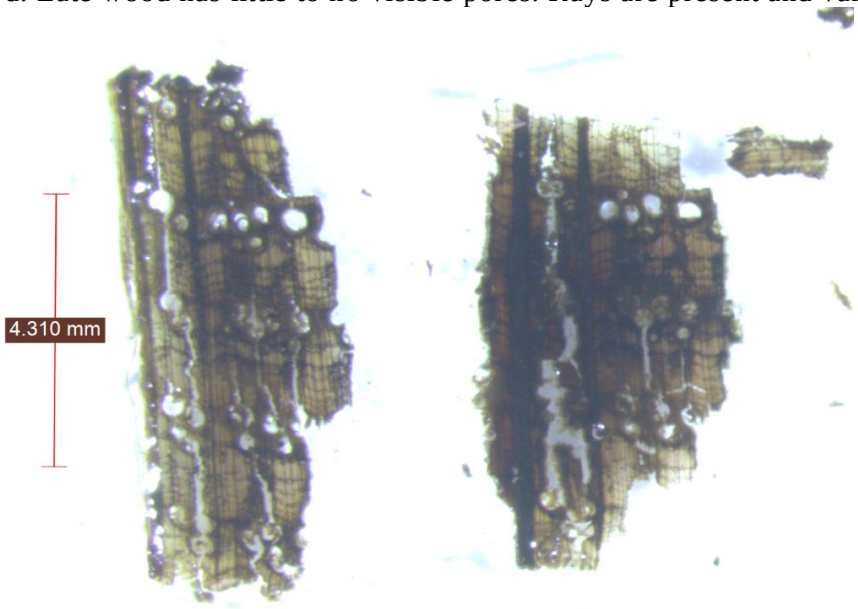
Appendix B. Timber Scantlings from Pacific Reef Wreck

Timber	Measurement	Metric Scantling	Imperial Scantling	
		Meters	Feet	Inches
Keel	Length	31	101	8
	Sided	0.42	--	16.5
	Molded	0.42	--	16.5
Floor	Length	4.81	15	9.5
	Sided	0.25	--	10
	Molded	0.21	--	12.8
Limber Hole	Length	0.1	--	4
	Sided	0.24	--	9.5
	Depth	0.05	--	2
Keel Step	Length	0.42	--	16.5
	Depth	0.035	--	1.37
Frame	Length	1.45-2.13	6-7	--
	Sided	0.25	--	9.84
	Molded	0.31	--	12.2
Frame Space	Between Sets	0.05	--	2
	Between Frames	0.1	--	4
Filling Frames	Length	0.7	--	27.5
	Sided	0.1	--	4
	Molded	0.2	--	7.87
Outer Hull	Length (maximum)	6.5	21.3	--
Planking	Sided	0.53	--	20.5
	Molded	0.08	--	3.1
Strake Repair	Length	0.75	--	29
	Width	0.06	--	2.25
Ceiling	Length	0.33-0.36	--	13-14
	Depth	0.07-0.1	--	3.04
Stanchion Post	Length	3.35	11	--
	Width	0.13	--	5.1

Appendix C. Results of Wood Sampling. (Images from NPS, 2017).

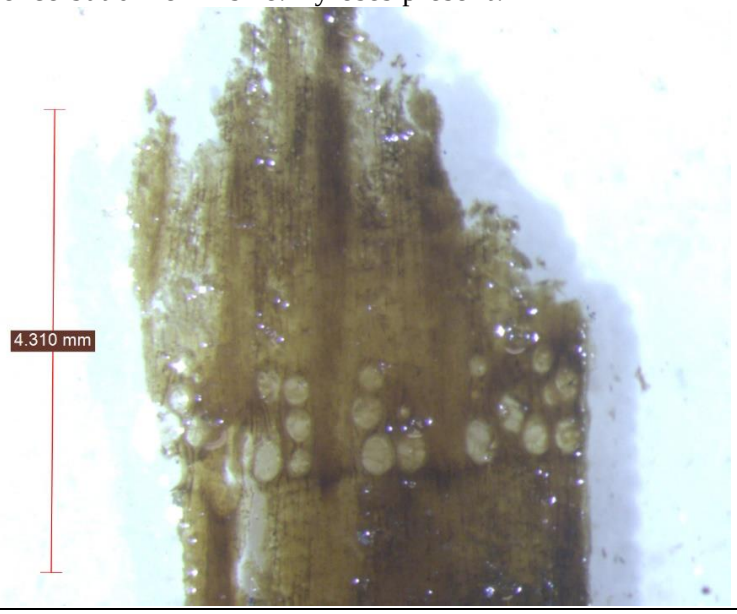
ID: TS 1 (FS 23.1) Location on Site: Floor (T1) Wood Type: Hardwood
Further Differentiation: Ring Porous Genus: *Carya*, sp. Unknown Common Name: Hickory

Defining Characteristics: Parenchyma banding is evidence, clear differentiation between early and late wood. Late wood has little to no visible pores. Rays are present and vary in size.



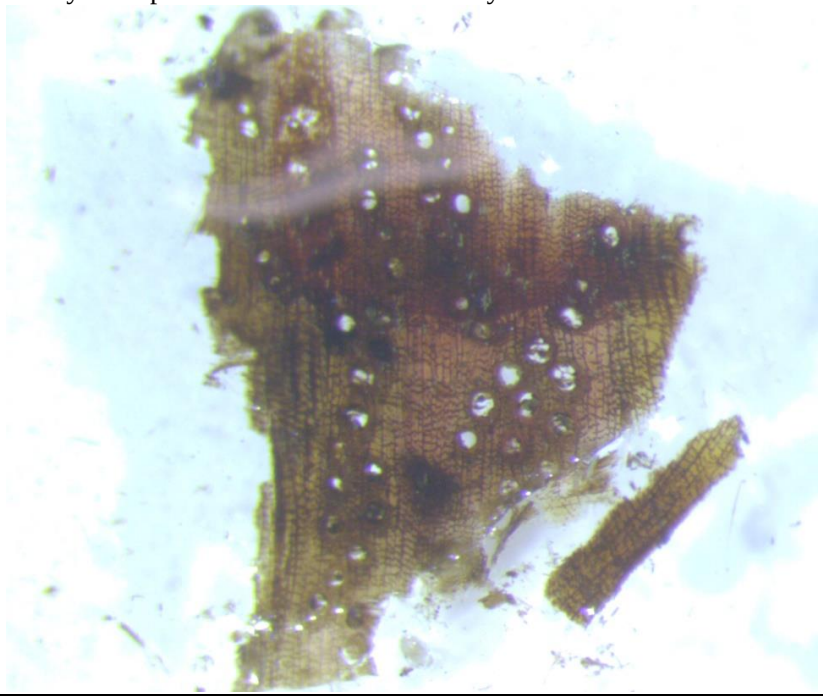
ID: TS 2 (FS 24.1) Location on Site: T2 Wood Type: Hardwood
Further Differentiation: Ring Porous Genus: *Quercus*, sp. *alba* Common Name: White Oak

Defining Characteristics: Parenchyma is less evident. Clear distinction between early and late wood, rays are evidence but differ in size. Tyloses present.



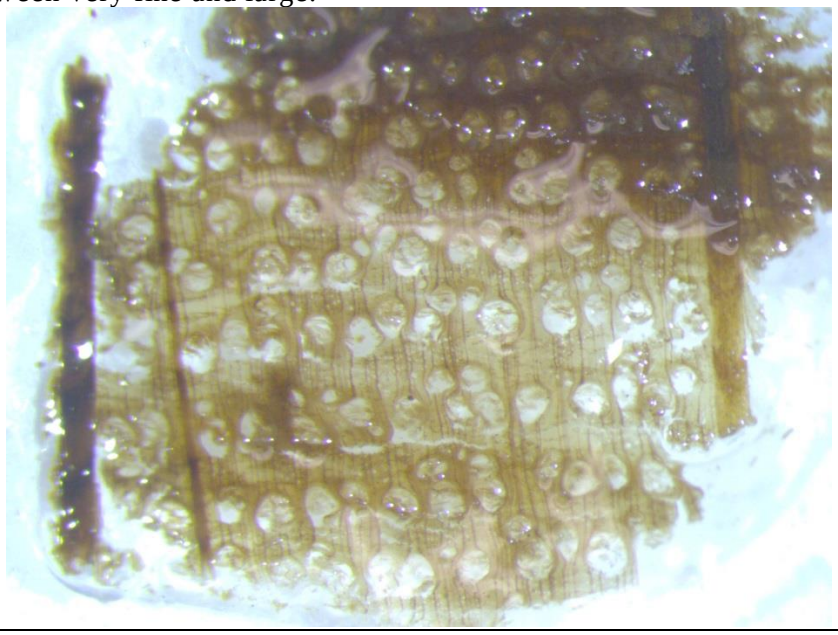
ID: TS 3 (FS 24.1)	Location on Site: T8	Wood Type: Hardwood
Further Differentiation: Semi-Ring or Ring Porous	Genus: *Quercus*, sp. Unknown, possibly *virginiana*	Common Name: Oak, possibly Live

Defining Characteristics: Some parenchyma is evident, but latewood pores are not as distinct as other samples. Rays are present. Wood is incredibly dense.



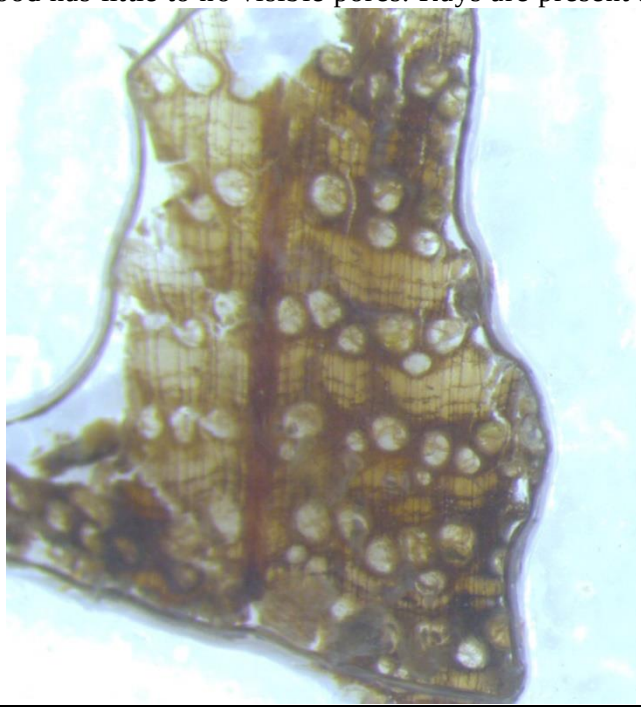
ID: TS 4 (FS 26.1)	Location on Site: T53	Wood Type: Hardwood
Further Differentiation: Diffuse Porous	Genus: *Acer*, sp. unknown	Common Name: Maple

Defining Characteristics: Parenchyma is not evident. Pores have tyloses present, rays are alternating between very fine and large.



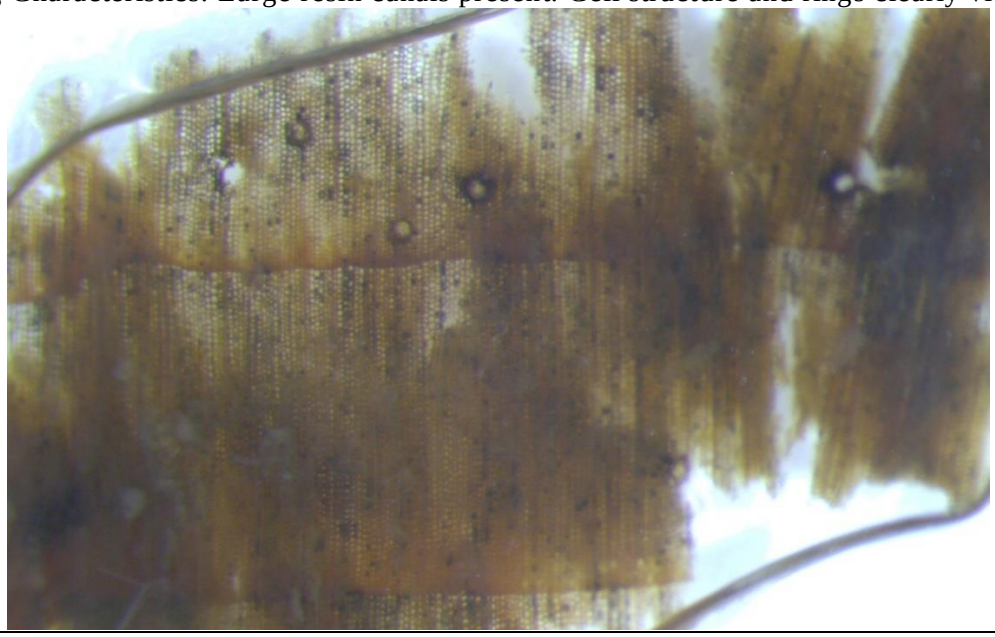
ID: TS 5 (FS 27.1)	Location on Site: T27	Wood Type: Hardwood
Further Differentiation: Ring Porous	Genus: *Carya*, sp. Unknown	Common Name: Hickory

Defining Characteristics: Parenchyma banding is evident, clear differentiation between early and late wood. Late wood has little to no visible pores. Rays are present and vary in size.



ID: TS 6 (FS 28.1)	Location on Site: Between T24 and T25	Wood Type: Softwood
Further Differentiation: Resin Canals	Genus: *Pinus*, sp. *strobus*	Common Name: White Pine

Defining Characteristics: Large resin canals present. Cell structure and rings clearly visible.



Appendix D. Transcription of the Court Case for *Merchant* (KWADM 1851)

Pg. 541
In the District Court of the Unites States
Southern District of Florida

Manuel Acosta et al.
Vs.
Cargo & Materials Sch. *Merchant*
To the Hon. William Marvin, Judge.

The libel and complain of Manuel Acosta, Master of the Smack called the *J.A. Latham*, of the burthen of 63 tons and navigated by 7 men; and of Henry C. Bethel, Master of the sloop *Texas* of 97 tons burthen and navigated by 15 men, and also of one boat of 3 tons burthen and navigated and manned with a crew of 3 men, licensed wreckers on this Coast, who pray & petition the Court to award and decree them salvage upon the cargo and materials of the Schooner *Merchant*, to writ: - one hundred and fifty seven tierces[13] of rice or thereabouts. Eight thousand dollars in species and several boxes surveying instruments, now being in the jurisdiction of this Honorable Court.

And thereupon the said Manuel Acosta, who libels as well for himself as for the respective owners and crew of the before mentioned smack, sloop, & boat, allege and articulately propound as follows.

1st First--That on Friday the 18th day of November last, about half past six in the morning, the said Libellant Acosta discovered a Schooner ashore on the Pacific reef, bearing east by North from Caesars Creek bank, with her colours union down. That said Libellant with all possible dispatch immediately, got his smack under sail and in about one hour afterwards brought up near to her, in order to render to her every possible assistance. For this purpose the boats of said smack were hoisted out and the Libellants proceeded to get on board the said Schr. which he found to be the *Merchant* of the port of Charleston of 179 tons, having on board a crew of six men and four passengers, and laden with a cargo of rice and eight thousand in species, having also on board the U States mail and bound from the port of Charleston to Havana by the way of Key West.

2nd Second—That at the time Libellants' boarded the said Schooner, she was on her beam ends, with five feet water in her hold and the water was two feet deep on the starboard side of the deck, and the cargo on board in great danger of entire loss. That the master of the Schooner *Merchant* begged the libellants that they with their smack and crew could assist in saving the cargo, and the U. States mail, and that they would at once receive on board their smack the passengers and their baggage & the mail.

3rd Third—That the libellants having caused the boats to be launched went to work to render all the assistance in [start 542] their power, and at the request of the Master of the said Schooner proceeded to get on board their smack, the U States' mail and the passengers & their baggage. That after this was accomplished they then proceeded to save the cargo, and while engaged in this duty, the sloop *Texas* came up, and being found necessary to have the services and aid of said sloop and her crew, she was consorted with libellants; and her master and crew immediately set to work using their best endeavors to save from injury as much as possible of the cargo. That

[13] A tierce is a cask or barrel size equivalent to approximately 42 gallons.

to save the cargo from the wreck it was necessary to boat it to libellants' vessels (as they could not get alongside) and this service was most arduous in consequence of a heavy swell, then breaking over the starboard quarter. That libellant Acosta with smack *Latham*, after having on board a part of the cargo, the mail, the passengers, and their baggage, at once proceeded to Key West, and left the sloop *Texas* to bring the residue of the cargo & the materials which duty was faithfully performed.

4th Fourth—That the said libellants by reason of the services they performed in saving the cargo laden on board said schooner are justly entitled to meet and competent salvage for such service.

Wherefore they pray that process in due form of law, and according to the course of Court of Admiralty in cases of Admiralty may issue against the cargo & materials of the said Schooner Merchant and they will ever pray etc.

Sworn to before me (s'g'd) Manuel Acosta
this 2nd December 1851 Samuel J. Douglas
C. M. Wells Clerk proctor
For J.C. Whalton Dz.

Upon reading the foregoing libel the Judge of the said court made his order thereon in writing as follows, to writ:

At Chambers
Dec. 2 1851

Let attachment & mention issue as prayed in said libel returnable before me at the Court Rooms of said Court on Friday the 5th instand.

(s'g'd) Wm. Marvin
Judge

Whereupon attachment issued from the said court to the Marshal thereof which was afterwards returned by the said Marshal with his certificate of execution therein unto them (See files).

And on the same third day of December aforesaid monition issued from the said Court to the [start 543] Marshal thereof which was afterwards returned by the said Marshal with his certificate of execution thereon written (See files).

And on Friday the 5th day of December aforesaid came the parties aforesaid, by their respective Proctors and advocates aforesaid and not being ready to proceed to the trial of this cause the same was continued until Monday the 8th writ and at the same time and place as the said Marshal filed with the clerk of said Court his account sale of said cargo & materials amounting to $955.87.

And on Monday the 8th day of December aforesaid Charles W. Westendorff, Master of the said Schooner Merchant, by his proctor and Advocate Wm. R. Hackley Esq. filed in the office of the clerk of said court his claim to the said cargo & materials and the accuser to the said libel with words & inquires following to writ:

District Court of the U. States
Southern District of Florida
To the Hon. Wm. Marvin Judge

The answer and claim of C.W. Westendorff, Master of the Schooner Merchant of Charleston, So. Car. And as Master agent for all persons interested in the said Schooner Merchant and the goods her lading. To the libel of Manuel Acosta and others against said cargo & materials aforesaid Schooner would respectfully set forth and allege,

1st—Your Respondent admits the facts set forth in the said libel to be here, but says that the mail and the surveying instruments, and baggage which were on deck at the time therein mentioned, were pointed out to Acosta and he promised to take them to Key West and not claim salvage thereon. The consideration for such promise being that he should be allowed to go to work at once on the wreck and were that the passengers and baggage could have been loaded in the schooner boats.

Wherefore Respondent prays that your Honor order the proceeds of the sale of the Materials and cargo of said schooner now in the hands of the Marshal of this Court to be paid over to him as master aforesaid upon the payment of such salvages as the court may decree and your respondent etc.

Seen to be for me (s'g'd) Charles W. Westendorff
This 8th day of Dec. 1851 Wm. C. Hackley
C.M. Wells Proctor
Clerk
For J.C. Whalton Dz.

And on the same day last aforesaid came the parties aforesaid, by their respective proctors and advocates aforesaid [start 544] and proceeded to the trail for this cause & after hearing the proofs and allegations of the parties and the arguments of counsel, the Court not being fully advised in the premises held the same under advisement.

And on Tuesday the ninth day of Dec. instand, the Judge being fully advised in the premises filed his decree in writing, in the words and fires following to writ—

Manuel Acosta and others
Vs.
The cargo & materials of the Schooner Merchant Libel for Salvage

The principal facts in this case may be briefly stated as follows.

The Schooner *Merchant* from Charleston, laden with rice and having on board the Key West, Havana, & California mails in the night of the 27th November ran ashore on that part of the Florida reef known as the Pacific Reef situated near Cape Florida and about one hundred and fifty miles from this port, and soon after sinking, bilged, filled with water, and became a total loss.

In the morning this Smack *J.A. Latham*, Manuel Acosta, Master, of the burthen of 68 tons and carrying a crew of seven men, and the Sloop *Texas*, Wm. H. Bethel, Master, of 97 tons and 15 men, both engaged in the business of wrecking, arrived at the wreck, and at the request of the Master C.W. Westendorff, took on board their vessels the mail, the passengers, their baggage, and the materials of the vessels, and so much of the cargo as could be got, and as was worth saving and brought them to this port. On their arrival they delivered the mail to the agent at the Contractor to be forwarded. The cargo saved and the materials have been sold producing the sum of $955.87. The Merchant had also on board $7760 in specie and three boxes of surveying instruments belonging to the United States, and then in the care of Mr. Totten, a passenger of the Coast survey and valued at $350. The specie and surveying instruments were brought to this port by the libellants.

It is very evident that the cargo and the materials saved would have been wholly lost, but for the services of the salvors. As to these, I think forty percent of the amount sold is a reasonable salvage to be allowed the libellants. It makes $382.34.

It is equally clear that the mails, the specie, and the surveying instruments were in no considerable peril of loss, for Captain Westendorff could have removed them to the land, in his boats; and without doubt would have done so, had no the assistance of the libellants [start 545] been offered. But had he removed them to the shore, they would still have been one hundred and fifty miles from any port or from any place where they could be used, or made available to any practical purpose. They would have been on a barren island, and to have removed them to this or to any other port would have required a vessel and he had none at his command, nor could one be procured, but by waiting for the arrival of some wrecking vessel cruising on the coast. Under these circumstances I think the libellants have rendered to the owners of this property a very substantial and real service, that ought to be reasonably rewarded.

The facts and circumstances fully considered I think six percent upon the species or $465.60 and fifteen percent or $52.50 upon the value of the boxes of instruments will be reasonable compensation for the service rendered. The aggregate of these sums is $900.44 and allowing the one half thereof to the owners of the wrecking vessels and dividing the residue among the men the share of each will be about fifteen dollars.

In making this decision I have allowed nothing to the salvors for their services in bringing the United States mails to this port. Under the circumstances, this was a valuable and important service, but it would be unequal and unjust to increase the amount of the salvage upon the cargo and materials and upon the specie in order to compensate the salvors for this service; for this would be in effect to take the money of the owner or underwriters of this property to pay a claim they are in no manner liable for.

Although the property of the United States is no more exempt from the payment of salvage than that of an individual, and in like manner may, in general (with exceptions founded on public policy) be retained by the salvor, or sold by order of the Court for the payment of salvage, yet the mails of the United States cannot be considered or treated in this regard as property or as liable to detention or sale. The mail bags may perhaps be considered as property, but not their contents; and both, upon principles or public policy, would be exempted from detention or sale, upon a claim of salvage.

In the present case, I think justice demands that a moderate and reasonable sum should be paid the libellants for their services in taking the mails from the wreck and bringing them to this port. But this Court has no means by which to make such compensation.

It is ordered, adjudged, and decreed, that the libellants have, recover, and receive in full compensation for their services insuring the cargo and materials of the schooner *Merchant* or by there able [start 546] forty percent (382.34) upon the amount sale thereof, and that they recover and receive six percent (465.60) for their services in bringing the specie to this port, and fifteen percent (52.50) upon the value of the boxes of instruments for like services and that upon the payment thereof and their proper proportions of costs, the marshal return said specie and boxes of instruments to the claimants for and on account of whom it may concern. That the clerk in taxing the costs in this case charge each species of property with the wharfage storage, or other charge, property belonging to it, and that he apportion the costs in this suit between the different claimants, or species of property, according to their respective value or amounts, and charge each species with its proper amount thereof.

(s'g'd')
Wm. Marvin
Judge

Whereupon order issued from the said Court to the Marshal thereof, which was afterwards returned by the said Marshal with his certificate of execution thereon written. (See files)

And on return of the said order, the Marshal paid into the Registry of said Court the sum of $955.87, the amount of the account sales of said cargo and materials, and $551.81, being the amount of the salvage and expenses on the specie & from which the said clerk paid the following taxes and bills of costs and expenses.

Manuel Acosta et al.
Vs
Cargo & Materials saved
From Schr. Merchant

Final Statement showing the amount of money paid into the Registry of the Court and the matter of its disbursement.

Amt. Ap. Sales of "Cargo"	$578.13		
" " Materials	377.74		955.87
" Collected as per Marshal return			551.81
From which the Clerk paid the following amounts			$1507.68
Paid salvage on materials	$167.49		
" A.J. Tish per wharf etc.	13."		
" Pro Court Expenses	27.97 $192.46		
" Salvage on Cargo	$231.25		
" A.J. Tish Whf. Storage etc.	44.13		
" Per ct. Expenses	42.82	318.20	
[start 547]			
Paid Salvage on Specie	$465.60		
" Pro: Court Expenses	86.21	551.81	$1507.68

Attest to the entire preceding Record dated at Key West Florida December 13 1851
(s'g'd) C. M. Wells
Clerk
Attest J.C. Whalton Dz.

Appendix E. Summary for BISC Interpretive Staff and the Public

PACIFIC REEF WRECK (BISC-029) ARCHEOLOGICAL SITE

In 1821, Florida became a territory of the United States. The shift from colony to territory introduced new legislation to residents and encouraged the growth of shipping traffic. As the number of vessels traveling along the coast increased, so did the number of shipwrecks. Local Keys residents found employment as 'wreckers,' a job which entailed assisting shipwrecked mariners and salvaging cargoes from stranded vessels. Key West became a port of entry for all salvaged property, and by the 1830s was home to an Admiralty Court which assigned wreckers compensation for salvaging otherwise lost cargoes. All salvaged goods brought to Key West were stored in warehouses until they could be shipped out to their intended destinations.

The Key West Admiralty Court records provide some of the best historical evidence for identifying 19th century shipwrecks within park waters. Each court case details the vessel, intended destination, crew, wreck location, and the wreckers who provided aid. Park archeologists have been able to use this information to understand maritime transportation through park waters in the 19th century and have created a list of potential shipwrecks which may be located within the park boundary. Furthermore, these records aided the park's cultural resource management team in identifying a historic shipwreck within the park—Pacific Reef Wreck (BISC-029).

First reported to park staff by a local treasure hunter, Pacific Reef Wreck (BISC-029) is the remains of a historic 19th century wooden sailing vessel lost near Pacific Reef at the southern end of the park. Like many shipwrecks in the park, Pacific Reef Wreck experienced looting during the 1960s and 1970s which resulted in the loss of the site's protective ballast layer and increased rates of deterioration. Treasure hunting activity also removed artifacts from the site which may have aided in identifying the vessel or the activities of those on board. As a result, park staff have monitored the site since the 1980s and recorded a noticeable loss of wooden structure. As of 2015, the wooden timbers remained exposed to the elements and park staff knew very little about the vessel's history.

In 2016, park archeologists determined the site was a good candidate for stabilization efforts which would slow the noticeable deterioration. The stabilization process involved three steps—removing sand from the site, recording the wooden structure, and returning the previously removed ballast stones to the structure. This final step was necessary as the rock ballast created a sediment trap on site. The sand layer, trapped under the ballast rock, produced an anaerobic environment hostile to organisms that cause deterioration such as algae and bacteria.

Following site stabilization, park staff began analyzing the vessel structure and artifacts which were recovered during the site reburial. The site itself consists of two areas of wooden ship structure—a disarticulated scatter of timbers on the east side of the site and part of the vessel's hull towards the western side of the site. The measurements of timbers taken in these two areas suggested to archeologists that the vessel's cargo capacity was anywhere from 200 to 500 tons. The vessel length was determined to be approximately 140 feet.

Archeologists also took samples of the timbers and sediment between timbers to identify wood species and potential cargo. Laboratory analysis indicated that the vessel was built from Oak, Maple, Pine, and Hickory woods. These species are all native to the Eastern United States, suggesting the vessel was American built. The sediment samples, too, provided insight into the vessel's origins; tar and rice were both found underneath some of the timbers. Archaeologists believe that the vessel was carrying both these materials on board. When the vessel sank, the casks holding these materials likely broke open, depositing their contents onto the wooden structure. The tar acted as a preservative and coated the rice, ensuring it did not degrade as time passed. Both tar and rice were common cargoes during the 19th century as Southern states including Florida, Georgia, and South Carolina grew rice and manufactured tar from pine forests.

The majority of artifacts recovered from the site were related to the vessel's construction. These artifacts included fasteners, copper hull sheathing fragments, and bolts. While common, these materials do indicate that the vessel's owners invested a considerable amount of money in its construction to ensure that the vessel would have a long working life. Several recovered artifacts served as indicators of when the vessel sank. Part of a wine bottle neck, for example, featured a machine mark that was not used until the 1830s. Another artifact—a door lock—had small lettering which read 'EN & BROAD NEW YORK.' Using historic resources, park staff determined that the lock was manufactured by the New York City locksmith company Green & Broad between 1838 and 1845. These dates provided concrete evidence that the Pacific Reef Wreck sank sometime after 1838.

Taken together, the material evidence recorded on site indicates that Pacific Reef Wreck was a sailing vessel built in North America and lost after 1838. The sturdily built hull was transporting rice and tar when it hit the shallow reef. Of the 14 wooden sailing vessels recorded by the Admiralty Court as wrecked near Pacific Reef, only one vessel was lost on the reef with a cargo of rice—the schooner *Merchant*. Working out of Charleston, SC since the early 1840s, *Merchant* was traveling to Havana, Cuba, with a cargo of rice and U.S. mail. Also on board were four passengers, their baggage, specie[14], and surveying equipment. The schooner struck Pacific Reef on November 27, 1851 and sank soon after. Wreckers rescued the crew and passengers along with their belongings and proceeded to salvage the site. They successfully recovered all specie, mail, and surveying instruments, however part of the rice cargo and other materials (including tar) were lost.

Today, Pacific Reef Wreck remains a significant archeological site. As one of the few identified vessels in the park, the site has offered insight into the uses of park waters during the 19th century. The vessel structure has provided further information on 19th century American shipbuilding trends and suggests there is still much to be learned from previously looted sites. Finally, the site remains significant as a resource which has brought people together across time and space, including wreckers, treasure hunters, archeologists, and Park visitors. Today, these stakeholders still have the opportunity to visit and interact with Pacific Reef Wreck. While site stabilization required reburial of the wooden structure, the site remains preserved through an interpretive video, images (including the site plan), and a 3-D model. Artifacts were also recovered from the site and conserved for display in the Park visitor center. For more information on how to see and use these materials, contact BISC cultural resource management.

[14] Specie is money in coin form.