LOWER SUWANNEE ARCHAEOLOGICAL SURVEY 2009-2010
INVESTIGATIONS AT CAT ISLAND (8DI29), LITTLE BRADFORD ISLAND (8DI32), AND RICHARDS ISLAND (8LV137)

Kenneth E. Sassaman, Paulette S. McFadden, and Micah P. Monés

Technical Report 10
Laboratory of Southeastern Archaeology
Department of Anthropology
University of Florida

LOWER SUWANNEE ARCHAEOLOGICAL SURVEY 2009-2010: INVESTIGATIONS AT CAT ISLAND (8DI29), LITTLE BRADFORD ISLAND (8DI32), AND RICHARDS ISLAND (8LV137)

Kenneth E. Sassaman
Paulette S. McFadden
Micah P. Monés

Technical Report 10
Laboratory of Southeastern Archaeology
Department of Anthropology
University of Florida
Gainesville, FL 32611

April 2011

Cover photo: Micah Monés (left) and Neill Wallis (right) recording profiles of test excavation at Little Bradford Island (8DI32), June 2009.

Management Summary

Field investigations in 2009-2010 at Cat Island (8DI29), Little Bradford Island (8DI32), and Richards Island (8DI137) inaugurate a long-term partnership between the Laboratory of Southeast Archaeology (Department of Anthropology, University of Florida) and U.S. Fish and Wildlife Service to inventory and assess archaeological resources in its Lower Suwannee and Cedar National Wildlife Refuges, as well as private and state inholdings contained therein. Fieldwork on the refuge was conducted under an Archaeological Resources Protection Act Permit (LSUWNWR042209) and Special Use Permit (41515). Limited subsurface testing at Cat Island and Little Bradford served the need to "rescue" samples from archaeological deposits that are actively eroding along the shorelines of low-relief islands, while reconnaissance survey of Richards Island initiated efforts to document archaeological deposits on elevated landforms such as relict dunes and hammocks. Research structuring rescue and reconnaissance efforts centers on the long-term relationships between environment and human settlement of the study area, notably changes in sea level that affected the inhabitability of land and access to resources of human value. Cat Island, a private inholding, contains evidence of human occupation spanning the past 4000+ years. Changes in the proportions of shellfish species register changes in the estuarine biome at the mouth of the Suwannee River from high to low salinity. Little Bradford Island, in contrast, contains a discrete component dating to about 2000 years ago with evidence for an intermediate level of salinity in the delta. Results from Richards Island suggest that elevated landforms in the study area have great potential for extensive midden deposits, as well as mounds and ridges dating as early as 2000 years ago. Although such sites are currently out of the zone of active erosion, they will eventually be subject to cutbank erosion and overwash flooding as sea level continues to rise over this century and beyond. Taken together, the results of these initial efforts underscore the enormous research potential of refuge sites and thus the pressing need to inventory and assess them before they are damaged any further. In addition to detailing the results of field investigations (Chapters 3-5), this report provides a framework for long-term investigations (Chapter 1), a summary of what is known about the archaeology of the greater study area (Chapter 2), and recommendations for a second phase of fieldwork (Chapter 6).

Acknowledgments

Archaeological investigations of Little Bradford Island and Richards Island were made possible through permits issued by U.S. Fish and Wildlife Services. Ours thank go to Regional Historic Preservation Officer Richard Kanaski for assistance in obtaining an ARPA permit (LSUWNWR042209) and for his overall support and encouragement of this project. Lower Suwannee and Cedar Key Refuge Manager John W. Kasbohm issued a Special Use Permit (41515) and likewise lent considerable support to this project. Additional assistance was provided by Refuge Law Enforcement Officer Ken McCain.

Access to Cat Island was granted by the landowner, Mike Crews, who also provided a copy of a report on earlier work by New South Associates, Inc. Author of that report, Steve Koski, lent his advice and assistance in designing our fieldwork on Cat Island.

The insight and generosity of many other individuals ensured success with this project. Foremost is Silas "Si" Campbell, who not only donated an extensive collection of artifacts, bone, and shell he amassed over the years from two dozen eroded sites in the study area, but also escorted crew members of several field trips on his boat and hosted us at his home in Suwannee. Si's observations on the distribution and condition of sites proved to be invaluable. Michelle LeFebvre, Neill Wallis, Meggan Blessing, Mark Donop, Asa Randall, Micah Monés, and Jason O'Donoughue each participated in at least one of several trips; Michelle and Neill were particularly active in two field visits with Si and recorded many of the observations he made as they traveled from site to site.

An initial effort to utilize Seahorse Key as a base station was enabled by Professor Harvey Lillywhite and staff of the Seahorse Key Marine Lab, University of Florida. Temporary use of McClamory Key as an overnight camp was made possible through the good offices of Gloria Barber (Florida Division of State Lands), and Jenelle Brush (Florida Wildlife Commission). Mrs. Thelma McCain provided useful insights on Richards Island from her time residing there in her youth.

Fieldwork for this project was ably executed by Micah Monés, Mark Donop, Michelle LeFebvre, Neill Wallis, Meggan Blessing, Paulette McFadden, and Elyse Anderson. Laboratory assistance was provided by Erin Harris-Parks and Elena Thomas. Ann Cordell of the Florida Museum of Natural History shared her considerable expertise on pottery typology, and Asa Randall of the Laboratory of Southeastern Archaeology lent his skill and advice on mapping and other graphics. Karen Jones of the Department of Anthropology handled the finances for this project with great care and efficiency. Most of the funding for this work was provided by the Hyatt and Cici Brown Endowment for Florida Archaeology.

Contents

Management Summary iii

Acknowledgments iv

Chapter 1. Introduction and Research Orientation 1

Chapter 2. Environmental and Archaeological Contexts 19

Chapter 3. Cat Island (8DI29) 57

Chapter 4. Little Bradford Island (8DI32) 85

Chapter 5. Richards Island (8LV137) 113

Chapter 6. Conclusions and Recommendations 133

References Cited 155

Appendix A: Catalog 169

Appendix B: Radiocarbon Data 191

CHAPTER 1
INTRODUCTION AND RESEARCH ORIENTATION

Kenneth E. Sassaman

In 2009 the Laboratory of Southeastern Archaeology, Department of Anthropology, University of Florida, launched a long-term project to investigate the archaeological resources of the northern Gulf Coast of Florida from Cedar Key to Horseshoe Beach (Figure 1-1). This 47-km stretch of the Gulf Coast is occupied by the Lower Suwannee and Cedar Key National Wildlife Refuges, as well as private and state inholdings. Outside of the towns of Cedar Key to the south, Horseshoe Beach to the north, and Suwannee in between, this is an undeveloped tract of coastal Florida. Aboriginal communities since at least 4500 years ago—when sea-level reached near-modern stands—thrived in this region, at times perhaps exceeding in number the populations of today. Our knowledge of these ancient coastal dwellers is very limited, however, as little archaeological research has been conducted in the modern era. The Lower Suwannee Archaeological Survey (LSAS) aims to remedy this situation with a sustained program of investigations in accordance with federal mandates of the U.S. Fish and Wildlife Service to inventory, assess, and manage its cultural, as well as its natural, resources.

Reported herein are the results of an initial round of archaeological investigations in the study area. Specifically, this report includes results from testing at two sites exposed in the eroding shorelines of Cat Island (8DI29) and Little Bradford Island (8DI32) and reconnaissance survey on Richards Island (8LV137). The former two locations were chosen to address the pervasive problem of site destruction attending sea-level rise, while the latter location was chosen to initiate the long-term goal of inventorying and evaluating archaeological resources in locations that have seen limited or no attention to date, but will, in the longer-term future, become vulnerable to rising water. Both types of investigations are structured by a research framework centered on the relationship between coastal settlement and environmental change.

RESEARCH ORIENTATION

Coastal locations have long attracted human settlement, and those of the lower Southeast were especially attractive for their rich estuarine and intertidal resources conducive to sustained human exploitation. But coastal dwelling in the lower Southeast has always been a challenge for humans because sea levels have routinely fluctuated with changes in global climate. The rate and magnitude of sea-level change has varied markedly over the course of human settlement. Since the time of human colonization at the end of the Ice Age, sea levels have increased a total of 100 m, flooding about half of the relict Florida peninsula. The rate of rise slowed sharply after 6000 years ago, and since about 4500 years ago sea level has fluctuated up and down a couple of meters in an overall rising regime. Sea level continues to rise today, arguably at rates that have accelerated over the past two centuries.

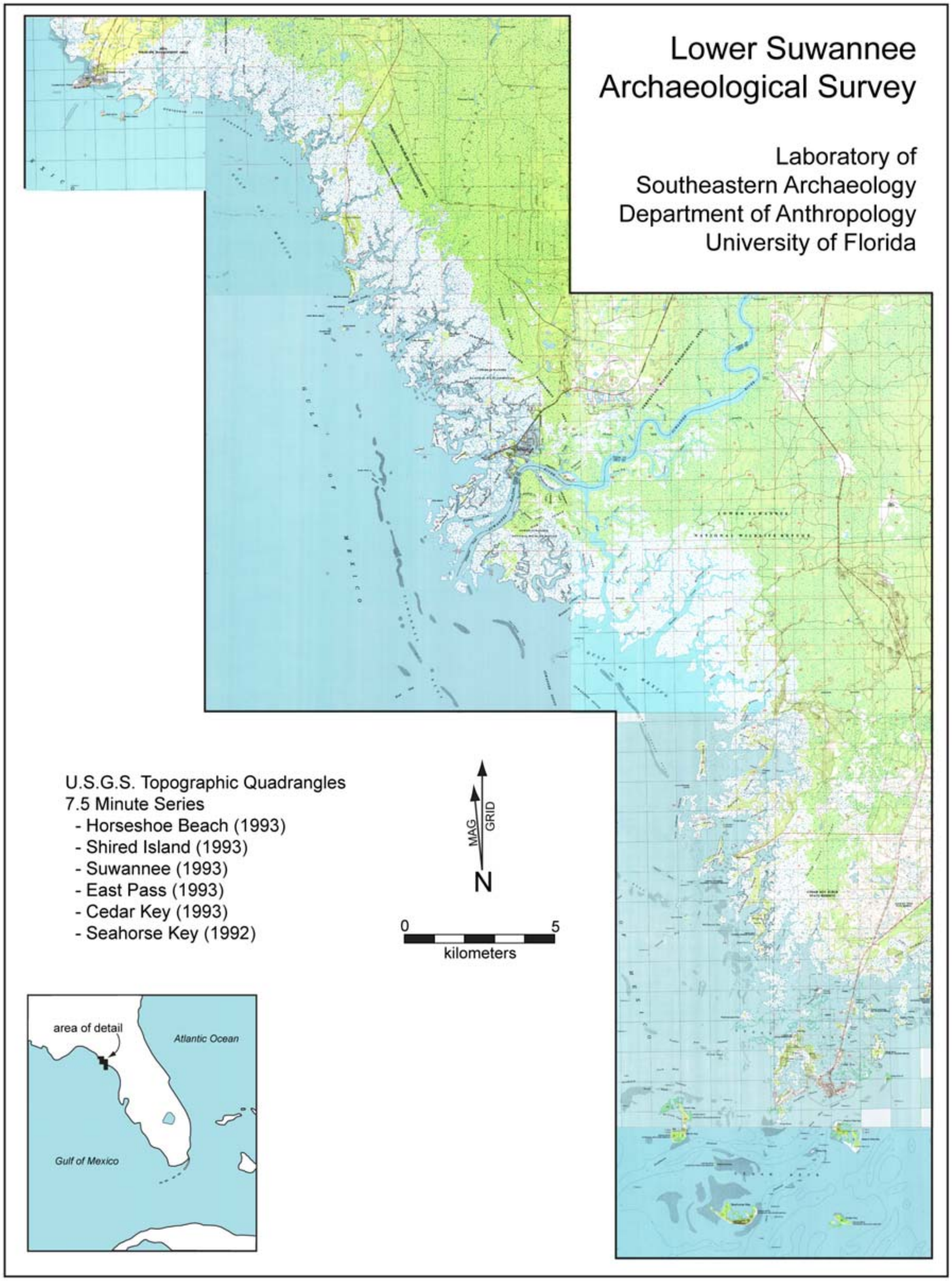

Figure 1-1. Composite U.S.G.S. topographic quad map of study area extending from Horseshoe Beach to the north to Cedar Key to the south.

Long-term perspectives on human dwelling in dynamic coastal settings are encased in the archaeological record of protected coastal areas, such as the Refuges of the northern Gulf Coast of Florida. Some 4500 years of human occupation is recorded in scores of coastal archaeological sites on the Refuges, along with an untold number of unrecorded sites yet to be found.

Like other locales of the lower Southeast, the Florida Gulf Coast is a relatively flat, low-relief landscape, subject to vast flooding with only minor rises in sea level. These same low-lying conditions are conducive to extremely productive estuarine and intertidal habitat. However, productive near-shore habitat is as vulnerable to coastal transgressions as are places suited to human settlement when sea levels change even modestly in such low-relief terrain. The many submerged and intertidal sites of pre-Columbian age on the Refuges are longitudinal records of changing settlement and culture against the multi-decade and century-long rhythms of sea-level change.

In repeatedly invoking the need for archaeological investigations, the 2001 Comprehensive Conservation Plan for the Refuges acknowledges that sites indeed hold great informational potential about environmental change, while also recognizing the vulnerability of these sites to coastal erosion. Previous archaeological investigations in the Refuges have been spotty and we know little other than the region was home to scores of communities since at least 4500 years ago. Sites of this age and younger exist in a zone of subaerial exposure that is the modern tidal range. There remains a large inventory of shoreline sites with preserved remnants, plus a sizable inventory of sites in hammocks that are inaccessible by boat, even at high tide. Collectively, the inventory of archaeological sites in the Refuges is an enormously rich record of long-term environmental and cultural change that may ultimately be destroyed by shoreline erosion in the 21st century.

The extant record of sites coincides with the contemporary shoreline and estuarine locales of modern sea level. As noted above, sea levels were lower than today for most of the ancient human past, and coastal sites predating ca. 4500 years ago are expected to be either totally destroyed by rising seas, or fully submerged and/or capped by estuarine deposits. Stone tools dating to the period before pottery was made (i.e., before ca. 4500 B.P.) are occasionally recovered from sites currently eroding into the Gulf or landward, but no intact coastal sites of this age are known for the Refuges.

Episodes of higher-than-present sea level may have occurred occasionally over the past few millennia (e.g., Mitchell-Tapping et al. 1989; Walker et al. 1995), creating an archaeological record of coastal occupations that are now stranded from the water as sea levels regressed. Not all paleoenvironmental scientists agree with the argument that levels rose to higher-than-present stands because changes in depositional regimes alter basin geometry, sedimentation, and water displacement (Fitzgerald et al. 2008; Otvos 2004). Nonetheless, the Refuges indeed contain hammocks that appear to have been occupied when tidal water abutted now-stranded landforms because of either higher levels or lower subaqueous substrate. Very few such sites are documented, but many potential locations await examination. While these sorts of preserved finds provide hope that we can still learn much about the coastal experiences of ancient residents, these sites will be the victims of sea transgressions in the decades to come if current projections of sea-level rise are accurate (e.g., Fitzgerald et al. 2008). Needless to say, efforts to locate and characterize these unaffected but vulnerable sites must begin now.

This is an opportune time to implement a program of sustained archaeological investigations on the Refuges to address the intertwined demands for conservation and research. A three-prong approach involving *reconnaissance*, *rescue*, and *research* addresses agency and academic needs simultaneously.

Reconnaissance

Basic inventory and evaluation of cultural resources on federal lands is the mandate of several legislative statutes and thus integral to agency policy on land use. Full-coverage reconnaissance survey is almost always beyond the economic reach of most agencies, U.S. Fish and Wildlife among them. The LSAS is designed to provide full-coverage reconnaissance of the coastal zones of the Refuges at no direct costs to U.S. Fish and Wildlife. Reconnaissance survey is divided into two aspects: (1) *shoreline survey*, and (2) *hammock survey*.

Shoreline survey constitutes one of the greatest challenges of the program. The 47-km linear stretch of coast encompassing the Refuges is scores of kilometers longer in actual shoreline, as this includes an untold number of tidal creeks coursing through salt marshes and other estuarine flats. In practice, shoreline reconnaissance entails careful inspection of all shorelines of landforms with subaerial exposures. Low-tide visitation at such locations is desirable to maximize exposures for eroding midden and related archaeological deposits.

Shoreline survey has been the method of choice for hundreds of private citizens who have collected pottery, stone tools, and other artifacts from the eroding middens of dozens of sites on the Refuges, as well as several state and private inholdings. Aside from collecting on private lands with landowner permission, artifact collectors have operated illegally. With limited manpower and little detail about the location and condition of archaeological sites, Refuge law enforcement cannot adequately enforce laws prohibiting artifact collecting and the more egregious acts of illicit digging. However, in some cases, private collecting has salvaged materials that would have otherwise been lost to sea. Although private collecting never guarantees public access to information that would otherwise be lost, we are fortunate that two citizens have availed their collections to analysis and reporting. In both cases these individuals made repeated visits to eroding sites over many years, collecting all exposed materials indiscriminately, and keeping all collected materials in separate lots, properly labeled and stored. The resulting collections are longitudinal samples of shoreline-exposed archaeological sites, samples that would be virtually impossible to obtain through standard archaeological practice.

The record of over two dozen sites collected by these citizens provides a baseline for the types of artifact assemblages we can expect on the Refuges, as well as a benchmark for salvaging sites that are actively eroding (see below). In effect, this inventory constitutes the extant record of *conspicuous* sites, those readily seen from open water and actively eroding at elevations in the modern tidal range. In some cases, eroding sites are accessible by boat only at high tide, but evident and easily collected only at low tide. This poses something of a challenge for artifact collectors and archaeologists alike. Gaining access by boat to islands and other landforms with shoreline middens requires careful timing of tides and winds, and protracted visits are required to ensure adequate inspection. Survey archaeologists learned quickly in this first year of investigation that contingency plans are a must, as many hours can be lost on mudflats and oyster bars if tides and winds do not cooperate.

Methods for effective shoreline survey are a work-in-progress. Small, low-draft watercraft is required in many locales and in others even canoe travel is problematical. Of course, all landforms currently outside the modern tidal range can be surveyed by foot during at least low tide, when mudflats and salt marshes are sufficiently drained to enable crossing. Such landforms may be invulnerable to tidal waters today, but they will be vulnerable to tidal erosion in the future as sea level continues to rise, plus many are currently subject to storm surge and related episodic erosion. The need to inventory and assess such landforms before they are destroyed is the intent of hammock survey.

Hammock survey is the catch-all term for reconnaissance survey of the many tree islands or hammocks that punctuate the marshes of the study area. As reviewed in Chapter 2, these include the low-lying landforms of the tidal zone that have subaerial exposure at least at low tide, as well as relict dunes that extend several meters above mean sea level. Landforms of both varieties are sometimes surrounded by extensive salt marsh lacking navigable channels and thus must be approached by foot, generally at low tide. Others, of course, are situated along tidal creeks or have gulf-facing exposures that are eroding today. In these cases, hammock survey follows from shoreline surveys that identified eroding sites. Irrespective of current exposure, all hammocks have potential to house significant archaeological deposits and, indeed, hammocks inspected to date prove this to be the case. As discussed in the research section below, occupation of hammocks cut off from navigable water today and those on high dunes pose interesting questions about changing environmental conditions.

Hammock survey is enabled by aerial photographs and other remotely sensed imagery (e.g., LiDAR) that provides sufficient information to design sampling schemes for particular landforms. All terrestrial landforms for which no surface evidence of human activity is observed must be subject to subsurface testing to explore the possibility of buried sites. Standard procedure in these cases is to excavate 30-x-30-cm shovel tests to a maximum depth of one meter spaced 30 m apart along linear transects. All fill from shovel tests is passed through ¼-inch hardware cloth and all recovered archaeological materials bagged by unit. Sketch profiles and photos of all shovel tests are taken as well.

All extant and newly discovered sites also require subsurface testing to determine their horizontal and vertical extent (i.e., site definition). Standard procedure for sites with terrestrial components is to dig 30-x-30-cm shovel tests to a maximum depth of one meter on a cruciform pattern spaced 10 m apart. Shovel tests for site definition are treated in the same manner as those for site discovery, although we exercise greater caution with the former in detecting stratigraphy within the profile of shovel tests and in maintaining separate proveniences for archaeological materials recovered from distinct strata.

All aspects of reconnaissance survey, as well as other investigations described below, are integrated in a regional Geographic Information Systems (GIS) database. Recently obtained LiDAR coverage for the study area provides high-resolution topographic data, as well as sufficient elevational data to relate all archaeological deposits to benchmarks for water levels. LiDAR is also useful for detecting above-ground anthropogenic deposits (i.e., mounds, ridges) when canopy cover is not too dense. On-the-ground mapping using a laser transit is necessary to record such features when LiDAR coverage is inadequate. The locations of all subsurface tests are recorded with a hand-held Global Positioning Systems (GPS) unit and uploaded into GIS coverage.

Whenever possible, reconnaissance survey includes inholdings in the tidal zone for which we can obtain landowner permission. Although inholding survey is not required by U.S. Fish and Wildlife to fulfill its obligation under the law, thorough knowledge of all archaeological sites in the greater region is required to provide the comparative basis to detect meaningful variations in time, space, and form. To date, three landowners have granted permission to conduct archaeological investigations on their properties. The investigations of Cat Island (8DI29) reported here are our first on private land, and constitute what we refer to as "rescue" operations.

Rescue

As noted earlier, many of the extant sites on the Refuges are actively eroding into the Gulf and will soon be lost forever. It is not clear in some cases whether the erosional face of any particular site is the remnant of a primary midden, or the secondary midden of a habitation site whose core remains intact. In other cases, shoreline deposits are merely the redeposited remnants of middens long since destroyed (e.g., Dasovich 1999).

Sites with intact midden deposits that are actively eroding need to be sampled before they are completely destroyed. Determining how much of a midden remains intact at any given location requires subsurface testing, but in some cases the landform in question has been reduced to a thin strip of subaerial land merely a foot or two above mean sea level and occasionally exposed only at low tide. The integrity of erosional remnants can sometimes be determined by the exposed profiles along shorelines, notably when escarpments expose both anthropogenic deposits and underlying soil. Of course, sites with substantial topographic relief (e.g., relict dunes) are less vulnerable to imminent destruction, although in such cases, the shoreline midden potentially represents a component of land-use and deposition that is functionally distinct from the deposits situated on the "upland" units of islands and peninsulas. In any event, erosion from tides and storm surge has been ongoing for millennia, so landforms currently flattened to near-sea-level relief include those that once stood in higher relief.

Washover and undercutting of shoreline middens are the two major forces of destruction observed at Refuge sites today (Dasovich 1999). Both processes operated throughout the past, but the magnitude of each would have been affected by the rate by which sea level rose. When sea level rises slowly and continuously, shoreline middens are most vulnerable to undercutting; in contrast, rapid, intermittent transgressions of sea preclude the gradual erosion caused by tides and waves. Moreover, storm surges carrying sediment also have the potential to “cap” near-shore deposits, rendering them less vulnerable to surface disturbances (and less visible to the survey archaeologist). In all cases, one has to bear in mind that archaeological materials eroded in one location get redeposited elsewhere, sometimes in formations that mimic anthropogenic deposits.

A thorough inventory of all sites facing imminent destruction awaits reconnaissance survey, but in the meantime, several sites collected by private citizens can be addressed immediately. One such site is Little Bradford Island (8DI32) in the Suwannee River Delta. Reduced to a narrow strip of intact midden, Little Bradford is situated in a pass between distributary channels of the delta that sees frequent, high-velocity boat traffic with destructive wakes. The site is one of those collected by a citizen who availed to us assemblages for analysis. In fact, this individual had earlier contacted the Bureau of Archaeological Research because human burials were being exposed by the eroding shoreline. State Archaeologist Ryan Wheeler (1998), then of the state’s CARL Program, visited Little Bradford and other sites known to this individual and filed a report on the exposed burials.

A second eroding site in proximity to Little Bradford is Cat Island (8DI29). The subject of archaeological evaluation in 2003 (Koski et al. 2003), Cat Island consists of low salt marsh with an “upland” ridge some 4.5 acres in extent but only five feet above mean sea level. Intact midden is eroding quickly from tidal undercutting, particularly when trees of the upland margins are uprooted. Our decision to conduct salvage work at Cat Island was partly motivated by logistics. The landowner, Mike Crews, not only granted permission to test the site, but also to use the island as base camp for our work at Little Bradford. Although Cat Island is not as vulnerable to imminent destruction as other sites on the Refuges, it is one of the only locations from which field operations in the delta area can be deployed.

Our “rescue” efforts were thus initiated with testing at Cat Island and Little Bradford. Standard procedure in these cases was to excavate two 1-x-2-m units each to the landward side of eroding shoreline middens. Units were excavated in 10-cm arbitrary levels within obvious archaeostrata and terminated at two “sterile” levels or at the water table at low tide, whichever came first. All fill was passed through ¼-inch hardware cloth and all recovered archaeological materials bagged by level. Plans and profiles were recorded in photos and scaled drawings. Finally, a 50-x-50-cm column was removed by archaeostrata from the most intact and representative profiles of each unit and all fill returned to UF for processing by fine-screening and flotation.

Research

Pursuant to the spirit and the letter of laws protecting cultural resources, the significance of archaeological sites most often resides in their potential to provide information relevant to science. Occasionally, federal agencies are able to support programmatic approaches to archaeological research (e.g., Savannah River Site of DOE; some U.S. Army Bases), but more often actions involving archaeological consultation are contracted out in piecemeal fashion with no integration of the individual research projects. A sustained research program for the Refuges will provide the strongest, most thorough, and most economical basis for rendering decisions about site significance for management purposes in the long-term.

We do not presume to know enough about the archaeological record of the Refuges to propose nuanced research questions at this time. Indeed, there is much basic archaeological work to be done to enable higher-order inquiry. Documenting the full range of variation in the distribution, timing, and content of sites is a fundamental goal. However, it will take years to attain this goal, and yet, as these data accumulate, any number of problem-oriented studies can be launched through the initiative and effort of faculty and graduate students of the University of Florida. Four basic problem domains are proposed to structure future research.

1. Environmental Change. It goes without saying that any research program aiming to investigate the changing relationship between people and environment must develop robust proxy data on variation in climate, water, vegetation, and fauna. The study area is one of the least developed coastlines of the Gulf and thus its present-day environments offer good opportunity for understanding the structural and processual relationships among natural forces affecting the inhabitability of land and the utility of its resources for humans. Natural science investigations of both modern and ancient environments are prevalent in and around the study area (e.g., Bergquist et al. 2006; Castaneda and Putz 2007; DeSantis et al. 2007; Wright et al. 2005) and offer a solid foundation for developing data relevant to specific archaeological questions.

Several areas of paleoenvironmental research bear relevance in any investigation of changing human-environment relationships. With respect to climate, changes in temperature, seasonality, precipitation, air circulation, solar radiation, and storm patterns are among the more obvious factors. Since the end of the Pleistocene, when humans first colonized the lower Southeast, climate has tended to become warmer and wetter. However, this overall trend was punctuated by shorter-term reversals, as well as periods of relative stability interrupted by rapid change. Moreover, in contemplating the effects of climate change on humans, it is important to distinguish climate variation from “regime” change, that is, the difference between fluctuations within a range of variation experienced by humans in real time, as opposed to change that is unanticipated for lack of experience and thus poses a threat to the perpetuation of “traditional” practice.

One of the most obvious effects of climate change in any coastal setting is change in sea level. Transgression of shorelines due to rising seas is one of the consequences of global warning as sea water expands with temperature increases and ice locked up in polar and mountain glaciers melts and is returned to the oceans. Shoreline regression comes into play too, as periods of cooling reverse the overall trend for rising temperatures and seas throughout the Holocene. Inasmuch as sea levels track changes in global climate, the overall trend has been for water to rise since the terminal Pleistocene, when levels were as much as 100 m below present and the breadth of the Florida peninsula was roughly twice what it is today. Virtually all models of sea-level rise acknowledge that the rate of rise has slowed over time, with rates averaging over 113 cm per century in the first millennium of the period to as little as 4 cm per century over the last five.

Multiple analysts have presented data that show intermittent higher-than-present sea level stands during the middle to late Holocene (e.g., Balsillie and Donoghue 2004; Mitchell-Tapping et al. 1989; Morton et al. 2000; Walker et al. 1995). Other analysts point to potential problems with the proxy data used to infer higher-than-present stands. In particular, Otvos (2001, 2004) contends that arguments for higher-than-present stands have not taken into consideration changes in sedimentation and basin geometry that affect water displacement. It has certainly been the case that with decelerating rates of sea-level rise over the Holocene, coastal sedimentation switched from transgressive to aggradational (Wright et al. 2005). This process helps to explain how landforms that were occupied intensively during the late Holocene are now cut-off from navigable water, even at high tide. Equally relevant to any reconstruction of sea-level change in the study area is alteration of the sediment supply via the Suwannee River. Whereas most of the gulf-draining streams fed by springs carry little to no sediment to the Gulf, the Suwannee River, with headwaters far into the Coastal Plain of Georgia, has potential to carry a substantial bedload. Coupled with episodes of denudation (e.g., large-scale fires or agricultural clearing), periods of heavy rain and runoff likely resulted in sedimentation spikes and delta progradation.

Changes in freshwater runoff would also have dramatic affects on the availability of resources of economic importance to humans. For instance, a common constituent of gulf coast middens is the inedible remains of the Eastern Oyster (*Crassostrea virginia*), a species of bivalve that thrives in the estuarine conditions of the Suwannee Delta region. Oysters enjoy a wide range of tolerance to salinity (ca. 5-35 ppt), and can thrive in both intertidal and subtidal conditions. However, the effect of parasites such as Dermo (*Perkinsus marinus*) and Oyster drills (e.g., *Urosalpinx* spp. and *Thais* spp.) on oyster survival and productivity are exacerbated with increased salinity (ca. <15 ppt), thus narrowing the range of habitat to intertidal zones with adequate freshwater input (Bergquist et al. 2006). Oyster predation is likewise strongly correlated with salinity, as well as submersion patterns. One study along a salinity gradient to the Suwannee River estuary suggests that recent decreases in freshwater flow from the river has diminished oyster productivity in the subtidal reefs and promoted greater intertidal reef development (Bergquist et al. 2006).

Variations in the use of oyster and other shellfish species are apparent in middens spanning 4000 years of human occupation in the study area. As we outline elsewhere in this report, the use of oyster at some sites gave way to increased use of Carolina marsh clam (*Polymesoda caroliniana*) over time, the latter comprising over 40 percent of the shellfish assemblage of Cat Island at ca. 1300 rcybp. It will be critically important to determine the extent to which this sort of trend is driven by cultural preference, ecological factors, or a combination of the two. Numerous other dimensions of environmental variation will become relevant as we delve deeper into the residues of human subsistence and the ecological parameters of relevant resources.

2. Changing Land Use. The sort of environmental changes that reconfigured the distribution of resources important to humans likewise affected the distribution of inhabitable land. Most directly, we can be certain that transgressions of the sea flooded the coastline, forcing people to relocate occasionally as "traditional" places of dwelling became uninhabitable. Coastal sites occupied during the late Pleistocene and early to mid-Holocene are now kilometers from the present-day coast, and archaeologists are actively seeking evidence of early coastal dwelling under meters of water (e.g., Adovasio and Hemmings 2008; Faught 2004).

If changing land use over the course of the past 12,000 years were simply a history of repeated relocation in response to a slowly transgressive coastal front, then the record of archaeological sites, both inundated and subaerial, would covary precisely with changes in sea level. A variety of factors mitigate against any such correlation. For one, changes in sea levels were neither constant nor unidirectional. Slow, gradual change over the course of one's lifetime, or even a century or two, may not warrant relocation, at least not in the short run. Building houses on stilts or on earthen platforms were among the tactics communities may have employed to combat the effects of gradual change. However, many changes would have been more eventful, potentially catastrophic, as in the increased storm surge attending sea level rise. Such dramatic, eventful change may have necessitated abandonment and relocation. Displacement landward is not unexpected for people eager to maintain the life with which they were familiar, but given the availability of paleodunes in the study area, relocation upward was an alternative. It is worth investigating the conditions under which use of paleodunes was favored over landward relocation. Seemingly the former option enabled communities to remain in close proximity to abandoned sites, but living on dunes posed new challenges, and eventually many such landforms were cut off from the mainland to become sea islands.

A second consideration is that sea level rise occasionally reversed its course for relatively short periods of time, long enough to have encouraged the relocation of communities seaward. This is well documented on the coasts of South Carolina and Georgia, where Early Woodland sites situated on the coast during a multicentury episode of dropping sea (and presumably global cooling) are now at least partly submerged (Brooks et al. 1989; DePratter and Howard 1981). Again, this need not be a unidirectional and gradual trend, however short in duration, but instead a process with fits and starts, and with alternatives besides relocation.

Because environmental factors affected communities and not simply individuals, the social consequences of change bear relevance. Specifically, we must be concerned with factors that affected not only the patterns of land use at the site-specific level, but also the relationship of sites and communities to one another. Social solutions to environmental change, as well as other disruptions, are actually the first line of defense for societies capable of relocating at will. Where people move after abandoning sites has as much to do with existing relationships with people in other communities as it does the physicality of inhabitable land. In other words, networks of affiliation and interaction play a large role in site selection and land-use patterning. At play here are both opportunities to relocate and join other communities, as well as impediments to relocation due to demographic (e.g., crowding) or political (e.g., conflict) factors. Land use clearly entails more than simply positioning communities relative to natural resources alone; the sociopolitics of land use—use rights, social obligations, cooperative labor, competitive relationships, and more—may occasionally trump the microeconomic imperatives of coastal living.

Sociopolitical impingements of land use remind us also that certain places on the landscape became significant to people for historical and symbolic reasons. Places of intensive and repeated occupation had the potential to draw people back, generation after generation, because of the gravity of tradition. With sustained settlement, landforms often accreted with midden, rendering them less vulnerable to rising water and erosion, and possibly affecting their economic potential, positively or negatively. These sorts of consequences were likely unintended, but nonetheless significant factors in the overall patterns of settlement. In addition, purposeful modifications of the landscape are evident in the many mounds erected in the study area. The association between mounds and human burials underscores the symbolic import of certain places, as well as the intentionality of coastal dwellers to create environments of their own design.

3. Built Environment. Mound construction in peninsular Florida arguably dates back as much as 7000 years (Sassaman and Randall 2011), and mounds erected specifically to inter the deceased date back at least 5000 years (Endonino 2010). Unfortunately, any coastal mounds this old or older would have suffered the fate of rising sea. Our first glimpse into coastal mounding dates to about 4500 years ago, when so-called "shell rings" and associated shell mounds took form along both the Gulf and Atlantic coasts of Florida (Russo 1991, 1996; Russo and Heide 2001). Because they are constructed of shell, rings and mounds this old on the coast, like those of the St. Johns Basin, have long been regarded as merely accumulations of food remains (Goggin 1952; Marquardt 2010; Milanich 1994; Miller 1998; Wyman 1875). The most recent research lends new evidence to the inference that shell rings and mounds in Florida were sometimes intentionally constructed (Sassaman and Randall 2011; Schwadron 2010) or at least the output of nonsubsistence, ritual activity (Russo 2004).

The intentionality of mounded deposits is not in question for constructions dating to the Woodland period. Starting at about 2500 years ago in the American Midwest, earth was used to construct elaborate mortuary mounds, platforms, enclosures, and animal effigies. The Hopewell tradition of ca. 200 B.C. – A.D. 500 exemplifies the elaboration of mound ritual centered on veneration of the dead. With extralocal influences over half a continent and adapted to a variety of local circumstances, Hopewell ritual became manifested in north Florida in a regional expression known as Swift Creek.

On the Florida Gulf coast, Swift Creek dates to the first few centuries after Christ, and it contributed to the subsequent Weeden Island tradition, which persisted on the Gulf coast until at least A.D. 800. Both traditions involved the construction of conical earthen mounds containing mortuaries, as well as platform mounds. Shell mounds and ridges are also known from these traditions, but too little evidence is available to ascertain their genesis and "function." Because Swift Creek and Weeden Island mounds often contain burials with whole pots and other items desired by collectors, most were destroyed long ago through uncontrolled digging. Also, like Archaic shell mounds, Woodland shell mounds were often mined for construction material.

At least two massive shell mounds and some 20 earthen mounds are known for the study area. Nearly all such constructions were destroyed by either haphazard or illicit digging, or mining for construction materials. The Philadelphian Clarence B. Moore excavated many mounds in the area in the late 19th and early 20th centuries (Moore 1902, 1903, 1918). His record of survey and excavation provides some of the only evidence we have for the location, configuration, and content of mounds. He and others that followed were motivated to explore mounds because they often contained human burials accompanied by whole pottery vessels, greenstone celts, and other elaborate artifacts. While we may have lost much of the contextual information of mound contents, including those of chronology, we still have locational information that is useful in determining the relationships between mounds and places of living and resource extraction. Some mounds were sited on landforms that have since been inundated and eroded by rising sea. To the uneducated observer, coastal mounds might appear to have been a pragmatic tactic for raising one's living space above flooded terrain, but most large earthen mounds appear to have been constructed expressly for mortuary purposes. Others constructed with truncated tops or those that included shell may have been erected for purpose other than burial, but nothing would suggest any were constructed for the express purpose of habitation.

Smaller mounds, linear ridges, and large U-shaped middens are indicative of intensive habitation, while the extent to which people resided on top of such deposits remains to be seen. Unlike the burial mounds, these sorts of deposits contain the refuse of everyday living and thus have not attracted the looters and antiquarians bent on recovering whole pots and other "treasures." We know of many such features in the study area and many more are expected to turn up as reconnaissance survey ensues. One of the primary goals of documenting and testing such deposits is to determine their "life histories," that is, the timing and circumstances of their initiation, their duration and abandonment, and any changes in use and deposition over time. Equally important is detailed information on the spatial relationships among above-ground deposits on particular landforms, as these have potential to reveal aspects of community organization and size. Needless to say, precise age estimates will be needed in order to establish contemporaneity and sequencing among such units.

An overarching issue relevant to research on the built environment is that places of either deliberate construction or long-term, accretional deposition were sometimes sited in places that simply could not sustain human habitation, or, in the case of nonresidential features, became inaccessible due to flooding or sedimentation. How changes in environment affected cultural perceptions of places on the landscape is a central theme of the proposed research, one that bears directly on contemporary challenges attending sea level rise. Anthropologists who study resettlement have noted that the toughest challenges of mitigating the adverse impacts of displacement are those related to the reconstitution of communities (e.g., Oliver-Smith 2003). Places of historical and cultural significance play a critical role in the formation and maintenance of community identity, so it stands to reason that geographic ruptures between such places and the people who regard them as meaningful erode the chances that communities can simply be relocated without undergoing major structural change. Of course, structural transformations arising from displacement are an important subject of study in their own right, and are particularly pertinent for understanding the social effects of climate change today.

4. Interregional Networks. Just as local environmental conditions are affected by and recursively affect larger-scale natural phenomena, local communities of the north Gulf Coast were both products of and precedents for extralocal social realities. Evidence for extralocal connections abound. Soapstone used in the manufacture of bowls during the Late Archaic period is found at many sites in the study area, and none of it could have come from sources closer than north-central Georgia. Pottery of the St. Johns tradition is actually quite abundant at many sites, and its temper of spicules from freshwater sponges points to sources in northeast Florida. The influences of north-central Florida communities during the late pre-Columbian era is evident in the substantial Alachua pottery assemblages in the northern part of the study area.

Other dimensions of interregional interactions can be cited, but perhaps none is more compelling than the geographic reach of Middle Woodland practices traceable to the Hopewell tradition on the Midwest. Generations of archaeologists have pondered the sorts of processes accounting for the widespread sharing of ritual practices manifest in mortuary mounds. Underwriting this practice materially is the acquisition of sumptuary items from far and wide, as well as an industry of elaborate pottery manufacture, much of it expressly for ritual uses. The longstanding but now largely discounted dichotomy between sacred and secular life (Sears 1973) implies that some manner of "world" religion sweep the country, imposing a sacred order to daily lives that varied from region to region, as nature and society dictated. There are clearly major contrasts between elaborate and simple pottery, between mound complexes and small midden sites, and between lavish and austere burial treatments. However, the contrasts are blurred when we investigate the provenance and final disposition of material culture presumed to be mundane and local. In a recent study of Swift Creek pottery, for instance, Neill Wallis (2011) shows that some of the more mundane classes of pottery were heirloomed and transported substantial distances to be gifted in the context of mound burial. A variety of supporting data enabled Wallis to infer how local communities were constituted through interregional connections that united diverse people in shared ritual.

It follows from this perspective that local communities of the study area cannot be investigated as if they were independent, autonomous collectives. This is not to say that they had to depend on distant communities to acquire daily food or make everyday pottery. Rather, as in small-scale societies generally, connections with other communities entail larger-scale, longer-term social and economic dimensions. In many cases, such connections were the basis for economic security, as the option to abandon sites and relocate may have been predicated on pre-existing ties. It is not unusual for such ties to be structured along lines of kin, particularly the marriage alliances of exogamous communities. Under some circumstances, materials and/or knowledge important to ritual practice implicated communities and social relations spread far and wide. The overall point is that biological reproduction may not have always involved scales of interaction beyond the local, but social reproduction, including alliances of marriage and the like, entailed far greater scales of interaction. In this sense, the political economy of Woodland communities, as well as those before and after, was regional in scope and thus irreducible to local circumstances. Indeed, one can argue that participation in political economies structure local economies as much, if not more, than do local ecologies (e.g., Bender 1985; Lourandos 1988). Ritual feasting, surplus production, and storage are potential manifestations of political economies involving food.

When considering extralocal scales of interaction and networking, the viability and reliability of transportation corridors bear relevance. In the study area, water and wetlands are the defining surface features. Movement of people by watercraft up and down the coastline is certainly expected, although we cannot assume that ease of transport is correlated directly with level of interaction or integration. Wind and shoreline currents can severely impede transportation by watercraft, as our field crew quickly learned. Equally important are demographic and cultural patterns of settlement that determine spacing between communities of cultural affinity. The study area is on the southern edge of the Woodland tradition known as Swift Creek, but fully situated within a broader gulf-coastal distribution of the subsequent Weeden Island tradition. How major mound centers such as Crystal River and those farther south around Tampa Bay affected the distribution of settlements in the study area and movement of people among them is a problem of considerable interest. Once again, the relationship between a domestic economy of daily subsistence and a political economy of regional integration lies at the crux of this problem.

Movement up and down the Suwannee River implicates other extralocal influences and histories of interactions and migration. The Suwannee River has headwaters in both the Okeefenokee Swamp of Georgia, as well as the south central Coastal Plain near the headwaters of Piedmont drainages that envelope sources of soapstone and the greenstone used to make celts of Woodland age. During the early Weeden Island era, the northern portion of Florida was home to the McKeithan tradition (Milanich et al. 1984), a regional expression of Weeden Island with unknown affinity to coastal counterparts. A Weeden Island mound complex along the Lower Suwannee known as Fowlers Landing (Moore 1903) is a possible link in river-wide interactions. Although this site was long ago destroyed, pottery and other items recovered by Moore may hold clues to relationships among coastal and interior communities.

Our understanding of regional interactions in Florida has long been dominated by analyses of pottery. It is not uncommon for pottery assemblages in Florida to be divided into local wares and trade wares, usually on the basis of tradition alone, but in more nuanced approaches—such as those of petrography (Cordell 1984) or chemical sourcing (Wallis 2011)—on the distinction between local and nonlocal sources of clay and temper. Sometimes the differences are very subtle and require sophisticated instrumentation, but in many cases nonlocal wares are evident in macroscopic technical attributes, as in the presence of mica (a Piedmont mineral) in clay. Even variations in the abundance and condition of aplastics as common as sand can signal divergent geographical roots in communities of potters. Extant collections of pottery available from sites in the study area lend themselves to a program of paste characterization as a means to identify seams of cultural and geographic variation that can be then tested against other, independent lines of evidence.

In sum, the four research domains outlined in the forgoing sections offer multiple points of entry into a long-term research program that has as its ultimate goal the detailed historical reconstruction in the study area for purposes of deriving generalizable knowledge about the relationship between long-term processes and short-term human experience. Given the patently multiscalar aspects of human experiences in the study area, all research efforts, no matter their particular bent, will benefit from an approach that tacks back and forth between the local and extralocal, and between the synchronic and diachronic. It bears repeating that any research effort in the study area will depend on the development of solid chronology, a thorough inventory and assessment of sites, and the integration of datasets that register both the natural and cultural dimensions of variation attending coastal living. Our inaugural efforts reported in this volume are a small, initial contribution to this empirical baseline.

BRIEF SUMMARY OF RESULTS

Cat Island (8DI29)

Rescue efforts at Cat Island entailed the excavation of two 1 x 2-m units in the “upland” portion that exists above the high-water level but not outside the zone of storm surge. A surface stratum of sand some 40 cm thick signals a recent storm deposit, presumably from the March 1993 “Storm of the Century” (Lott 1993). Beneath these sands in both units was a 40-50-cm thick shell midden, underlain by “sterile” sands situated just above the watertable. Charcoal from the base of the midden in Test Unit 1 returned a two-sigma calibrated age range of A.D. 610-680. Pottery recovered throughout the midden consisted primarily of sand-tempered plain ware, but also present was a moderate yet diverse assemblage of sherds of the Weeden Island tradition. Overall, the assemblage of pottery accords well with the calibrated date range, roughly the early portion of Willey’s (1949) Weeden Island II subperiod.

Test Unit 2 at Cat Island, a mere 16 meters east of Test Unit 1, presented a similar profile but with a basal sample of charcoal returning a two-sigma calibrated age range of 2830-2820/2630-2470 B.C. This Late Archaic age was a bit surprising given the results of Test Unit 1, but missing in this second unit was any trace of Weeden Island pottery. Several examples of nondiagnostic, plain sand-tempered sherds were accompanied by a few St. Johns sherds. The age estimate at the base of the midden is proximate to the age of Orange fiber-tempered ware, and although no examples of this pottery type were recovered from the unit, Orange sherds are present in private surface collections, as are soapstone vessel sherds. Aside from differences in pottery between the two test units, midden content differed markedly. Whereas oyster comprised over 90 percent of the shell in all levels of the midden in Test Unit 2, Carolina marsh clam (*Polymesoda caroliniana*) rose from 15 to 60 percent of the shell in the midden sequence of Test Unit 1. Evidently, local shellfish procurement had shifted from species with a wide range of salinity tolerance to those that do not tolerate salinity above 15 ppt. That midden records of such divergent age and composition reside only 16 m apart in an undisturbed context reminds us of the horizontal dimensions of midden formation and thus the need to sample more intensively, even at sites with only small middens.

Little Bradford Island (8DI32)

Like at Cat Island, testing at Little Bradford Island consisted of two 1 x 2-m units spaced about 16 m apart on the landward (west) side of an eroding, shoreline escarpment. Both units presented the same surface stratum of storm-surge sands, roughly 40 cm thick, underlain by a 30-cm-thick shell midden resting on clean basal sands. A sample of charcoal from the base of the midden in Test Unit 1 returned a two-sigma calibrated age range of A.D. 120-260/280-330; charcoal from the base of the midden in Test Unit 2 returned a calibrated age estimate of A.D. 20-220. Pottery throughout the midden was dominated by sherds of sand-tempered and limestone-tempered (Pasco) plain wares, accompanied by linear check stamped sherds (Deptford) and a few Swift Creek sherds. Carolina marsh clam comprises about one-third of the shellfish assemblage throughout the midden, with oyster dominating the remaining matrix.

Richards Island (8LV137)

Reconnaissance survey of Richards Island proved to be especially fruitful. The island was known to house substantial shell-bearing deposits along its eroding shorefaces, but the nature of archaeological deposits along the spine of this kilometer-long relict dune was unknown. Shovel testing along this spine and along several transverse transects revealed midden across most of the landform. Especially notable were thick midden deposits along the northwest and southeast portions of the main spine, as well as nearly continuous midden along the southern arm of the dune. Above-ground anthropogenic deposits were located in several spots, most notably a large U-shaped deposit at the northwest end of the island. Apparently the result of intensive occupation at a semi-circular village, the U-shaped deposit signals one of the few fully intact “shell rings” in the region. It holds enormous potential for informing on village structure and organization and thus warrants additional testing. Variations in pottery recovered from shovel tests across the island suggest possible spatial segregation of earlier and later components spanning the Deptford, Swift Creek, and Weeden Island periods.

Stratigraphic testing in multiple area of the island will be required to delineate more precisely the spatial segregation of components and to date these radiometrically.

CONCLUSION

The first phase of a long-term program of archaeological investigations in the Cedar Key and Lower Suwannee National Wildlife Refuges substantiates the potential of this region to inform on long-term histories of coastal dwelling. Sites that have been and continue to be damaged by tidal waters and related shoreline erosion retain good potential for data recovery, although the window of opportunity is closing fast as sea level continues to rise. The many hammocks, tree islands, and relict dunes of the study area add another layer of data potential in locations that are currently invulnerable to erosion, but nonetheless in danger of destruction from both natural and human agents. Given that we know so little about this part of Florida's archaeological record, simple, basic information of the distribution, age, and content of sites is sorely needed before larger research questions can be addressed. Still, with each bit of new information we are beginning to expose patterning that reflects both the adjustments humans had to make to changing environments, as well as the emergence, reproduction, and transformation of cultural practices that mediated the relationships between people and nature. The archaeological potential of the northern Gulf coast is robust indeed, and we trust that the results of our initial phase of fieldwork substantiate this claim.

CHAPTER 2
ENVIRONMENTAL AND ARCHAEOLOGICAL CONTEXTS

Kenneth E. Sassaman and Paulette S. McFadden

The northern Gulf coast of Florida is a complex environmental setting that has been and continues to be strongly influenced by both short- and long-term changes in global climate, as well as processes that operate at lesser scales of time and space. For a variety of reasons, the environment of the region has been reasonably well studied in the modern era, resulting in a robust literature dealing with marine ecology, geomorphology, fluvial influences, and human impacts. In contrast, and despite sporadic investigations spanning 150 years, archaeological knowledge of the region is not so well known to us, at least in ways commensurate with modern natural science. Moreover, data relating human experiences to environments of the ancient past are particularly sparse, limiting our ability to infer relationships between cultural and environmental change. If the ultimate goal of the Suwannee Archaeological Survey is to achieve greater resolution in human-environment relations in the region, spanning all of human history, a great deal of data must be developed on both sides of the equation. This chapter outlines what is known environmentally and archaeological to this point, and thus serves as a springboard for research yet to come.

ENVIRONMENTAL CONTEXT

Our review of the environmental context of the project area begins with contemporary conditions and works from general to specific scales of observation. This is followed by consideration of paleoenvironmental conditions, notably changes attending the rise of sea level since the late Pleistocene.

Regional Physiography

The project area is situated squarely within the so-called "Big Bend" area of Florida's Gulf Coast. Extending roughly from Apalachicola to Tarpon Springs, the Big Bend is a 350-km-long stretch of marine and brackish-marine marshy coast with a complex surface geology due to variations in limestone bedrock (Davis 1997a:165). Hine et al. (1988) referred to this coastal area as the margin of an incipient epicontinental sea, based on its location on the broad, flat, flooded carbonate platform. Because of the broad, low-gradient shelf of the underlying Florida platform (which extends more than 150 km into the Gulf of Mexico), the relatively weak winter storms, and the small fetch of the Gulf of Mexico when compared to the larger oceans, the Big Bend is a low-wave-energy coast (Hine et al. 1988). Storms produce enough surge to flood marsh habitat and either deposit sediment or cause significant erosion, but hurricanes rarely cross this portion of the peninsula and dominant winds (north-northwest) blow mostly along shore.

Coupled with a low-wave-energy regime, the relative lack of siliciclastic sand and mud in the Big Bend contributes to a heavily vegetated marshy biome. The Suwannee River is the only appreciable source of sand from the uplands to the east. Most other freshwater rivers draining in the Big Bend are fed by springs of the Floridan aquifer system, and do not carry significant sediment loads. Although the Suwannee delta is relatively small, it has aggraded enough to protrude into the Gulf several kilometers and it supports several distributary channels (Davis 1997a:165).

Limestone substrate in the Big Bend is generally shallow, often exposed at the surface in the southern reaches. Dissolution and collapse of limestone has produced a complex karst topography including broad bedrock depressions that form embayments, hammocks developed on bedrock nubs, and marsh island archipelagos on flooded, irregular bedrock planes (Davis 1997a:166).

In addition to the karst topography of the Big Bend region, many of the small islands protruding from the shallow waters along the coastline are relict paleodunes that most likely formed during the late Pleistocene and early Holocene. These landforms are consistent with other similar inland dunes that accreted throughout the southeastern United States between 30,000 and 15,000 years ago during a period of glaciation and drier climatic conditions (Ivester et al. 2001). Accretion of sediments on the dunes ceased and they became inactive, or relict, as the region became wetter. Reworking of the crests may have signaled reactivation of the dunes sometime during the early Holocene; however, there is no evidence of significant deposition on these landforms after about 3000 years ago (Markewich and Markewich 1994).

Compositionally, inland dunes are accumulations of aeolian (wind-borne) sediments, which originated in the floodplains of nearby rivers and streams. These sediments overlie older fluvial (water-borne) levee deposits or are the result of reworked riverine sands (Markewich and Markewich 1994; Wright et al. 2005). Dune sediments are well-sorted medium-sized sand grains that range from .5 to .25 mm in diameter, and little or no pedogenic soil formation is evident. The distinctive filled-in parabolic, or U-shape is a product of the direction of the prevailing winds in the region at the time of formation (Markewich and Markewich 1994), and in the case of the coastal region, reworking by marine processes as sea level rose and the land around the dunes was inundated (Wright et al. 2005)

Offshore, substantial oyster reefs parallel the coastline, affecting both the sediment rates and current patterns of the estuarine system. The eastern oyster (*Crassostrea virginica)* thrives in both subtidal and intertidal zones of brackish water estuaries, including those in the Big Bend region of Florida. The reefs constructed by these filter-feeding bivalves can grow from a small colony of around one square meter to hundreds of hectares in size, and it is common for oyster reefs to be exposed during periods of low tide since they tend to cluster in depths of less than 3 meters of water. Firm, muddy bottoms and faster moving nutrient-rich currents provide optimal conditions for oyster colonization and areas with these attributes tend to foster the largest reefs (Kilgen and Dugas 1989).

Soils

Brown et al. (1990) describe ten major physiographic zones in Florida, with the Big Bend region being included in the Ocala Uplift District. This highly diverse region accommodates a variety of elevations, surficial materials, and landscapes. At or near the surface, tertiary limestone creates rolling karst plains, punctuated with other topographic features, such as hills and valleys that have been sculpted by streams. The northern portion of this karstic landscape is composed of soils with medium to high clay content, which grades to the south and west into sandy flatwoods.

Because of its relatively diverse topography and formational history, Florida sports a variety of soil types. Seven of the 11 soil types described by the U.S. Soil Classification System are found in this state (University of Florida 2006), with specific conditions contributing to the type of soil found in any given region. Soil variation is a product of differential landscape position, ages of parent material, layering of sediments, and hydrology, among other factors. A variety of soils are present within the Ocala Uplift District. Spodosols, soils that contains a subsurface horizon of organic material combined with accumulations of iron and/or aluminum, are the most extensively occurring in the state and are found in the inland portions of the district (Brown et al. 1990; University of Florida 2006).

The coastal areas in the Ocala Uplift District are dominated by Histosols and Entisols. Histosols are heavily organic soils, with the organic material extending down at least 40 cm from the surface or to within 10 cm of the underlying marl or limestone bedrock. Overall, organic matter composes more than half of the soil column above the bedrock. This type of soil is found predominantly in swampy or marshy areas and, because of its highly organic content, is prone to subsidence and thus is unsuitable for urban development or the construction of homesites. Two suborders of Histosols characterize marsh soils: Hemists, in which organic matter has not yet completely decayed, and Saprists, in which organic material has become virtually unrecognizable due to excessive or complete decay (Brown et al. 1990).

Composed of inert parent materials, such as limestone or quartz sand, Entisols are characterized by the lack of soil-forming processes (Brown et al. 1990; University of Florida 2006). Like Spodosols, Entisols occur extensively in Florida. This soil type is found mostly in the sandhills and in sand pine scrub areas with level to sloping, well drained sandy deposits. Aquents, a suborder of Entisols that stay wet unless artificially drained, are found predominantly in marshy areas (Brown et al. 1990).

Brown et al. (1990) describe the coastal area specifically as a region of combined Histosols and Entisols with gently sloping to nearly level sandy beaches that are characterized by poorly drained, flood-prone marshes of mineral and organic sediments. These attributes make the coastal areas in the Ocala Uplift District attractive for wildlife and recreational activities, but undesirable for development.

Climate

The humid, subtropical climate of Florida is heavily influenced by a number of factors. Perhaps the most important is the peninsular configuration of the state, sandwiched between the Caribbean Sea to the east and the Gulf of Mexico to the west (Chen and Gerber 1990). Additionally, the state's climate is a product of latitude, land and water distribution, prevailing winds, storms, and pressure systems (NCDC 2006). Cyclical in nature, the climate alternates between cool, dry periods from October/November to May, and warm, wet periods from June to September/October, with the degree of dryness or wetness more pronounced in the southern portions of the state (Chen and Gerber 1990).

Temperatures are linked to both latitude and proximity to water (Chen and Gerber 1990). Mean winter temperatures range from the low 50s in the northern part of the state to the upper 60s in the southern portion. During the hottest months of July and August, the average temperature statewide is 81-83 degrees Fahrenheit. Temperatures vary from the mean and average somewhat, with northerly areas being cooler than south Florida. More than any other state, Florida has a substantial number of days that fall within the comfortable range of 70-85 degrees Fahrenheit, with 125-150 days in the north and over 200 days in the south (NCDC 2006).

Unfortunately, while the state experiences relatively few days over 95 degrees Fahrenheit, excessive humidity makes Florida summers notoriously uncomfortable. Statewide, the relative humidity during the warmest hours of the day is 50-60%, which can create a heat index of more than 10 degrees above the actual temperature. During cooler parts of the day, humidity increases to around 70-80%; however, because it is mitigated by lower temperatures, the heat index does not increase along with it (NCDC 2006).

Averaging 54 inches a year, just one inch behind Louisiana, Florida receives the second greatest amount of precipitation in the United States. Because of its southerly orientation, virtually all of this precipitation falls as rain, with a rare contribution from snow in the northern regions. At least one tenth of an inch of rain falls on seventy to eighty days in an average year, with the majority being convective rain in the summer months. Winter months see greatly reduced amounts of rainfall due to the Bermuda High, which moves over Florida around October and weakens around May. This high pressure system causes atmospheric subsidence, which restricts the formation of convective clouds and thus prevents precipitation. Geographically, the panhandle and south Florida receive the most rain, while the Florida Keys and the offshore bar of Cape Canaveral receive the least (NCDC 2006).

Because it is a peninsula, Florida receives breezes from both the Atlantic and the Gulf of Mexico, with the wind direction changing seasonally. In winter, winds come from the north, bringing colder northern air with them. During the transitional months of spring and fall, winds are from the east, southeast, and northeast. Summer winds come from the south, southeast, and southwest, bringing warm air up from the south. Nearly constant breezes moderate temperatures in coastal areas; however, breezes are not of substantial velocity (Chen and Gerber 1990).

Florida's generally mild climate is punctuated by extreme events, the most destructive of which are tropical storms and hurricanes. Originating in the Atlantic tropical cyclone basin, these destructive storms can develop in the North Atlantic Ocean, the Caribbean Sea, or the Gulf of Mexico. Each year around ten tropical disturbances develop into tropical storms and five develop into stronger hurricanes, with the peak time of storm formation in September and October. Only half of the hurricanes that form make landfall along the coasts of the United States, with some impacting Florida. The highest risk areas for hurricane landfall are in the panhandle, southeast, and southwestern regions of the state, while the Big Bend region, historically, has experienced less hurricane activity (Chen and Gerber 1990).

While wind damage and rain induced flooding from hurricanes cause substantial damage in upland areas, coastal areas are especially vulnerable because of the addition of flooding from storm surge and destruction from powerful wind-generated waves. Erosion or deposition of sediments that occur during these storm events can significantly alter the coastline and the immediately adjacent marine environment (Chen and Gerber 1990).

Of lesser destructive power, thunderstorms are quite frequent in Florida. During summer months, when the Bermuda High has ceased its restrictive influence, warming of the land surface in an unstable atmosphere causes thunderstorm development. These storms of varying intensity can bring heavy rains, lightning, high winds, sudden and violent uplifts, hail, and sometimes tornadoes (Chen and Gerber 1990). Florida has the highest tornado density, per 10,000 square miles, of any state. However, unlike the strong tornadoes in the Midwest, Florida's tornadoes are of relatively low intensity and many are small waterspouts that form and dissipate rather quickly (NCDC 2006).

Winter brings with it the risk of colder than normal temperatures when cold fronts dip down from the north. These brief, but sometimes intense periods of cold can result in damage to plant communities. For instance, mangrove trees cannot tolerate freezing temperatures and extensive areas of mangrove forest have been destroyed by abnormally cold periods (Chen and Berber 1990).

The Suwannee Delta region in the Big Bend area of Florida experiences much the same climate conditions as other central and northern areas of the state. At Cedar Key, average temperatures range from lows in the 50s during winter to highs in the 80s during summer. Average rainfall ranges from only three inches in April and May to a peak of ten inches in July and August. Winds are fairly constant and consistent, with mean wind speeds ranging from lows of around 6 knots in January and July to highs of around 9 knots in April and September (NBDC 2010).

Referred to as a "wind-driven estuary," the Suwannee Delta region experiences tides that are consistently affected by breezes from the Gulf of Mexico. Tides in the estuary are semi-diurnal, meaning there are two unequal low tides and two unequal high tides per day. The low and high tides are separated by just over 6 hours with a tidal range of one meter at the mouth of the Suwannee River (Farrell et al. 2005; Light et al. 2002). The estuary averages only 6.6 feet in depth, with deeper channels, of about 20 feet in depth, maintained in the East and West passes where the river discharges into the Gulf of Mexico (Farrell et al. 2005). When the shallow depth is combined with the large tidal range, this makes for a significant difference in land area that is exposed during low tide and inundated during high tide. Wind directionality and intensity can amplify the tidal range, causing excessively high or low tides.

Because of the flat, shallow topography of the Big Bend coast, even small increases in relative sea level can cause significant inundation of low lying areas. Two main processes combine to raise mean sea level globally, which significantly impacts Florida coastal areas locally. Eustatic sea level rise is an increase in the volume of liquid that is held by the world's oceans due to the addition of water. Melt water from the Arctic ice sheets and from Greenland contribute significantly to the increased volume of water, and global warming has accelerated the process. The addition of meltwater; however, is less significant than steric sea level rise, or increased water volume due to thermal expansion. Even a small increase in global temperatures can result in significant sea level rise due to warming of the oceans' waters.

In addition to changes in mean sea level, several other factors combine to create a complex mosaic of natural processes that affect the relative sea level in the Suwannee Delta. These include sedimentation, erosion and deposition by storm surges (Leonard et al. 1995), subsidence (Ning et al. 2008), and isostatic uplift (Adams et al. 2010). Sedimentation occurs when particles fall out of suspension in the water column and fall to the bottom, accreting the marsh surface. Punctuating the rates of sedimentation are storm surge events that can cause significant erosion, or deposition, depending on the nature of the event.

Along with sedimentation, isostatic uplift acts to somewhat mitigate relative sea level rise along the Florida coastline. Florida's Swiss cheese-like karstic topography developed as ground water slowly dissolved the weaker areas of limestone in the state's platform. The dissolved limestone is carried to the ocean where it is redeposited somewhere offshore. The result of this lost material is a lighter platform, which continues to rises up as weight is removed (Adams et al. 2010). In the local area of the Suwannee Delta, however, isostatic uplift is not enough to overcome the negating factor of subsidence.

While isostatic uplift and accretion by sedimentation act to raise the elevation of the land in relation to the sea, subsidence negates both of these processes. In the coastal areas of the Big Bend region, subsidence is the result of soil compaction and decomposition; the decomposition of organic materials contained in the soils; the extraction of ground water; and a lack of a sediment source to replenish subsiding surfaces (Ning et al. 2008).

The combined processes of subsidence and sea level rise far outweigh the mitigating factors of accretion and isostatic uplift. Since 1852, sea level has risen relative to the land an estimated 30.5 cm in the vicinity of the mouth of the Suwannee River (Light et al. 2002), and as the climate continues to warm, rates of sea level rise will continue to accelerate, putting the Suwannee estuary system at significant risk.

Biota

Florida's diversity of climate, soil types, and hydrology foster a highly variable biota, which can be classified into three distinct ecosystems. Upland ecosystems contain regions of pine flatwoods and dry prairie, scrub and high pine, temperate hardwood forests, and the south Florida rockland. Freshwater wetlands and aquatic ecosystems contain regions of swamps, freshwater marshes, lakes, rivers, and springs. Lastly, coastal ecosystems contain regions of dunes and maritime forests, salt marshes, mangroves, inshore marine habitats, and coral reefs (Myers and Ewel 1990).

The Big Bend region of the state supports all three ecosystems, and with the exception of the south Florida rockland, all of the habitats within these ecosystems are present. The inland portions of the region are characterized by the upland ecosystem, with extensive areas covered by pine flatwoods and dry prairies, intermingled with the freshwater and aquatic ecosystem. The westernmost extent of the region is characterized by the maritime forests, marine habitats, and especially the salt marshes of the coastal ecosystem.

Within the coastal ecosystem in the Suwannee Delta estuarine region, there are distinctive habitats that support different species of plants and animals. Tuckey and Dehaven (2004) identified and described three marine habitats in the region: tidal-creeks, areas of sea grass, and oyster reefs, each of which supports a diversity of plant and animal species. Focusing mainly on fish species, Tuckey and Dehaven (2004) collected nearly three years worth of data on tidal creek and sea grass habitats. Fish were collected from randomly chosen areas within the two habitats on a monthly basis with a goal of tracking changes in frequencies by species and size. They identified several species of fish that were restricted to certain habitats during certain times of the year, including gar, eagle ray, and sunfishes that were restricted to the tidal-creeks; and barracudas, mackerels, and triggerfishes that were restricted to the sea grass habitat. Of significance was their finding that areas of sea grass were used as a nursery for many species of fish that inhabited other territories as adults, making this one of the most important habitats in the marsh.

Colonies of eastern oyster (*Crassostrea virginica*), some of which can grow quite large in areas that provide optimal conditions, create the oyster reef habitat. Temperature, salinity, and food availability are all important factors in the success of any colony. Oysters are poikilothermic, meaning they are cold-blooded organisms whose body temperature varies with that of their environment. They can tolerate a wide range of water temperatures, from just above freezing to nearly 97 degrees Fahrenheit. However, while the oyster may tolerate differing temperatures, other factors that are indirectly affected by temperature, for instance the amount of soluble oxygen in the water, can adversely affect the organism (Kilgen and Dugas 1989). Salinity and food availability can be significantly influenced by freshwater inflows from the Suwannee River and various smaller creeks (Livingston 1990). Additionally, rising sea levels can change water conditions enough to destroy an established reef.

A large, diverse, yet characteristic community of organisms, ranging from micro to macro fauna, inhabits the oyster reef. Kilgen and Dugas (1989) provide an extensive list of organisms that inhabit oyster reefs, including protozoa; sponges; anemones; tube worms; various gastropods and other mollusks; various species of crab, shrimp and other shellfish; and multiple fish species. Sheepshead, black drum, goby, blenny, and toadfish are among the major fish species that are associated with the oyster reef habitat.

The salt marshes provide both terrestrial and marine environments, making it the most complex of the habitats in the estuary. Plants and animals that inhabit these marshes must be able to cope with both environments, and thus, species in salt marshes are often abundant but of low diversity (Montague and Wiegert 1990). Black needlegrass (*Juncus roemerianus*) and cordgrass (*Spartina alterniflora*) are the two dominant plant species found in salt marshes, and characteristic of northwest Florida marshes, they occur in monospecific stands. These marsh grasses grade into high marsh plants, such as wax myrtle (*Myrica cerifera*), and eventually to trees, such as live oak (*Quercus virginiana*), as elevation increases and flooding is less frequent.

A variety of vertebrate species finds food and cover on the fringes of the marsh grass. These transient species include raccoon (*Procyon lotor*), mink (*Mustela vison*), marsh rabbits (*Sylvilagus palustris*), cotton rats (*Sigmodon spp.*), and cotton mice (*Peromyscus gossypinus*) (Montague and Weigert 1990). Within the salt marsh environment, Montague and Weigert (1990) identified four distinct habitats, each of which supports different plants and animals. The aerial habitat includes the leaves and stems of salt marsh plants, which supports birds, insects, spiders and various species of snails. The intertidal zone, where water and marsh sediments interface, supports various gastropods, crustaceans, and mollusks, such as the Carolina marsh clam (*Polymesoda caroliniana*), that burrow into the sediments beneath the marsh grasses. Salt marsh creeks are home to various fish species, including mullet (*Mugil* spp.), spot (*Leiostomus xanthurus*), and pinfish (*Lagodon rhomboides*). Crabs, including blue crab (*Callinectes sapidus*), make their home in salt marsh creeks, as do oysters. Lastly, salt marsh tide pools are topographic depressions that retain water even as the surrounding marsh is exposed during low tide. The species supported in this environment is much the same as in the salt marsh creeks.

A multitude of invertebrates inhabit the nearshore marine environment, including mollusks and gastropods, and vertebrates, including fishes, reptiles, and marine mammals. In addition to the fish species found in the marsh environment, speckled trout (*Cynoscion nebulosus*), and various species of snapper and mackerel are found in the marine environment bordering the marshes (Livingston 1990). Marine mammals, frequently the bottlenose dolphin (*Tursiops truncatus*) and occasionally manatees

(*Trichechus manatus*), share these waters with green (*Chelonia mydas*) and loggerhead (*Caretta caretta*) sea turtles.

The small islands that dot the marsh, numerous hammocks of varying sizes, and the inland areas adjacent to the marsh provide sufficient elevations to allow for colonization by terrestrial vegetation. The forest canopy in these areas includes pumpkin ash (*Fraxinus profunda*), swamp tupelo (*Nyssa biflora*), sweetbay magnolia (*Magnolia virginiana*), live oak (*Quercus virginiana*), laurel oak (*Quercus laurifolia*), loblolly pine (*Punus taeda*), and cabbage palm (*Sabal palmetto*) (Darst et al. 2003). The understory is dominated by saw palmetto (*Serenoa repens*), but also can include wax myrtle (*Myrica cerifera*), blueberry (*Vaccinium* spp.), blackberry (*Rubus* spp.), and various species of greenbriar (*Smilax* spp.).

These forested terrestrial zones are home to numerous species of fauna, many of which utilize the surrounding marsh and marine habitats. Mammalian species include opossum (Didelphidae), rabbit (Leporidae), Eastern Grey squirrel (*Sciurus carolinensis*), otter (Lutrinae), raccoon (*Procyon lotor*), and white-tailed deer (*Odocoileus virginianus*) (Montague and Weigert 1990). Additionally, the wild offspring of once-domesticated pigs (*Sus domesticus*) are occasionally found.

Avian species that inhabit both the terrestrial and marsh environments include ducks and geese (Anatidae), herons (Ardeidae), wild turkeys (*Meleagris gallopavo*), swallow-tailed kites (*Elanoides forficatus*), bald eagles (*Haliaeetus leucocephalus*), and osprey *(Pandion haliaetus*). Additionally, smaller birds, such as seaside sparrows (*Ammodramus maritimus*), wrens (Troglodytidae), and other passerine birds inhabit these areas (Montague and Weigert 1990).

Prominent reptiles that inhabit the forest and marsh environments include pygmy rattlesnakes (*Sistrurus miliarius*), water moccasins (*Agkistrodon piscivorus*), and various turtles, including mud and musk turtles (Kinosternidae), soft shell turtles (Trionychidae), snapping turtles (*Chelydra serpentina*), and gopher tortoise (*Gopherus polyphemus*) (Kohler 1974). Additionally, several species of lizard (Lacertilia) also make their homes among the vegetation.

Late Pleistocene and Holocene Environmental Trends

The Florida coastline along the Gulf of Mexico as we know it today took shape after the end of the Ice Age. During the late Pleistocene, glacial conditions had lowered sea levels significantly and as a result, the continental shelf along the margins of the peninsular formation of Florida was exposed. In the Big Bend region of Florida, the late Pleistocene shoreline of the Gulf of Mexico was approximately 200 km to the west of its current position. Melting of the glaciers during the early Holocene contributed significant amounts of water to the oceans, and global warming compounded the eustatic changes with thermal expansion of sea water. This caused rapid sea level rise that inundated the low lying continental shelf along Florida’s coasts.

Numerous studies have sought to understand late Pleistocene and Holocene sea level changes. Using geomorphic beach ridges in the coastal area of central west Florida, Stapor et al. (1991) suggest that sea levels rose to higher than present levels around 2000 years ago before falling again around 1500 years ago. Walker et al. (1995) suggest archaeological evidence from aboriginal shell middens demonstrate higher than present sea levels between 1750 and 1450 years ago. Using geomorphic features that they interpreted as raised marshes, wave cut benches, scarps, and spits along the Texas Gulf Coast, Morton et al. (2000) suggest higher than present sea levels of almost 2 meters from 5,500 to 1200 years ago. Also considering raised ridges near the coast in Texas, Blum et al. (2001) used foraminifera and radiocarbon dates to suggest these ridges are abandoned paleoshorelines dating from 6800 to 4800 years ago. Many of these studies have been criticized for using proxy data to infer marine highstand in the absence of evidence of peat formations that are indicative of marine environments (Otvos 2004).

To further complicate the controversy over higher-than-present sea levels, a recent study by Adams et al. (2010) suggests elevated paleoshorelines along the eastern coasts of Florida and south Georgia are the result of isostatic uplift rather than retreating seas. As in Texas and other areas where supposed paleoshorelines are found, this region of Florida and Georgia is a tectonically stable, passive margin. The isostatic uplift that created these paleoshorelines was a result of the lightening of the Florida (and portions of Georgia) platform due to carbonate dissolution over the millennia. This uplift creates marine terraces that are above present sea level, the most recent of which was dated in the study to 120 ka.

While the controversy over higher than present sea level continues, the nature of sea level rise has also become a contentious issue. Nelson and Bray (1970) studied a series of sand and shell ridges, oriented parallel to the coasts of Texas and Louisiana and interpreted them as relict shorelines. Later, Frazier (1974) studied offshore ridges on the Gulf shelf, also interpreting them as relict shorelines, and proposed a model that suggests sea levels rose in a stair-step fashion, characterized by long periods of shoreline stability punctuated by periods of rapid sea level rise. Later studies by Thomas (1990) and Thomas and Anderson (1994) used seismic data to infer prolonged still-stand phases from sedimentary parasequences deposited during the Holocene off the coast of southeast Texas. The presence of these relict shorelines, specifically their location and dates of formation, could offer important information about marine still stands. However, a study by Rodriguez et al. (1999) found several ridges overlying more modern lagoon and backshore deposits, suggesting these ridges had been reworked by the marine environment and had migrated landward.

Contrasting with the stair-step model, several significant studies suggest gradual but decelerating sea level rise over the course of the Holocene. Scholl et al. (1969) and Robbin (1984) used data from peat formation in mangrove swamps and salt marsh sediments to show rapid sea level rise in the early Holocene, with declining rates in the middle to late Holocene. Goodbred et al. (1998) published similar findings but with evidence for a short period of rapid rise around 1700 cal yr BP before rates once again decelerated. More recent studies by Törnqvist et al. (2002) in the Mississippi Delta and

Toscano and Macintyre (2003) found evidence for gradually declining rates of sea level rise from 8000 to 3000 BP.

Wright et al. (2005) conducted an extensive study in the Suwannee Delta and developed a localized model for changing rates of sea level rise during the Holocene. Cores were collected from three transects, one at the mouth of the Suwannee River, one from an area to the north, and one from an area to the south. Analysis of sediments in the cores provided information about the discrete depositional environments and radiocarbon dates obtained from organic materials within the stratigraphic units of the cores provided important chronological information. The results of the study suggest that between 7500 and 5500 cal yr BP, sea level was rising at a rate of .16 centimeters per year. Between 5500 and 2500 cal yr BP, the rate declined to .07 centimeters per year. Rates further declined to .05 centimeters per year between 2500 and 750 cal yr. BP.

Shoreline transgression was significant along the coastline in the region that would become the Suwannee Delta. Prior to 8000 cal yr BP the Suwannee Delta region was well inland from the coast of the Gulf of Mexico. This flat plain was thinly covered with sediments, punctuated by eolian dunes that had accreted during the Late Pleistocene, when other southeastern dunes were forming from riverine sands. The shoreline transgressed quickly across the low, flat shelf, and by 5400 cal yr BP was within eight kilometers of its current position. Rates of rise slowed after 5400 cal yr BP, allowing for the formation of oyster bioherms offshore, which trapped marine and other biogenic sediments. The accretion of these sediments kept pace with sea level rise for a time, but by 4440 cal yr BP, this was no longer the case and the shoreline moved to within six kilometers of its current position. Along with the new shoreline, a new, inner oyster bioherm began to form and was well established by 3630 cal yr BP. Rates of rise again slowed, but the shoreline continued to transgress and by 2400 cal yr BP, it was close to its modern position (Wright et al. 2005).

Decelerating sea level rise, coupled with increased sediment discharge from the Suwannee River, allowed for the formation of the deltaic system at the mouth of the river. By 4840 cal yr BP, modern riverine sediments began to accumulate where the Suwannee River empties into the Gulf. As the shoreline transgressed, those riverine sediments were overlain by marine sediments, and by 3810 cal yr BP, the delta reef bioherm was established. The modern marsh began to form after 2350 ca yr BP. To the south of the mouth of the Suwannee River, marshes moved landward and inundated freshwater swamps and upland sand and limestone areas. The relict dunes that dotted the landscape were flooded, creating islands in the growing estuary and by 1380 cal yr BP, the sand sheet to the north of the Suwannee River was overtopped and the marshes transgressed as they had in the south (Wright et al. 2005).

Of interest in the study by Wright et al. (2005) is their conclusion that there is no evidence of higher-than-present sea levels in the Suwannee Delta region. Additionally, in opposition to the stair-step model, the authors suggest that sea level rise was gradual, albeit decelerating over time. However, the discovery of an abrupt change to salt marsh sediments from brackish water sediments at 1600 cal yr BP is suggestive of a brief period of accelerated sea level rise, much like that proposed by Goodbred et al. (1998).

Obviously, sea level rise significantly affected the ancient human populations that inhabited the coastal areas of Florida. In addition to displacement as the shoreline transgressed, resource availability most likely would have changed. For instance, increased salinity in localized areas would have significantly affected oyster reefs (Bergquist et al. 2006).

ARCHAEOLOGICAL CONTEXTS

Much is known about Florida's ancient human past from a long and storied history of investigation beginning in the 19th century (Milanich 1994). Comparatively speaking, however, the region encompassing the Lower Suwannee and Cedar Key National Wildlife Refuges is woefully understudied. Like other regions of Florida, it was the subject of investigation by antiquarians who had established that mounds were good places to find burials and that burials were good places to find museum-quality artifacts. Thereafter, the region fell into a long history of intermittent work, much of it very productive and insightful, but none of it sustained for more than a year or two. Once the study area came under the jurisdiction of U.S. Fish and Wildlife, preservation and conservation took precedence. Unlike the U.S. Forest Service and other federal agencies, Fish and Wildlife does not conduct many ground-disturbing operations. It follows that they have fewer Section 106-related actions than other agencies and thus fewer opportunities with compliance funding to conduct archaeological investigations.

Before moving on to discussion of specific localities and sites in the project area, it is worth mentioning a survey conducted by Florida State University (FSU) on behalf of U.S. Fish and Wildlife. In February 1980, a team of three FSU archaeologists surveyed select tracts and properties of the Chassahowitzka, Cedar Key, and proposed Suwannee National Wildlife Refuges (Dorian 1980). Some limited testing was conducted at several locations, while others were simply visited to document surface conditions. Despite its spotty coverage, this study stands today as one of the only large-scale surveys in the project area. A grant-sponsored project run out of the University of Florida some nine years later provided additional coverage in the Cedar Key area (Borremans and Moseley 1990). Other compliance-related surveys, noted in turn below, have involved relatively small tracts of land, and no major excavations have been conducted at sites in the study area since the mid-twentieth century.

To facilitate discussion of previous research, it is useful to divide the study area into subunits that reflect patterned variation in site density and type (Figure 2-1). Of course, a comprehensive survey of the project area has never been executed, so the known inventory of sites—a total of 111 as of this reporting—is likely to be heavily biased toward the largest and most elaborate sites (which attracted the attention of antiquarians), as well as middens and other anthropogenic deposits that present themselves today along eroding shorelines and escarpments (which are the convenient target of modern relic seekers).

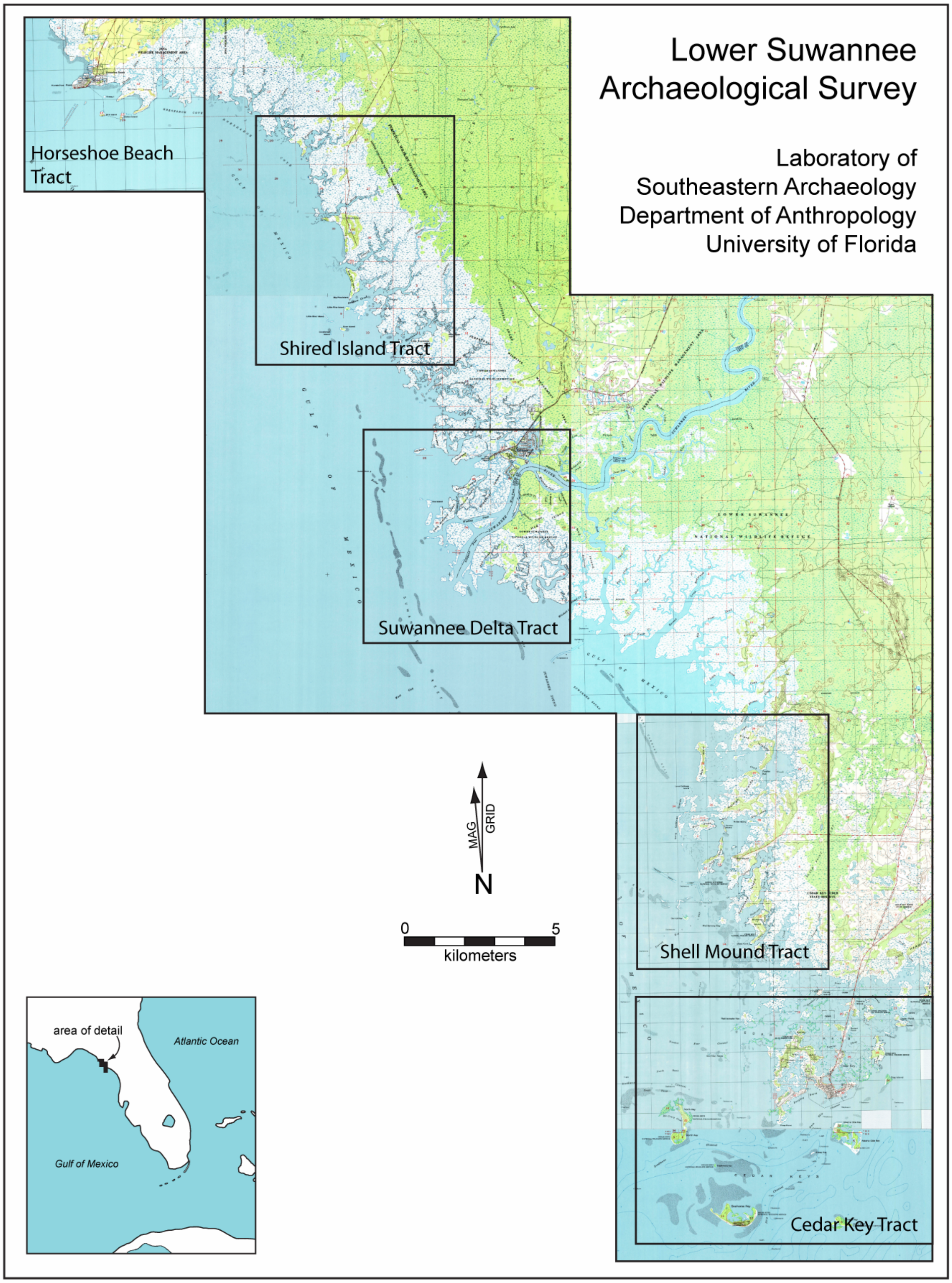

Figure 2-1. Composite topographic map of study area, showing inset maps of five tracts discussed in text.

Figure 2-1 depicts the entirety of the study area on relevant portions of U.S.G.S. topographic quads, along with the outlines of five tracts that encompass virtually all known archaeological sites in the coastal zone. Coastal areas not encompassed by these tracts, as well as adjacent lands to the interior, are also relevant to the overall goals of the project, but we focus our discussion below to the demarcated tracts, beginning with the Cedar Key tract to the south and working progressively northward toward the Horseshoe Beach tract at the north end of the study area.

Cedar Key Tract

The Cedar Key tract is the largest of the five tracts and it contains the largest number of recorded sites (n = 34). As is clearly evident in Figure 2-2, the tract consists entirely of islands, twelve of which are under jurisdiction of the U.S. Fish and Wildlife. The most seaward of the islands (Snake Key, Seahorse Key, Deadman's Key, and North Key) are designated "Wilderness" areas and the distal most, Seahorse Key, supports one of the largest colonial bird rookeries in north Florida.

The town of Cedar Key occupies Way Key, which is linked to other sea islands and the mainland by a causeway and state route 24. Prior to 1896, when a hurricane wiped out the town, Cedar Key was located on the island of Atsena Otie, about one kilometer south of Way Key. At various points in its fascinating history (McCarthy 2007), the Cedar Key area was a way station for Spanish galleons, an interment camp for Indians, a trans-Florida railroad depot, a Federal outpost during the Civil War, a leading producer of cedar for pencils, and a major fishing and shipping port (Figure 2-3).

With the early development of its railroad, as well as its shipping infrastructure, Cedar Key was accessible to nineteenth-century visitors interested in its archaeological resources. Among the earliest accounts were those of R. E. C. Stearns (1869) and Jeffries Wyman (1870), both of whom made mention of sites on Way Key, notably its impressive mounds. Although these accounts offer limited analytical value, they do give a good sense of the size and configuration of mounds that were later mined for shell or destroyed by illicit digging. The account of mounds on Way Key by Stearns (1869) is especially informative.

> At the south end of Way Key there is a group of mounds of unusual size and elevation; the largest and most southerly presents an abrupt face to the beach, having been partially dug away. Its height, as seen from this point, cannot be far from twenty-five feet; but this, as well as others of the group was, like the large mound near Fernadina, used for military purposes during the recent war. The aggregate thickness of the shell strata with the intercalated seams of ashes, upon the southerly side of the principal mound, and directly facing the sea, is about twenty feet and composed principally of the valves of Oysters (*Ostrea Virginica*), while on the north side of the same mound the shell deposit is somewhat less in thickness, and largely composed of valves of Scallops (*Pecten dislocates*?) (Stearns 1869:354).

MAP REDACTED FOR SECURITY PURPOSES. CONTACT REGIONAL HISTORIC PRESERVATION OFFICER, U.S. FISH AND WILDLIFE, FOR FURTHER INFORMATION

Figure 2-2. Topographic map of Cedar Key tract, showing locations of sites on file with the Florida Master Site Files, Bureau of Archaeological Research.

Stearns goes on to describe two other mounds to the north of this first mound and an area between the mounds that was apparently used as a cemetery.

> Just north of the above is the second in point of size, but the shell deposit, composed of the same species, is not as thick or deep, while at the northeast is a third mound of exceedingly regular form, also composed of shells; this latter has not been materially defaced, though a house of considerable size has been erected upon its summit. Between the two largest mounds, and connecting them, is a piece of flat or slightly uneven ground, which was used apparently for burial purposes, for here can be obtained human remains undoubtedly aboriginal, and fragments of pottery of large size may be picked up (Stearns 1869:355).

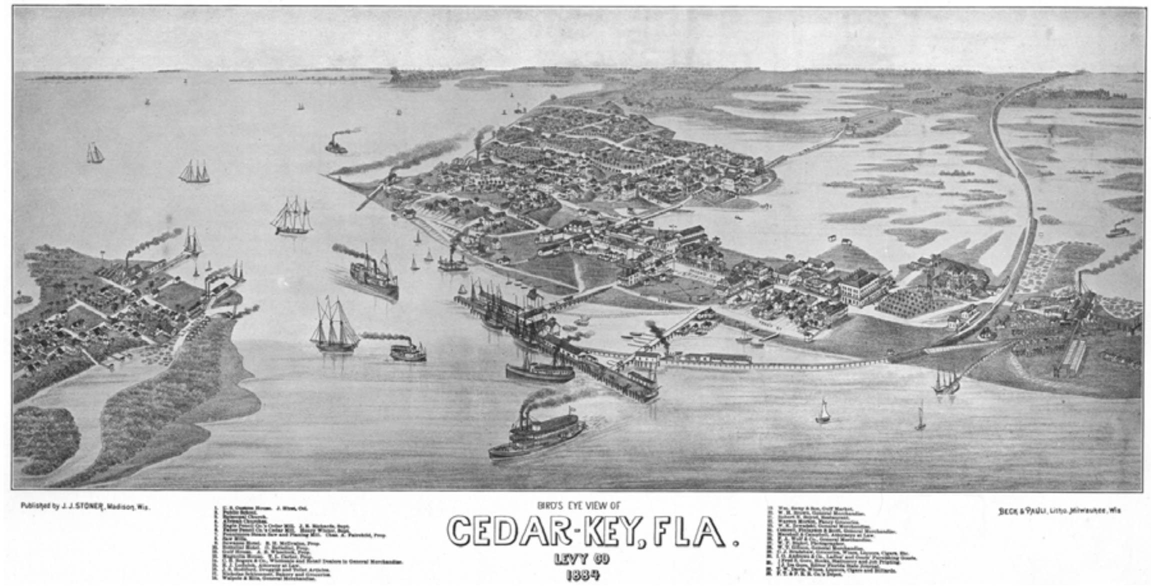

Figure 2-3. 1884 panoramic lithograph of Cedar Key, Florida (produced for Levy County by J. J. Stoner, Madison, Wisconsin; lithograph by Beck and Pauli, Litho, Milwaukee, Wisconsin). Library of Congress, Washington, D.C. Digital source: commons.wkimedia.org/wiki/File:Cedar-key_florida-1884-historicalmap.png. Accessed June 15, 2010.

The complex Stearns described is now largely destroyed. Its exact location is uncertain, but is purported to have been in the area marked 8LV19/20 in Figure 2-2, the Goose Creek Midden (8LV19) and Goose Creek Mound (8LV20) (Borremans and Moseley 1990). It is not clear if the modern site polygon for the larger of the two (8LV19) also encompasses the two other mounds noted by Stearns. If not, the area of site 8LV4 may have contained the mound Stearns mentioned to the north of the shoreline midden/mound complex, and the area of site 8LV284 may have contained the one he noted to the northeast (Figure 2-2). Persistent ambiguity in the locations of mounds, cemeteries, and middens in Cedar Key makes it difficult to connect specific historical references to the faint remnants of what apparently was an expansive and impressive built landscape. Some additional insight on the location and nature of the mounds can be gleaned from historic maps and photos, as discussed further below.

Among those who dug in or near the midden and mound complex described by Stearns was Lt. A. W. Vogeles (1879) and W. W. Calkins (1877-1880), while A. Ecker (1878) reported on human crania exhumed from one of its sand mounds (see Willey 1949:17). S. T. Walker (1883)[1] followed with a report on shell strata exposed in a road cut in town (although we cannot be certain of location, Figure 2-3, which dates to same time as Walker, shows several major road cuts through apparent mounds; more on this lithograph below). If Walker's description of four distinct shell strata in the mound is correct, he observed a sequence that had successive layers of Early, Middle, and Late

[1] Willey (1949:314) cites Walker 1885 for this observation, but the correct citation is Walker 1883. Authors since Willey have perpetuated this error (e.g., Dorian 1980:28; Weinstein and Mayo 2006:17).

Woodland deposition, capped with a component of the Mississippian era (Willey 1949:314). Walker was also impressed with the hiatus in shell accumulation in the middle of the sequence, accompanied by soil development he suggested was a period of abandonment of about least two centuries. We know today that the soil between layers of shell could very well have been emplaced deliberately, but no matter the process of formation, Walker observed a marked unconformity that signals a change in site use and/or depositional practice.

On the last of his many excursions through the Southeast, C. B. Moore in 1917-18 conducted excavations at two sites in Cedar Key, including 8LV4, which he termed "aboriginal cemetery in Cedar Key" (Moore 1918:569). By the time Moore delved into the cemetery, it had already been severely impacted by prior digging. Local informants reported that relics in the cemetery were numerous and elaborate. Among previous relic seekers were members of the Buffalo Society of Natural Sciences, the director of which, W. L. Bryant, supplied Moore with records of the finds, including a photograph of a whole Weeden Island Incised vessel (Moore 1918:569). Digging into an intact portion of the cemetery, Moore's crew encountered 11 burials, eight in the sand overlain with shell, and three from a shell stratum limited to only a portion of his excavation area.

In commenting on the apparent Weeden Island age for this site, Willey (1949:309) noted that no other (nonmound) cemetery of this era was known, suggesting to him that Moore and others had dug into the basal portion of a mound that was razed. If so, the shell deposit from which Moore exhumed three interments may have been a submound midden of earlier age. A compliance-related project in 1991 documented the presence of Late Archaic and Deptford period components at the site, but this work was unable to determine the relationship of these earlier deposits and those of Weeden Island age (Borremans 1991; see also Borremans 1993). With lingering ambiguity over the distribution and structure of all components, the possibility remains that one of the mounds noted by Stearns (1869:355) existed in the confines of what today is classified as 8LV4. It is equally likely that at least a portion of the flat area between mounds used for burials is likewise encompassed by 8LV4.

In the late 1980s, the Cedar Key Lions Club initiated some development in an area that Calvin Jones (1992) considered to be a southern extension of the cemetery Moore investigated. Grading had already exposed three burials in a 3-m high cutbank before Jones was dispatched to monitor land-clearing operations. Observed by Jones in another area of grading was the remains of a small Weeden Island sand mound that was built atop a Weeden Island midden, then capped with later shell midden. Five tightly flexed skeletons were recovered from the sand mound at depths of ca. 60-70 cm. Given the likelihood that additional burials would be encountered, grading of this portion of the site was halted and the remnant of mound was preserved in place at the site of the Lions Club (809 6th St.). The mound is listed in the site files as 8LV284 although Jones (1992) referred to it as 8LV4.

One final note on 8LV4 comes from Moore's observation that few artifacts were associated with the 11 burials he excavated. Contrasted with the richly adorned graves dug by his predecessors, the depauperate graves Moore excavated led him to suggest that the "aborigines had used one part of the cemetery in which to place burials with mortuary deposits and had selected another part to make interments without such deposits" (Moore 1918:375). Again, this may very well signal the contrast between either mound and nonmound burials, or between Weeden Island and earlier (e.g., Deptford) burials

The other site excavated by Moore is recorded in the site files as 8LV43, evidently located along the southeast shoreline of Way Key. At the time of Moore's visit, the site consisted of a seven-foot-high mound, some 32 x 73 feet in plan at the base, and composed largely of sand. The owner, W. H. Hale, told Moore that shell had been removed from the seaward side of the mound. Others who had earlier dug into the mound showed Moore celts and beads that were found "superficially in the mound" (Moore 1918:568). In digging three excavation units, Moore's crew found disarticulated human bone, a celt, shell beads, and a fragment of a copper ornament.

In the 1940s Willey and Goggin conducted limited surface collection of sites near Cedar Key. The only published accounts of this work are the short summaries provided by Willey (1949:313, 315-316), although the collections are well maintained at the Florida Museum of Natural History. Other collections from the greater area are housed at the Peabody Museum at Harvard (Willey 1949:310) and at Yale (Willey 1949:312-313).

Another noteworthy site on Way Key is Hodgeson's Hill (8LV8). Goggin in 1947 made a small surface collection that Willey (1949:312) reported, and, accompanying Goggin and students in 1949, Willey (1949:313) helped collect a second assemblage he likewise reported. A few Deptford, Swift Creek, and possibly Safety Harbor sherds were recovered, but the majority of pottery from Hodgeson's Hill is of the Weeden Island series (see also Borremans and Moseley [1990:22], who report sand-tempered plain and Pasco plain sherds from shovel tests in shell midden in one area of the site). The Piney Point site (8LV9) one kilometer south of Hodgeson' Hill also produced a predominately Weeden Island surface assemblage (Willey 1949:313).

Before considering archaeological work in other portions of the Cedar Key tract, we review in brief some insights enabled by the 1884 lithograph panorama shown in Figure 2-3. Panoramic drawings were very popular in the late 19th and early 20th centuries. Dating from the Renaissance, the technique used to produce these images involved careful observations of the shape and distribution of features across the landscape, from which isometric projections were made on a predetermined angle and distance. Although panoramic, or "bird's eye" views were never marketed as technical renderings, they were, in fact, often quite accurate.

The Cedar Key panorama features good detail about its buildings, streets, and topography. In a close-up view of the area encompassing the mounds described above, shown in Figure 2-4, several details hint at slopes and contours of anthropogenic deposition. Area A, in the foreground, provides the best example. Evident in this area are contours (marked with red dashed lines) of mound slopes, the steepest of which faces the Gulf to the south and appears to be scarred by a series of erosional rills. This large shell mound occupied land known today as 8LV43/279. Whether this particular location was the one visited by Moore (1918) is uncertain. In fact, Moore described a sand mound that does not appear in the panoramic view, and Moore's visit postdates that drawing by 33 years. We hasten to add, however, that the sand mound Moore observed was in an area of shell mining, as he noted (Moore 1918:568). Thus, like the Lions Club mound Jones encountered, the one Moore observed may have been fully encased in shell when the panorama was drawn.

One other relevant note about Area A is the cruciform road cut seen at the intersection of 2nd and E streets (marked by dashed yellow lines in Figure 2-4). The cut exposed in tall profiles the heart of the shell deposit. This location is the likely spot where Walker (1883) described a 12+ ft profile of mounded deposition. Both the cross-sectional imagery of this locus and the description of strata provided by Walker would suggest that anthropogenic deposits continued well below the grade of the road, that is, deeper than 12 feet.

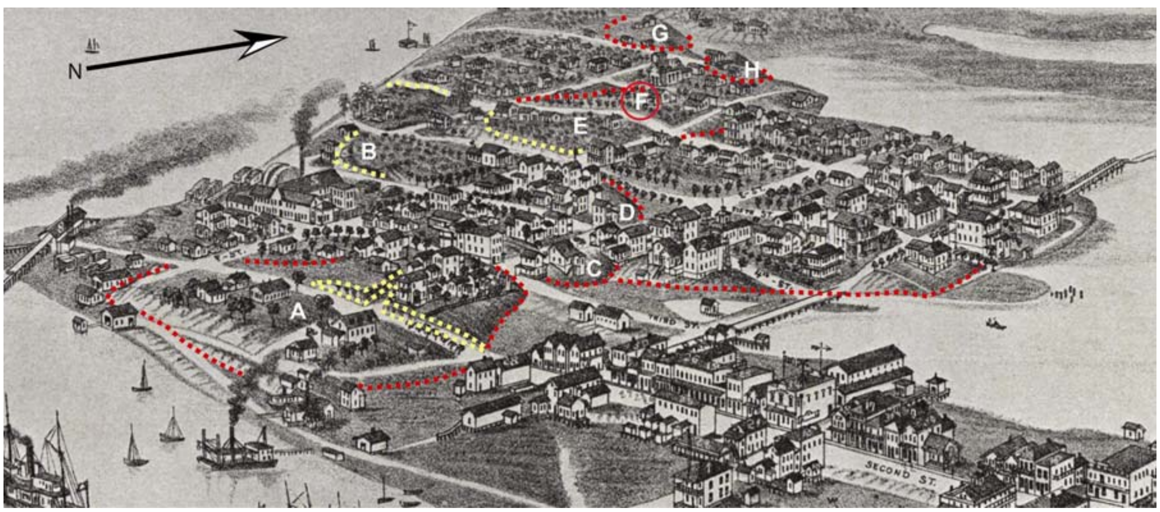

Figure 2-4. Portion of 1884 panoramic lithograph of Way Key, showing landscape features that appear to coincide with 19th-century descriptions of shell and sand mounds (red dashed lines mark apparent mound slopes; yellow dashed lines mark road cuts through mounds; letters designate mound loci discussed in text).

Locus B on the panoramic view is an apparent escarpment, presumably composed of shell, with two structures tucked behind. As we noted earlier, this location is generally regarded as 8LV19/20 and speculated to be the 25-ft tall shell deposit that Stearns (1869:354) noted had "an abrupt face to the beach." This same escarpment appears on the 1890 Sanborn map as a 20-ft high "shell bank." One additional historic resource lends a bit more detail to this setting. An undated photograph on a website for a rental property in Cedar Key known as the Coachman House (www.roi.us/cedar.htm) shows an "Indian Mound" with a steep bluff (Figure 2-5). To the right of the shell bluff is a small dwelling, and in the background, behind this building, is the roofline of a second structure. If facing southward, the perspective of this photo matches closely the relationship between the shell bluff and two shoreline buildings in the panorama. Substantiating this notion is wording on the website that indicates that this image was taken one-half block west of the Coachman House. With the Coachman house located on the 700 block of 4th Street, the location of the photo comes very close to the location of the escarpment in the panoramic view and the Sanborn map.

Figure 2-5. Mound and adjacent structures depicted in this undated photograph posted on the website of the Coachman House in Cedar Key (www.roi.us/cedar.htm), accessed June 18, 2010.

Areas C and D in Figure 2-4 are short, curvate creases in the topography brought into view, like other slopes facing east, by the shadows of an artist-imposed afternoon sun. The house with a walkout basement in Area C bolsters the inference that this artistic convention truly signals a sloping surface and its inflection by flatter terrain. Areas A and B would likely be contiguous were not for the structure built in the hollow between them. Of related interest to the immediate east of this structure is a larger complex of structures on elevated terrain, including a lobe extending to the shoreline. Its south-facing slope resembles the escarpment of Area A, although perhaps not as steep.

Area E is another area of elevated terrain with apparent road cuts but an indecipherable planview shape. The circle marked “F” in Figure 2-4 is the location of the Lions Club mound (8LV284), between 6th and 7th streets. It would appear that the lack of a sand mound at this location in the panorama would call into question the accuracy of this representation. However, it bears repeating that the Lions Club mound, like the sand mound Moore observed to the south, was encased in shell deposition, apparently becoming a component of an amalgam of large depositional units, which included other mounds, as well as midden. Added to the ambiguity of this area is its distance from the observer. As with any perspective with great depth, the panorama lacks detail in the background. Areas G and H, for example, provide some sense of topographic relief, and Area G is even symmetrical in outline. Despite the lack of detail, these distant features no doubt signal additional mounds and related deposition. Added up, the anthropogenic landscape of this portion of Way Key was expansive and complex. Estimated to cover about 16 ha, the totality of the mounded landscape in the Way Key area of the panorama is nearly twice the extent of the Crystal River complex to the south.

Turning now to work in the Cedar Key tract on islands other than Way Key, the record consists largely of recent research projects and a few compliance-driven efforts. Regional survey by the University of Florida in 1989 involved surface inspection and limited subsurface testing at several of the islands surrounding Way Key. Four shell middens (8LV268-271) on Scale Key were dominated by Pasco plain pottery, although one (8LV270), along the eastern margin of the island, produced Carabelle punctate and check stamped sherds (Borremans and Moseley 1990:17). One kilometer to the south on Dog Island, the trace of a badly eroded site (8LV278) was detected by a single sand-tempered sherd in a shovel test, while at Cedar Point Key to the northeast, another heavily eroded site (8LV25) produced a large assemblage of Pasco plain, as well as sand-tempered plain and dentate stamped sherds. Rattlesnake Key to the west of Way Key also contains an eroded midden (8LV287) with an intact component to the interior dominated by plain sand-tempered sherds (Borremans and Moseley 1990:27). Candy Island to the west of the Cedar Key causeway features (redeposited?) shoreline deposits (8LV273) with sand-tempered sherds but no Pasco pottery (Borremans and Moseley 1990:20). Three other shell midden sites (8LV275-277) on islands along the causeway are largely destroyed.

The only comprehensive, well-reported survey of islands in the Cedar Key tract was undertaken on Atsena Otie by Panamerican Consultants., Inc. in 2001-02 (Ambrosino et al. 2002). Although the bulk of this project was devoted to documenting the historic remains of the abandoned town, its cemetery, and industrial works, two recorded and two new aboriginal shell midden sites were investigated. Site 8LV15, on the southwestern corner of the island, has long been known as an eroding Middle Woodland shell midden with burials. The other three sites, like 8LV15, are badly disturbed, but noteworthy for midden that includes scallop, as well as oyster and gastropod. Site 8LV418, near the Atsena Otie cemetery, yielded an abundance of scallop shell in apparent association with Pasco plain pottery.

Given the advanced level of development on Atsena Otie in the 19th century, any mounds or middens in the interior of the island were likely leveled. The portion of Atsena Otie in the panorama is indeed quite flat. The only relief depicted in this image lies along the eastern margin of an inlet used to float logs to a mill (Figure 2-6). Incidentally, the Panamerican project compared the distribution of structures in the panorama to their survey data on foundations and related structural footprints and found relatively good concordance. Ambrosino et al. (2002:89-90) noted, however, several discrepancies between the two records, reminding us of the biases attending this manner of representation.

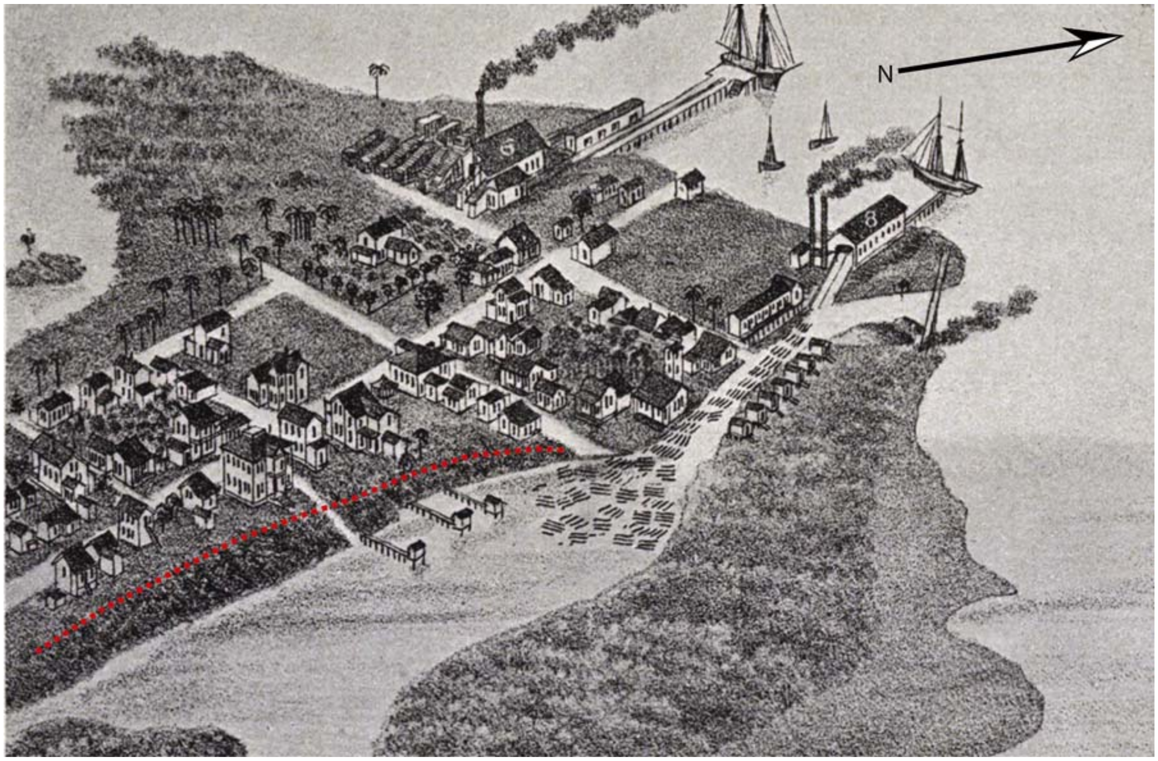

Figure 2-6. Portion of 1884 panoramic lithograph of Atsena Otie, showing one likely area of relief (red dashed line) along the bank of an inlet.

Finally, the three large islands that form the distal reach of the Cedar Keys have never been adequately reported, although an occasional project has resulted in some preliminary data. Seahorse Key, the anchor of the three, is the locus of two recorded shell midden sites: 8LV64 and 8LV68. Dorian (1980:41-42) reported that 8LV64 was an oyster shell midden extending some 90 m along a terrace on the southeast margin of the island with an average height of 1.5 m. A Middle Woodland component is noted, but pottery was too eroded to lend greater specificity to a cultural affiliation. Site 8LV68 was in similar shape when Dorian and crew (Dorian 1980:43) visited in 1980. It too had an eroding escarpment facing the gulf, in this case to the north.

Snake Key to the east of Seahorse Key and the much smaller Deadmans Key to the north was visited in 1980 by the FSU survey crew, but no cultural material was observed (Dorian 1980:51).

North Key, to the west of Seahorse Key, holds substantial deposits of shell in three locations (8LV65, 66A, 66B). Site 8LV65, on a terrace of the southeastern aspect of the island, was an intact shell midden 50 x 200 m in plan when observed in 1980 (Dorian 1980:42). On the north side of the major eastern bight, 8LV66A ran for 300 m along the shoreline and some 35 m to the interior, with an extension to the western shore at the narrowest point of the island. A high ratio of clam (*Mercenaria*?) to oyster was noted by Dorian (1980:43). Its counterpart on the eastern shore to the north, 8LV66B, consists of a 200-m long shoreline midden and a 2.5-m tall parallel berm to the interior. It is not clear if this berm is cultural or a product of storm surge.

Nina Borremans (1989) initiated field work on Seahorse Key and North Key as part of her dissertation research. Test units produced samples of pottery, faunal remains, and charcoal for radiometric dating, but none of this has been reported, at least not in full. A list of eight radiocarbon assays made on clam shell (*Mercenaria campechiensis*) on file at the Florida Museum of Natural History shows that midden accumulation at 8LV65 on North Key spanned roughly 1300-50 cal B.C., while accumulation at 8LV68 on Seahorse Key spanned cal A.D. 500-1200. In a synthesis of the north peninsular Gulf coast, Borremans (1991) notes that zooarchaeological analysis of materials from these islands indicates year-round occupation, but she does not specify the time period or components involved.

Shell Mound Tract

Twenty-two archaeological sites are known in the area designated here as the Shell Mound Tract (Figure 2-7). Among the sites is the largest extant shell deposit in the study area, the namesake Shell Mound site (8LV42), as well as some of the most elaborate mortuary facilities known for the region. Also included in this tract but very poorly understood are semi-circular or ridge-parallel shell structures of presumed villages. Our current investigations include limited work at one such feature, on Richards Island, which we report fully in Chapter 5. Others are coming to our attention through the application of LiDAR data, as well as inventory associated with the 2010 Deepwater Horizon oil spill (Randall et al. 2010).

Shell Mound (8LV42) is one of the very few large mounds in the region that has not been leveled by mining, development, or vandalism. When C. B. Moore (1902:349) visited the area in 1902, the landowner, W. R. Young, was residing in a house atop the mound, and presumably prevented anyone from compromising its substrate. Its present configuration shows a central hollow that is open to the southeast (Figure 2-8), apparently the result of shell mining at some unknown time. No information is readily available to substantiate this assumption, and, until such information is found, we remain open to the possibility that its present configuration is more-or-less original. As discussed further below, semi-circular enclosures like this exist in the area, albeit at lesser scales of relief.

Shell Mound is the tallest extant anthropogenic deposit in the region. It currently stands about 6 m above the surrounding ground surface and some 8 m above mean sea level. In maximum plan dimensions it currently measures 120 x 160 m. Information about its internal structure and composition is limited to a report by Bullen and Dolan (1960) on a 10 x 10-ft unit the junior author excavated at the summit of the mound in 1959. Retrieved throughout this 10-ft deep sequence of mostly oyster shell were sherds of the Pasco series and some sand-tempered plain. In the upper four feet of the sequence Pasco sherds were joined by several sherds of St. Johns plain, and traces of other, coeval types. Surface collections from around the mound produced sherds of later age (e.g., Wakulla check stamped, St. Johns check stamped, Chattahoochee Brushed), but no such sherds came from secure mound strata. Bullen and Dolan (1960:20) note a significant change in mound stratigraphy with the disappearance of the St. Johns wares. At this depth, roughly 4-5 feet below surface, shell became pulverized and mixed with black earth, and possible hearth-like features were observed. This apparent occupational level was underlain by additional shell, but with increased frequencies of clam. Bullen and Dolan (1960:22) posited a shift in economy at this point toward greater use of fish and shellfish, perhaps, they suggest, attending rising sea levels.

MAP REDACTED FOR SECURITY PURPOSES. CONTACT REGIONAL HISTORIC PRESERVATION OFFICER, U.S. FISH AND WILDLIFE, FOR FURTHER INFORMATION

Figure 2-7. Topographic map of Shell Mound tract, showing locations of sites on file with the Florida Master Site Files, Bureau of Archaeological Research.

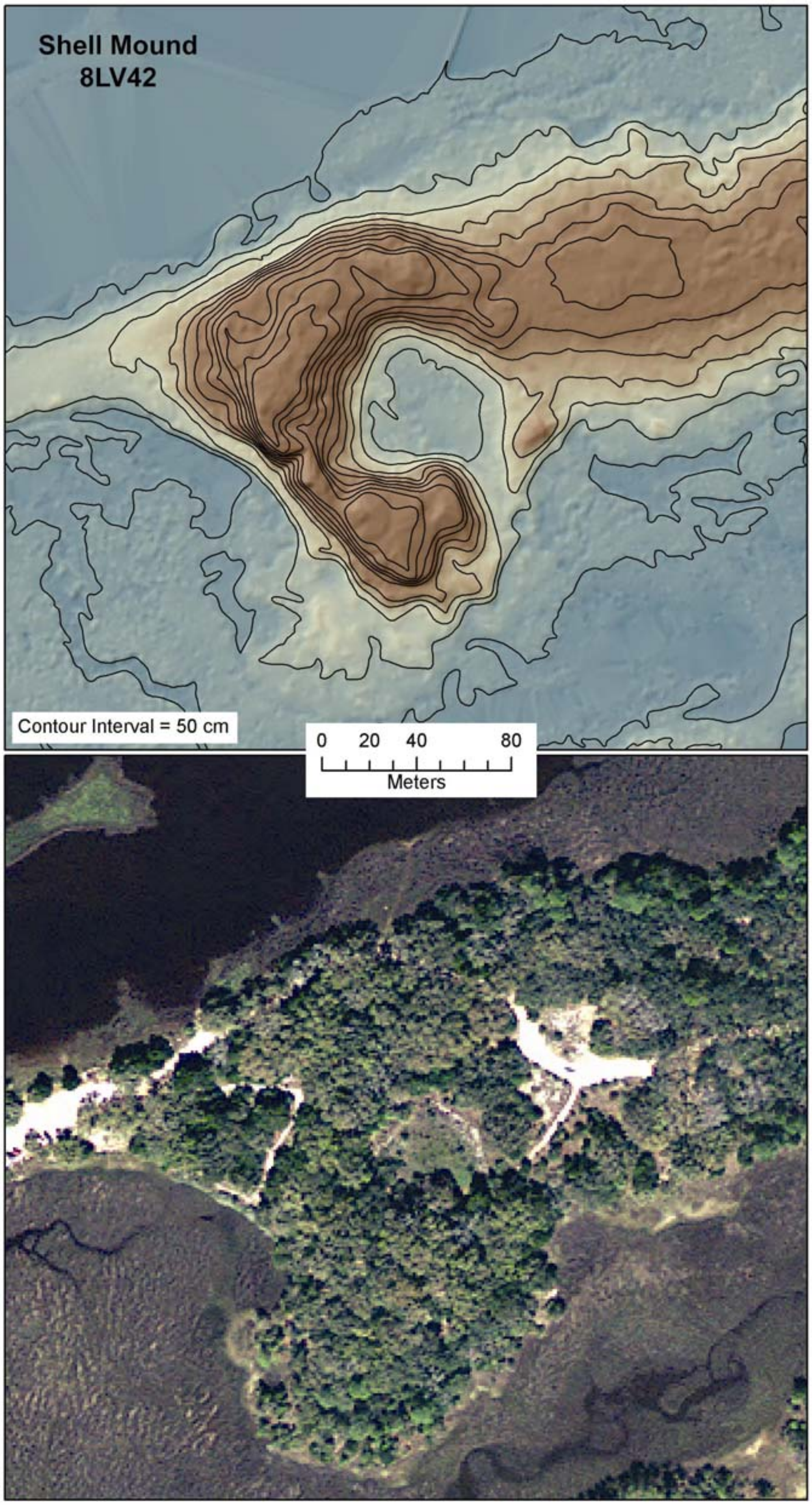

Figure 2-8. LiDAR topographic projection (top) and aerial photo (bottom) of Shell Mound (8LV42) (courtesy of Asa Randall).

The bottom half of Shell Mound remains completely uninvestigated and we thus can only speculate on the initiation of mound deposition. Pottery has not been located anywhere on the surface or eroding faces of the mound in three casual surface inspections by the authors over the past year. It seems reasonable to suggest that the basal core of Shell Mound is actually prepottery in age. If so, it would stand alone in the region as not only the sole intact mound, but also the oldest, intact or not. Further subsurface investigation is clearly warranted.

A mortuary complex on Hog Island, opposite Shell Mound (8LV42) was the target of repeated and aggressive digging since at least the mid-19th century. Also known as Graveyard Island, Palmetto Island, Rattlesnake Island, Pine Island, and Pine Key (Mitchem 1999:7), Hog Island was the locus of a cemetery and/or burial mound recorded variously in the site files as 8LV2, 7, and 40. Mitchem (1999:23) discusses the confusion surrounding the identity and location of this site. Moore (1902:348-349) lists the locus as "Mound on Pine Key," but he describes it as a "sort of burial place, or cemetery." Moore was preceded by others, notably Decatur Pittman in the 1880s, whose large collection of pottery at the Florida Museum of Natural History was reported by Willey (1949:311-312). Swift Creek and Weeden Island wares dominate the assemblage, but Willey was impressed by their association with sherds of the St. Johns, Papys Bayou, and Pasco series. One additional note on this mortuary locus is the unreported work of Montague Tallant, as summarized by Willey (1949:308). A couple of decades after Moore's visit, Tallant dug into what Willey states was a "sand mound." He located secondary burials accompanied by pottery caches in marginal fill of the mound, as well as skulls inside of large vessels. Some of the burials apparently came from a submound pit, and Tallant found stone celts, pendants, a copper gorget, and lump galena in pit burials. Why Moore did not mention this mound in his report of earlier work suggests that he and Tallant worked different sites on the island, or perhaps different islands altogether. Notwithstanding the ambiguity, the Hog Island locus immediately opposite Shell Mound was a major mortuary locus during Swift Creek and Weeden Island times, perhaps even later (see Willey 1949:308).

In 1962 John Goggin conducted a field school at this Hog Island location (what he called 8LV2) with students from the University of Florida. Although Goggin never issued a report of this work (he died less than a year later), students wrote papers that provide some information about the method and results of excavation (e.g., Mykel 1962; Rubin 1962). The 10 x 10-ft unit they excavated along the (east?) margin of a heavily looted sand mound contained a dense concentration of sherds some 20-28 cm below the surface. Although the vast majority of nearly 2200 sherds from this unit were plain or eroded sand-tempered, the balance included a few hundred Weeden Island types. The student reports note that sherd concentrations such as this are not uncommon in burial mounds of early Weeden Island age, and they cite Willey's (1949:405) mention that such concentrations formed "pathways" or pavements connecting the eastern margin with the center. Willey further indicates that pottery was deliberately broken for this purpose. A visit to this locus in 1989 showed that looting has continued in more recent decades (Borremans and Moseley 1990:32).

Another mound on the mainland, immediately northeast of Shell Mound (8LV42), was described by Moore (1902:349) as 6.5 ft tall and 64 feet wide at the base. Moore's trenching revealed alternating strata of oyster shell and sand, with an 18-inch cap of sand over the top. Although Moore encountered no burials, he noted the presence of fragmentary human bone from earlier looting. The location of this mound is recorded in the site files as 8LV41.

The 1989 University of Florida survey headed by Borremans included visits to several sites in the Shell Mound tract. Shell midden was observed across the entirety of McClamory Key (8LV288), although storm surge and erosion has compromised the integrity of this low-lying deposit (Borremans and Moseley 1990:27). A short visit to the south end of Seabreeze Island revealed shell midden but no pottery, although subsurface testing was not possible due to logistical constraints (Borremans and Moseley 1990:29). One-half a kilometer to the northwest of Seabreeze Island and an equal distance south of Shell Mound, the UF crew encountered a remarkable site on an unnamed island they dubbed Komar (8LV290; Borremans and Moseley 1990:29). The entire island consisted of a ridged, horseshoe-shaped midden with shell mounds on either side. A single shovel test placed in the top of the ridge produced dense shell with mostly Pasco plain pottery, but also some Carabelle Incised and sand-tempered plain. As we discuss in Chapters 5 and 6, similar horseshoe-shaped middens with considerable relief and associated mounds are now known for at least four other locations in the Shell Mound tract. Shell Mound (8LV42) itself would be a fourth such construction if its horseshoe-shaped plan were not simply an artifact of shell mining.

Richards Island (8LV137), the subject of Chapter 5 of this report, was also visited by the UF crew (Borremans and Moseley 1990), and before then the 1980 survey crew from FSU (Dorian 1980:48-51). The FSU crew documented substantial midden and ridge deposits at the south end of the island in the clearing of an old home site. Observed in the spoil of potholes and gopher tortoise burrows were sherds of Middle and Late Woodland affinity, as well as human skeletal remains. Weather drove the crew from the island before the northern half could be inspected. As we will see in Chapter 5, this portion of the island houses a large, intact "shell ring."

Immediately north of Shell Mound and Hog Island, the UF survey crew recorded shell midden deposits on Garden Island (8LV291) and Buck Island (8LV292) (Borremans and Moseley 1990:29). Only one plain sand-tempered sherd was recovered from Garden Island, but Buck Island contained Swift Creek and check stamped pottery. Two additional middens (8LV293, 294) were located on Raleigh Island to the northeast (Borremans and Moseley 1990:34).

Several of the larger islands in the Shell Mound tract are private inholdings (e.g., Deer Island, Clark Island), and a few (e.g., McClamory Key) are state property. Each of these locations are known to contain shell middens, some recorded in the site files, others not. The overall pattern for landforms in this tract is for widespread midden punctuated by arcuate or semi-circular ridges of shell enclosing a "plaza" area 30-50 m in maximum dimension. Sand mounds other than 8LV2/7 are not known for the tract, but we note that such features may be obscured by later shell deposition, as we have seen on Way Key.

Suwannee Delta Tract

Thirteen archaeological sites are listed in the area designated the Suwannee Delta tract in Figure 2-9. The only known mound sites among them are those listed in the site files as 8DI26, 27, and 39, just southeast of Alligator Pass at the mouth of the river. The large marsh island and hammock complex known as Hog Island was visited by C. B. Moore in 1902 (1902:348), when he described only one mound, and again in 1917-18 (Moore 1918:568), when he noted the presence of two other mounds. All three mounds were dug into prior to Moore's visits, and all three consisted of sand overlying shell, ranging in size from 40-50 ft in diameter and 3-9 ft tall. He mentions burials in one of the mounds, confined apparently to a foot-thick mantle of sand. This mound was located on a "considerable" shell ridge (Moore 1918:568). No data are available on the cultural affiliation of any of the mounds or the shell midden, but it is noteworthy that one of the mounds featured limestone slabs.

MAP REDACTED FOR SECURITY PURPOSES. CONTACT REGIONAL HISTORIC PRESERVATION OFFICER, U.S. FISH AND WILDLIFE, FOR FURTHER INFORMATION

Figure 2-9. Topographic map of Suwannee Delta tract, showing locations of sites on file with the Florida Master Site Files, Bureau of Archaeological Research.

Other sites in the tract are known primarily as eroding shoreline middens. Cat Island (8DI29) and Little Bradford (8DI32)—both reported here in detail in Chapters 3 and 4, respectively—are good examples, as are several others on other islands and peninsulas in the vicinity. Casual survey of sites such as this shows that most locations with "upland" units proximate to shoreline middens contain intact components of Woodland age, and, as Cat Island shows, occasionally older deposits. Most such sites also contain human interments, although none are known to come from mounds or other sorts of specialized facilities. Otherwise, one of the defining features of the delta sites are assemblages of shellfish that include sizeable proportions of Carolina marsh clam, a species adapted to the low-salinity conditions enabled by a constant input of freshwater.

Before closing this section it bears mentioning that C. B. Moore's work in 1903 involved an excursion some 16 km up the Suwannee River. He investigated a series of sand mounds at locations along this stretch of the river, most notably a mound at Fowler's Landing (8LV1). Described as 7-ft tall and 50-ft in diameter, this circular sand mound was completely excavated by Moore (1903:364-370) to reveal 47 bundle burials. A large cache and smaller deposit of "killed" pottery vessels included examples of Weeden Island Incised and Plain (Willey 1949:307). A second, badly damaged sand mound 69 m southwest from the first was classified by Moore (1903:371) as "domiciliary." Moore's work up the Suwannee River reminds us of the importance of regional-scale processes such as trade and migration that brought populations of the coast and the interior into contact.

Shired Island Tract

Thirty-one recorded sites are known for the area we designate the Shired Island tract (Figure 2-10). The namesake for the tract, Shired Island, is a complex of 11 recorded sites, the westernmost (8DI7) of which was recorded by John Goggin in 1948, and later excavated from 1951-53. The entirety of this five-acre parcel is shell midden, with portions up to two meters thick. At the highest point on the landform is a shell mound 30 x 40 m in plan that has been badly damaged from looting. An escarpment up to 2.5 m high along the south shoreline has undergone severe erosion. Dorian (1980:59) indicate that this was the location of Goggin's excavations, which, in 1980, was flooded at high tide. Goggin never published the results of this work, but a UF student used the materials curated at the Florida Museum of Natural History to write an M.A. thesis (Goldburt 1966). This work reports stratified deposits spanning the ceramic Late Archaic through Swift Creek periods, and additional artifacts from the site push the sequence both back into the prepottery Archaic and forward to perhaps the Safety Harbor period. Dorian (1980:59) make particular note of fragments of soapstone sherds and hematite plummets in a private collection from the site, evidence of interaction with communities from interior locales to the north and west. The Bird Island site in the Horseshoe Beach tract (see below) duplicates this evidence.

MAP REDACTED FOR SECURITY PURPOSES. CONTACT REGIONAL HISTORIC PRESERVATION OFFICER, U.S. FISH AND WILDLIFE, FOR FURTHER INFORMATION

Figure 2-10. Topographic map of Shired Island tract, showing locations of sites on file with the Florida Master Site Files, Bureau of Archaeological Research.

The area of Shired Island marked as 8DI47 was the locus of Goodson's Fish Camp when the FSU crew surveyed in 1980, but is now part of the Lower Suwannee National Wildlife Refuge. Although no subsurface testing was conducted during the FSU survey, the landowners showed the crew artifacts collected from the parcel spanning the Middle Archaic through Woodland periods, and they indicated that human burials were encountered when a septic tank was installed.

Another extensive site in the Shired Island complex is 8DI35. The site occupies a sand ridge running some 350 m north-south with a ~30-cm-thick shell midden across most of the landform. Historic debris is scattered about, as are occasional potholes. A few check stamped and complicated stamped sherds are reported by Dorian (1980:62) amid an assemblage dominated by eroded sherds.

Small beach hammock sites (8DI36-38) along a spit extending south of Shired Island contain sparse shell and Woodland sherds of various types, but much of this material may have been redeposited as these small hammocks eroded in recent decades. Additional small middens (8DI74, 8DI76) were located across the upland unit to the northeast of this spit, as was a vandalized low sand mound (88DI75).

Little Pine Island (8DI64) and Big Pine Island (8DI22-25) were surveyed by the FSU crew in 1980 (Dorian 1980:55-57). The former site consists of a small, sparse shell midden with purportedly Weeden Island pottery. The latter complex of four sites is dominated by a 200+ m long beachfront midden (8DI23) along the western shoreline. Its counterpart to the north (8DI22) is likely an extension of this first site, as Dorian (1980:56) note that cultural material is continuous between the two. A third shoreline site (8DI24) and an interior midden 15 x 50 m in plan are not well documented, and definitive diagnostic artifacts are not reported for any of the four sites. However, the private collection donated to LSA contains sherds spanning the Late Archaic through Woodland periods, including abundant Deptford, Pasco, St. Johns, and Weeden Island sherds.

Sites just north of the mouth of Fishbone Creek (8DI21A-C) are distinct from most of the other midden sites in the study area in their general lack of shell and relatively high frequency of lithic artifacts. The FSU survey crew visited the largest of the three (8DI21B) and placed shovel tests to the interior to reveal thin shell lenses some 35 cm below the surface. Little other information on the Fishbone Creek sites is available, but given the frequency and diversity of the pottery in the private collection at LSA, as well as human skeletal remains, we disagree with the conclusions of Dorian (1980:57) and Goggin, who they cite, that 8DI21B is not worth investigating further. The same applies to the other two Fishbone sites, which, as far as we know, have never been examined professionally.

Horseshoe Beach Tract

The Horseshoe Beach tract (Figure 2-11) is the smallest of the five in the study area and it contains the least number of archaeological sites (n = 10). The small number of sites may be deceiving, however, because little work has been conducted in the area now occupied by the town of Horseshoe Beach and it likely housed substantial midden and perhaps mounds before the 19th century. Midden deposits recorded on the mainland peninsula of the town (8DI71, 8DI129) consist of poorly documented shoreline exposures. Better detail is found in the professional work conducted at sites on Bird Island (8DI52) in the Gulf, and Garden Patch (8DI4) on the mainland to the northeast.

MAP REDACTED FOR SECURITY PURPOSES. CONTACT REGIONAL HISTORIC PRESERVATION OFFICER, U.S. FISH AND WILDLIFE, FOR FURTHER INFORMATION

Figure 2-11. Topographic map of Horseshoe Beach tract, showing locations of sites on file with the Florida Master Site Files, Bureau of Archaeological Research.

Bird Island is a privately owned island one-and-one-half kilometers southeast of Horseshoe Beach. Since first recorded by Goggin in the 1960s, the archaeological site on Bird Island (8DI52) has been investigated repeatedly as storm surge and erosion exposed midden and human burials along its southern shoreline. Although subsurface testing has never been conducted, surface collections of eroding midden include artifacts spanning the Late Archaic through Weeden Island periods. Notably, the fragmentary skeletal remains of 33 individuals were salvaged and analyzed by Stojanowski and Doran (1999) to provide some of the only modern data on human interments in the study area. A single radiocarbon assay on human bone returned an uncalibrated age estimate of 4570±100 B.P. (Stojanowski and Doran 1999:139). Because this assay was not corrected for 12/13C fractionation, calibration is not warranted; nonetheless, the assay corroborates circumstantial evidence to suggest that the majority, if not all of the skeletal population is preceramic Archaic in age, making it the oldest in the study area. Archaic pottery and a large assemblage of soapstone vessel sherds (one AMS dated to 3630±70 B.P. [Yates 2000]) from Bird Island signal a slightly later component. The volume of soapstone at this site is unparalleled in the region, suggesting that Late Archaic inhabitants were connected to the network of soapstone exchange that delivered tons of soapstone vessels from sources in Georgia and Alabama to sites as far afield as Poverty Point in northeast Louisiana (Sassaman 2006).

After repeated hurricanes in 2004, the eroding shoreface of Bird Island was stabilized with a seawall. The effects of storm surge and shoreline erosion on the island's archaeological deposits have been well studied (Dasovich 1999; Stojanowski 2002), but the lack of systematic subsurface testing across the site limits our knowledge to data recovered from disturbed context. Fortunately, the landowners are open to proposals to tests portions of the site they have protected from ongoing erosion.

Three kilometers northeast of Horseshoe Beach along a terrace overlooking the salt marsh is a complex of mounds and midden known as Garden Patch (8DI4). In 1948 John Goggin of the University of Florida (UF) located three "sites" in the area of Garden Patch. What he deemed Garden Patch 1 is a natural sand ridge with midden; Garden Patch 2 is a sand mound measuring 20 x 30 m in plan and 1.5 m high; and Garden Patch 3 is an extensive shell midden in close proximity to the sand mound (Kohler 1975:28, 31; Willey 1949:306-307). Students of Goggin conducted limited test excavations in what ostensibly was Garden Patch I and III, and in 1974 Timothy Kohler added a couple more test units and reported his findings in a UF masters thesis (Kohler 1975). Results of the most recent work warranted the consolidation of Garden Patch 1-3 into a single site designation, 8DI4. Kohler verified that much of the mound complex was Weeden Island in age, but was able to infer that mound components varied in function and age. He also proposed that the Weeden Island occupation of the site, being situated between marsh habitat and soils suited to agriculture, was supported by a combination of marine procurement and corn farming. That Weeden Island residents of the project area engaged in food production has not been substantiated in later work, although, admittedly, little work has since been conducted.

Moore (1902:346-348) investigated a mound complex on the edge of the salt marsh north of Horseshoe Point in an area of extensive shell midden. Willey (1949:304) reports this location as 8DI1, which is not shown on Figure 2-11. The complex Moore investigated included three mounds, the southern most situated on old shell midden. Burials and Swift Creek and Weeden Island vessels were encountered in this 40-ft diameter, 6-ft high sand mound. The second mound consisted of a 6-ft high linear ridge 60 x 80 ft in plan with burials, celts, and plain pottery, and the third was a circular sand mound lacking burials and thus considered "domicillary" by Moore. According to Kohler (1975:19) 8DI1 has occasionally been mistaken for the Garden Patch site (8DI4), and he suggested that the mound complex Moore visited, purportedly now destroyed, was located approximately 2 km north of Garden Patch (Kohler 1975:20). However, in the National Register of Historic Places Nomination Form, filed in 1991 (an update of the 1986 nomination), a new map of the site is included which shows three additional mounds to the east of those illustrated by Kohler (1975:29). In addition, the narrative of the nomination form indicates that Moore was the first to investigate Garden Patch, and the three mounds he described are included as part of 8DI4. Although no mention of 8DI1 is made in the nomination, it is evident that whoever prepared the form and the new map (Kohler?) decided that the mounds Moore described and Willey lists as 8DI1 are contained within the boundaries of 8DI4.

Other sites of note in the Horseshoe Beach tract include an unaffiliated shell midden on Cotton Island (8DI51), two Deptford and Swift Creek middens on the eastern arm of Butler Island (8DI50, 8DI97), unaffiliated sites north of Horseshoe Beach reported to the state's CARL program by private collectors (8DI131, 8DI132), and an alleged burial mound north of Garden Patch named Hosie Pond (8DI79) with Alachua tradition pottery.

Discussion

> The lack of adequate communication routes, the swampy terrain, the sandy soil, and the low lying coast (subject to drastic storm surge) have all contributed to the cultural pattern of this area being out of the mainstream of regional developments (Dorian 1980:14)

Although the sentiment expressed by Alan Dorian about the "cultural pattern" of the study area was directed specifically at the area of the Lower Suwannee National Wildlife Refuge, and was clearly influenced by the lack of development in historic times, new, emerging data for the region challenges this characterization. We are beginning to understand that the extant record of human occupation in the study area has been woefully underestimated in both scale and complexity. Surely there were places that were only sparsely populated, or used for only transient purposes, but there are also many places on the landscape that supported intense, repeated utilization for at least the past 2000 years. The mound and village complexes of the Cedar Key and Shell Mound tracts rival those of other Gulf coast localities.

The complete inventory of recorded coastal sites in both Refuges includes some 111 aboriginal sites, almost all with shell-bearing deposits (Table 2-1). The sorts of shoreline middens collectors have visited over the years dominate the inventory of known sites, but included as well are many sand and shell mounds of the region, most eradicated by early excavators and looters. In addition, a few intact sites located on hammocks and paleodunes surrounded by salt marsh attest to probable occupation at times of either higher-than-present sea level and, more likely, before marshes accreted with slowing sea level rise. As reported in Chapter 5, work at Richards Island shows how pervasive and intensive use of paleodunes appears to have been. When we factor these sorts of landforms into the inventory of potential site location, we can expect a manifold increase in the actual number of sites. Happily, these landforms have been the least impacted by natural forces since they were occupied and thus hold great potential for garnering new data.

We are fortunate that two local collectors who salvaged materials eroding from shoreline sites have recently donated collections for professional study and permanent curation. In the late 1990s, one of these individuals contacted the University of Florida and the Bureau of Historical Resources to alert archaeologists about the research potential of actively eroding sites. State Archaeologist Ryan Wheeler (at the time an archaeologist with the state's CARL Program) accompanied this individual on a tour of

Table 2-1. Components and Other Attributes of Recorded Sites in the Five Tracts of the Study Area.

	Horseshoe Beach	Shired Island	Suwannee Delta	Shell Mound	Cedar Key	Total
Number of sites	10	31	13	23	34	111
Number of sites w/diagnostics artifacts	6	14	8	12	22	62
(% of total tract sites)	60.0	45.2	61.5	52.2	64.7	55.9
Number of sites with:						
Orange	1	3	3	5	1	13
(% of diag. sites)	16.7	21.4	37.5	41.7	4.5	21.0
Deptford	4	8	4	9	7	32
(% of diag. sites)	66.7	57.1	50.0	75.0	31.8	51.6
Swift Creek	2	4	3	3	4	16
(% of diag. sites)	33.3	28.6	37.5	25.0	18.2	25.8
Weeden Island	2	6	4	10	17	39
(% of diag. sites)	33.3	42.9	50.0	58.3	18.2	30.6
St. Johns	0	4	4	7	4	19
(% of diag. sites)	0.0	28.6	50.0	58.3	18.2	30.6
Alachua	2	3	2	3	0	10
(% of diag. sites)	33.3	21.4	25.0	25.0	0.0	16.1
Mississippian	0	0	1	3	1	5
(% of diag. sites)	0.0	0.0	12.5	25.0	4.5	8.1
Colonial	0	1	1	1	2	5
(% of diag. sites)	0.0	7.1	12.5	8.3	9.1	8.1
Shell mound(s)	1	2	3	3	3	12
(% of total tract sites)	10.0	6.5	23.1	13.0	8.8	10.8
Sand mound(s)	2	6	3	3	6	20
(% of total tract sites)	20.0	19.4	23.1	13.0	17.6	18.0
Burial(s)	4	8	5	7	8	32
(% of total tract sites)	40.0	25.8	38.5	30.4	23.5	28.8

the area and provided recommendations for recording provenience information. Since then, this individual maintained site-level provenience for some 26 sites stretching from Horseshoe Beach to Cedar Key. The second individual, who collected mostly sites in the

Cedar Key tract, likewise keep site-level provenience and both individuals were nondiscriminatory in what they picked up and kept.

Inventory and analysis of these private collections, along with others curated at the Florida Museum of Natural History, are underway and promise to provide valuable information on the distribution of sites by period across the study area. The pottery typology appropriate to these efforts is the one developed by Willey (1949). Although it is now over 60 years old, this typology has withstood decades of application to remain the most comprehensive and effective tool for sorting pottery. However, as with any typology, its application across different contexts must be applied critically. We simply do not have enough information about the formal, temporal, and spatial variations of pottery types in the study area to accept without question the parameters of variation established elsewhere. Indeed, one of the major goals of the Lower Suwannee Archaeological Survey is to refine the typology and chronology of Willey's scheme so that we can confidently arrange in sequence the cultural changes attending site establishment and abandonment, transformations in ecology, and the contours of "tradition" and innovation. It is premature to propose typological refinements in the study area, so we close this chapter with a brief summation of patterning using the nomenclature and time periods of established culture-historical taxa.

Judging from observed archaeological evidence, most of the shoreline sites eroding into the Gulf are multicomponent middens containing pottery of varied chronological and geographic affinity. The most intensive and sustained human settlement of the Refuges took place during the Deptford (ca. 500 B.C.-A.D. 250) and Weeden Island periods (ca. A.D. 200-900). Virtually all sites in the collection have appreciable quantities of Deptford pottery and smaller, but pervasive assemblages of Weeden Island sherds. Sand burial mounds dating to the latter period were attractive to early excavators, like Moore, who recovered whole vessels and other items of ritual importance from graves. Most of the Weeden Island sites recorded to date are likely the domestic sites of communities with affinity to nearby burial mounds.

Pasco pottery is present in nearly all pottery assemblages of the private collections (although not included in Table 2-1 because of lack of consistent reporting in site files), and it often comprises the majority ware at sites near Cedar Key. It is believed to be coeval with Deptford and early Weeden Island throughout the Refuges, although to the south, towards its namesake county, Pasco pottery apparently persisted for a few centuries more. Plain sand-tempered pottery believed to be coeval with late Weeden Island was perhaps the counterpart to late Pasco ware in the Refuges, especially north of the Suwannee River delta, where it likely coexisted with Deptford and Weeden Island pottery since 500 B.C.

Another minor but pervasive pottery ware in the collections is Swift Creek, a cultural expression whose more conspicuous manifestations date to A.D. 150-300, thus bridging the Deptford-Weeden Island continuum. Considerable chronological overlap among these various traditions is apparent and it continues to challenge efforts to refine chronology through cross-dating alone. A large suite of radiometric dates from good contexts and with sound pottery associations is sorely needed.

Other aspects of the pottery assemblages reflect both greater time-depth and geographic reach than the local Deptford-Weeden Island continuum. Occasional fiber-tempered sherds with incised decorations attest to occupations during the Orange period (ca. 2500-1500 B.C.) and a consistent presence of spiculate-paste wares includes potentially early St. Johns pottery (ca. 1000 B.C. through possibly Weeden Island). Late St. Johns pottery (i.e., check-stamped wares, post-A.D. 750) occurs in only trace amounts. Both the Orange and St. Johns wares have regional distributions centered on the St. Johns River and adjacent Atlantic coast. Finally, traces of Alachua (A.D. 700-contact) and Safety Harbor (A.D. 900-contact) pottery attest to late-period connections with populations up the Suwannee River and down the Gulf Coast, respectively.

As shown in Table 2-1, mounds are recorded at some 32 sites in the study area. Those described as "shell" mounds occur at sites in all of the five tracts, ranging from a low of 6.5 percent to a high of 23.1 percent of total sites per tract. Those classified as "sand" mounds likewise occur at sites in each of the tracts, ranging from 13.0 to 23.1 percent of total sites per tract. As should be evident from the foregoing description of many of the area's mounds, the distinction between sand and shell mounds is not altogether valid. Many of the sand mounds described by C. B. Moore and others consisted of mantles of sand overlying shell deposits. Mounds consisting entirely of sand are likewise known for the study area. Whether sand was emplaced over shell or deposited alone, humans were often interred in sand. Burials also occur in what are described as "shell mounds" and clearly they occur with relatively great frequency in shell deposits (middens?) that do not express much topographic relief. Across the entire study area burials are reported at no fewer that 23.5 percent and as much as 40.0 percent of sites per tract. Needless to say, interment of the dead at sites in the study area was very common and at times it was attended by the construction of mounds and inclusion of elaborate material culture.

As we continue to investigate the hammocks and paleodunes of the study area we will have to address the appropriateness of the term "mounds" to accumulations of shell with topographic relief and geometric regularity. Many such features are linear or arcuate in plan and some are clearly circular or semicircular. We are inclined to refer to the latter features as "shell rings," conscious of the fact that these are not necessarily the equivalent of Late Archaic shell rings elsewhere on the Gulf and Atlantic coastlines (Russo and Heide 2001). Work to date suggests that many such "rings" in the study area are Woodland in age (Deptford through Weeded Island?), and may thus have greater affinity to the circular villages known for Woodland sites in the greater Southeast (e.g., Stephenson et al. 2002). Still, some of the circular or semi-circular accumulations of shell are indeed quite high, like some Late Archaic rings and unlike the low-lying middens known for Woodland villages of the Florida panhandle, for instance. This goes to show how extant knowledge of variability among Gulf coast sites elsewhere may be insufficient to interpret project area sites.

Before closing this chapter we note in brief some recent projects in areas outside the five tracts reviewed above. These include survey of Gulf Hammock west of the Waccasassa River (Jones and Borremans 1991); survey of a proposed 400-acre Suwannee Wastewater System (Archaeological Consultants, Inc. 1995); survey of the Suwannee O&M Project Upland Disposal Site (Weinstein and Mayo 2006); and survey of disposal sites for the Suwannee River Dredging Project (Janus Research, Inc. 2001; Koski et al. 2003). In addition, personnel of the Gulf Archaeological Research Institute have conducted multiple surveys of the Withlachoochee Gulf Preserve, Crystal River shoreline, and elsewhere along the northern Gulf coast (Gary Ellis personal communication, 2008). Finally, of particular interest is the ongoing work of Pluckhahn, Thompson and Weisman (2010) at the famous Crystal River complex some 50 km southeast of the study area. We are eager to examine how this famous site compares to the mound and villages complexes of the Cedar Key and Shell Mound tracts, which, as we have mentioned, were perhaps even larger in scale than their counterpart to the southeast before they were razed by development and looting (Randall et al. 2010).

CONCLUSION

Natural science studies have been diverse and extensive in the project area owing in large measure to the mission of the Refuges to preserve and manage natural resources in areas set aside from development. Archaeological studies in the Refuges lag far behind. Understandably, the lack of land-altering activities by U.S. Fish and Wildlife precludes the sort of mitigative archaeological projects common on other federal installations or federally funded projects. At the same time, natural forces such as tidal erosion are destroying archaeological evidence at a frightening pace. Whereas the forces of nature can be more destructive than any manner of land development, federal mandates and resources to mitigate the forces of nature do not exist. The Lower Suwannee Archaeological Survey offers a stopgap measure to capture information on the Refuges before it is lost forever, and to relate this information to the large and growing body of natural sciences studies the Refuges enable. To the extent archaeological investigations provide a deeper time perspective on the processes and forces of nature that transform landscape, ecologies, and ultimately human societies, they are consonant with the greater mission of the Refuges. In addition, our limited knowledge about the archaeology of the study area begs modern investigation to both fill in the gaps of an understudied area of Florida, as well as rethink the biased perspectives that were forged in the age of antiquarianism.

CHAPTER 3
CAT ISLAND (8DI29)

Kenneth E. Sassaman

Cat Island is a roughly 5-ha island approximately 4 km north of the mouth of the Suwannee River (Alligator Pass) and 3 km west of the town of Suwannee. Privately owned, Cat Island is the location of an archaeological site (8DI29) that continues to be damaged by shoreline erosion. In 2002 the U.S. Army Corps of Engineers proposed to deposit channel dredge material on the eroding shoreline of Cat Island in order to stabilize the landform and protect its archaeological resources, which include aboriginal human interments. That plan never materialized and the island continues to erode from tidal action, boat wake, and storm surge. Local artifact collectors continue to retrieve materials from the beach and midden escarpment.

Given the ongoing damage to Cat Island, testing in 2009 was designed to retrieve some stratigraphic samples of the eroding midden before it is lost forever. Consistent with the plan described in Chapter 1, this "rescue" operation entailed the excavation of two 1-x-2-m test units and the recovery of bulk samples from profiles exposed in these units. The chapter summarizes the methods and results of this effort.

BACKGROUND

Setting

Although it was connected to the mainland long ago, today Cat Island is an elongated tidal marsh island approximately 425 m long and 150 m wide (Figure 3-1). At its western end, facing the Gulf of Mexico, a 50-m wide sandy ridge demarcates an "upland" unit that is currently about 1.5 m above mean sea level. The ridge is attenuated along the southwestern aspect of the island, where it curves to the south and back to the east, fronting a beach face up to 20 m wide at low tide. Along most of the western and southwestern aspects of this ridge is an erosional escarpment less than 1 m high that reveals a shell-bearing midden with aboriginal pottery, vertebrate fauna, shell tools, lithic artifacts, and occasional human skeletal remains. Portions of midden have been undercut and dislodged from the upland unit and redeposited on the beach, where it is reworked in tidal surf and exposed for collection by local relic seekers. Most of the upland unit at the west end of the island preserves intact midden beneath a 40-cm-thick mantle of recently deposited sand. A second, smaller sand ridge at the east end of the island apparently does not contain archaeological remains.

Erosion of Cat Island is most active at its western end (Figure 3-2), which is exposed occasionally to high velocity winds and attendant wave action. Sand eroded from the western end is redeposited along both the northern and southern margins of the island, forming arcuate spits along the former and an aggrading point along the latter. The amount of erosion in recent years is difficult to assess, but judging from a comparison of aerial photographs since the late 1960s (Koski et al. 2003:10), as well as anecdotal evidence from fallen trees and slump banks, erosion has been and continues to

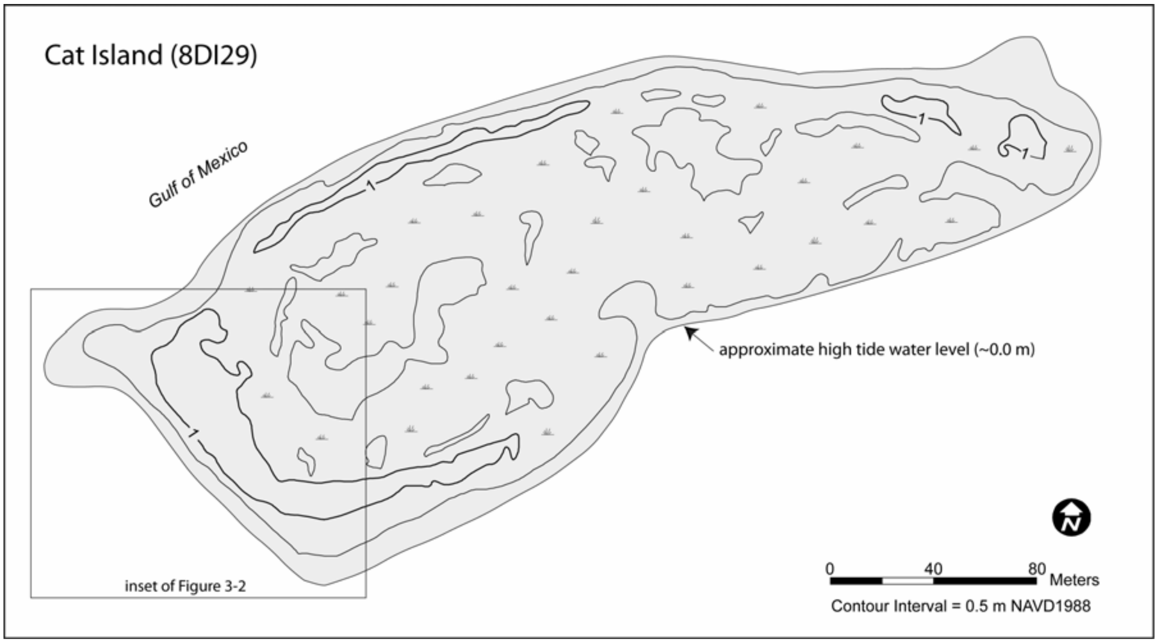

Figure 3-1. Topographic map of Cat Island based on LiDAR coverage (courtesy of Asa Randall).

be severe in the location of site 8DI29, essentially the entire sand ridge at the west end of the island.

Most of Cat Island consists of tidal marsh that is surrounded, and thus somewhat protected, by the upland ridges at either end and by the strands of redeposited sand along much of the intervening margins. The ridges support sparse live oak and eastern red cedar with a thin understory of saw palmetto, cabbage palm, and yaupon holly. Much of the area of the western ridge is kept clear by visitors who burn available fuel and trample sparse ground cover consisting of grasses, coontie, and smilax vines. A substantial oyster bar is situated in intertidal water 20-30 m off the southwest corner of the island. Additional oyster bars exist in intertidal water along the northern and northeast margins of the island.

Previous Research

Site 8DI29 on Cat Island was recorded for the state site files by John Goggin in 1951. Although local collectors and the property owner, Mike Crews, have retrieved artifacts from the eroding shoreline of Cat Island for decades, only recently has subsurface testing been conducted and there is no obvious evidence that the site has been impacted by illicit digging.

In March 2002, New South Associates (NSA) of Stone Mountain, Georgia conducted an intensive survey of Cat Island on behalf of U.S. Army Corps of Engineers

Figure 3-2. Two views of erosion along southwest shoreline of Cat Island: reworked midden exposed on beach at low tide (top) and toppled trees fronting midden escarpment in background (bottom).

(Koski et al. 2003). Cat Island was one of several dredge disposal sites under consideration by the Corps for its Suwannee River Dredge Project.

After careful surface inspection, the NSA crew excavated a total of 52 shovel tests across the western, upland portion of the island and portions of the adjoining beach. Spaced between 10 and 20 m apart, the shovel tests were excavated to a depth of at least 1.0 meter, and most tests were continued to depths of up to 2.0 m with a three-inch bucket auger. In addition, augers were placed in the marsh adjoining the island along its northwest, west, and southwest margins. Finally, three 1 x 1-m test units were placed in locations where shovel testing indicated the presence of intact midden (New South Associates test units in Figure 3-3 marked as NSA TU1-3).

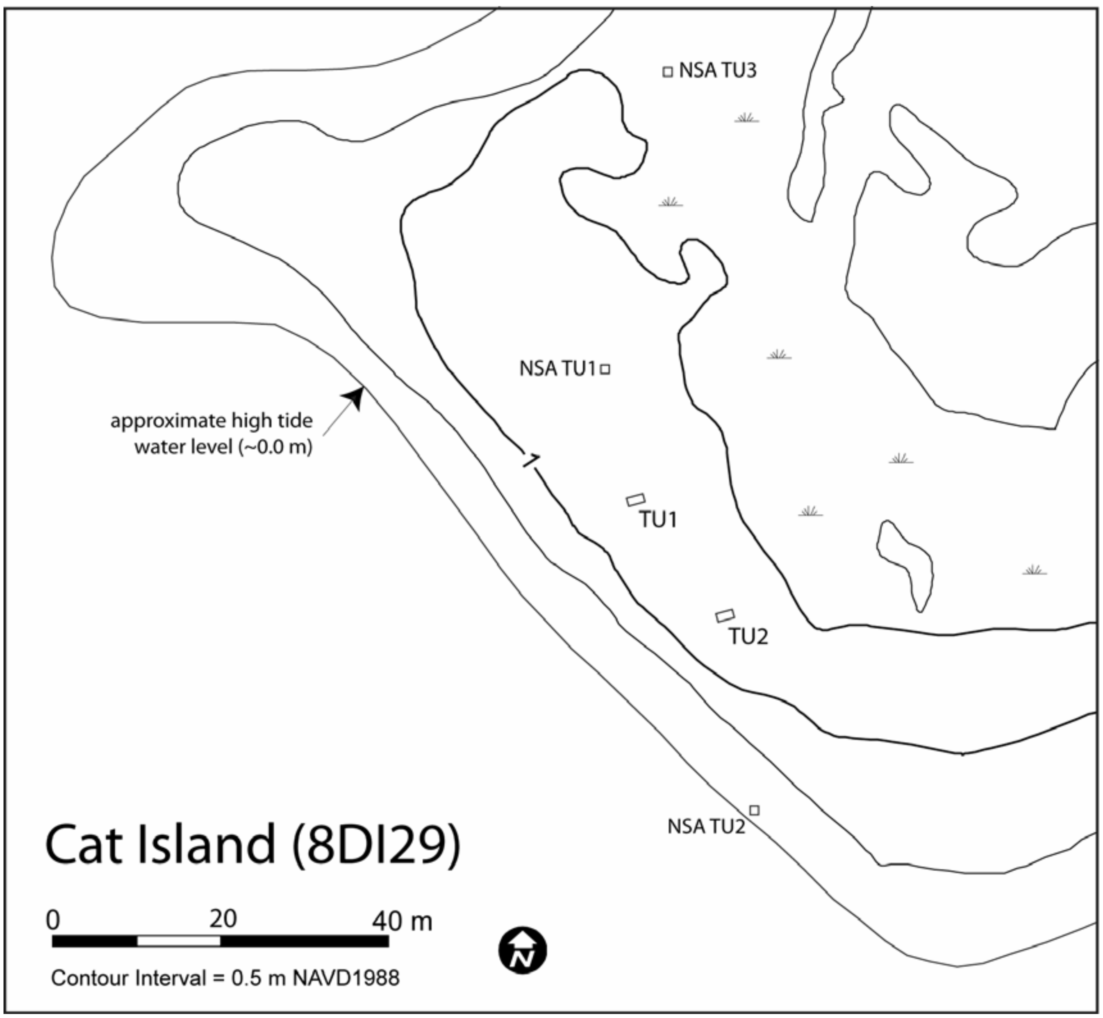

Figure 3-3. Topographic map of western, upland unit of Cat Island, showing locations of three 1 x 1-m test units excavated by New South Associates (NSA) in 2002, and two 1 x 2-m units excavated by the Laboratory of Southeastern Archaeology in 2009. Topography based on LiDAR coverage (courtesy of Asa Randall).

The results of surface inspection by NSA showed that the midden along the northwest portion of the site was severely impacted by tidal erosion. Along the western aspect of the island, and continuing along its southwest aspect, NSA archaeologists observed archaeological materials eroding from a dark-brown sandy midden with shell and a gray clayey matrix with abundant animal bone and shell. This clay deposit was exposed as well in patches on the southwest beach, where human remains had been reported (Koski et al. 2003:90). In a visit to the site in January 2009 with a local collector, human remains were observed in this clayey, beach-shore deposit. Additional human remains were observed during the May 2009 fieldwork reported here.

Thirty-six shovel tests were excavated by NSA in the upland ridge at the west end of the island. Twenty-seven tests contained cultural materials, and of these, 20 revealed dense shell midden. Test Unit 1 (1 x 1-m unit) was placed in the center of the ridge, at the highest point of the landform, where visitors today camp. Observed in profile was a 35 to 40-cm thick stratum of white sand capping the buried surface of a 25-30 cm thick dark gray sandy midden with oyster shell, pottery, and vertebrate fauna. Another 40 cm of dark gray sands beneath the midden contained archaeological materials. Dominating the pottery recovered from the shell midden were types of the Weeden Island tradition, as well as Pasco Plain and sand-tempered plain. Sparse sherds of the Swift Creek, St. Johns, and Pasco traditions were recovered beneath the shell midden, along with vertebrate fauna and a few lithic flakes (Koski et al. 2003:92).

Test Unit 2 was located on the southwest beach, just above the high-tide line, where clayey midden was exposed. Dense oyster shell in clayey matrix was observed 30-40 cm below the beach surface. Clay with virtually no cultural material continued for another 25 cm below this upper midden deposit, but at 65 cm below surface, oyster and bone again appeared. Excavators encountered great difficulty extracting the clayey matrix from the unit, and even greater difficulty processing it through a ¼-inch screen. Recovered from the upper shell midden were several plain sand-tempered sherds and one St. Johns sherd; sherds were not recovered from the lower midden, although the reduced size of the unit (0.5 x 1.0 m) and difficulty screening likely biased recovery. Still, two lithic flakes and a sandstone abrader were recovered. Augering at the base of the unit showed that clay continued down to ca. 120 cm below the surface, where it overlaid dark gray-brown sand.

A third test unit (Test Unit 3) was placed near the north shoreline of the upland unit, where shovel tests revealed dense midden. The overlying sands observed in TU1 were thinner in this location (10-15 cm) and capped a 20-30 cm thick shell midden. Sterile brown sands were observed in levels below 45 cm.

Taking into consideration not only the results of subsurface testing but also the personal collections of the landowner, two local residents, and a small assemblage curated at the Florida Museum of Natural History, NSA archaeologists concluded that 8DI29 contained deposits extending from at least the Late Archaic period (soapstone and fiber-tempered sherds) to the historic era (Leon-Jefferson ware). Dominating the assemblages were sherds of plain sand-tempered pottery, which is generally not diagnostic of particular cultural traditions. Sherds of Pasco, St. Johns, and Weeden Island types appear with appreciable frequency, while trace amounts of Orange, Deptford, Swift Creek, Alachua, Safety Harbor and Leon-Jefferson wares attest to at least transient use of the site over the past four millennia. Lithic flakes and tools, shell and bone tools, and moderate to abundant vertebrate fauna, as well as human interments, reflect diverse uses of the site.

Despite the advanced erosion of 8DI29, NSA archaeologists concluded that the remnant of the site expressed sufficient integrity and content to make it eligible for nomination to the National Register of Historic Places.

METHODS AND RESULTS OF 2009 INVESTGATIONS

Archaeological investigations of Cat Island by the Laboratory of Southeastern Archaeology (LSA) took place from May 18-21, 2009 during an unusual spring storm that brought high winds, cool temperatures, and abundant rain to the region. A stalled, late-season cold front was characterized by gale-force winds that pushed northern Gulf coastal waters far beyond normal tidal lows, stranding the crew and its boats on Cat Island for three days. Fortunately, abundant supplies of near-by oysters supplemented the crew's food provisions and a series of well-placed tarps kept both camping and excavation areas sufficiently dry and protected. The planned work was completed on time and the crew was able to depart the island on May 21 amid heavy rainfall.

Following the research design for "rescue" outlined in Chapter 1, the plan for Cat Island was to excavate two 1 x 2-m test units in locations proximate to the eroding midden along the southwest aspect of the island. Given the results of work by NSA, units were positioned in the area just to the south of NSA TU1, where shovels tests showed consistent shell-bearing midden. A baseline was established with a Nikon Total Station running parallel to the eroding midden escarpment (roughly NW-SW) and Test Unit 1 (TU1) was sited near Datum A, at the north end of the line. Oriented roughly perpendicular to the escarpment, TU1 was dug in 10-cm arbitrary levels within observable strata and all fill passed through ¼-inch hardware cloth (Figure 3-4). All artifacts and vertebrate fauna were retrieved from the screen and bagged by level. Observations on content and composition of each level were recorded on forms, as were depths taken from a corner datum and notes on any obvious features. Upon completion of the unit, all profiles were cleaned, photographed, and drawn to scale. Strata descriptions including texture, density, and color were recorded on the profile drawings. Finally, a representative profile—in the case of TU1, the north profile—was sampled with a 50 x 50-cm column that was excavated in 10-cm levels within archaeostrata and all fill recovered for waterscreening and flotation back in Gainesville (Figure 3-5).

Test Unit 2 (TU2) was located approximately 16 m southeast of TU1 (Figure 3-3). It was excavated in the same manner as TU1 except that the sample column was taken from the east profile.

Figure 3-4. LSA Crew excavating Test Unit 1 at 8DI29, May 18, 2009.

Figure 3-5. Removal of sample column from Test Unit 1, 8DI29, May 20, 2009.

Test Unit 1

Photographs of the north and south profiles of TU1 are provided in Figure 3-6, and Figure 3-7 gives the scaled drawings of all four profiles of this unit. Table 3-1 provides descriptions of the strata marked in Figure 3-7, and Table 3-2 gives an inventory of the archaeological materials recovered by level and column strata.

Excavation of both TU1 and TU2 shows that the upland unit of Cat Island was the recipient of a recent deposit of sand, evident in the strata marked I-III in Figure 3-7. These upper strata consist of thinly bedded sands ranging in color from white to light gray. The combined thickness of Strata I-III is 42 cm, which appears to represent a single depositional event of pulsating sedimentation. However, a thin buried root mat at about 30 cm below surface (cm BS) suggests an interruption to this process, possibly long enough to allow organic matter to accumulate subaerially on freshly deposited sands. Alternatively, Stratum II is merely a lens of organic matter that precipitated out of a relatively still water column after higher-energy waters subsided temporarily. In any event, the presence of 20th-century artifacts throughout these strata point to a recent depositional process, and the lack of soil development precludes long periods of stability. It seems likely that most, if not all of this mantle of sand formed during the "Storm of the Century," in March 1993. Over 3 m of storm surge along the northern Gulf Coast resuspended and transported nearshore sediment onto the open-marine marshes and many of its low-relief islands (Goodbred and Hine 1995). The effect at Cat Island was especially marked, with at least 28 and as much as 42 cm of sand dumped onto a landform only slightly 1.0 m amsl.

Beneath the sand mantle in TU1 excavation revealed a buried A horizon (Stratum IV) consisting of very dark gray fine sandy loam. This stratum grades conformably into the underlying shell midden (Stratum V) to extend down about 83 cm BS. Consisting of relatively dense clam and oyster shell, Stratum V also contained a moderate amount of pottery sherds of the Weeden Island tradition. A sample of charcoal recovered from the bulk sample at the base of this stratum returned a conventional AMS assay of 1380 ± 40 B.P., which gives a two-sigma calibrated range of A.D. 610-680.

The stratum immediately below the shell midden consists of a dark brown fine sandy loam generally lacking shell and cultural material. Interpreted as a zone of organic leaching from the overlying midden, Stratum VI extends down some 10-15 cm below the shell midden. Within this stratum, and extending even farther down into the underlying sterile sands (Stratum VII) are at least two zones of fine sandy loam generally lacking shell but with moderate amounts of vertebrate fauna. Designated Strata Va and Vb in Table 3-1 and Figure 3-7, these zones likely signal the presence of pit features emanating from a surface within Stratum V. Unfortunately, these zones were not recognized as possible pit features during level excavation and became apparent only after profiles were prepared for photography and drawing. It is likely that most of the vertebrate fauna recovered from Levels G-I in TU1 came from these two zones; associated sherds were too sparse and fragmented to draw any inference about the age of these possible features.

Figure 3-6. Photographs of the north (top) and south (bottom) profiles of Test Unit 1, 8DI29.

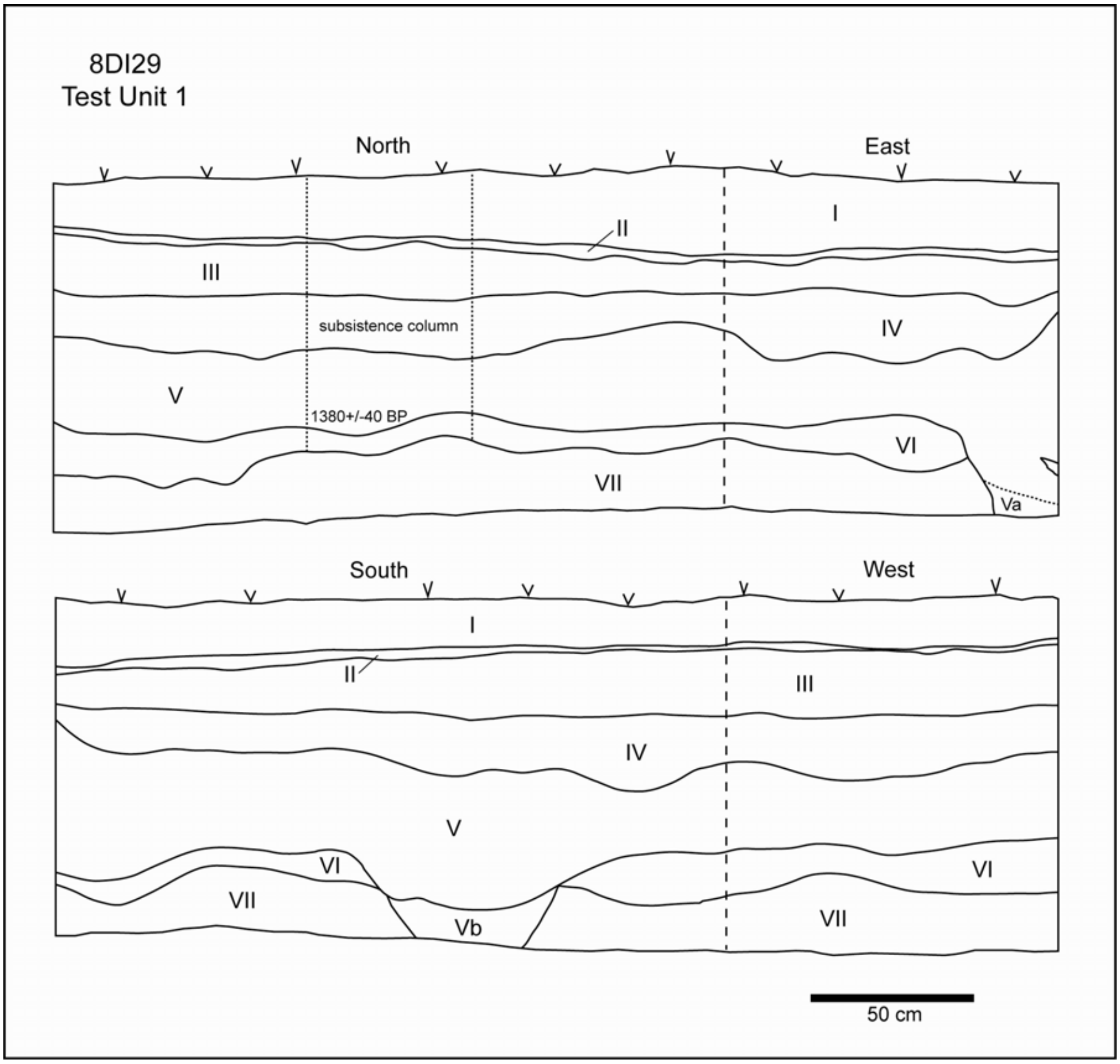

Figure 3-7. Stratigraphic profiles of Test Unit 1, 8DI29.

Excavation of TU1 was terminated at 115 cm BS after removing a level of generally sterile, brown fine sand (Stratum VII). A soil tube was inserted into the floor of the unit to verify that the underlying sediments were free of additional anthropogenic deposits. The watertable at low tide was encountered 70 cm beneath the floor of the unit, or roughly 185 cm below the ground surface.

Test Unit 2

Located approximately 16 m south of TU1, Test Unit 2 (TU2) was sited in an open area about six meters landward of the erosional escarpment fronting the beach. Although the profiles of this second unit bear similarity to those of TU1, the content, composition, and age of the buried shell midden in TU2 is appreciably different. Photographs of the north and south profiles of TU2 are provided in Figure 3-8, and

Figure 3-9 gives the scaled drawings of all four profiles of this unit. Table 3-3 provides descriptions of the strata marked in Figure 3-9, and Table 3-4 gives an inventory of the archaeological materials recovered by level and column strata.

Blanketing the midden in TU2 is the same ~44-cm thick sand stratum observed in TU1. Microbedding in these sands is interrupted by a discontinuous, thin lens of organic matter (Stratum II) that, again, reflects either a period of subaerial accumulation or changes in the force and tempo of storm surge that produced the laminations of Strata I and III. Either way, these sands cap a buried A horizon (Stratum IV) with a maximum depth of 60 cm BS. The western half of this stratum contained considerable oyster shell but little vertebrate fauna and only sparse cultural materials, notably a few small sand-tempered sherds with eroded or unidentifiable surface treatments.

Table 3-1. Stratigraphic Units of Test Unit 1, 8DI29

Stratum	Max. Depth (cm BS)	Munsell Color	Description
I	28	10YR8/1	fine, unconsolidated white sand with discontinuous bedding planes and occasional oyster shell
II	30	10YR7/1	buried root mat/organic stringer with minimum light gray fine sand
III	42	10YR8/1	fine, unconsolidated white sand with discontinuous bedding planes and occasional oyster shell; intercalated organic matter along base of stratum
IV	60	10YR3/1	very dark gray fine sandy loam (buried A horizon)
V	83	10YR2/2	very dark brown fine sandy loam with dense clam and oyster shell, and occasional gastropod shell (intact midden); AMS assay of 1380 ± 40 BP obtained from charcoal near base of stratum
Va	115*	10YR3/3	dark brown fine sandy loam lacking shell but emanating from Stratum V (possible pit feature)
Vb	115*	10YR3/2	very dark grayish brown fine sandy loam lacking shell; relationship to Stratum V ambiguous; possible pit feature
VI	98	10YR3/2	very dark grayish brown fine sandy loam; zone of organic leaching from stratum above; generally devoid of cultural material
VII	115*	10YR4/3	brown fine, moist sand generally devoid of cultural material (sterile substrate?)

*terminated at maximum depth of excavation, ca. 115 cm BS, where top of watertable was encountered.

Table 3-2. Inventory of Materials Recovered from Test Unit 1, 8DI29.

	Pottery (n)	Lithics (n)	Vert. Fauna (g)	Shell (g)	Concret./ Pebbles (g)	Charcoal (g)	Historic[1] (g)	Other (g)
Level								
A	2	2	15.5	6.6	26.0		38.9	
B	7	1	50.4		11.7		21.0	
C	1	2	18.5	0.1	0.2		3.3	
D	5		32.8	0.2	6.3		3.4	
E	28	1	137.3	0.3		0.1	19.9	
F	75	2	446.7	4.9	13.3	8.0	0.4	
G	5	2	304.3	22.3	26.6	0.9	0.1	
H	1		195.9	6.3	1.3	0.1	0.3	
I								
J		2	16.1	1.1				
K			4.4	350.2				
Total	124	12	1221.9	392.0	85.4	10.0	87.3	
Bulk								
IV-A	1	1	7.0	319.2		0.7		
IV-B	3	2	82.0	652.0	5.1	6.3		
V-A	4		97.5	2540.8	5.8	1.2		2[2]
V-B			96.0	2152.5	1.2	0.4		1[3]
V-C			46.1	653.4	0.7	0.1		
VI			20.7	103.8				
Total	8	3	349.3	6421.7	12.8	8.7		3

[1] historic artifacts include glass, metal, plastic, and other modern materials
[2] bone pin fragments that conjoin at old break
[3] gastropod shell fragment with battering at base

The underlying stratum, Stratum V, contained sparse-to-moderate shell, sparse vertebrate fauna, and only two sherds, one with spiculate paste, presumably of the St. Johns tradition. Below that was the primary shell midden deposit of this unit, Stratum VI. Dominated by oyster and with only minor traces of clam and gastropod, Stratum VI has only a moderate amount of vertebrate fauna and virtually no pottery. One punctated sherd and several nondescript sand-tempered sherds were recovered from Level H (76-86 cm BS), but sherds were absent in the bulk of the stratum and completely absent in the fill from the column. A few lithic flakes, a fragment of bone awl, and a shell disk bead (Figure 3-13) round out the small artifact assemblage of this stratum. A sample of charcoal recovered from the bulk sample at the base of this stratum returned a conventional AMS assay of 4030 ± 40 B.P., which gives two-sigma calibrated ranges of 2830-2820 and 2630-2470 B.C.

The stratum beneath the shell midden, Stratum VII, is a bit more complex than that observed below the midden exposed in TU1, but it too consists predominately of relatively shell-free sand that is organically enriched from leaching of the overlying midden. However, Stratum VII in TU2 returned a greater amount of vertebrate fauna than its counterpart in TU1, and it contained zones of concreted sand with minor amounts of shell. As in TU1, these submidden anomalies most likely reflect pit features that

Figure 3-8. Photographs of the north (top) and south (bottom) profiles of Test Unit 1, 8DI29.

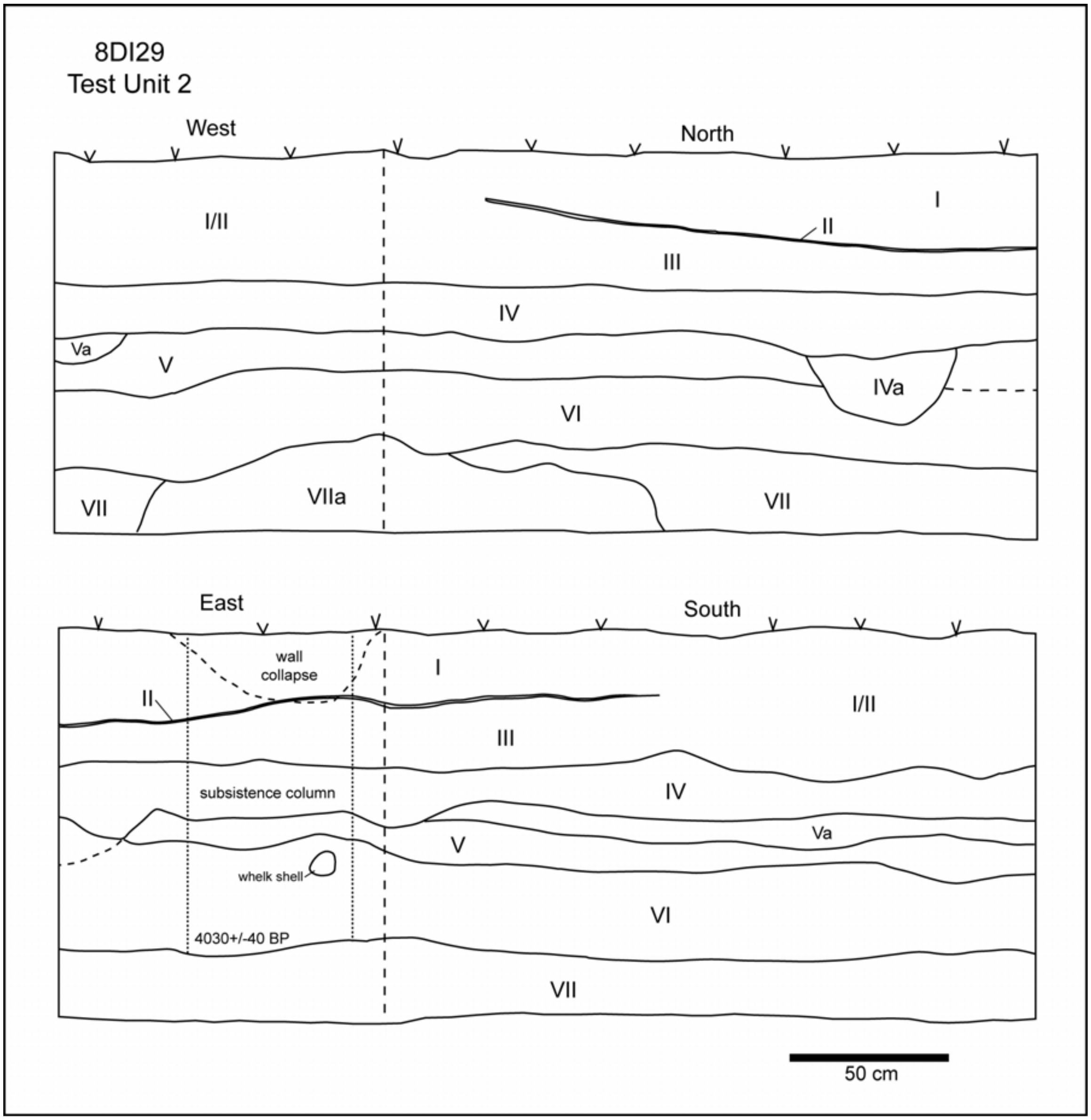

Figure 3-9. Stratigraphic profiles of Test Unit 2, 8DI29.

penetrated the sand below, but no such features were defined in level excavation. Water was encountered at 121 cm BS, where excavation was halted. A soil tube sunk into the floor of the unit verified the absence of additional anthropogenic deposits to a depth of ~200 cm BS.

ARTIFACT ASSEMBLAGE

A total of 201 artifacts were recovered from the excavation of Test Units (TU) 1 and 2 at 8DI29. The inventory is dominated by pottery sherds (n = 170), 78 percent of which came from TU1. Flakes of chert from modification of stone tools comprise a small sample of 24, and worked bone and worked shell occur in trace frequencies. Descriptions of artifacts in these respective classes follow in the subsections below.

Table 3-3. Stratigraphic Units of Test Unit 2, 8DI29

Stratum	Max. Depth (cm BS)	Munsell Color	Description
I	31	10YR8/1	fine, unconsolidated white sand with discontinuous bedding planes and occasional oyster shell
II	32	---	discontinuous buried root mat/organic stringer
III	44	10YR8/1	fine, unconsolidated white sand with discontinuous bedding planes and occasional oyster shell
IV	60	10YR4/1	dark gray fine sandy loam (buried A horizon)
IVa	85	10YR2/1	black fine sandy loam with moderate shell (pit feature)
V	77	10YR4/2	dark grayish brown fine sand with sparse shell
Va	68	10YR3/3	black fine sandy loam with moderate shell
VI	102	10YR2/1	black loamy sand with abundant shell (intact midden); AMS assay of 4030 ± 40 BP obtained from charcoal near base of stratum
VII	121*	10YR4/2	dark grayish brown wet sand with very sparse shell (sterile substrate?)
VIIa	121*	10YR4/3	dark brown sand with gravel-like, concreted texture

*terminated at maximum depth of excavation, ca. 121 cm BS, where top of watertable was encountered.

Pottery

The frequency of pottery by levels and type in TUs 1 and 2 is provided in Tables 3-5 and 3-6, and representative sherds are shown in Figures 3-10 and 3-11. The types listed in these tables include both culture-historical types and “generic” or analytical types that crosscut culture-historical types. For instance, the only variety of Deptford pottery that is listed in Table 3-5 is the Linear Check-Stamped (LCS) variety. Other types of Deptford pottery (plain, simple-stamped) are not sufficiently diagnostic to warrant sherd-level classification. Sherds that are sand- or grit-tempered and bear demonstrably plain surface treatments are classified as simply “sand-tempered plain” and eroded or otherwise undetectable surface treatments of sherds with sand/grit tempering are included under the “sand-tempered unidentifiable” (UID) class. All sherds less than ½-inch in maximum dimension are given to the class of “crumb” sherd; the disproportionately high frequency of crumb sherds from the bulk samples is a function of matrix processing that was finer (1/8-inch) than that of level excavation (1/4-inch).

Table 3-4. Inventory of Materials Recovered from Test Unit 2, 8DI29.

	Pottery (n)	Lithics (n)	Vert. Fauna (g)	Shell (g)	Concret./ Pebbles (g)	Charcoal (g)	Historic[1] (g)	Other (g)
Level								
A	3		16.9	0.1			8.7	
B	1		6.8				8.8	
C	8		55.1	0.8	0.9	0.2	12.3	
D	7		68.8	0.7	6.2		95.6	
E	5		50.0	1.2		0.1	2.9	
F	4	1	66.5	0.4		0.2	3.2	
G	2		38.4	0.5		0.3	2.8	
H	8	3	160.2	707.1	27.9	1.8		
I		2	114.9	8.8	82.6			
J			172.9	39.9	46.6			2[2]
K			21.8	0.4	2.5			
L		2	2.3					
Total	38	8	774.6	759.9	166.7	2.6	134.3	2
Bulk								
IV-A			12.2	594.3	0.8	0.3	2.3	
IV-B			15.2	688.2	1.3	0.7		
V			115.6	1068.7	0.8	0.9		
VI-A			132.3	2259.1	48.3	0.1		
VI-B		1	115.1	2859.9	1.9	0.8		
VI-C			156.8	4514.0		1.0		2[3]
Total		1	547.2	11,984.2	53.1	3.8	2.3	2

[1] historic artifacts include glass, metal, plastic, and other modern materials
[2] crown conch shell with perforations in body and battering on bases
[3] one bone pin fragment and one shell disk bead

In TU1 the inventory of sherds ½-inch or greater in size is dominated by sand-tempered plain (n = 12) and UID (n = 34) sherds, the majority of which came from Levels E and F, the heart of the shell midden. However, these same levels also produced a moderate yet diverse assemblage of pottery of the Weeden Island tradition. Examples of Weeden Island Plain (Figure 3-10d) and one Weeden Island Red (Figure 3-10e) are accompanied by several sherds of Ruskin Dentate Stamped (Figure 3-9:F-2, right) and a couple of Wakulla Check Stamped sherds (Figure 3-10f). One burnished plain sherd from the bulk sample column of the midden (Str. IV-B) is also likely a Weeden Island variety. A single sherd of Lochloosa Punctate (Figure 3-10b) is not directly related to Weeden Island (being part of the Alachua Tradition of interior Florida), but, as noted in Chapter 2, it is not unusual to find in association with Weeden Island pottery on the northern Gulf Coast. Finally, a single example of Carabelle Punctate (Figure 3-10a) was recovered from the storm surge deposits overlying the midden. Overall, the assemblage of pottery accords well with the cal. A.D. 610-680 date range, roughly the early portion of Willey's (1949) Weeden Island II subperiod.

The three Deptford sherds recovered from TU1 are badly preserved examples of the Linear Check-Stamped variety. Whereas two of these came from the very top of the intact midden, the third was recovered from the base of the overlying sands, suggesting that at least some of this material was dislodged and redeposited from storm surge. Other Deptford sherds have been observed in surface collections from Cat Island (e.g., Koski et al. 2003:99), in some cases in appreciable frequency (e.g., Campbell collection at LSA). Given that most of the surface-collected materials came from the beachfront of the island, its Deptford component(s) may have been largely, if not completely destroyed by tidal erosion and storm surge.

Pottery sherds from TU2 were generally older, less diverse, and less frequent than those of TU1. The assemblage of 38 sherds is dominated by crumbs (n = 16), sand-tempered plain (n = 7) and sand-tempered UID (n = 8). Other sherds include one Swift Creek Complicated Stamped (Figure 3-11a), four eroded specimens with St. Johns (spiculate) paste, and one sand-tempered punctated sherd of uncertain cultural affiliation (Figure 3-11c). One of the larger sand-tempered sherds (Figure 3-11b) exhibits a dark-colored paste or use-related residue on a pocked surface. This sherd, the punctated sherd, one of the St. Johns sherds, and a few small sand-tempered sherds were the only sherds from the midden proper; no sherds (not even crumb sherds) were retrieved from the bulk sample column.

The AMS assay from the base of the midden in TU2 is at the dawn of pottery making in Florida (ca. 2500 cal B.C.). The general lack of pottery in the midden of TU2 is thus not surprising, although both the sand-tempered punctate sherd and the St. Johns sherd near the base of the midden are not likely to date this old. The midden in TU2 is clearly a good bit older than the midden in TU1, and there is nothing to suggest that the two overlap in any appreciable fashion. Thus, while the greater age of midden in TU2 is substantiated by the AMS assay, the pottery in this context, albeit at low frequency and generally early, does not corroborate the absolute age estimate.

Additional analyses of the pottery from Cat Island await larger samples. As indicated earlier, just about every pottery type known for the region is present in surface-collected samples from the island. Research to investigate how variations through time are registered in vessel size, shape, and function necessitates large samples of large sherds (or reconstructible vessel portions). The Campbell collection housed at the LSA has this potential, but more samples from secure, radiometrically dated contexts are needed as well.

Table 3-5. Absolute Frequency of Pottery Sherds from Test Unit 1, 8DI29

	Deptford LCS	Ruskin Dentate	Wakulla C-S	W.I. Plain	Sand-Tempered Plain	Sand-Tempered UID	Other	Crumb	Total
Levels									
A							1[1]	1	2
B						2		5	7
C								1	1
D	1	1			1	1		1	5
E	2		1		3	11	1[2]	10	39
F		16	1	3	8	19	1[3]	27	87
G								5	5
H						1			1
I									0
J									0
Total	3	17	2	3	12	34	3	50	124
Bulk									
IV-A		1							1
IV-B							1[4]	2	3
V-A								4	4
V-B									0
V-C									0
VI									0
Total		1					1	6	8

[1] Carabelle Punctate
[2] Lochloosa Punctate
[3] Weeden Island Red
[4] sand-tempered burnished plain

Table 3-6. Absolute Frequency of Pottery Sherds from Test Unit 2, 8DI29

	St. Johns (eroded)	Swift Creek	-------Sand-Tempered------- Plain	Punctate	UID	Historic	Crumb	Total
Levels								
A							3	3
B	1							1
C		1	2		2		3	8
D	2		2			1	2	7
E							5	5
F			2		2			4
G	1						1	2
H			1	1	4		2	8
I								0
J								0
K								0
L								
Total	4	1	7	1	8	1	16	38

Note: no pottery was recovered from the bulk sample column of TU2

Figure 3-10. Examples of sherds recovered from Test Unit 1, 8DI29 (a. Carabelle Punctate; b. Lochloosa Punctate; c, f. Wakulla/St. Johns Check Stamped; d. Weeden Island Plain; e. Weeden Island Red; g. Ruskin Dentate/Punctate).

Figure 3-11. Examples of sherds recovered from Test Unit 2, 8DI29 (a. Swift Creek Complicated Stamped; b. sand-tempered plain with a slip or use-related residue and surface pocking; c. sand-tempered punctate).

Lithic Artifacts

The only lithic artifacts recovered from the test excavations of 8DI29 were small flakes of bifacial retouch. TU1 yielded 15 such items, while TU2 produced only nine. Although the small sample size precludes inferences about associations with pottery and midden, it appears flakes are widely distributed vertically, including in the storm surge deposit over TU1, with a slight tendency to occur deeper than pottery in the middens of both units. It appears likely that some of these flakes came from pre-pottery occupations of the island. Early and Middle Archaic bifaces have been recovered from the surface at Cat Island (Koski et al. 2003:103), as have later period flaked stone tools.

All the flakes from TUs 1 and 2 were struck from cores or bifaces of chert. No silicified coral were observed, consistent with earlier investigations (Koski et al. 2003:102). Overall, the meager flake assemblage of this and earlier investigations suggest that reduction of chert cores was not a primary activity at the site, and that all flaking activities were centered on the thinning, rejuvenation, and recycling of bifaces brought to the island in finished or near-finished form.

Modified Shell

Three modified shells from the crown conch (*Melongena corona*) were recovered in testing, one from TU1 and two from TU2 (Figure 3-12). Each exhibits battering at the basal end, and each has at least one hole that likely received a handle. Thus, each of the specimens was likely used as a hafted hammer, consistent with Type G in the typology used for south Florida (Luer et al. 1986; Marquardt 1992). Type G hammers are quite common at sites across the study area.

The single example from TU1 came from the middle part of the Weeden Island midden. It expresses considerable attrition at both the apex and basal end, and the hole in its whorl is elongated (ca. 32 x 22 mm) and irregular in shape. Its location in the whorl is not opposite the aperature, as it is with Type G specimens elsewhere, including those from TU2, so it may not qualify, technically, as a Type G hammer. Nonetheless, the hole is positioned in a way that would allow a handle to be inserted and wedged against the columella sufficiently to enable light hammering.

The specimens from TU2 both came from Level J, just below the midden proper, in the stratum that includes concreted sands and what perhaps are submidden features. The smaller of the two is actually very small (ca. 48 mm in maximum length), owing in part to its young age at death, but also advanced attrition of both ends. The ca. 15 mm diameter hole in its whorl is paired with a ca. 12 mm notch on the margin of the aperture. The larger one (ca. 93 mm in maximum length) is in a good state of preservation, with two holes cut into the whorl, each slightly ovate at 20-22 mm in maximum dimension. With this configuration, the shell could have been hafted in two ways: either through the two cut holes of the whorl, or through the aperture and the cut hole opposite the aperture, which is the more typical design.

One additional shell artifact is a flat disk bead made from marine shell (Figure 3-13). Measuring 9.8 x 9.0 mm in plan and 1.7 mm thick, this roughly circular bead has a cylindrical hole that measures from 3.2 to 3.4 mm in diameter. It was recovered from the very base of the shell midden in the bulk column of TU2.

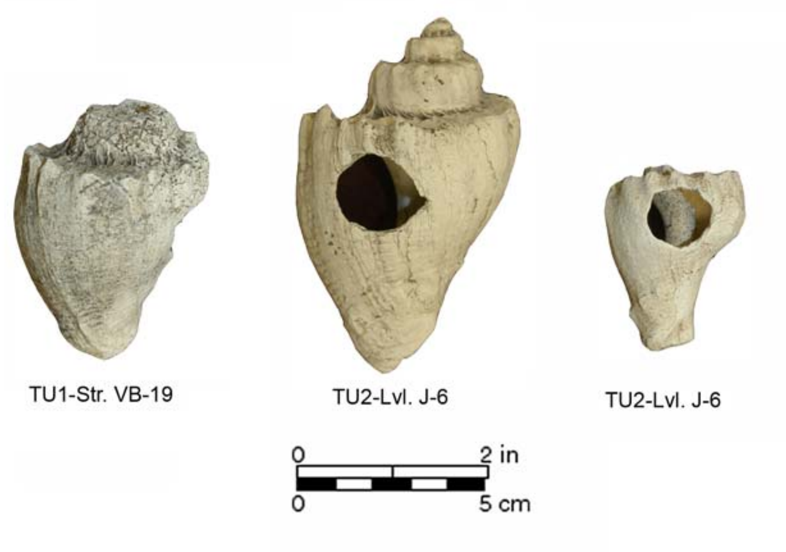

Figure 3-12. Hafted hammers (Type G) from 8DI29 made from shells of Crown conch (*Melongena corona*).

Modified Bone

Analysis of vertebrate fauna from the bulk column samples has yet to be conducted, but in the process of sorting bulk matrix, three pieces of worked bone were located. All three are fragments of "bone pins," essentially cut, split, and ground large mammal long bones (almost certainly deer) with one tapered (pointed) end (Figure 3-13). Two fragments from Stratum V-A in TU1 fit together at an old break; the other, from Stratum VI in TU2 is the distal portion of a pin. These are not unusual finds for sites throughout Florida, and they enjoyed a long period of use beginning at least 8000 years ago. The generic forms of those recovered from 8DI29 do not lend themselves to culture-historical classification, but given proveniences involved, both Late Archaic and Weeden Island era uses are implicated.

Figure 3-13. Modified bone (left and center) and shell disk bead (right) from 8DI29.

FAUNAL ASSEMBLAGE

Invertebrate

As might be expected on any shell midden, the inedible remains of shellfish make up the bulk of food remains in the midden matrix. Of course, shell is usually discarded in the act of eating the flesh of shellfish. As we have seen, some shell is parlayed into raw materials or blanks for tools, and other shell may have very well been ground, burned or otherwise destroyed. Likewise, shell middens are notorious for their complicated stratigraphy and other sampling biases that render comparisons between units or strata within units suspect. Nonetheless, the samples retrieved from bulk columns at 8DI29 reveal some sharp contrasts in the composition and structure of shell matrix. Putting these into temporal context, variations possibly reflect changing estuarine ecology, cultural preferences, season of collection, site formational factors, or any combination of these and other factors.

Tables 3-7 and 3-8 provide frequency data on the occurrence of shell by taxa and strata in the two bulk samples columns from 8DI29. On the whole, shell from the column of TU1 (Table 3-7) is relatively evenly distributed between two main taxa: eastern oyster (*Crassotrea virginica*) and Carolina marsh clam (*Polymesoda caroliniana*). These two taxa are simplified in the tables and discussion that follows as “oyster” and “clam.” Occasional shells of hard clam (*Mercenaria mercenaria*) were observed in the test unit excavations, and at some sites in the study area they are prevalent, but none were recovered from the bulk columns at 8DI29. Other, lesser species of shellfish in Table 3-7 include occasional crown conch (*Melongena corona*), and miscellaneous fragments of unidentifiable gastropods.

Although the aggregate proportions of oyster and clam in TU1 are roughly equal, when compared across strata, a spike in the frequency of clam is evident in Stratum V, particularly in its upper 10-20 cm (V-A and V-B). Oyster also expresses its highest frequencies in these same levels, reflecting the overall relative density of shell in this portion of the profile. This is the same position of the greatest density of Weeden Island sherds and the AMS assay of 1380 ± 40 B.P. (cal A.D. 610-680). Given these associations, it seems safe to conclude that Stratum V is an excellent subsistence and paleoecological datum for the early part of the Weeden Island II subperiod.

Shell recovered from the bulk column of TU2 (Table 3-8) is dominated by oyster, while clam comprises less than four percent of the aggregate sample. Lesser numbers of other shellfish in Table 3-8 include occasional crown conch (*Melongena corona*), one large, whole shell of a lightning whelk (*Busycon sinestrum*) near the base of the midden (Stratum VI-B), and miscellaneous fragments of unidentifiable gastropods. Not shown in Table 3-8 is a trace of barnacle shell (7.2 g total) distributed across four levels of the column strata, but mostly (5.4 g) in the basal level of the basal stratum (VI-C).

Proportionally, oyster does not vary much across strata of TU2, but in absolute terms, the basal stratum (VI) holds the greatest density of oyster, and, within that stratum, it is concentrated in the lowest level (VI-C). This stratum also contains the only crown conch, the whole lightning whelk, and virtually all the barnacle shell fragments. Two large hard clam shells were also collected from the level excavation of this stratum. Thus, while oyster dominates the basal stratum throughout, a variety of other shellfish species are present in trace frequencies. Although a few pottery sherds were recovered from this stratum, the AMS assay of 4030 ± 40 B.P. (cal B.C. 2830-2820 and 2630-2470) provides tentative evidence that Stratum VI provides a solid Late Archaic datum for subsistence and paleoecology at 8DI29.

Table 3-7. Absolute frequency of marine shell by strata of bulk sample column, taxa, and valve (for oyster and clam), Test Unit 1, 8DI29.

OYSTER	Right Valve		Left Valve		Fragment	Total
	ct.	wt. (g)	ct.	wt. (g)	wt. (g)	wt. (g)
IV-A	9	33.6	21	71.2	137.0	241.8
IV-B	29	103.0	35	129.4	220.0	452.4
V-A	47	124.6	68	270.1	371.0	765.7
V-B	40	175.5	34	299.3	182.7	657.5
V-C	15	55.6	14	125.3	205.7	386.6
VI	3	6.8	3	38.7	24.5	70.0
Total	143	499.1	175	934.0	1140.9	2574.0
CLAM	**Right Valve**		**Left Valve**		**Fragment**	**Total**
	ct.	wt. (g)	ct.	wt. (g)	wt. (g)	wt. (g)
IV-A						
IV-B	1	1.6	3	4.9		6.5
V-A	47	191.9	70	272.2	723.2	1187.3
V-B	36	157.5	56	230.9	534.2	922.6
V-C	10	38.4	10	45.7	25.1	109.2
VI			1	3.0	12.4	15.4
Total	94	389.4	140	556.7	1294.9	2241.0
OTHER	**Crown Conch**		**UID Gastropod**		**UID Fragments**	
	ct.	wt. (g)	ct.	wt. (g)	wt. (g)	% of Total
IV-A			1	7.5	69.9	21.9%
IV-B			1	16.5	176.6	27.1%
V-A			2	13.1	574.7	22.6%
V-B	2	77.2			493.0	22.9%
V-C	1	58.2			99.4	15.2%
VI					18.4	18.3%
Total	3	135.4	4	37.1	1432.0	22.3%

In comparing the shell assemblages from Weeden Island II (TU1, Stratum V-A and V-B) and Late Archaic (TU2, Stratum VI) bulk samples, at least three differences bear mention (Table 3-9). First, the density of shell in the Late Archaic stratum is greater than in the later stratum. This is especially the case for the basal level of Stratum VI in TU2, where the total weight of shell exceeds any other level in either test unit by nearly two kilos. Relatedly, the density of shell in the Late Archaic stratum increases with depth, whereas the shell in the Weeden Island II stratum decreases with depth. It would appear that the two formed under different circumstances, or perhaps that the Late Archaic stratum of dense shell was buried under sediment and then intermixed before additional shell (Strata V and VI) was deposited. Not knowing the age of the upper shell strata in TU2, we are in no position to speculate on the timing of these presumed events.

Table 3-8. Frequency of marine shell by strata of bulk sample column, taxa, and valve (for oyster and clam), Test Unit 2, 8DI29.

OYSTER	Right Valve		Left Valve		Fragment	Total
	ct.	wt. (g)	ct.	wt. (g)	wt. (g)	wt. (g)
IV-A	18	58.9	24	83.7	365.8	508.4
IV-B	32	111.8	33	277.3	229.0	618.1
V	46	97.7	53	343.7	404.2	845.6
VI-A	119	403.0	148	973.2	676.1	2052.3
VI-B	113	444.2	107	811.7	859.4	2115.3
VI-C	149	527.9	214	2151.4	1376.9	4056.2
Total	477	1643.5	579	4641.0	3911.4	10,195.9

CLAM	Right Valve		Left Valve		Fragment	Total
	ct.	wt. (g)	ct.	wt. (g)	wt. (g)	wt. (g)
IV-A	1	5.2			9.9	15.1
IV-B	1	6.8	1	6.4	2.2	15.4
V	3	12.2	7	31.4	30.7	74.3
VI-A	8	28.7	4	5.1	54.7	88.5
VI-B	8	37.6	4	30.5	35.6	103.7
VI-C	2	14.1	2	15.3	28.4	57.8
Total	23	104.6	18	88.7	161.5	354.8

OTHER	Crown Conch		UID/Other Gastropod		UID Fragments	
	ct.	wt. (g)	ct.	wt. (g)	wt. (g)	% of Total
IV-A					70.5	11.9%
IV-B			1	10.7	44.0	6.4%
V			1	0.6	148.2	13.9%
VI-A			2	1.9	115.2	5.1%
VI-B	2	21.2	1	462.3[1]	157.1	5.5%
VI-C	5	147.5			247.1	5.5%
Total	7	168.7	4	475.5	782.1	6.5%

[1] one whole whelk (*Busycon sinistrum*) shell

The second difference follows from the first in that the shell of the Late Archaic stratum is less fragmented than that of the Weeden Island II stratum. This is indicated in Table 3-8 by the proxy value of percent UID fragmented shell by weight. None of the levels in the Late Archaic stratum contain more than 5.5 percent UID fragmented shell, while the Weeden Island II levels have values no less than 22.6 percent. Again, rapid burial of the Late Archaic stratum may account for this difference, insofar as burial would preclude the comminution of trampling or other sorts of near-surface disturbances.

And finally, the ratio of oyster to clam is dramatically different between the two samples (Table 3-9). Late Archaic shell contains no more than 5 percent clam by weight, whereas the Weeden Island II sample consists of roughly 60 percent clam. Oyster remains important in the Weeden Island assemblage, but clam rises to be the dominant species. As discussed in the final chapter of this report, the trend toward increased use of

Carolina marsh clam appears to be a slow and steady development, perhaps attending changing estuarine conditions but also possibly attending an expanding shellfish diet during the Woodland period.

Table 3-9. Comparison of Test Units 1 and 2 for Total Weight (g) of Shell, Percent by Weight UID Fragments, and Ratio of Oyster to Clam Shell, by Stratum, 8DI29.

	Total Shell Wt. (g)	Percent by Wt. UID Fragments	Ratio Oyster: Clam (1:*x*)
Test Unit 1			
IV-A	319.2	21.9%	0.00
IV-B	652.0	27.1%	0.01
V-A	**2540.8**	**22.6%**	**1.55**
V-B	**2150.3**	**22.9%**	**1.40**
V-C	653.4	15.2%	0.28
VI	103.8	18.3%	0.22
Test Unit 2			
IV-A	594.3	11.9%	0.03
IV-B	688.2	6.4%	0.02
V	1068.7	13.9%	0.09
VI-A	**2259.1**	**5.1%**	**0.04**
VI-B	**2859.9**	**5.5%**	**0.05**
VI-C	**4514.0**	**5.5%**	**0.01**

Vertebrate

Full-blown analysis of vertebrate fauna recovered from both level and bulk samples has yet to be completed. Inspection of the total weight of animal bone recovered from both contexts (Tables 3-2 and 3-4) shows that bone density covaries with shell density. This applies both to the relative density of bone within the levels/strata of each unit, as well as the difference between the units. The greatest bone density is found in the Late Archaic stratum (VI) at the base of the TU2 shell midden, followed by the Weeden Island II stratum (V-A, V-B) in TU1.

In a zooarchaeology course at the University of Florida taught by Susan deFrance in the Fall 2009 semester, graduate students Paulette McFadden (2009) and Ellen Lofaro (2009) analyzed the vertebrate faunal remains from three levels of TU1, specifically, Levels F-H, which amounts to the lower aspect of the Weeden Island II midden. Although the ¼-inch recovery method of level excavation precludes adequate characterization of the actual vertebrate fauna represented in the midden, the general results of their analyses are worth mentioned. As might be expected, the bony elements of fishes dominate the assemblages from all three levels (88 to 94 percent by NISP and 81 to 91 percent by MNI). Among the more prevalent species represented by MNI are sheepshead (*Archosargus probatocephalus*), black drum (*Pogonias cromis*), hardhead catfish (*Ariopsis felis*), gafftopsail catfish (*Bagre marinus*), and Crevalle jack (*Caranx* *hippos*), followed by lesser numbers of gar (*Lepisosteus* sp.), mullet (*Mugil* sp.), speckled trout (*Cynoscion nebulosus*), and red drum (*Sciaenops ocellatus*), and traces of members of the grunt (Haemulidea) and porcupine fish (Diodontidae) families. A moderate number of bones of unidentified turtle (Testudines) were accompanied by a small numbers of mud/musk turtles (Kinosternidae), sliders (*Trachemys spp.*), and box turtles (*Terrapene*). Identified mammal bones were restricted to a few elements of Northern raccoon (*Procyon lotor*) and rabbit/hare (*Leporidae*), and only a few unidentifiable bird bones were present. Traces of ray (Rajiformes), shark (Lamniformes), American alligator (*Alligator mississippiensis*), and unidentified snake (Serpentes) round out the assemblage.

Pending analysis of larger, fine-screened samples from 8DI29, it is worth noting in closing that within the three level samples analyzed by Lofaro and McFadden, there is a trend for decreased frequency of sheepshead and drum and increased frequency of catfish through time. This trend coincides with the increased use of Carolina marsh clam through time. Data on the size of the fish captured could help to resolve the degree to which this trend reflects differences in seasonality, estuarine ecology, cultural preference, or merely sample bias.

CONCLUSION

Limited testing at 8DI29 on Cat Island provides a small glimpse into what appears to be a complex, multicomponent midden deposit sealed beneath a ~40-cm-thick storm surge deposit. Active shoreline erosion of the site ensures that this midden will eventually be destroyed completely. Comparing surface-collected materials in private collections to the materials recovered in the testing reported here suggest that some of the site's components may have already been eliminated by shoreline erosion. Still, portions of Late Archaic and Weeden Island II middens remain intact and warrant further investigation.

Situated only about 16 m apart, Test Units 1 and 2 both revealed subsurface midden but from vastly different time periods and appreciably distinct composition. The differential composition of shell midden and associated artifacts corroborates the radiocarbon assays, with the midden of TU2 expressing a Late Archaic basal age, and that of TU1 dating to the early Weeden Island II subperiod. Oyster dominates the older one, while clam grew increasingly important over the time the TU1 midden accumulated. Apparent changes in vertebrate fauna accompany the increased use of clam. Additional fieldwork at Cat Island is required to reconcile the stratigraphic relationship between Test Units 1 and 2, and additional analysis, particularly of the fauna, are recommended to determine the degree to which apparent changes in the collection of shellfish and fish signal changing estuarine conditions over the nearly three millennia represented.

CHAPTER 4
LITTLE BRADFORD (8DI32)

Paulette S. McFadden

Little Bradford is a small, federally owned Gulf coast island, located at the mouth of the Suwannee River approximately 3.2 km southwest of the town of Suwannee. The archaeological site, designated 8DI32, was first recorded by John M. Goggin in the 1950s. It is situated on a small strip of elevated sandy ground that is currently endangered by tidal and boat-wake erosion. As part of the overall research plan for the Lower Suwannee National Wildlife Refuge, Little Bradford Island was targeted for test unit excavations as a means of mitigating the loss of important archaeological information. Two 1-x-2-m test units were excavated, one in 2009 and the other in 2010, and associated bulk samples were collected from each. The following chapter will outline the methods and results of these excavations.

BACKGROUND

Setting

Little Bradford is located at the mouth of the Suwannee River in a deltaic formation consisting of salt marsh islands cut off from the mainland by Wadley Pass to the south and Northern Pass to the east (Figure 4-1). While the southwest to northeast oriented island is approximately 1.3 km long and 0.6 km at the widest point, it is comprised mostly of saltmarsh. The only area of the island that supports terrestrial vegetation is a small sandy strip, approximately 130 meters long and 30 meters wide, on the eastern side of the island that fronts Northern Pass (Figure 4-2). Unlike erosion at Cat Island, which fronts open tidal water, site 8DI32 on Little Bradford is affected most directly by the wakes of boats traveling at high speed through Northern Pass. The channel connecting Northern Pass to the main channel of the Suwannee River (Wadley Pass, aka McGriff Pass) was designated an entrance channel in the Water Resource Development Act of 1999. Since then, proposed additional dredging of this channel has met significant public resistance (www.saveoursuwannee.org). Erosion of 8DI32 to date has resulted in a roughly 1 meter high escarpment along the shoreline of this sandy strip, revealing aboriginal midden materials (Figure 4-3). The exposed artifacts, coupled with easy access to the island, have made this site an attractive target for collectors.

Previous Research

Ryan J. Wheeler investigated the site in 1998, after a local collector notified the Office of State Archaeology of exposed human remains along the erosional escarpment of 8DI32. He reported that the midden was composed primarily of oyster shell and contained a variety of pottery types, including fiber tempered, Perico linear punctated, and Deptford simple stamped, check stamped, and linear check stamped (Wheeler 1998). The pottery types, in addition to a Citrus point found by the collector, led Wheeler to suggest that the site dates to the Florida Transitional (1200-500 B.C.) and Deptford (500

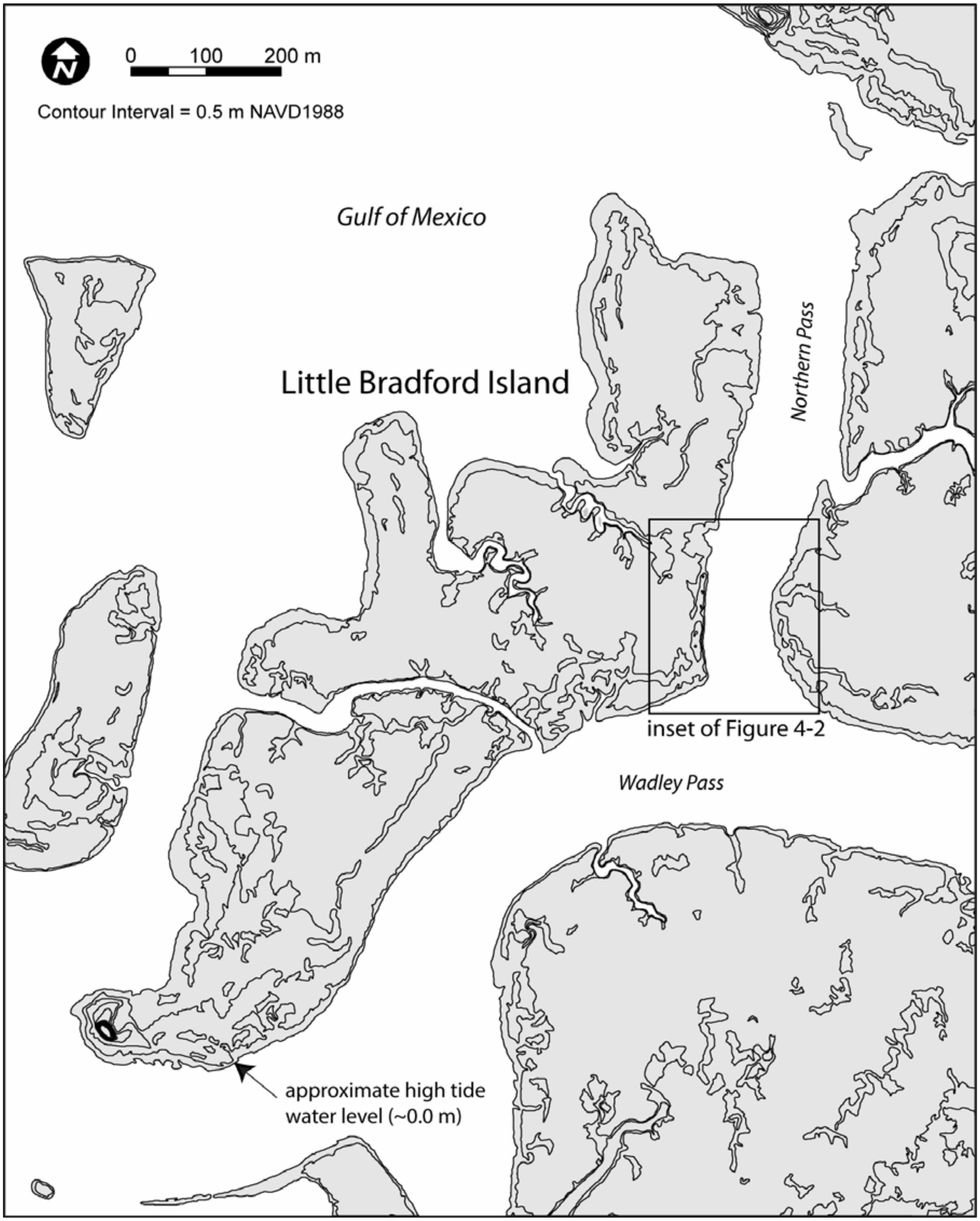

Figure 4-1. Topographic map of Little Bradford Island and vicinity based on LiDAR coverage (courtesy of Asa Randall).

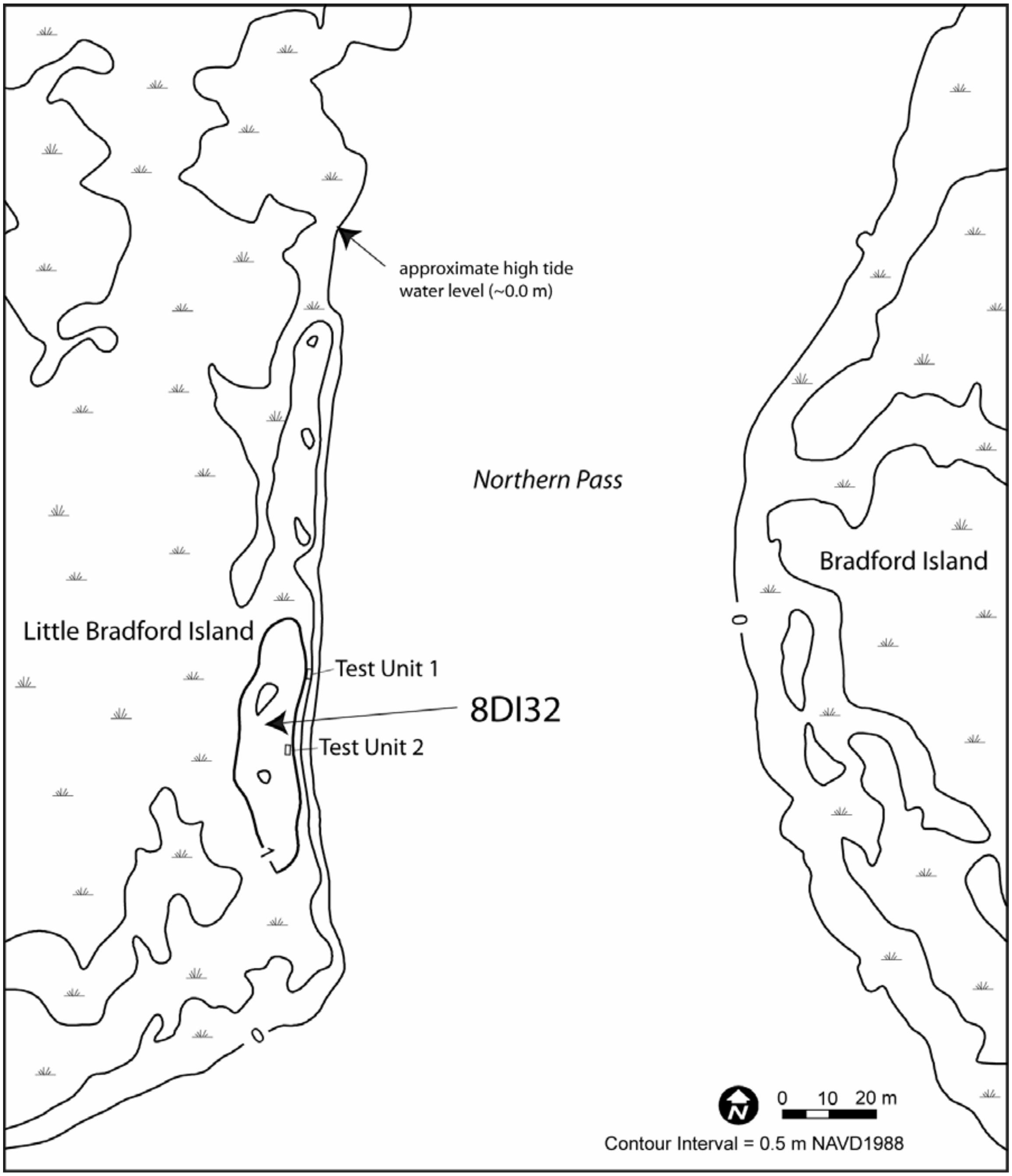

Figure 4-2. Topographic map of portions of Little Bradford and Bradford islands, showing locations of two 1 x 2-m units excavated at 8DI32 by the Laboratory of Southeastern Archaeology in 2009 and 2010. Topography based on LiDAR coverage (courtesy of Asa Randall).

Figure 4-3. Two views of shoreline erosion along eastern margin of Little Bradford Island: toppled tree with midden in root mass, at low tide, facing north (top); erosional midden escarpment at low tide, facing south (bottom).

B.C.-A.D. 100) periods. The human remains observed by Wheeler were found in concreted portions of shell midden, and he estimated that up to 10 individuals had been disturbed by erosion of the midden. Wheeler recommended stabilization and protection of the site because it was a representative example of the region's coastal shell middens and contained an interesting type of human burial.

METHODS AND RESULTS OF THE 2009/2010 INVESTIGATIONS

Consistent with the research design outlined in Chapter 1, testing at 8DI32 entailed the excavation of two 1 x 2-m units adjacent to the erosional escarpment fronting Northern Pass (Figure 4-2). The units were spaced approximately 15 m apart to provide samples for comparison.

Test Unit 1 was excavated in June of 2009 (Figure 4-4). Standard archaeological techniques were utilized, with the excavation of 10 cm arbitrary levels, designated by letter (i.e., A, B, C, etc.). All level matrix was screened through ¼-inch hardware cloth on site. Lithics, bone, pottery, and other cultural materials were recovered, bagged, and labeled; however, shell was discarded unless it appeared to have been modified. Profiles were photographed and drawn after excavation (Figure 4-5) was complete and bulk samples were collected from a 50 x 50-cm column in the west profile at 10 cm levels within Stratum II, the main midden stratum. Samples were not collected from the upper stratum, which proved to be storm surge deposits from the 1993 storm that also affected Cat Island. Five-liters of each bulk sample were reserved for future flotation and the remaining material was water screened using 1/8-inch hardware cloth at the Laboratory of Southeastern Archaeology. All recovered materials, including shell, were sorted and analyzed along with the ¼-inch materials collected from the unit.

Test Unit 2 was excavated in May of 2010. The upper 50 cm of storm surge deposits were removed by shovel without screening. Subsequent levels of intact midden were excavated using standard archaeological techniques as described above. Bulk samples of the midden were collected from a 50 x 50-cm column situated along the west profile.

Test Unit 1

Test Unit 1 (TU1) was placed on top of the erosional escarpment parallel to the north-south-oriented shoreline at a location where a large fallen tree had recently exposed subsurface midden. Situated near the northern limit of exposed midden, TU1 was set back from the escarpment about 1.5 meters in a small area free of trees and dense surface vegetation. A local datum was established at the northwest corner of the unit, and a permanent datum (Datum A) was set 23.0 cm grid west and 9.0 cm grid north of the local datum. A second permanent datum (Datum B) was established with cloth tape 10.0 m grid south of Datum A. Both permanent datums were marked with 3-ft long sections of ¾-inch galvanized conduit driven into the ground nearly flush with the surface.

Figure 4-4. Excavation of Test Unit 1 at 8DI32, June 13, 2009.

Figure 4-5. LSA Crew drawing the profile of Test Unit 1 at 8DI32, June 13, 2009.

Four distinct strata were revealed in the excavation of TU1. Photos of the west and east profiles are provided in Figure 4-6, and scaled drawings of all four profiles are given in Figure 4-7. Descriptions of each stratum are provided in Table 4-1 and Table 4-2 gives an inventory of the archaeological materials that were recovered by level and column strata.

Stratum I consists of medium grained sands in alternating microstrata of white and very pale brown and represent accretion due to past storm surges and other natural processes. These deposits contain modern debris, such as fragments of glass, metal, and plastic, and also include some displaced aboriginal artifacts. The modern materials are consistent with an early 1990s age and support the inference that Stratum I formed when the area was inundated by the surge of water associated with the March 1993 "Storm of the Century." Due to its recent age and lack of organic matter, this sandy stratum has a limited root mat. Relatively large roots from the surrounding trees however, penetrate this stratum in several locations. This upper stratum continues down 37-40 cm and encompasses levels A through C and some of the upper portion of level D. No artifacts were collected from these levels, with the exception of the lower portion of level D from which pottery and bone were collected from the upper part of a buried shell midden.

The buried shell midden, Stratum II, was identified by a sharp contrast in color and content from Stratum I and represents the bulk of the archaeological deposit of 8DI32. It is characterized by organic, very dark brown, dense, fine sand with mollusk shell, vertebrate bone, and pottery, with only occasional root intrusions from the surrounding trees. Stratum II is relatively uniform in thickness, ranging from 42 cm at its thinnest to 50 cm at it thickest and encompasses the lower portion of Level D, all of levels E, F, and G, and the upper portion of Level H.

The mollusk shell in this stratum is dominated by whole and broken eastern oyster (*Crassostrea virginica)* and Carolina marsh clam (*Polymesoda caroliniana*), with occasional larger, thicker-shelled hard clam (*Mercenaria mercenaria*). A portion of an unidentified gastropod was retrieved from level H that may exhibit battering at the base. Clam is the dominant mollusk in the upper 10 cm of this stratum, but oyster dominates the remainder of the stratum. Pottery fragments recovered included Pasco limestone tempered sherds, Deptford Linear Check Stamped sherds and one Swift Creek sherd, along with several unidentified sand tempered and crumb sherds. As with the shell and pottery, vertebrate faunal material appears to have been uniformly distributed horizontally throughout the unit while varying vertically. Charcoal recovered from the base of Stratum II returned a conventional AMS assay of 1810 ± 40 BP, which gives two-sigma calibrated age ranges of A.D. 120-260 and A.D. 280-330 (see Appendix B for details).

Figure 4-6. Photographs of the west (top) and east (bottom) profiles of Test Unit 1 at 8DI32.

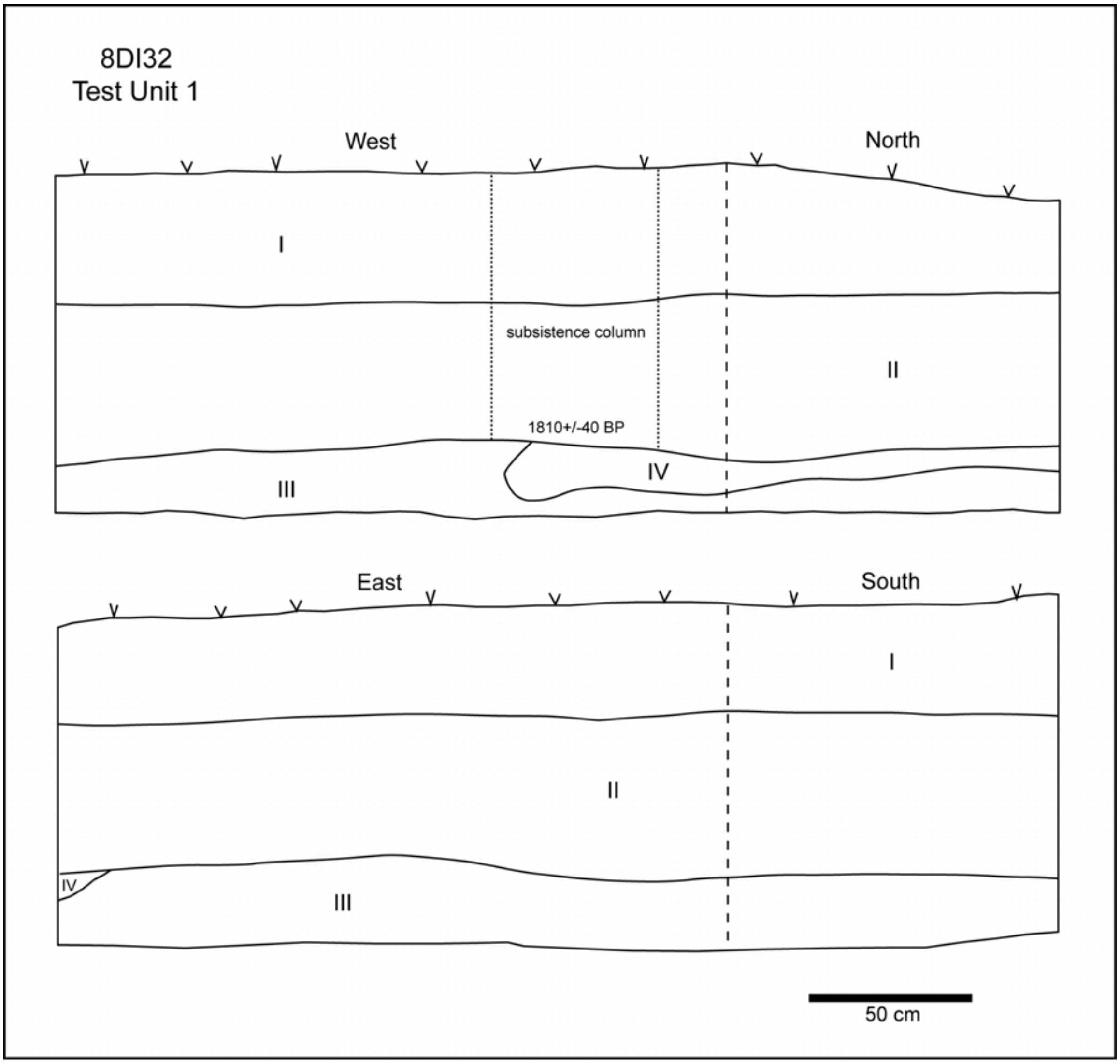

Figure 4-7. Stratigraphic profiles of Test Unit 1, 8DI32.

Stratum III encompasses the lower portion of level H and all of levels I and J, and is characterized by very dark gray fine sand in the upper portion, grading to light gray brown, and eventually to light gray at the base of the unit. Field observations note that the upper portion of the stratum contains reduced amounts of shell. Additionally, it contains a moderate amount of vertebrate fauna, and a few sherds of Pasco and Deptford Linear Check Stamped pottery, all of which decline in density with depth. One-quarter-inch material was collected from level excavations in this stratum; however, no bulk samples were collected. Excavation was terminated at 110 cm below surface (cm BS) when relatively sterile sand was encountered; however, Stratum III extends down below this depth. A soil tube used to retrieve a small core sample from an additional 40 cm below the excavation floor returned clean wet sand with the water table evident at about 150 cm below the datum at the midpoint of the rising tide.

Table 4-1. Stratigraphic Units of Test Unit 1, 8DI32.

Stratum	Max. Depth (cm BS)	Munsell Color	Description
I	41	10YR8/1-3	alternating fine white and very pale brown laminated sand
II	89	10YR2/2	very dark brown organic fine sand with dense oyster, hard clam, occasional whelk, moderate vertebrate fauna, and ceramics
III	110[1]	10YR3/1	very dark gray fine sand
IV	98[2]	10YR4/1 10YR4/1	dark gray and pale brown mottled concreted sand

[1]Terminated at maximum depth of excavation, ca. 110 cm BS.
[2]Lense of ashy concreted sand in northwest corner and west wall terminated at ca. 98 cm BS.

Table 4-2. Inventory of Materials Recovered from Test Unit 1, 8DI32.

	Pottery (n)	Lithics (n)	Vert. Fauna (g)	Shell (g)	Concret./ Pebbles (g)	Charcoal (g)	Historic[1] (g)	Other (g)
Level								
D	6		0.1					
E	16		33.8	31.9		0.1	145.3	
F	23		82.2	4.9			2.5	
G	5		24.3	0.8				
H	16		114.6	57.1	0.5			
I	5		200.7	14.9	1.2			
J	1	3	38.1	1.3				
Total	72	3	493.8	110.9	1.7	0.1	147.8	
Bulk								
II-A	4	1	42.1	2794.7	4.3	13.2	31.0	
II-B	4		55.4	3623.9		54.0	13.2	
II-C	4		105.1	4916.4	0.6	4.5		
II-D	1	5	140.1	4689.4	0.3	2.7		2.7[2]
II-E	4	4	75.6	3766.1	5.4	3.7		
Total	17	10	418.3	19,790.5	10.6	78.1	44.2	2.7

[1] historic artifacts include glass, metal, plastic, and other modern materials.
[2] fossilized coral
Note: A chert hafted biface not included in this inventory was found on the surface in the vicinity of TU1.

In the northwest corner of the unit, seen in both the west and north profiles, Stratum IV, recognized by a change in color and texture, intrudes into Stratum III. This lens of mottled dark gray and pale brown concreted sand is approximately 18 cm at its thickest in the west profile, thinning in the north profile to 5 cm. Materials, if any, recovered from this stratum were not segregated from the other materials in the level, as this stratum was not evident until profiles were cleaned for photography and drawing.

Test Unit 2

Test Unit 2 (TU2) was located approximately 15 m south of TU1, its northwest corner specifically 16.8 m grid south of Datum A, at an azimuth of 190 degrees. Like TU1, it was placed parallel to the shoreline on the top of the escarpment and was oriented north to south along its long axis. Photos of the west and east profiles are provided in Figure 4-8, and Figure 4-9 gives the scaled drawings of all four profiles. Descriptions of each stratum are provided in Table 4-3, and Table 4-4 provides an inventory of the archaeological materials recovered in level excavations and from the column strata.

Excavation of TU2 revealed four distinct strata, two consisting of aboriginal shell midden. Stratum I consists of medium to light brown, coarse to fine laminated sands and corresponds to the same upper stratum in TU1. Vegetation was sparse in this shoreline location and root mat was relatively light, with the exception of a few tree roots that were encountered throughout excavation of the unit. As in TU1, this stratum yielded modern materials, such as glass, metal, and plastic, along with a few displaced aboriginal artifacts. Because it represents an overburden of recent storm deposition, material from this roughly 55-cm thick stratum was not screened and no level designations were assigned.

Stratum II was identified by its abrupt color and texture change. This 5-9 cm-thick lens of material is characterized by very dark brown, highly organic, silty fine sand and is interpreted as a buried A-horizon. The first level designation, Level A, was assigned at the interface of this stratum with Stratum I. Few artifacts appear to be present in this stratum, which immediately overlies the main midden stratum.

Beginning at around 65 cm BS, the primary midden is represented by two distinct strata. Stratum III, which corresponds to Stratum II in TU1, is identical in color and texture to Stratum II, but it contains dense shell, and includes bone and pottery. It is 27 cm thick in the southwest portion of the unit, but gradually increases to an unknown thickness as it extends below the terminal level of excavation in the northwest portion of the unit. This stratum crosscuts the lower portion of Level A, all of B and C, and the upper portion of Level D.

Oyster (*C. virginica)* is the predominate mollusk in the upper portion of Stratum III, accompanied by lesser amounts of Carolina marsh clam (*P. caroliniana)* and one crown conch (*Melongena corona*). Clam increases relative to oyster with depth in this stratum, eventually almost equaling it. Vertebrate fauna accompanies shell in this midden layer, including a cluster of unidentified turtle (*Testudines*) bone found in the southeast corner of the unit toward the bottom of this stratum. Pottery was present throughout the midden, and this stratum contained Pasco plain, Deptford Linear Check Stamped and Bold Check Stamped, Swift Creek Complicated Stamped, and unidentified sand tempered and crumb sherds.

Figure 4-8. Photographs of the west (top) and east (bottom) profiles of Test Unit 2 at 8DI32.

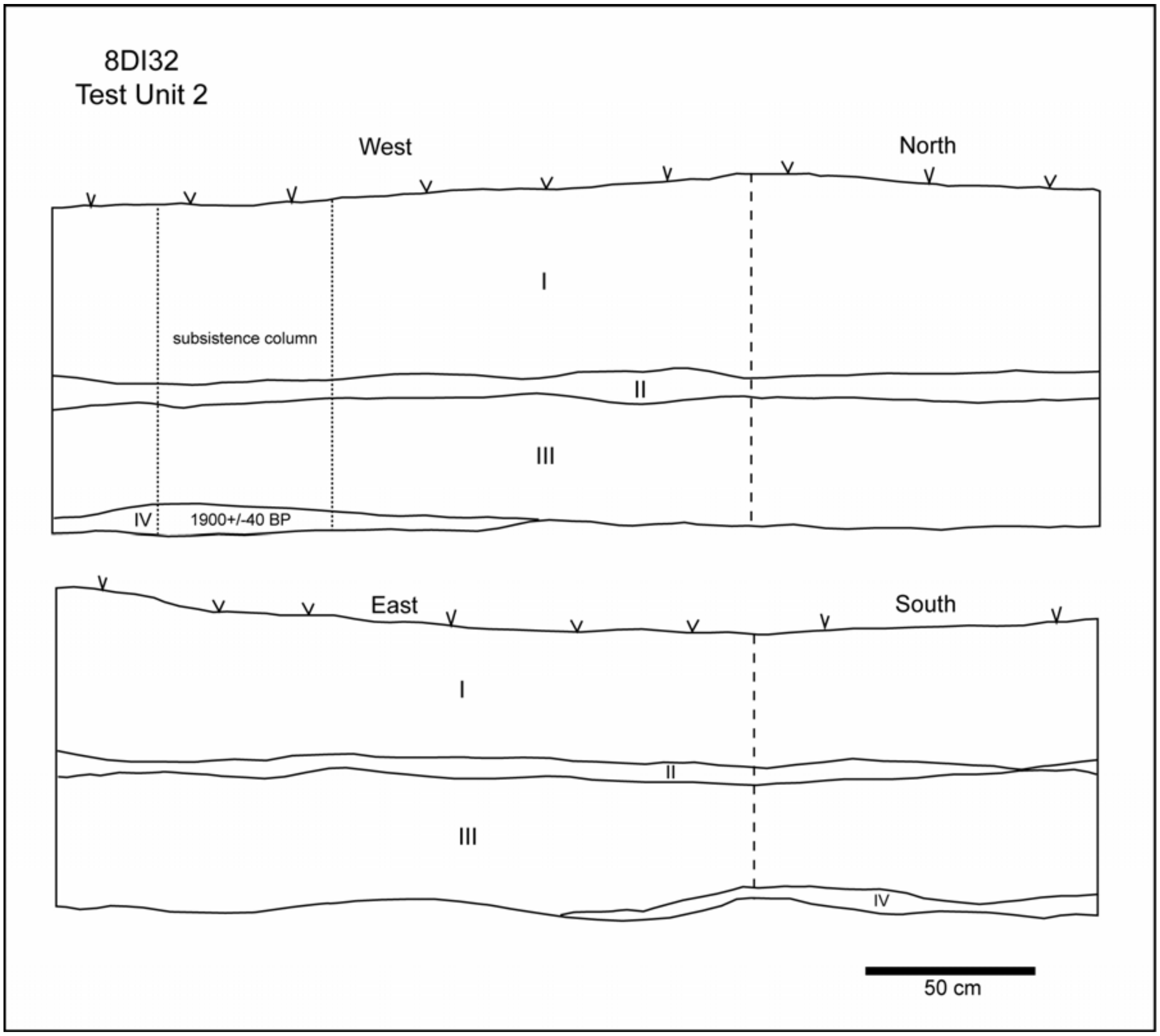

Figure 4-9. Stratigraphic profiles of Test Unit 2, 8DI32.

Table 4-3. Stratigraphic Units of Test Unit 2, 8DI32.

Stratum	Max. Depth (cm BS)	Munsell Color	Description
I	60	10YR6/4	medium to light brown, coarse to fine laminated sands
II	69	10YR2/2	very dark brown, highly organic, silty fine sand; buried A-horizon
III	101	10YR2/1	very dark brown, highly organic fine sandy loam containing abundant oyster and clam
IV	103[1]	10YR3/1	dark gray, cemented, fine to medium sands containing a moderate amount of shell and abundant small vertebrate fauna

[1] excavation was terminated 103 cm BS, where top of watertable was encountered.

Table 4-4. Inventory of Materials Recovered from Test Unit 2, 8DI32.

	Pottery (n)	Lithics (n)	Shell Tool (n)	Vert. Fauna (g)	Shell (g)	Concret./ Pebbles(g)	Char-coal (g)	Historic[1] (g)
Level								
A	33	1		58.9	32.9	149.3	0.8	37.3
B	11			106.8				1.7
C	6			77.9				
D	8		1[2]	99.9		2.7		
E	3			31.1		138.1		
Total	61	1	1	374.6	32.9	290.1	0.8	39.0
Bulk								
III-A	12			45.7	3329.0	0.8	4.9	13.6
III-B	1			48.0	5510.8		0.6	
III-C				118.5	6386.6	0.4	2.0	
IV-A	15			67.8	3106.7	1369.3	0.5	
Total	28			280.0	18,333.1	1370.5	8.0	13.6

[1] historic artifacts include glass, metal, plastic, and other modern materials
[2] conch shell with battering at the base

The dark brown, silty deposits of the Stratum III grade into dark gray organically rich calcium-cemented sand in Level E, at a depth of roughly 98 cm BS in the southern portion of the unit. This stratum, designated Stratum IV, thins toward the northern half of the unit, and contains shell, bone, and pottery that are concreted with sediments. The stratum includes reduced amounts of both oyster and clam, abundant vertebrate fauna, and Pasco plain pottery sherds, along with a few unidentified sand tempered sherds. Despite not reaching the bottom of Strata III and IV, excavation was terminated at 103 cm BS, where the water table at high tide was encountered. A small core was extracted from the center of the unit floor, returning sterile, white/gray sand 12 cm below the last level. Charcoal recovered from the base of Stratum III returned a conventional AMS assay of 1900 ± 40 BP, which gives two-sigma calibrated age range of A.D. 20-220 (Appendix B).

ARTIFACT ASSEMBLAGE

A total of 194 artifacts, including pottery, lithics, and shell tools, and 39,834.1 grams of vertebrate fauna and shell were recovered from the level excavations and bulk samples collected from the test units at 8DI32. Descriptions of the artifact classes and preliminary analyses of the pottery and marine shell assemblages follow.

Pottery

Pottery frequencies by level for both test units are provided in Tables 4-5 and 4-6, and representative sherds are presented in Figures 4-10 and 4-11. The pottery assemblage is composed of 139 identifiable sherds. An additional 39 crumb sherds—sherds that pass through a ½-inch mesh—were excluded from further analysis. Sherds were classified by type, which includes Pasco (limestone tempered) plain and UID, St. John's

Table 4-5. Absolute Frequency of Pottery Sherds from Test Unit 1, 8DI32.

	----Pasco----		St. Johns	Deptford	Swift	----------Sand-Tempered----------						
	Plain	UID	Plain	LCS	Creek	Plain	CS	Punc	UID	Other	Crumb	Total
Levels												
D	3			1		1					1	6
E	6		1			1	1	3	1	1[1]	2	16
F	12			3		1	3		1		3	23
G				1	1	1	1		1			5
H	7				2				4		3	16
I	1	1		3								5
J	1											1
Total	30	1	1	8	3	4	5	3	7	1	9	72
Bulk												
II-A										1[2]	3	4
II-B	2			1						1[3]		4
II-C		2		1							1	4
II-D		1										1
II-E	1	1									2	4
Total	3	4		2						2	6	17

[1] sand-tempered fibrous
[2] St. Johns eroded
[3] sand-tempered dentate

Table 4-6. Absolute Frequency of Pottery Sherds from Test Unit 2, 8DI32.

	Pasco	Pasco	St. Johns	Swift	Ruskin	Sand-Tempered				
	Plain	UID	LCS	Creek	Dentate	Plain	UID	Other	Crumb	Total
Levels										
A	14		1		4	3	6	1	4[1]	33
B	4						5	1[2]		10
C	3			2				1[3]		6
D		6							2	8
E	1					2				3
Total	22	6	1	2	4	5	11	3	6	60
Bulk										
III-A	1	1	1						9	12
III-B									1	1
IV-A		7							8	15
Total	1	8	1						18	28

[1] sand-tempered check stamped
[2] Deptford Bold Check Stamped
[3] Deptford Linear Check Stamped

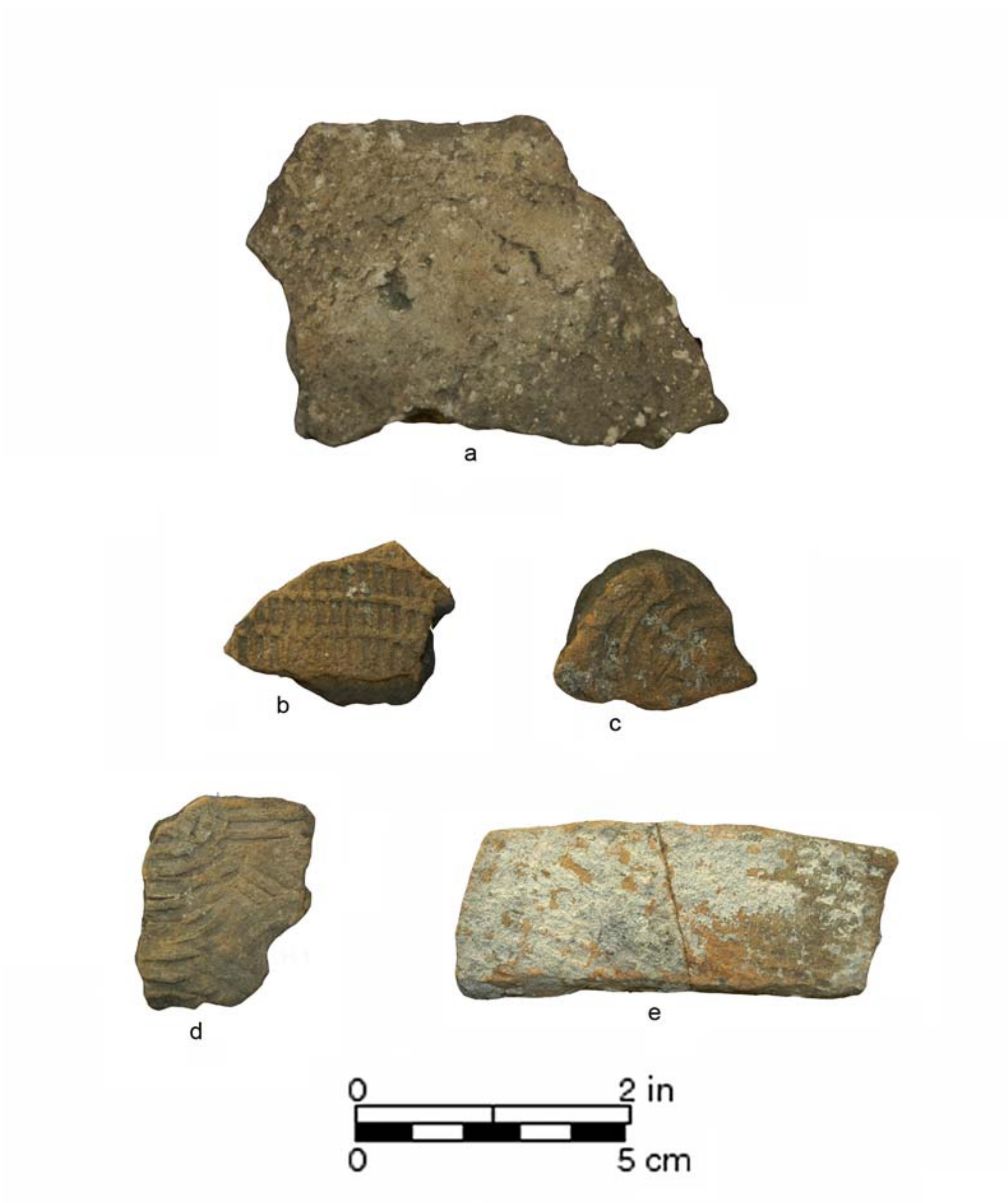

Figure 4-10. Examples of sherds recovered from TU1, 8DI32 (a. Pasco Plain; b, e. Deptford Linear Check Stamped [e. with crossmend of fresh break]; c, d. Swift Creek Complicated Stamped).

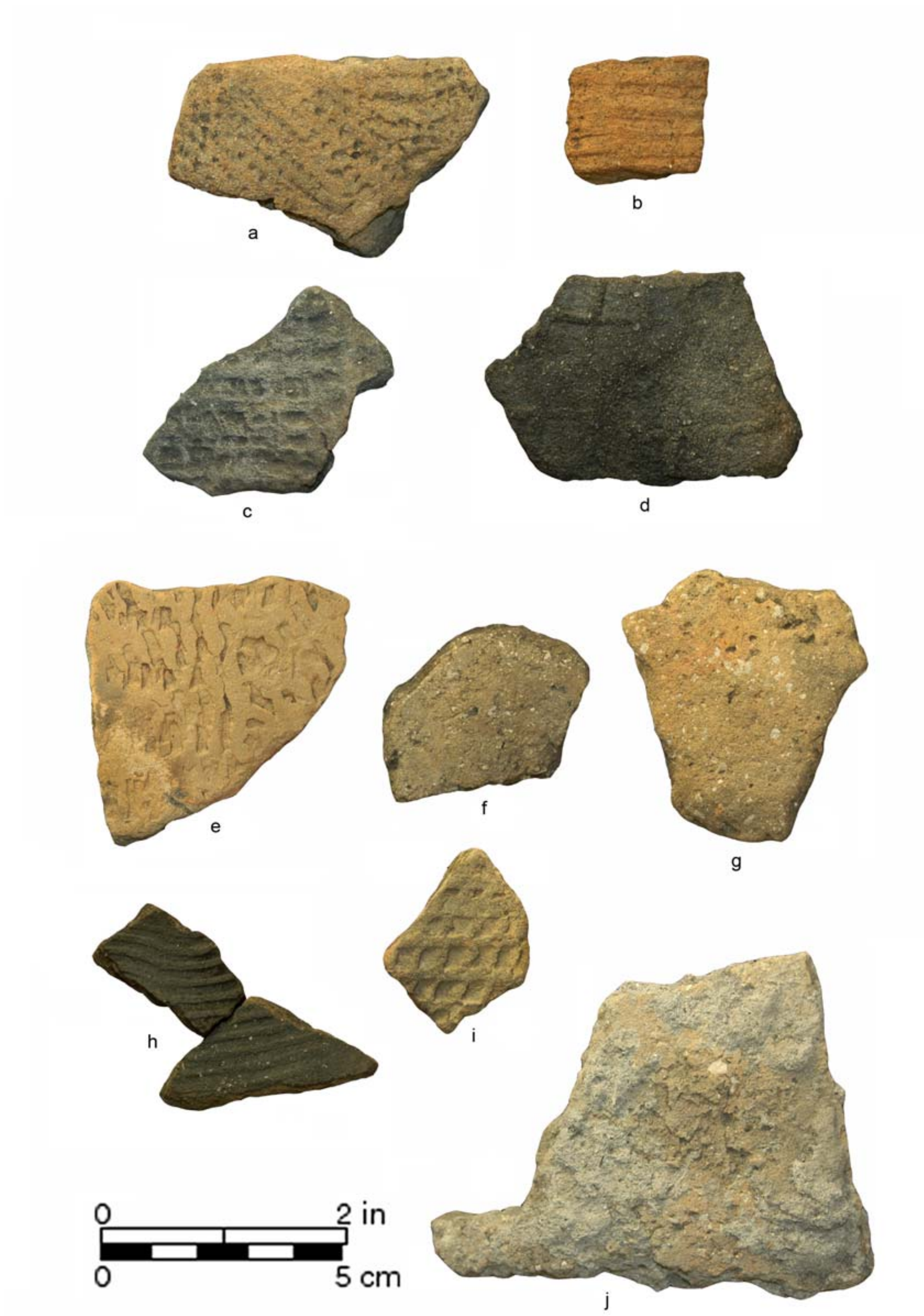

Figure 4-11. Examples of sherds recovered from TU2, 8DI32 (a. Ruskin Dentate; b, e, i. Deptford Linear Check Stamped; c. sand tempered check stamped; d. Deptford Bold Check Stamped; f, g. Pasco plain; h. Swift Creek Complicated Stamped [crossmend of sherds from different levels]; j. concreted Pasco UID).

plain and UID, Deptford Linear Check Stamped and Bold Check Stamped, Swift Creek Complicated Stamped, Ruskin Dentate, and where the type could not be determined, simply "sand tempered." The sand tempered category was further subdivided based on surface treatment into plain, check stamped, punctate, dentate, and unidentified. One sand tempered sherd was classified separately as fibrous based on the porous nature of the paste that was observed under a stereoscope. During sorting, efforts were made to identify crossmends, or pieces of pottery that can be fitted back together. Crossmends of fresh breaks, regardless of the number of sherds, were counted as one sherd so as not to inflate the frequency of types in the assemblage.

The highest density of ceramics occurred in a 20-cm vertical section of the midden in both units; however, the elevation of this section is slightly different between the two. In TU1 the greatest frequency of pottery was recovered from 40 to 60 cm BS (n = 39), although there is a secondary spike from 70 to 80 cm BS (n = 16), and in TU2 the greatest frequency was recovered from 50 to 70 cm BS (n = 43). This variation in elevation is mostly likely due to differential sedimentation of the sandy storm surge deposits (Stratum I) that overlie the midden. Stratum I was recorded as 40-cm thick in TU1 and just over 50-cm thick in TU2.

Pasco series plain pottery (Figure 4-10a and Figure 4-11f, g), a limestone tempered ware, was the dominate type in the assemblage, constituting 54.0 percent (n =75) of all sherds. It represents 51.4 percent (n = 38) of the pottery in TU1 and 56.9 percent (n = 37) of the pottery in TU2. While this type was distributed vertically throughout both test units, Pasco sherds are found in their highest numbers above 60 cm BS in both test units. Stratum IV, the lowermost stratum in TU2, yielded seven sherds identified as Pasco, all possibly belonging to the same vessel as they were found clustered together. Unfortunately, because the outside edges of the sherds are concreted with sand (Figure 4-11:D-1), it is difficult to determine if they crossmend.

Deptford pottery is second to Pasco in frequency, making up 7.9 percent (n = 11) of the total assemblage. In TU1, Deptford comprises 13.5 percent (n = 10) of the pottery but in TU2, it accounts for only 1.5 percent (n = 1). In TU1, Deptford pottery is at its greatest frequency from 50 to 90 cm BS. In contrast, only one sherd was recovered from TU2 between 70 and 80 cm BS. Linear check stamping is the predominant surface treatment identified in the Deptford component of the assemblage (Figure 4-10b, e, and Figure 4-11b, e, i).

Six Swift Creek complicated stamped sherds were recovered during excavation, three from TU1 and three from TU2. All were recovered from levels below those with the highest density of Pasco sherds, between 60-80 cm BS. The two sherds recovered from levels G and H in TU1 (Figure 4-10c, d) appear to belong to two different vessels; however, two of the three Swift Creek sherds from TU2 crossmend. The sole Swift Creek sherd from Level D crossmends with one of the two sherds from Level C (Figure 4-11h). Overall, Swift Creek represents only 4.3 percent of the total assemblage.

Over a quarter of the assemblage is sand tempered pottery that could not be classified by type. These 38 sherds comprise 27.3 percent of the total, 28.4 percent (n = 21) of the pottery in TU1 and 26.2 percent (n = 17) of TU2. The majority of these sherds (n = 18) are heavily eroded, making identification of surface treatment impossible. The remaining sand tempered category contains nine plain, six check stamped, three punctuate , one dentate, and one fibrous sherd.

When comparing the sherd assemblages of the two test units, it is interesting to note that, while Pasco is fairly evenly distributed between the two units, Deptford pottery was confined predominately to TU1. Ten Deptford sherds were recovered from TU1, but only one Deptford sherd was recovered from TU2. Additionally, sand tempered sherds constitute almost the same percentage of each test unit; however, TU1 has much more surface treatment variation. While both test units contained about the same amount of plain and UID sand tempered sherds, TU1 yielded five check stamped sherds compared to only one in TU2. Punctated and dentate sherds were present in TU1, but not TU2, in addition to the one fibrous sherd recovered from TU1.

Four Ruskin dentate sherds (Figure 4-11a) were found in Level A of TU2. It is unclear if the sherds from this Weeden Island II ware originated from the same vessel; however, the presence of them in the upper portion of the midden is not unexpected.

Lithic Artifacts

Fourteen flakes were recovered from test excavations at Little Bradford, 13 from TU1 and one from TU2. With the exception of one flake of indeterminate material, all of the flakes are chert. The small size of the flakes suggests that they are not the product of primary lithic reduction, but rather were generated in the process of thinning, rejuvenating, or reduction of bifaces that had been brought to the site either finished or as preforms.

A stemmed biface, somewhat resembling a Middle Archaic Newnan type, was found on the surface in the vicinity of TU1 (Figure 4-12). It measures 4.1 cm long by 3.3 cm wide and was made on light-colored beige to gray chert. There is a small amount of secondary mineralization on the stem and on one shoulder, as well as midway between the tip and the shoulder on the reverse side. The opposite shoulder has been broken. Because the stem appears to have been shaped from the plane of a transverse break, the form of this biface is possibly a produce of scavenging and recycling. However, no evidence is found for differential patination on the stem. The age and cultural affiliation of this form remain uncertain.

In addition to the chipped stone artifacts, a small amount of fossilized coral (2.7 grams) was recovered from TU1; however, it does not appear that this material has been modified.

Figure 4-12. Stemmed hafted biface found on surface in vicinity of Test Unit 1, 8DI32.

Modified Shell

Only one possible shell artifact was recovered from test units at Little Bradford, from Level D (80-90 cm BS) of TU2 (Figure 4-13). This unidentified columella, with some portion of the outer spiral shell, measures 10.3 cm long. It appears to have significant wear at the base that may be indicative of battering. However, the shell is badly degraded, making identification as a tool somewhat tentative.

Figure 4-13. Portion of gastropod columella with battered end from Level D, Test Unit 2, 8DI32.

FAUNAL ASSEMBLAGE

Invertebrates

Shell recovered from the bulk sample columns of both test units was sorted into five categories: oyster, which is composed exclusively of *C. virginica* (eastern oyster); clam, which includes *P. caroliniana* (Carolina marsh clam) and *M. mercenaria* (hard clam); Crown conch (*M. corona)*; UID conch (*Strombidae*), UID barnacles (*Cirripedia),* and UID shell fragments. The side of the oyster and clam shell was determined where possible, based on hinge attributes. They, along with crown conch and UID conch were counted, so that the minimum number of individuals could be estimated, and weighed. All other shell fragments were simply weighed.

Initially, the clam shells at Little Bradford were thought to be from the common Rangia (*Rangia cuneata*); however, upon further inspection of the hinge, it was determined that the species represented in the midden was not Rangia, but rather the small Carolina marsh clam (*P. caroliniana)* that prefers the needlegrass marsh environment around the island (Duobinis-Gray and Hackney 1982). These two species roughly share the same salinity preferences and are very similar in size (MacKenzie 2004); however Rangia have two cardinal teeth (see Figure 4-14), whereas Carolina marsh clam is distinguished by three cardinal teeth and an additional lateral tooth both anteriorly and posteriorly of the main cardinal teeth (See Figure 4-15) (Leal 2002).

Figure 4-14. Hinge assembly of *R. cuneata* (USGS 2009)
(red circle indicates location of cardinal teeth)

Figure 4-15. Hinge assembly of *P. caroliniana (Kohl 2010)*
(red circle indicates location of cardinal teeth)

Absolute frequencies of shell by taxa and strata for both units is provided in Tables 4-7 and 4-8. Oyster and clam overwhelmingly dominate the shell assemblage, with oyster constituting 48.3 percent (18,524.7 g) and clam 28.7 percent (11,014.7 g) of the total. The third largest category is the UID shell fragments, which make up 22.4 percent (8,570.4 g). These are followed by crown conch at 0.3 percent (107.2 g), UID conch at 0.2 percent (75.9 g), and UID barnacles at 0.1 percent (28.5 g).

Shell densities in both units are highest in a 20-cm vertical band (See Tables 4.x and 4.x); although, like the previously discussed pottery frequencies, this range occurs at different elevations below the surface in each unit, most likely due to the differential deposition of sandy deposits overlying the midden. The highest shell density in TU1 occurs from around 60 to 80 cm BS and in TU2 the highest density is from 70 to 90 cm BS. Of interest is the disparity between areas of highest shell and pottery densities, with shell at its highest below the levels at which pottery is at its maximum.

Table 4-7. Absolute frequency of marine shell by strata of bulk sample column, taxa, and valve (for oyster and clam), Test Unit 1, 8DI32.

OYSTER	Right Valve		Left Valve		Fragment	Total
	ct.	wt. (g)	ct.	wt. (g)	wt. (g)	wt. (g)
II-A	38	163.0	22	141.2	264.1	568.3
II-B	91	270.4	93	397.1	1259.0	1926.5
II-C	80	376.0	125	843.9	1343.1	2563.0
II-D	105	322.8	121	933.9	1567.3	2824.0
II-E	65	276.2	82	622.8	712.2	1611.2
Total	379	1408.4	443	2938.9	5145.7	9493.0

CLAM	Right Valve		Left Valve		Fragment	Total
	ct.	wt. (g)	ct.	wt. (g)	wt. (g)	wt. (g)
II-A	39	54.1	42	64.4	911.4	1029.9
II-B	84	157.7	46	167.3	882.0	1207.0
II-C	54	204.5	73	443.1	1031.1	1678.7
II-D	39	147.8	49	268.4	866.5	1282.7
II-E	47	180.5	43	165.9	468.0	814.4
Total	263	744.6	253	1109.1	4159.0	6012.7

OTHER	Crown Conch		UID Gastropod		UID Fragments	
	ct.	wt. (g)	ct.	wt. (g)	wt. (g)	% of Total
II-A					1196.5	42.8%
II-B					490.4	13.5%
II-C					673.7	13.7%
II-D					578.1	12.3%
II-E					1327.7	35.3%
Total	0	0.0	0	0.0	4266.4	21.6%

Table 4-8. Absolute frequency of marine shell by strata of bulk sample column, taxa, and valve (for oyster and clam), Test Unit 2, 8DI32.

OYSTER	Right Valve		Left Valve		Fragment	Total
	ct.	wt. (g)	ct.	wt. (g)	wt. (g)	wt. (g)
III-A	179	393.2	121	310.3	549.3	1252.8
III-B	316	1160.3	237	1337.5	1068.1	3565.9
III-C	138	663.0	148	1240.0	960.0	2863.0
IV-A	44	217.9	40	368.9	763.2	1350.0
Total	677	2434.4	546	3256.7	2240.6	9031.7
CLAM	**Right Valve**		**Left Valve**		**Fragment**	**Total**
	ct.	wt. (g)	ct.	wt. (g)	wt. (g)	wt. (g)
III-A	29	52.3	28	59.0	462.8	574.1
III-B	52	182.4	52	233.0	585.0	1000.4
III-C	175	425.7	120	571.6	1372.6	2369.9
IV-A	41	303.6	43	212.4	493.8	1009.8
Total	297	964.0	243	1076.0	2914.2	4954.2
OTHER	**Crown Conch**		**UID Gastropod**		**UID Fragments**	
	ct.	wt. (g)	ct.	wt. (g)	wt. (g)	% of Total
III-A					1502.1	45.1%
III-B	1	53.2			891.2	16.2%
III-C					1149.9	18.0%
IV-A					740.7	23.8%
Total	1	53.2	0	0.0	4283.9	23.4%

In the interest of detecting changes in patterns of shellfish utilization, oyster and clam were compared using quantities from the bulk column samples. Table 4-9 provides ratios of oyster to clam (1:*x)* in both test units. In TU1 oyster is the dominant species, ranging from 0.5 to 0.6 clams for every oyster in the lower 40-cm of the midden (strata II-E to II-B). There is a significant shift in the upper 10-cm of TU1, with clam weight surpassing oyster weight, creating a ratio of almost two clams for every oyster. There is a significant drop in weight for oyster in this uppermost level from 1926.5 grams in Stratum II-B to only 568.3 grams in Stratum II-A. This is the only level in which clam weight is greater than oyster weight.

TU2 shows a somewhat different pattern, with oyster and clam present in almost equal ratios in Stratum IV and in the lowest level of Stratum III (III-C). The ratio of clam to oyster drops significantly, however, in the upper two levels of Stratum III (III-B and III-A). Unlike the drop in oyster weight in TU1, the uppermost level in Stratum III has considerably less clam than in the levels below, dropping from 1000.4 grams in Stratum III-B to only 574.1 grams in Stratum III-A.

Because the shells were sorted by side (right vs. left) when the diagnostic hinge elements were present, a minimum number of individuals (MNI) could be estimated. Table 4-9 provides a ratio of oyster to clam (1:*x*) by MNI. When considering MNI, there

Table 4-9. Comparison of Test Units 1 and 2 for Total Weight (g) of Shell, Percent by Weight UID Fragments, and Ratio of Oyster to Clam Shell, by Stratum, 8DI32.

	Total Shell Wt. (g)	Percent by Wt. UID Fragments	Ratio Oyster: Clam (1:*x*) by Wt.	Ratio Oyster: Clam (1:x) by MNI
Test Unit 1				
II-A	2795.0	42.8%	1.8	1.4
II-B	3623.9	13.5%	0.6	0.7
II-C	4916.4	13.7%	0.7	0.6
II-D	4689.4	12.3%	0.5	0.4
II-E	3766.1	35.3%	0.5	0.6
Test Unit 2				
III-A	3329.0	45.1%	0.5	0.2
III-B	5510.8	16.2%	0.3	0.2
III-C	6386.6	18.0%	0.8	1.0
IV	3106.7	23.8%	0.7	1.0

are three stratigraphic levels in which clam is the dominate species or is equal to oyster: in the upper 10 cm of Stratum II (II-A) in TU1, and in Stratum IV and Stratum III-C of TU2. The ratios of individuals from each species closely correlate with, and thus support, the ratios determined using total weight of each species, which suggests that using total species weight may be a good proxy for determining species density.

Both the uppermost and lowermost levels of both test units have the greatest percentage of crushed shell, which could suggest several different processes affecting midden formation. The percentage of UID fragments by weight was used as a proxy for crushed shell. Table 4-10 provides total shell weight, weight of UID fragments, and the percentage of UID fragments by strata. The bottom 10-cm of each unit have higher percentages of UID fragments than the levels that represent the bulk of the midden, with 35.3 percent of total level shell weight in TU1 and 23.8 percent in TU2. The center sections of each midden range from 12.3 percent at the lowest to 18.0 percent at the highest. In the upper 10-cm in both units almost half of each level's shell weight is UID fragments, with 42.8 percent in TU1 and 45.1 percent in TU2. The higher density of crushed shell in the lower levels is most likely due to taphonomic processes and breakage during recovery. The center levels above have significantly less crushed shell, which may suggest rapid burial that precluded excessive crushing. Finally, the upper portion most likely represents a long-term stable surface that permitted the degradation of exposed shell by anthropogenic and natural processes.

Vertebrate

Vertebrate fauna has yet to be analyzed; however, a cursory inspection of the remains suggest the inclusion of additional marine species, such as sheepshead (*Archosargus probatocephalus*), black drum (*Pogonias cromis*), and catfish (*Ariopsis felis* or *Bagre marinus).* As mentioned earlier, a cluster of remains from an unidentified turtle (Testudines) were recovered from Stratum III of TU2.

Table 4-10. Comparison of Test Units 1 and 2 for Total Weight (g) of shell and percent by weight of UID Fragments, 8DI32.

	Total Shell Weight (g)	UID Shell Fragments By Weight (g)	% of Shell Fragments by Wt. (g)
Test Unit 1 – Bulk			
II-A	2794.7	1196.5	**42.8%**
II-B	3623.9	490.4	13.5%
II-C	4916.4	673.7	13.7%
II-D	4689.4	578.1	12.3%
II-E	3766.1	1327.7	**35.3%**
Total	19790.5	4266.4	21.6%
Test Unit 2 - Bulk			
III-A	3329.0	1502.1	**45.1%**
III-B	5510.8	891.2	16.2%
III-C	6386.6	1149.9	18.0%
IV-A	3106.7	740.7	**23.8%**
Total	18,333.1	4283.9	23.4%

DISCUSSION AND CONCLUSION

Test unit excavations at 8DI32 have yielded data that will contribute to a better understanding of ancient life along the northern Gulf Coast of Florida. Two immediate questions can be addressed with the data collected during the 2009 and 2010 excavations. First, what is the chronology of the occupation of the site, and second, can we identify changing environmental factors that affected resource usage at the site? These two fundamental questions merely scratch the surface of much larger issues that need to be addressed in the Suwannee Delta region. However, they are the types of questions that build a firm foundation for future archaeological work, specifically the refinement of a poorly understood culture-history and ceramic chronology, both of which are necessary first steps in answering the types of questions put forth in Chapter 1 of this report.

The Deptford period is characterized by linear check stamped pottery (Milanich 1994; Willey 1949), and is followed by the subsequent Weeden Island period. Crosscutting these two periods is the Swift Creek period, which is predominant in the Florida Panhandle to the northwest of the study area. Further south, below Cedar Key, Pasco pottery was used extensively during the Deptford period, and continued to be used well into the Weeden Island period (Milanich 1994:211).

The stratigraphic position of the various pottery types in the Little Bradford test units is consistent with this basic chronology and, given the wide range of pottery types, it could be interpreted as an intermediate assemblage. The two-sigma calibrated age estimate of A.D. 120-260/280-330 from charcoal at the base of the midden in TU1 and the calibrated age estimate of A.D. 20-220 from the base of TU2 suggests that this midden began to accrete during the Late Deptford Period. The distinctive linear check stamped pottery of the Deptford period is present throughout the vertical extent of the midden in TU1. Likewise, the Pasco series is present throughout the midden, but increases in frequency in the upper portion. Swift Creek pottery is restricted to a 20-cm zone of the midden, from 60-80 cm BS and later Weeden Island period Ruskin Dentate is present in the uppermost level of the midden in TU2, along with sand tempered sherds that have surface treatments that are also associated with the Weeden Island period.

The invertebrate marine resources utilized by occupants of Little Bradford Island inhabited a relatively narrow range of salinity and therefore most likely were collected close to the shoreline. While oysters can tolerate fairly wide variations in salinity, ranging from 1-20 parts per thousand (ppt), they tend to prefer brackish waters with salinity of less than 10 ppt. Above that, they fall prey to Dermo (*Perkinsus marinus*), a parasitic organism that requires salinity above 10 ppt, and oyster drills (*Urosalpinx cinerea*), a small predatory snail that flourishes above 15 ppt (Bergquist et. al. 2006). Carolina marsh clams (*P. caroliniana),* like oysters, can tolerate a wide range of salinities, from 1-20 ppt, but prefer the needlegrass (*Juncus roemerianus*) marsh areas in estuarine systems where they are protected by the vegetation but not hindered by extensive root mats. Needlegrass prefers a salinity range of 11-14.5 ppt (Duobinis-Gray and Hackney 1982). In short, the oyster and clam species found in the Little Bradford midden would most likely have been collected in the brackish waters near the mouth of the Suwannee River where salinity was around 10 ppt. The infrequent inclusion of hard clam (*M. mercenaria*), which requires salinity above 20 ppt, in the shell assemblage (only 249.9 grams in TU2) suggests that forays into deeper water further from the coast may have been uncommon.

As suggested in Chapter 1, changing ratios of oyster to clam could be indicative of changing environment, specifically changing salinity due to sea level rise or fluctuations in fresh water inflow. However, the assemblage at Little Bradford does not show a significant shift from one species to another. This could be due to several factors. For instance, the midden began to accrete after rates of sea level rise had already slowed (e.g. Wright et. al. 2005) and changes in salinity may have been mitigated somewhat due to the close proximity to the mouth of the Suwannee River, which provided enough fresh water to keep salinity levels within species' tolerances. Additionally, the species that were exploited by the occupants of the site could tolerate the same fairly wide range of salinities and therefore minor changes may not have significantly affected the availability of the resources. While there is some variation in the assemblage, it is unclear if this is due to changing resource availability, changing preferences, or simply a product of differential deposition of materials in the midden.

Little Bradford is an important, but highly vulnerable site that can help us to answer some of the larger questions posed in Chapter 1 of this report. Its placement at the transition from the Deptford period to the Weeden Island period makes this site especially interesting as it may help us to understand the circumstances that attended changing cultural traditions. More detailed analysis of data from Little Bradford could yield information that will help to answer additional questions. For instance, how did the vertebrate faunal assemblage change over time, and could this shed more light on questions of changing sea levels and fluctuating fresh water inflow? Additional analysis of the pottery recovered from the site would be useful for determining origin of raw materials, or to identify nonlocal pottery styles, which could help identify relationships with other communities or regions. Significantly, when considered with other data that will be collected in the coming years, the information from Little Bradford will help to create a chronology for a region that is currently poorly understood.

CHAPTER 5
RICHARDS ISLAND (8LV137)

Micah P. Monés

An initial round of archaeological survey in the study area was launched in 2009 on Richards Island in Levy County. The location of at least one archaeological site (8LV137), Richards Island provided an opportunity to deploy reconnaissance survey to better characterize known sites and to search for additional archaeological deposits across an entire landform. This chapter reports the methods and results of this initial survey effort.

BACKGROUND

Setting

Richards Island is located approximately 2.5 km south of Shell Mound (8LV42) and 5 km north of Cedar Key (Figure 5-1). Richards Island is roughly "S" shaped with a relatively high central ridge and two lower arms, one extending to the northeast and the other to the southwest. Sand Creek bounds the southern and eastern shores of Richards Island before meeting with Seabreeze Creek to the north. The western shore of Richards Island contains a tidal creek and a storm-deposited berm that separates it from a shallow bay that contains many oyster reefs and shoals visible during low tides.

The central ridge of Richards Island rises 7.4 meters above mean sea level. The ridge is dominated by mature live oak and hickory with some pine and cabbage palm. The understory is mostly immature oak with intermittent palmetto becoming thick in places. The western side of the ridge, facing the gulf, becomes predominantly juniper with increased proximity to the water. The forest floor under the juniper is scattered with Spanish Bayonet and coontie. The leeward side of the island is covered in scrub oak and palmetto increasing as it slopes downward.

The northeast arm of the island becomes increasingly scrubby as it decreases in elevation. The center of this part of the island is mostly scrub oak and palmetto with patches of exposed sand, dry moss, and lichen. Shovel tests in this area encountered deposits of fresh water at depths of 75 cm and below. The margin of the island is ringed by large pines before descending into marsh grasses. The southwest arm is dominated by juniper with thick clumps of greenbrier and palmetto common in the understory.

The entire island is surrounded by marsh grasses with well used trails traversed by the feral hogs that frequent Richards and many of the nearby islands. Throughout the island, pig signs in the form of rooting and droppings are found. In some instances, the pigs have disturbed the surface of some of the archaeological deposits. Although no gopher tortoises were seen on the island, many burrows were located with artifacts in the tortoises' backdirt piles.

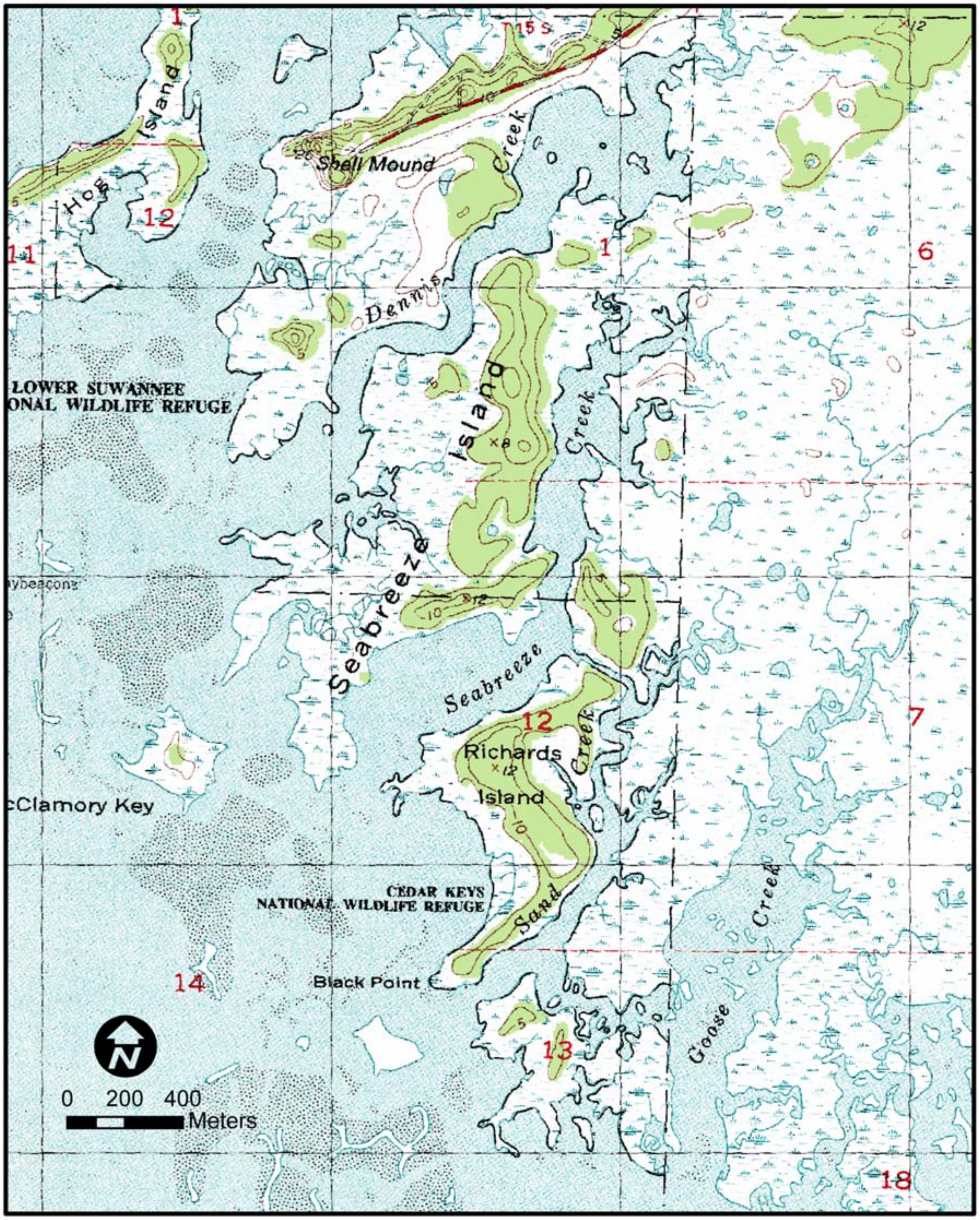

Figure 5-1. Section of U.S.G.S. topographic quad (Cedar Key, FL 1955, revised 1993) showing area of Richards Island and vicinity, Levy County, Florida.

Due to its location among shallow creeks, oyster shoals, and mud flats, Richards Island proved to be very difficult to reach at times. The island is accessible by small motor boats only during the highest of tides and can prove to be difficult even for canoes and airboats during low tides. It may be the remoteness of Richards Island that has kept it from being looted and collected to the degree of many neighboring islands, although with increased traffic and rising sea levels, Richards Island will likely succumb to human impact.

On the north and south ends of the main ridge there are two large clearings. The northern clearing is the smaller of the two with small patches of aboriginal midden visible as well as 20th-century refuse. To the north of this clearing there are many gastropod shells littering the forest floor as well as mounded earth and midden. A little beyond the above-ground features there are two large pits of unknown origin. They are each 4-5 meters across and a meter or more in depth.

The southern clearing has evidence of more intensive use during both the pre-Columbian and historic eras. Throughout the southern clearing there is a relatively significant amount of 20th-century domestic refuse. It is the only place on the island that exhibits any intensive use in recent times. The area is littered with building debris, pane glass, bottles, cans, pots, pans, bricks and even an engine block and an axle. Aboriginal activity, in what is now an open area, was also substantial. Small, circular shell-bearing middens only a few meters across are present as well as a midden ridge that runs the distance of the opening on the west side of the clearing. Off of its northwest corner, the ridge raises to approximately 1.5 m in height. A looter’s pit was dug into the ridge near the highpoint and revealed a profile of dense oyster midden with some pottery near the rim of the pit that was discarded by the looters.

The USDA (USDA Natural Resources Conservation Service 1996) soil survey describes Richards Island as being comprised of two main soil types: Zolfo series sand along the main spine of the landform, and Myakka series muck across much of the surrounding, low-lying areas, including the northeast and southwest arms of the island. Both soils are deep, poorly drained marine sediments that formed in thick, sandy beds. The soil descriptions reported by the USDA soil survey are inconsistent with what was encountered in subsurface testing on Richards Island. The intact soils encountered in subsurface testing consisted mostly of fine light gray to brown well-drained sand with a nearly ubiquitous yellow brown sand substrate. The largest variation in soil types tended to occur in anthropogenic deposits. These deposits contained much darker soils with high organic content, and often dense deposits of marine shell.

Previous Research

The first record of the archaeological deposits on Richards Island was provided by Alan Dorian (1980) in an unpublished report detailing a cultural resource survey carried out by the Interagency Archaeological Services for U.S. Fish and Wildlife Service. Dorian reported Richards Island as a single site (8LV137) with the Florida Master Site File but was unable to fully survey the entire island due to time constraints and inclement weather. Because Dorian was unable to examine the northern part of the island, the site limits were not adequately established in his report. The northernmost limit of the pedestrian and limited subsurface exploration terminates at the large clearing located at the southern end of the main ridge. Dorian also observed a shell ridge running north/south along the length of the clearing. Additionally, a looter's pit with hundreds of pottery sherds was noted in the northwest portion of the clearing and human remains were identified as having been displaced by a gopher tortoise burrow south of the looted area. Diagnostic artifacts collected by Dorian are reported to be of Middle to Late Woodland affiliation. In addition, two Late Archaic Orange period sherds were recovered from unknown contexts on the island. In the arm that extends southwest from the clearing, Dorian also observed sparse shell and Woodland pottery along the entire length of the landform.

In 1989, Nina Borremans and a small team of students from the University of Florida conducted a survey that resulted in an unpublished report with minimal information (Borremans and Moseley 1990). Their survey of Richards Island consisted of a single day's pedestrian walkover of the same southern extent of the island that was examined by Dorian (1980) a decade earlier. The diagnostic artifacts recovered pointed to a largely Middle to Late Woodland occupation of the island and failed to report any new findings beyond the earlier report.

SURVEY METHODS AND RESULTS

The goal of survey by the Laboratory of Southeastern Archaeology (LSA) was to examine Richards Island through a series of shovel tests along transects covering the entire landform. This method allowed LSA archaeologists to both relocate the deposits described in previous surveys (Borremans and Moseley 1990; Dorian 1980) and to locate previously unknown areas of archaeological interest for study and comparison.

Using topographic maps of Richards Island generated from LIDAR data relative to the NAVD 1988, three main transects of shovel test pits (T-A, T-B, T-C) were established (Figure 5-2). These transects followed the extent of the dominant upland ridges along azimuths aligned with the main contours of the landform. Five additional transects: T-F, T-G, T-H, T-I and T-J were positioned at 90-m intervals perpendicular to T-B along the main ridge of Richards Island, thus covering the widest portion of the upland ridge. Two final transects, T-D and T-E were sited along small spurs off the northeast arm of the island.

All fieldwork on Richards Island was conducted by the same two-person team intermittently from October 2009 through February 2010, and involved a total of 18 person-days of fieldwork. Shovel test pits (STPs) were assigned sequential numeric designations that were recorded along with azimuth of the transects as well as distance to and number of previous STP. The UTM location of every STP was recorded with a Magellan MobileMapper CX Handheld GPS Receiver.

All material excavated from STPs was passed through ¼-inch hardware cloth. All recognizable cultural material and vertebrate faunal remains was collected from all STPs. Most STPs were excavated to a depth of at least one meter, and in cases where it was still viable and deemed necessary, excavations continued past a meter with a maximum of

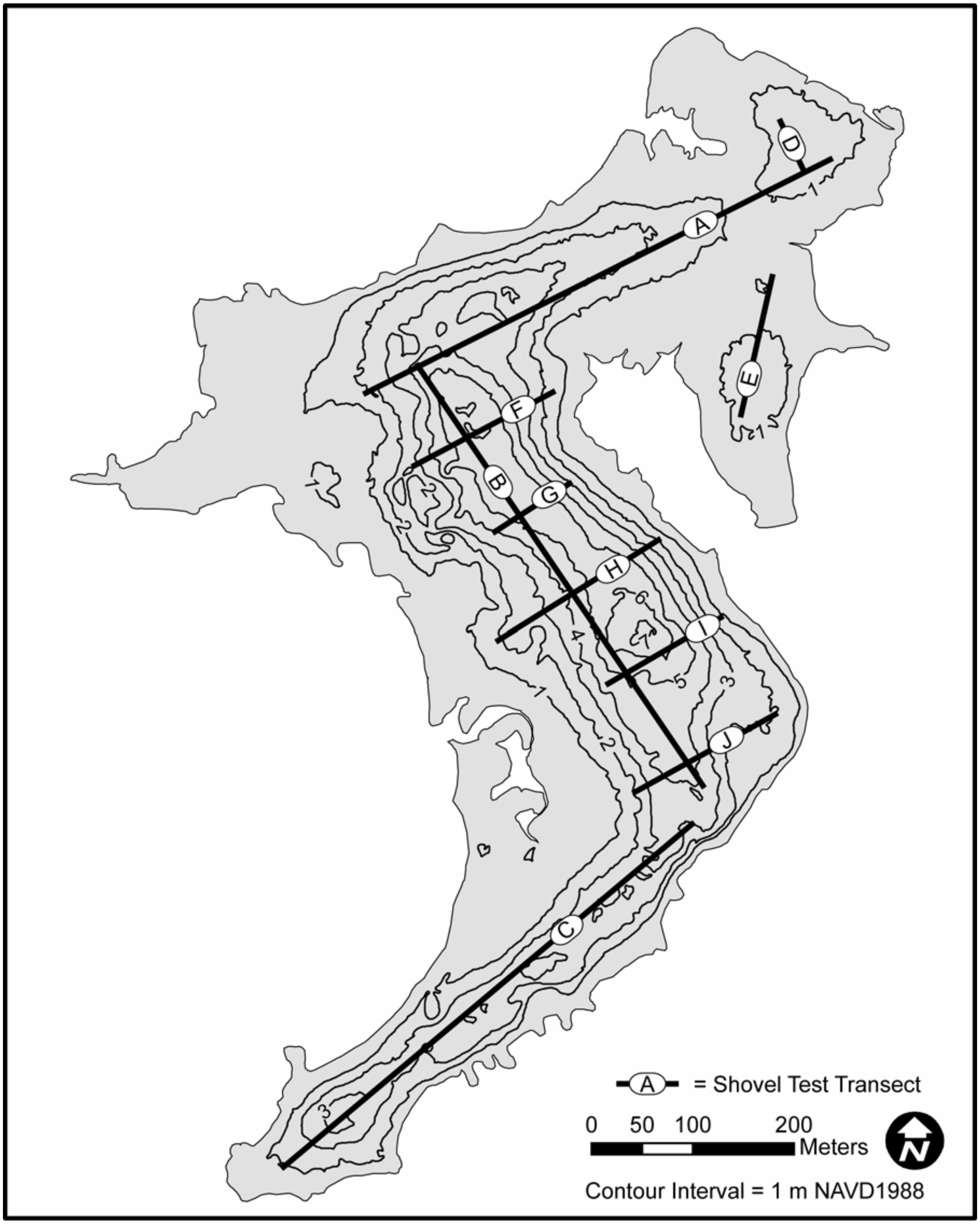

Figure 5-2. LIDAR-generated topographic map of Richards Island showing locations of shovel test transects excavated by LSA archaeologists in 2009-2010 (courtesy of Asa Randall).

Figure 5-3. LSA archaeologist recording information on shovel test pit excavated on Richards Island (8LV137).

1.25 meters. In a few cases, STPs were terminated early due to large root obstructions or water. If the STP was shallow and/or had not already produced cultural materials, it was moved to a nearby spot and restarted. Along transect C several STPs were moved to avoid looters potholes located directly in the line of the survey.

After excavation of STPs, a graphic profile along with notes on the nature and number of cultural materials was recorded on standardized STP forms (Figure 5-3). All cultural materials were bagged and provenience information recorded on the bags as well as on tags inserted in all bags.

Survey Results

During the 2009-2010 survey of Richards Island, a total of 81 STPs were completed, 57 of which yielded cultural materials in the form of artifacts, shell deposits, or both (Figure 5-44). Some of the STPs that were intended to be dug were excluded due to placement in salt marsh or wetlands. Positive STPs were encountered over much of the island with the exceptions of the northeastern arm of land and down slope of the island on the leeward side. During the investigation several above-ground features were encountered, many of which are likely aboriginal features. These features range from small circular middens less than half a meter in elevation and few meters across to larger features of mounded shell and midden. Discovered at the northwest end of the island's main spine was a large, approximately 65-m-diameter circular ridge reaching a height of over 2 m from the forest floor. Adjacent to the northeast edge of the ridge are two mounds of midden of unknown dimensions and origin.

Given the relative density of material, it is unclear whether bounding all positive STPs would be fruitful. In many parts of the island it is likely that bounding would result in a massive number of positive STPs with little knowledge gained other than the presence or absence of archaeological deposits at particular locations. It is unclear how far the site/sites extend into the wetlands. Testing in the wetland and intertidal zones may prove productive in discovering inundated archaeological materials. Due to the fact that Richards Island is so dense in archaeological deposits and there is likely considerable overlap of components and areas of occupation, it might prove difficult to delineate separate sites on the island. Therefore, it would be of little value to assign additional site numbers beyond the existing Master Site File designation of 8LV137 for the entire landform. However, as is described below, it is useful to divide 8LV137 into discrete loci for purposes of comparison.

Most of the diagnostic artifacts recovered during survey indicate intensive occupation during the Middle and Late Woodland periods. Although tentative, three separate loci have been identified based on preliminary results (Figure 5-4). They are identified as separate areas (Loci A, B, and C) based on relative density of material as well as clustering of diagnostic artifacts. The assignment of separate loci are based strictly on initial survey results and will require further investigation to determine if indeed there were discrete episodes and/or areas of occupation during the Woodland period.

Locus A. The northern-most section of the main spine of Richards Island is designated Locus A. A total of 21 STPs were dug in this area in which 16 contained aboriginal artifacts with an additional 4 STPs containing only shell (Table 5-1). The majority of artifacts recovered consists of pottery sherds, of which plain or unidentifiable sand tempered wares comprises 73 percent (by count) of the assemblage (Table 5-2). Besides plain sand tempered sherds from presumably utilitarian pottery, limestone tempered Pasco Plain pottery was the second most common pottery type at nearly 15 percent. Much of the diagnostic pottery belongs to the Weeden Island tradition (Figure 5-5). Diagnostic types recovered that correspond to the Middle Woodland period include Pasco Plain, St. Johns, Ruskin Dentate, Carrabelle Punctate, and a Weeden Island folded rim on a plain sherd. The oldest materials recovered from Locus A were two diagnostic sherds of Deptford Linear Check Stamped pottery, indicating a minimal Early Woodland presence on the island. Lithic artifacts were far less common. Only 26 stone artifacts were recovered in this area, 24 of which are chert debitage, along with one small core and a possible sandstone grinder fragment.

MAP REDACTED FOR SECURITY PURPOSES. CONTACT REGIONAL HISTORIC PRESERVATION OFFICER, U.S. FISH AND WILDLIFE, FOR FURTHER INFORMATION

Figure 5-4. Results of shovel tests and inferred loci (Loci A-C) based on variations in the density and type of cultural material recovered from tests (courtesy Asa Randall).

Table 5-1. Absolute Frequency of Artifacts and Weight of Vertebrate Fauna Recovered from Shovel Tests of Transects in Locus A, 8LV137.

STP #	Sherds (n)	Lithics (n)	Modified Shell (n)	Vertebrate Fauna (g)
9		2		
11	62	4	1	45.8
12	10	2		
13	13			
14	1			
15		1		4.3
16		3		
19	7			
21		8		
22	1			
66	1	1		
67		1		
69	18	1	2	54.3
70	39	1	3	45.0
71		1		
72	1			
Total	153	25	6	149.4

Table 5-2. Absolute Frequency of Pottery Sherds Recovered from Shovel Tests of Transects in Locus A, 8LV137.

			Deptford	Weeden Is.	------------Sand-Tempered------------					
	Pasco	St. Johns	LCS	Plain	Plain	Punct.	Dentate	UID	Crumb	Total
STP#										
11	5	4	1		21		6		23	62
12		2			5				3	10
13					4	1			8	13
14			1							1
19					7					7
22			1							1
66					1					1
69	11				6			1		18
70	6	1		1	21				10	39
72					1					1
Total	22	7	3	1	66	1	6	1	44	153

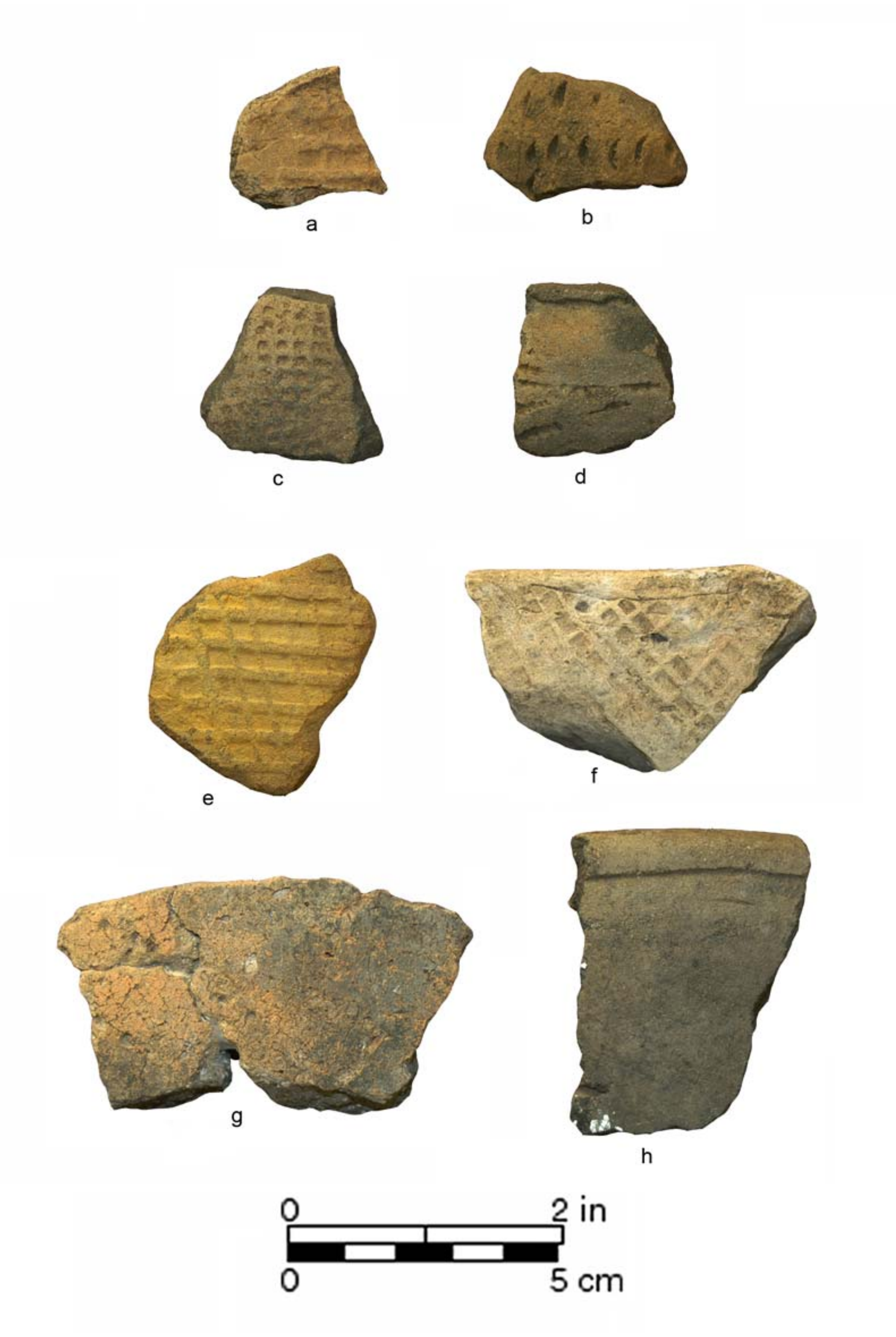

Figure 5-5. Examples of sherds recovered from STPs of transects in Locus A, 8LV137 (a, e. Deptford Linear Check Stamped; b. Carabelle Punctate; c. check stamped; d. Ruskin Dentate; f. St. Johns Check Stamped; g. Pasco plain; h. Weeden Island plain).

Seventeen STPs in Locus A produced marine shell, four consisting of dense shell midden. It was in these dense midden deposits that all of the vertebrate fauna and most of the pottery were recovered. Throughout Locus A, surface evidence of subsurface deposits is apparent. Near STP 11 there are many gastropods, presumably all aboriginal, littering the forest floor. In places where bare sand is exposed aboriginal artifacts are not uncommon. Also located in the vicinity of STP 11 are several large holes and some mounded earth and midden. It is unclear whether these are pre-Columbian or historic-era features, but they are clearly associated with subsurface archaeological remains.

On the western branch of Transect F, STPs 69 and 70 intersected a large above-ground anthropogenic deposit (see contours in Figure 5-2). The feature is roughly arcuate in shape with a central open space measuring approximately 65 meters at its widest point. The ridge reaches a height of over 2 meters along its western margin. Two short ridges of midden are adjacent to the circle in the far northeast corner at STP 69. The ridges are separated by steep bifurcation and may indeed have been a single feature in the past, perhaps a mound. The relatively steep slope and sharp pinnacle atop the ridges may indicate a recent disturbance of the feature. STPs 69 and 70 were dug in the ridges to reveal dense deposits of shell with plentiful vertebrate fauna and pottery. Other than plain sand tempered pottery, Pasco Plain was the second most plentiful variety recovered in these test pits.

To the north of the large shell ridge and approximately 10-20 meters south of the western extent of Transect A there is a possible mound situated near a low marshy area. The feature is roughly 15-20 meters in diameter and rising to no more that 1.5 meters above the marsh (Figure 5-6). No disturbances were observed on or near the mound.

Locus B. Locus B is situated on the central and southern aspects of the main ridge of Richards Island (Figure 5-4). Archaeological deposits in this locus extend down slope to the west close to, and perhaps extending under the tidal marsh that protects the island’s western shore. The densest deposits on the island are located in and near the large clearing at the southern end of the main ridge adjacent to STPs 32 and 33. East and southeast of the clearing the large midden extends down slope to Sand Creek, which runs behind (east of) Richards Island. At the water’s edge dense deposits of shell are exposed and artifacts are easily found eroding out. This midden is the largest deposit on the east side of the island.

Across most of the island there is scant evidence for historic-era use and/or occupation. The large clearing on the south side of the main ridge appears to have been the focus of particularly intensive historic activities. There is significant historic refuse and evidence for architecture in the form of brick, wooden beams, and pane glass. Domestic refuse such as bottles, jars, pots, and pans are also easily seen in the clearing. An old engine block along with other automotive parts is strewn about the clearing.

Figure 5-6. Possible mound in Locus A, 8LV137.

A total of 23 STPs were excavated in Locus B, 22 of which yielded prehistoric materials (Table 5-3). A total of eight STPs contained dense midden consisting largely of marine shell, all of which yielded vertebrate fauna. Plain sand tempered pottery made up the majority of the Locus B pottery assemblage, at 81 percent. This locus expressed far more diversity in surface treatment of pottery than did Locus A. Weeden Island and Middle Woodland surface treatments are again well represented with check stamped, complicated stamp, dentate, punctate, burnished, fabric impressed, cord marked, incised, Weeden Island folded rim all present (Table 5-4). Sand tempered ceramics dominate the assemblage with Pasco Plain and St. Johns sherds present in lesser numbers. Four linear check stamped sherds were recovered in STPs 29 and 31 near the center of Locus B and the highest point of the island. These sherds are likely Early Woodland Deptford artifacts and are perhaps the oldest diagnostic artifacts recovered on the island. Unique to Locus B is the presence of Swift Creek Complicated Stamped pottery. All such sherds of this type were recovered in units between STPs 27 and 36. Diagnostic artifacts recovered indicate that the greatest occupation in the vicinity of Locus B occurred in the Middle Woodland and suggest an early Weeden Island component around AD 200-300.

Table 5-3. Absolute Frequency of Sherds and Lithics and Weight of Vertebrate Fauna and Historic Artifacts Recovered from Shovel Tests of Transects in Locus B, 8LV137.

STP #	Sherds (n)	Lithics (n)	Modified Shell (n)	Vertebrate Fauna (g)	Historic Artifacts (g)
24	7				
25	1	3			
26	15	1			
27	69	1	1	27.3	
28	2				
29	6				
30	3				
31	40			106.7	0.7
32	43	2		0.3	0.3
33	3				
34	31	1		27.3	
35	34	1		56.2	
36	14			0.9	
51	1				
54	27			9.6	
55	30	1		34.0	
56	104		2	45.0	
57	1				
60	1				
61	1				
62	5		4	0.4	
64		1			
Total	438	11	7	308.2	1.0

One of the defining characteristics of Locus B is the presence of several small circular middens located on the main ridge, on the western slope, and with a few partially down slope on the eastern portion of the island. These small middens are fairly discrete and are only a few meters in diameter rising to a height of only about 10-20 cm. These are most visible in the clearing, where leaf litter is sparse. They consist of dense concentrations of shell and dark organic soil containing vertebrate fauna and pottery.

Northeast of the clearing was observed an inactive looters pit that cut into the end of a short ridge of midden (Figure 5-8). The midden was very compact marine shell with pottery. The looted ridge extends to the north for several meters and reaches a height of over 1 meter. Fortunately, the ridge feature has not been heavily impacted by further looting activity. Several other ridged middens were encountered in Locus B. STPs 27 and 56 were both situated atop ridge middens that extended to about a meter in depth. The ridges run roughly east-west, but the length or shape are unknown due to heavy undergrowth. South of the clearing, not far from the midden that extends to Sand Creek, two or three linear ridges run east west from the top of the eastern slope for several meters at heights of approximately 1 meter. STPs 34 and 35 were both placed directly on top of these ridges revealing dense midden deposits of marine shell with artifacts and vertebrate fauna.

Table 5-4. Absolute Frequency of Pottery Sherds Recovered from Shovel Tests of Transects in Locus B, 8LV137.

			Swift	Weeden Is.		---Sand-Tempered---								
	Pasco	St. Johns	Creek	Plain	Burnished	Plain	Punctate	Cordmark	Incised	Ck. St.	Fabric Imp.	UID	Crumb	Total
STP#														
24						3							4	7
25						1								1
26		2		3		1							9	15
27	5		1	2		33	1			3			24	69
28						1						1		2
29						2				1			3	6
30						2				1				3
31		1	3			14				9			13	40
32			1			9			1	1			31	43
33						3								3
34		1	1		1	14	3			1			10	31
35			4			17				3			10	34
36			2			7	2			1			2	14
51						1								1
54				1		14	1			3			8	27
55				2		13	2						13	30
56		2	4			36	3	1	1	4	3		50	104
57						1								1
60						1								1
61						1								1
62						2							3	5
Total	5	6	16	8	1	176	12	1	2	27	3	1	180	439

Figure 5-7. Examples of sherds recovered from STPs of transects in Locus B, 8LV137 (a, s. Weeden Island plain; b. burnished; c, d. punctate; e. irregular rim; f, l, m. complicated stamp; g. Carrabelle Punctate; h. complicated stamp; i. incised; j. Deptford Linear Check Stamp; k. fabric impressed; n. New River Complicated Stamp; o, p. Weeden Island plain; q. check stamp; r. dentate).

Figure 5-8. Old looters' pit northwest of the clearing in Locus B, 8LV137.

Locus C. Locus C spans much of the southwest arm of the island. The archaeological deposits here were first noticed by Dorian (1980) and again by Borremans (Borremans and Moseley 1990) in their surveys of the area. This locus consists of a long peninsula with a maximum elevation of less than 4 meters above mean sea level. All of the testing in this locus was laid out in a singular linear transect (Figure 5-2) that followed the natural contour of the island. No perpendicular transects were necessary in this area due to the relative narrowness of this part of the island.

Archaeological materials were present over much of this locus. Dense midden was located from STP 42 to STP 48 along with fairly dense concentrations of artifacts. It is also in this area of dense midden that the majority of looting has taken place on the island. During testing, several STPs had to be relocated due to the presence of fairly large and numerous looters pits. Some pits were several meters across and perhaps two meters deep. They were concentrated in one area and represent a fairly large investment of time by pot hunters.

The artifact assemblage of Locus C is likewise dominated by plain sand tempered pottery making up 85 percent of all pottery recovered in this area (Table 5-5). The most frequent recognizable diagnostic pottery recovered in Locus C is Middle Woodland period and likely Weeden Island phase (Figure 5-9). Relatively little variety existed in ceramic types in this area compared to the rest of the island. The most common diagnostic is nonspecific check stamped pottery as well as six sherds with Weeden Island folded rims, and traces of St. Johns and sand-tempered dentate stamped (Table 5-6). A possible Deptford Linear Check Stamp sherd is the only diagnostic of the Early Woodland recovered in Locus C. Lithics were more numerous in this locus than any other area tested. Of the 87 stone artifacts recovered in this survey, 41 came from Locus C with 26 of that number coming from STP 47. This single shovel test also contained the only recognizable stone tools in the locus, a micro-drill and a core/tool.

Table 5-5. Absolute Frequency of Artifacts and Weight of Vertebrate Fauna Recovered from Shovel Tests of Transects in Locus C, 8LV137.

STP #	Sherds (n)	Lithics (n)	Modified Shell (n)	Vertebrate Fauna (g)
38	4			
39	3			
40	25	10		0.1
41	6	1		
42	37			0.7
43	56	3	1[1]	31.6
44	23			5.6
45	19			10.3
46	2			1.4
47	65	26	3	14.2
48	10	1	1	6.5
49	5			8.0
Total	255	41	4	78.4

[1]olivella shell bead

Table 5-6. Absolute Frequency of Pottery Sherds from Shovel Tests of Transects in Locus C, 8LV137.

		Deptford	Weeden Is.	-------Sand-Tempered--------				
STP#	St. Johns	LCS	Plain	Plain	Ck. Stmp.	Dentate	Crumb	Total
38				4				4
39				3				3
40				11	2		12	25
41				3			3	6
42			2	19	1		15	37
43			4	21	1		30	56
44		1		12	2		8	23
45				5	11		3	19
46				2				2
47	1			39		2	23	65
48				5			5	10
49				5				5
Total	1	1	6	129	17	2	99	255

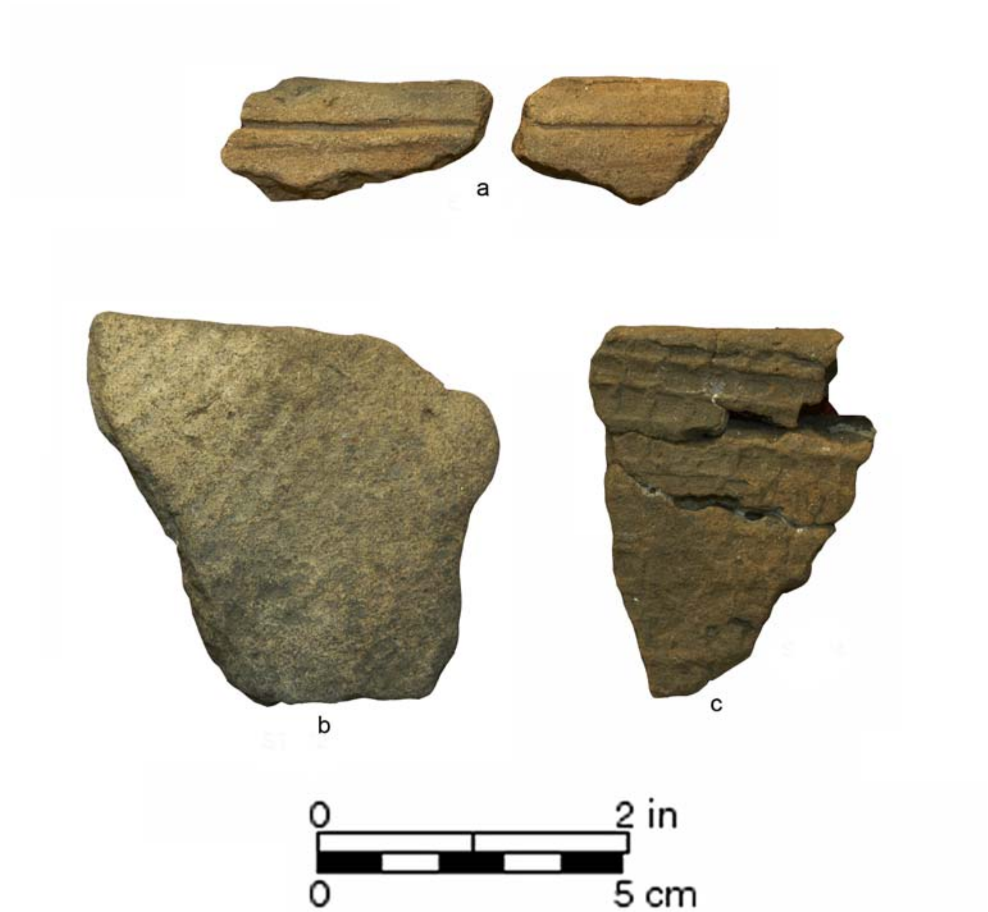

Figure 5-9. Examples of sherds recovered from STPs of transects in Locus C, 8LV137 (a. Weeden Island plain; b. eroded check stamped; c. Deptford Linear Check Stamped).

CONCLUSION

The shovel test survey carried out by the Laboratory of Southeastern Archaeology provides the first systematic survey of the archaeological deposits of Richards Island. The survey revealed three loci of activity and/or occupations on Richards Island that may represent separate distinct temporal and spatial components occurring primarily during the Middle Woodland period (Figure 5-4).

Locus A, on the northern end of the island, is distinguished by the large arcuate shell ridge near the northwestern shoulder of the island. The distance across the partial ring spans approximately 65 meters and may be the remnants of a Middle Woodland village or special-purpose location. STPs 69 and 70, excavated in the northern section of the ring, revealed dense concentrations of shell midden to at least 90-100 cm below surface and likely continuing to a greater depth below the excavated STPs. Locus A had few diagnostic artifacts that designate anything beyond an intense occupation during the Middle Woodland and possibly Early Woodland periods.

At the southern end of the main ridge, Locus B contains the remains of what was likely to have been the most intense occupation on Richards Island. This locus it dotted with small circular middens and large ridges of shell midden in and near the large southern clearing. During the survey it was not possible to discern any pattern to the ridge middens due in large part to dense vegetation cover. It is clear by the number and size of the above-ground anthropogenic deposits in Locus B that this area was the focus of significant occupation and activity. The larger features may indicate intentional construction of monumental or public structures with the smaller circular middens indicative of single household domestic deposits. Diagnostic artifacts recovered in survey excavation in Locus B indicate an earlier Middle Woodland occupation than those at Loci A or C. All Swift Creek Complicated Stamp pottery (n = 16) was found between STPs 27-36 (Figure 5-4) in Locus B with a diversity of Weeden Island types also being found in relatively high numbers. This locus is also distinctive with the only significant leeward archaeological expression on the island.

Locus C is situated on the southwest arm of Richards Island. This is the most studied part of the island, having now been surveyed on three separate occasions, each reporting essentially similar results. Locus C contains nearly continuous midden that varies in density along the entire length. Perhaps due to its relative ease of access this area has also seen the greatest amount of looting activity. Like Loci A and B, Locus C appears to have had a mainly Middle Woodland occupation represented by the presence of Weeden Island pottery. In this survey, no above ground anthropogenic deposits were observed in what is determined to be Locus C.

The most outstanding features of Richards Island are the above-ground features. They were observed the entire length of the main ridge and ranged in size from small circular middens and low mounds to large ridges and a village size arcuate ring. Preliminary STP testing and observations made in the field have yielded diagnostic artifacts that would indicate that the most significant occupations in all three loci occurred during the Middle Woodland period. Artifact assemblages at all loci were dominated by Middle Woodland pottery and shell deposits of varying intensity and configuration. Lithic artifacts were limited to a total of 87 items, with 26 recovered in STP 47 alone. Only six of the recovered lithic artifacts exhibit what may be some form of modification or utilization, mostly in the form of edge-wear or secondary flaking.

Due to the occasional overwhelming presence of shell in the STPs, modified shell was often difficult to identify. The most common form observed were whelk and conch hammers. This tool form was recognizable by battering on the basal end, as well as presumed hafting holes through the body. Without a more refined strategy to discern what was a tool or not, only 16 shell hammers with both basal battering and haft holes were collected in the survey. Many more shells were recovered that had either battering or holes but were discarded.

The earliest occupation of Richards Island is represented by eight sherds of Deptford Linear Check Stamped. This may represent an ephemeral occupation of the island prior to the Middle Woodland period or simply the older occupations were not discovered or lay buried beneath the larger, younger deposits. Further testing and excavation units taken to sterile soil will likely encounter more evidence of the island's earliest occupants.

CHAPTER 6
CONCLUSIONS AND RECOMMENDATIONS

Kenneth E. Sassaman, Paulette S. McFadden, and Micah P. Monés

Archaeological investigations reported in the preceding chapters are but a modest, initial step towards the long-term and comprehensive study of the Lower Suwannee and Cedar Key National Wildlife Refuges. In this concluding chapter we review the most salient findings of this initial phase of fieldwork, and follow with recommendations for the next phase. Despite the tentative nature of many of the observations discussed in sections that follow, an inescapable conclusion resulting from this first phase of research is that the archaeological potential of the refuges and its various inholdings is substantial.

REVIEW OF INVESTIGATIONS

Our review of LSA investigations in 2009-2010 is structured by the three-part project design outlined in Chapter 1: *reconnaissance*, *rescue*, and *research*. To a large extent, the results of our reconnaissance and rescue efforts guide our developing research agenda because they each reveal patterned variation, including evidence for change, that begs further investigation. As with most archaeological projects that venture into areas that are poorly known, this project has generated much new information and many new ideas, even in its infancy.

Reconnaissance

Reconnaissance of terrestrial portions of the project area was initiated with full-coverage survey of Richards Island. The primary objective of reconnaissance survey is to examine areas that are unknown archaeologically. It is also directed toward locations where sites are known to exist but have yet to be sufficiently investigated to determine site boundaries, depth of deposits, and other properties. Richard Island is a good example of a refuge property that fits both of these criteria: it was surveyed twice before and a site was designated (8LV137), but subsurface tests were not conducted and much of the island was never inspected. As with many sites with shoreline exposures, Richards Island has been known to archaeologists primarily by the midden eroding at the south end of the island. That aspect of the site—clearly significant and in need of rescue—is but a small component of an expansive, complex archaeological resource.

Results of shovel testing across the entire upland unit of Richards Island shows that subsurface archaeological deposits are distributed virtually everywhere except the northeast arm of the island. What is more, above-ground features consisting of mounded shell, refuse, and possibly sand are found across much of the island. Apparently, the density and diversity of above-ground features at Richards Island are not all that uncommon in the greater Shell Mound area north of Cedar Key (see *Research* section below).

Variations in the pottery associated with subsurface midden and above-ground features across Richards Island reveal three loci of activity and/or occupations that may represent distinct, if overlapping, components of the Woodland period. The arcuate above-ground feature of Locus A (north end of island) produced mostly plain sand-tempered pottery, but also a number of sherds with limestone temper (Pasco), as well as traces of St. Johns Check Stamped, and a plain, sand-tempered rim sherd with a Weeden Island fold. Several factors intervene in any attempt to infer the age of this "ring-like" feature based on this small sample. Indeed, only two shovel tests have been dug into this feature. One (STP 69) produced mostly Pasco pottery; the other (STP 70) also produced Pasco sherds but a greater number of sand-tempered plain sherds, the aforementioned Weeden Island rim sherd, and a St. Johns Check Stamped sherd. Because Pasco pottery appears to date as early as 2000 B.P. in the study area (see Little Bradford summary below), the onset of arcuate-shaped shell accumulation at Locus A may actually date to the early Deptford era, perhaps earlier. Sherds recovered from the second test pit suggest a younger age estimate for this aspect of the feature, even post-dating A.D. 750 if the St. Johns sherd is crossdated literally. We hasten to add, however, that the age range of this type and all others in the study area are uncertain, and it will take many stratigraphic sequences and associated radiometric assays to establish their chronology. It is nevertheless noteworthy that another portion of Locus A, some 100 m north of the "ring," contained a variety of pottery types, including check-stamped sherds of probable Deptford affiliation, as well as presumably later wares. On balance then, it would appear that Locus A witnessed repeated use over much of the Early and Middle Woodland periods (ca. 500 B.C. to A.D. 750), but the arcuate accumulation of shell likely dates to the earlier end of this time span.

One additional note about Locus A is the possible mound situated near a low marshy area at the northwest corner of the upland unit. Shovel test transects did not intercept this feature and it may be ill-advised to dig into it because of the potential for human interment. A program of small-diameter coring may be sufficient to determine if in fact this feature is aboriginal and to characterize its composition, stratigraphy, and age.

Locus B on Richards Island consists of the south-central portion of the spine of the landform. Subsurface midden and low-relief above-ground features are distributed differentially across this area, with possible segregation among certain components. Locus B is the only portion of Richards Island to yield significant numbers of Swift Creek sherds. These are concentrated in the northern part of the locus and may be associated with low circular midden-mounds and east-west oriented midden ridges of uncertain length and composition. To the south of this area are found greater numbers of Weeden Island sherds in midden ridges proximate to the shoreline fronting Sand Creek. Taken together, the results of shovel testing in Locus B suggests that the area was utilized intensively—presumably for habitation—over the Swift Creek and early Weeden Island periods, ca. A.D. 150-400, with a possible trend for increasingly southern use of the landform over time. It bears mentioning that Pasco pottery was restricted to a single test pit in Locus B. It is also noteworthy that midden on the upslope portion of this locus is oriented towards the gulf (west) side of the island; although archaeological remains extend easterly toward the leeward side of the island, the density of both midden and artifacts is sparse compared to that of the windward side.

Locus C, along the southwest arm of the island, is a continuous midden deposit of apparent Middle Woodland age. In some areas dense midden with abundant vertebrate fauna and pottery extends more than a meter below the surface. Old looters pits are concentrated in such deposits but it appears doubtful that the efforts of these illicit diggers were rewarded because whole or elaborate artifacts are rare to nonexistent. Plain sand-tempered sherds were dominant in all but one of the 12 test pits with pottery, comprising 85 percent of the total Locus C assemblage. Estimating the age of these midden deposits beyond a generic "Woodland" timeframe is difficult with so few decorated sherds. A few Weeden Island folded rims provide tentatively more precise timing, presumably post-A.D. 200. This estimate may be supported by the absence of Pasco pottery in Locus C, if, that is, Pasco pottery did not extend into the Weeden Island period, as is presumed but not yet documented locally. Contrasted with the relative abundance of Pasco sherds from Locus A, its virtual absence from both Locus B and Locus C may portend a shorter lifespan for Pasco than imagined.

In sum, Richards Island holds a nearly continuous anthropogenic deposit across its upland unit, and several of its above-ground features, as well as subsurface midden in excess of one meter deep, attest to very intensive occupation during the Middle Woodland and possibly Early Woodland periods. Divisions of this more-or-less continuous archaeological site into more specific components (and possibly distinct site numbers) must await further testing. The method of shovel testing used in this reconnaissance survey proved to be successful in documenting the island-wide distribution of subsurface deposits. This method was equally effective in gathering information that enables us to recognize that northern and southern halves of Richards Island hold evidence for somewhat different sequences and activities. Additional shovel tests will improve the spatial and temporal resolution of these vast archaeological deposits, but nothing short of secondary testing, such as that employed in "rescue" operations, will provide the context needed to achieve analytical resolution commensurate with the goals of this project. Reconnaissance is an important first step in locating and documenting sites, but additional investigations are necessary to develop their significance for research, the primary rationale for federal protection.

Rescue

Our initial phase of "rescue" work focused on two sites located in the delta of the Suwannee River: Cat Island (8DI29) and Little Bradford Island (8DI32). This area is hardly unique in its inventory of vulnerable sites, but adding to the ravages of natural destructive processes is the erosion of wakes from boat traffic in and out of the river. The area is likewise distinct from others in the greater study area because of its output of freshwater and sediment, the latter contributing to complex relationships between aggradation and sea level change. The erosion of these sites is enough to remind us of the dynamic nature of the delta environment, but they also provide a strong reminder that the relationships between any two forcing variables, such as climate and sea level, will be mediated by local factors, such as delta progradation. Our initial effort to salvage information from eroding sites in the delta reveals variations in the composition of midden that may be useful in identifying some of these mediating factors.

Patterned variations in the results of 1 x 2-m test units at Cat Island and Little Bradford are evident. In four units excavated (two at both sites) we observed three different sequences. Units at Cat Island alone revealed marked variation, while those of Little Bradford were similar to each other but unlike either sequence observed at Cat Island. Absolute age estimates were obtained from charcoal collected from the basal shell-bearing stratum of each unit. Calibrated age estimates of ca. 2500 B.C. and A.D. 650 from units at Cat Island are complemented by a pair of estimates in the range of A.D. 20-280 from Little Bradford. We thus have preliminary “snapshots” of early, middle, and late occupations of the delta over more than three millennia.

Bearing in mind the limitations of such small, preliminary samples, we find promising indications that delta sites such as these encase good evidence for changes in midden composition. For instance, increases are evident in the frequency of Carolina marsh clam (*Polymesoda caroliniana*) through time. Shell of this species comprises less than 5 percent by weight of total sampled shell in the 2500 B.C. stratum at Cat Island, but around 60 percent in the ca. A.D. 650 stratum only 16 m away. Dating to an intervening period of ca. A.D. 20-280, basal strata at Little Bradford express relative rates of Carolina marsh clam of about 30 percent. Thus, over a 3000-year period, this brackish water species goes from insignificant, to moderate, to dominant in the samples examined thus far.

It is hard to imagine that this change in clam frequency was independent of rising sea level, but the relationship is not likely to be direct. Carolina marsh clams are brackish water species, and thus depend on the input of freshwater from rivers or springs to maintain conditions under which they can thrive. Indeed, the species has not been observed in abundance at any of the middens we have visited at sites away from the mouth of the Suwannee. It is a consummate estuarine species and thus a good barometer of changing salinity, marsh aggradation, and intertidal conditions. It follows that if rising seas since, say, 2500 B.C. caused saltwater to transgress over freshwater regimes, the local availability of brackish water species like the Carolina marsh clam would wane through time. That we observe the opposite pattern suggests that either cultural factors intervened to undermine a direct connection between ecological availability and human selection and/or salinity conditions were not in lock-step with rising seas. As regards the latter, possible intervening factors include: (1) increases in the rate of freshwater input from the river; and (2) aggressive progradation of the delta. Both factors would have contributed to estuarine development by introducing processes that outpaced and thus superseded rising sea level. (Incidentally, the relatively small size of the Suwannee delta compared, for example, to the Mississippi River, minimizes the potential that subsidence has itself outpaced aggradational processes and thus accentuated coastal flooding). In addition, possible regression of seas within an overall rising regime must be considered, as we discuss in the *Research* section below.

In interpreting the results of rescue operations, we are sensitive to the fact that samples of eroding midden come largely from the “back” edges of deposits that have been truncated by a regressive front. That is, samples may be biased towards deposits that accumulated on the landward side of near-shore middens. Likewise, the upper portions of some deposits may have been truncated by surging water. The same storm event(s) that left mantles of bedded sands at both Cat Island and Little Bradford appears to have scoured the surface, removing an unknown portion of overlying midden. Given these potential biases, it is imperative that we not overextend the interpretive potential of rescue samples. For now we should be safe in assuming that the samples represent data points on the age and location of anthropogenic deposition, as well as records of change over time using standard stratigraphic principles. To the extent we are able to acquire good age estimates of the upper, as well as basal portions of deposits, we are able to make inferences about the time span involved, again sensitive to the potential for the loss of younger deposits that may have been truncated.

Other aspects of site formation must be investigated before we attempt to infer changes in environment from changing archaeological patterning. We are probably safe to assume that the materials we salvaged from sites such as Cat Island and Little Bradford are “midden” materials, that is, an outcome of the procurement, consumption, and disposal of matter (including tools) associated with biological sustenance. However, middens often express intersite and intrasite variations that have little to do with long-term environmental change (e.g., primary versus secondary midden, or seasonal midden). The same can be said for variations in human activities that mediate the time-space relationship between procurement and disposal; we simply cannot assume, for instance, that all shell disposed in middens was harvested from nearby beds. We must be mindful, too, that the middens we have sampled to date each contained multiple human interments. Certainly the interment of humans in mounds in the study area provides contrast with “midden” burials such as these, but the existence of this alternative mode of burial does not lessen the likelihood that interment in middens was likewise attended by practices that affected the location, composition, and structure of accumulated shell. Midden may not often be *only* midden.

Finally, our sampling strategy may need some adjustment to accommodate the complexities of site formation for even small remnants of sites. The results of Cat Island remind us that shell midden often accumulates horizontally, as well as vertically. Had we located our two units only 10 m to the west we would have missed the Late Archaic deposits and thus missed the chance to collect data conducive to the study of change. Shell midden deposited only 16 m apart and lying at roughly the same elevation marked the end points of a 3000-year period. Clearly additional testing is warranted to not only determine if our data from each stratum is replicated by coeval samples, but also to determine the stratigraphic relationship between the two deposits. Given the length of time involved, we are likely to find either a long hiatus in the accumulation of midden or a stratigraphic unconformity, such as a scouring event that truncated the earlier deposit. At Little Bradford, in contrast, generally similar results from the two units (including roughly similar basal age estimates) encourages us that single components can sometimes be “rescued” effectively with a pair of test units. This is not to say that our units captured the full range of variation encased in the midden remnant, only that we observed nothing to suggest that additional tests are necessary before we consider the samples worthy of further research.

Research

Our discussion of reconnaissance and rescue results has already touched on a series of research issues that have arisen directly from field observations. Here we simply reiterate the four guiding research topics outlined in Chapter 1 with attention toward the emerging potential for research that our preliminary observations enable.

Environmental Change. It is axiomatic that local environments changed over the course of human occupation in the study area, and it is equally evident that changes in local environments were affected by global-scale climatic processes. Those truisms aside, the relationships of global climate to local environment and human history are matters to be investigated, not assumed, if we are to reach any semblance of understanding of what it was like to live through environmental change and how such experiences shaped perceptions of change and thus motives for intervention. In keeping with the overall theoretical orientation of this research, we are interested in developing perspectives on environmental change that are scaled at the level of actual human experience. We acknowledge that the archaeological record is not usually considered to be conducive to such observation or inference, but we recognize too that perspectives on the interpretive potential of the archaeological record have changed over the years as new questions were asked and new technologies expanded the scope of observation.

A great deal of environmental data is needed to even begin to outline human experience with change in the study area. Ideally, baseline data on changing environmental conditions should be developed from observations independent of the archaeological record. That is, changes in air and water temperature, precipitation, freshwater streamflow, salinity, sedimentation, sea level, and climatic events (e.g., hurricanes, droughts) should be inferred from depositional records outside of archaeological sites. Archaeological deposits clearly provide abundant information on such change, but only indirectly, as they formed through mediating human actions and postdepositional processes. Of course, archaeological deposits encase the evidence we seek on human experience with change, but we have to guard against the potential for circular reasoning that comes from using archaeological evidence as both the proxy for environmental change and the human response to such change.

We have yet to initiate the collection of independent data on environmental change but propose that it begin with coring of marsh sediments in the immediate vicinity of sites for which we are collecting samples from archaeological middens. A program of coring along transects perpendicular to the coastline such as that employed by Wright et al. (2005) may be effective at smaller scales of analysis. As regards delta formation, which was a main objective in the Wright et al. (2005) study, basic stratigraphic data are needed to establish the timing and sequence of marsh aggradation across transgressive fronts. Associated proxies for salinity, water temperature, turbidity and the like are needed to draw distinctions between regional or larger-scale climatic factors and local depositional processes. Equally important is the development of data from locations outside the area of delta formation, mindful that local siliciclastic sediment sources (e.g., paleodunes) will contribute to variations in the rate and magnitude of marsh aggradation. Oyster reef formation is another variable that needs to be investigated.

In the absence of independent data on environmental change, we remain cautious in attributing changes in archaeological midden to climatic variables alone. As we have described in this report, preliminary observations indeed show significant changes in the composition of shell midden, notably the increased incidence of Carolina marsh clam over time. Measurable changes in the use of certain boney fishes, oyster, hard clam, and various gastropod species are expected too as sampling expands to other sites. The likelihood of environmental causes for such change grows as coincident sequences are replicated across a variety of microenvironments. Thus, irrespective of independent evidence for environmental change, we must strive to collect as many samples as possible from as diverse settings as possible. Chronological controls are needed for each sequence sampled, and each sequence needs to be replicated at least once in coeval samples.

As we continue to develop local benchmarks for environmental change, we can begin to compare our emerging data to models established elsewhere along the Florida gulf coast. Foremost are models developed from research in southwest Florida by personnel of the Florida Museum of Natural History (Marquardt 1992; Walker and Marquardt n.d.). The approach to this ongoing research has been to compare archaeological patterning to models of climate change derived from field studies conducted far and wide. Assuming that local climate and sea level are influenced by global- or hemisphere-scale processes, proxy data from across the northern Atlantic are considered applicable to southwest Florida. In particular, Walker (1992, n.d.) and Marquardt (2010a, 2010b) have championed the use of Danish beach ridge records developed by Tanner (2000) to model changes in sea-level and climate for their study area. They argue rightfully that the 50-year resolution of Tanner's sea-level curve is conducive to monitoring human response to rapid climate change. A variety of ancillary studies from across the north Atlantic region bolster their claim for large-scale "teleconnections" in climate and sea level (Walker n.d.).

Figure 6-1 provides a simplified version of Tanner's (2000) sea-level curve and the climatic sequence Walker (n.d.) has proposed to help explain major changes in Calusa history. She identifies four periods: (1) Roman Warm Period, A.D. 1-550; (2) Vandal Minimum, A.D. 550-850; (3) Medieval Warm Period, A.D. 850-1200; and (4) Little Ice Age, A.D. 1200-1850. These changes in climate correspond with changes in sea level, with warm periods enabling episodes of transgressive seas, and cool periods episodes of regressive seas. Importantly, variation in sea level, and presumably climate, are apparent within each of these four periods, according to Tanner's proxy data, a point to which we will return below shortly.

Some of our preliminary data from the Lower Suwannee region can be reconciled with the model Walker proposes, but contradictions between the two are striking.

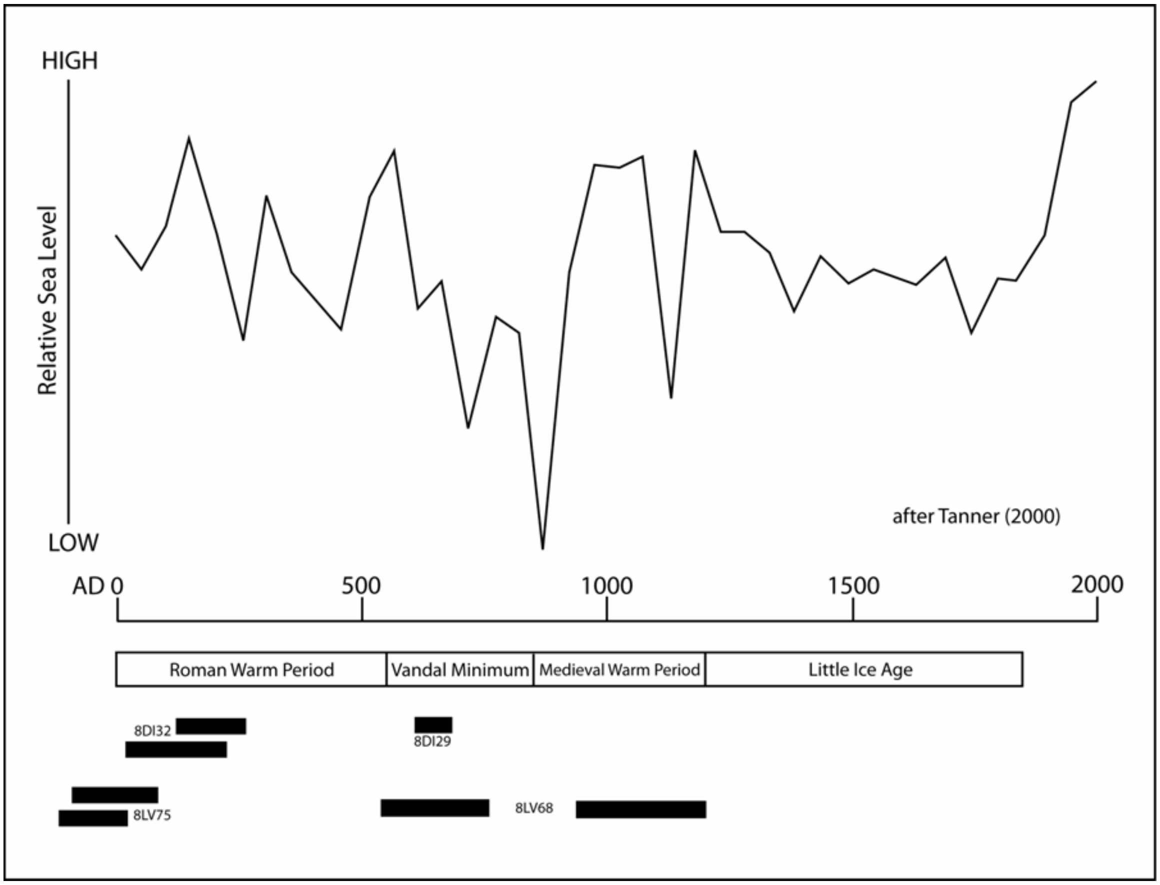

Figure 6-1. Graph showing proxy measure of relative sea level after Tanner (2000) and climatic periods recognized by Walker (2011) as influential in Calusa history. Two-sigma calibrated date ranges for sites investigated thus far by the LSA (8DI29, 8DI32, 8LV75) and a site on Seahorse Key (8LV68) investigated by Borremans (n.d.).

Among the contradictions is the occupation of Little Bradford Island (8DI32) at A.D. 20-280. This period spans the first half of the Roman Warm period, when sea levels were not only relatively high, but, according to studies by Stapor et al. (1991) and Walker et al. (1995), some 0.6-1.4 m higher than the 20th-century mean (known in these studies as the "Wulfert High," ca. 50 B.C. to A.D. 550). As we reviewed in Chapter 2, rigorous debate surrounds claims for higher-than-present sea levels along the Gulf coast, and the study by Wright et al. (2005) at the mouth of the Suwannee found no support for such claims. Our admittedly limited data from Little Bradford corroborates the results of Wright et al. (2005): during the time midden (and burials) began to accumulate at the site, sea level had to have been at or below present elevation. The base of the midden rests on sands only a few centimeters above high tide. Sea level during the A.D. 20-280 interval may very well have been at current levels during that time, but clearly not above.

In contrast to occupation of low-elevation landforms such as Little Bradford Island, occupation of paleodunes in the study area lends some credence to the hypothesis that higher elevations were attractive to local residents during times of rapidly rising sea. We have yet to collect radiometric samples from the occupations of Richards Island, but we recently acquired some age estimates for an occupation at another of the relict dunes in the Shell Mound area, Deer Island. Shown in Figure 6-1 as 8LV75, a ring-like feature at the north end of Deer Island accumulated in the range of 180 B.C. - A.D. 80. This period is widely acknowledged as an era of rapid and marked sea level rise (see Walker n.d.), even before the onset of the Roman Warm Period shown in Figure 6-1. It follows that use of elevated landforms may have been precipitated by rising seas, although we hasten to add that occupation of Little Bradford during the latter half of this interval causes us to question the magnitude and rate of rise, at least for the delta area. We will have to test low-elevation landforms in the Shell Mound area and elsewhere to see what the effect may have been away from the area of delta formation.

Judging from the results of limited testing by Borremans (n.d.), occupation of one of the low-elevation locations on Seahorse Key spanned two of the climatic periods of Walker's model. As shown in Figure 6-1, age ranges on four C14 assays from two test units at 8LV68 are divided into an early component (A.D. 520-760) coincident with the Vandal Minimum, and later component (A.D. 940-1200) coincident with Medieval Warm Period. Without additional information on these tests, we cannot comment on the extent to which changes in the composition of midden, if any, correlate with lower and higher sea-level stands, but it would appear safe to suggest that if the climate changes of Walker's model apply to sea level fluctuations and attendant ecological changes in our study area, the record at 8LV68 ought to be instructive.

Finally, the Weeden Island II occupation of Cat Island (8DI29) provides the best possible concordance between midden composition and sea-level change as modeled by Walker (n.d.). As noted earlier, the increased use of Carolina marsh clam over the preceding Deptford and Late Archaic periods is counter-intuitive if we model sea level as rising gradually and irreversibly over time and we assume that midden accumulated from only local procurement. An age estimate of ca. A.D. 650 taken from charcoal of the Weeden Island II component at Cat Island places the occupation in the Vandal Minimum period, coinciding, it would appear, with a trend toward falling sea level. If indeed sea level dropped over this time, seaward advances of the freshwater plume from the Suwannee River likely occurred, enabling brackish water species like the Carolina marsh clam to flourish farther away from the current coastline.

In closing this section two additional points bear mentioning. First, synchronization among the various chronologies of archaeological and environmental data is absolutely essential to any inference about the cause and effect of climatic change on human communities. The AMS assays we have listed in this report have been corrected for fractionation and then calibrated by our laboratory of choice, Beta Analytic, Inc. (see Appendix B for details). All of our assays were taken from samples of wood charcoal, the standard for radiocarbon dating, and thus corrections for fractionation were no greater than 20 radiocarbon years. Those acquired by Borremans (n.d.) were run on marine shell and only half were corrected for fractionation based on the C13/C12 ratio. The other half of her assays were corrected by simply adding the average fractionation correction to the standard age estimate, in this case 390 radiocarbon years. The chronology Walker (n.d.) employs in the climatic model outlined above apparently was constructed from assays that were consistently corrected and calibrated, but that is not at all clear. Walker (n.d.:32) notes rightfully that the differential between radiocarbon and calibrated years over the past two millennia is not all that great, but we suggest that if the goal is to develop reconstructions relevant to the level of human experience—or at least 50-year increments—then it is imperative that we ensure consistency in the reporting and comparison of age estimates, even if correction and calibration provide adjustments of only a decade or two.

Second, in moving forward with efforts to determine how climate change affected human communities, we suggest that climatic records be examined not as periods of relatively warm or cold and wet or dry conditions, but instead as measures of relative stability or instability over a given period of time. Each of the multi-century periods of Walker's chronology is marked by fluctuations in climate that, in the Tanner sequence at least, exceed the boundary conditions between periods. If instead of viewing each period for its modal tendencies, we scored each period for the mean magnitude of change over 50-year increments, we find the greatest variation in the Vandal Minimum and the least variation in the Little Ice Age. Alternatively, if we scored each period for the variance in mean change over 50-year increments, we find the greatest variation in the Medieval Warm Period, and the least variation in the Roman Warm Period. The point here is that the climatic periods outlined for southwest Florida hide internal variations that are pertinent to an experiential understanding of climatic effects on humans. Walker (n.d.) clearly acknowledges the variations within each period but seems to regard the changes from one period to the next as something akin to the regime change of resiliency theory (Gunderson and Holling 2001) or the phase transition of thermodynamics. Rather than reify these periods as regimes or phases in a long-term sequence, we think it best to treat time as continuous and avoid periodization that imposes order where it may not have existed.

Changing Land Use. The ultimate goal of reconstructing the details of environmental change is to determine its relationship to cultural change. Changes in human subsistence are perhaps the most direct consequence of environmental changes that affect the distribution of edible resources, but humans are mobile organisms and they certainly have the capacity to adjust their physical positions and movements in a changing environment to evade major transformations in diet. When major changes in subsistence are documented—not merely foodstuffs but also subsistence technology, practices, and labor—it is important to consider that they arose from the repositioning of human communities across the greater landscape, a consequence itself, in some cases, of environmental change. Moreover, the distributions of humans on the landscape, as well as material traces of their pasts, are themselves structuring factors in land use. Landscapes physically accrue the material outcomes of lives lived, and they also materialize histories constructed from memories that motivate and naturalize subsistence practices.

Research on land use in the study area might profitably be divided into three scales of inquiry: (1) the entire study area; (2) clusters within the study area, as defined in Chapter 2; and (3) sites within clusters. As with research on environmental change outlined above, our observations on land use are very preliminary and must necessarily be regarded as working hypotheses.

Our original field work has been limited to two relatively small areas within the greater study area, so we are hardly in a position to infer large-scale patterns of land use from these limited data alone. However, we have been building a larger frame of reference from a combination of collections research, literature review, and landscape modeling. Considering all available information, we can safely infer that the study area encapsulates a marked range of land-use variation that is somewhat obscured by an overall veneer of pervasive settlement during the Early and Middle Woodland periods, ca. 500 B.C. to ca. A.D. 750. Land use before and after this era of pervasive settlement is evident in more limited distributions of diagnostic artifacts, the earliest clearly victimized by rising sea level.

Despite an occasional early or middle Holocene artifact in private collections we have observed, in situ evidence for settlement of the study area prior to about 5000 years ago has yet to present itself. Of course, much inhabitable land adjacent to intertidal waters has been inundated by rising seas since the late Pleistocene. On the other hand, relict dunes bordered by tidal creeks were somewhat invulnerable to rising sea due to the marked relief of such landforms. At Deer Island we have encountered an elevated stratum of shell midden estimated at 1940-1740 B.C., presumably laid down at a time when the nearby tidal creek (Giger Creek) coursed farther out in gulf waters. The Late Archaic stratum at Cat Island, estimated to date ca. 2800-2400 B.C., was likely laid down when the location was a peninsula. An even older (ca. 3400-3100 B.C.) Late Archaic deposit at Bird Island to the north (8DI52), replete with burials, likely formed while the island was the distal limb of a parabolic dune. That it was reoccupied a millennium later (ca. 2130-1900 B.C.) when nonlocal soapstone vessels were deposited in unusually large numbers may have something to say about the gravity of its mortuary history.

In short, intact evidence for human land use during the Late Archaic period exists in landforms that continue to be reduced by transgression of the sea, and in elevated locations that were adjacent to tidal creeks when sea level was lower. Importantly, the accumulation of shell and associated midden over the course of the Late Archaic period appears to have subdued the effects of rising sea and storm surge by both elevating landforms and by adding matrix that is less vulnerable to erosion than are typical marine sands. This is a process that of course continued in select locales as later peoples added additional shell and other midden materials, or, possibly, built-up land deliberately with midden materials mined from older deposits. The oysters that dominate Late Archaic strata we have observed to date reflect an established maritime economy that continued with variations for millennia afterwards. We can add to this subsistence-oriented land-use pattern the cultural predilections for human interment, and the extralocal processes that delivered substantial mounts of soapstone to the northern Gulf coast from sources over 600 km away. Likewise, we have good reason to suspect that shell accumulation at

Shell Mound commenced during the Late Archaic period. It follows that the positioning and movement of communities during this era entailed more than simply accessing edible resources from locations of inhabitability.

We have too few data for the period between about 1500 and 500 B.C. to infer much of anything about land use patterns at the dawn of the Woodland era. Considering the composition of private collections we have observed, candidates for diagnostic pottery dating to this interval include late fiber-tempered wares, St. Johns plain, Pasco plain, and the ubiquitous sand-tempered plain. The only radiometric assays for this interval are Borreman's dates on marine shell from North Key (8LV65), ca. 1300-50 B.C. The relationship of these assays to diagnostic pottery sherds has yet to be determined. Nonetheless, if most of the sherds of the types listed above truly date to this interval, land use would have thus been pervasive because each of these types, with the exception of the fiber-tempered wares, are found in at least trace frequencies—and often in large quantities—at most sites collected by private citizens.

After about 500 B.C., the accepted onset of the Deptford period (Milanich 1994:114), the human presence across the study area resulted in a dense and diverse array of archaeological remains. The apparent conspicuousness of this record is partly a function of increased visibility over that of preceding settlement, again, the victim of long-term natural forces. But a veritable explosion in settlement may have actually occurred. If the linear check-stamped pottery of the Deptford tradition was accompanied by the limestone-tempered pottery of the Pasco tradition, the landscape of the study area was densely populated.

The relationship between the Pasco and Deptford traditions is important not only for estimates of chronology and demography, but also to establish the contours of cultural diversity that contributed to a burgeoning rituality involving mounds and human interment. As we understand it today, Deptford has a northerly orientation in its history and regional expressions, whereas Pasco traces to the south. Not knowing the absolute chronology of either tradition in the study area, we are ill-equipped to assert which of the two appeared first, if not together, and whether either was brought to the study area by the resettlement of communities from elsewhere. We do know this: while there may be a slight tendency for Deptford-dominant assemblages to be more frequent at sites in the north end of the study area (north of the mouth of the Suwannee), and for Pasco-dominant assemblages to be more frequent to the south, they co-occur far more often than they do not, and often in large numbers. We feel confident that they were used simultaneously at some locations, such as Little Bradford, during ca. A.D. 20-220.

Settlement of the Shell Mound area after about A.D. 1 may have been especially dense. The ring-like midden at the north end of Deer Island (8LV75), dating to about this time, is but one of many such above-ground features in the Shell Mound area. Recent visits to islands in this area by Asa Randall and one of us (Monés) during assessment of the Deepwater Horizon oil spill of 2010 revealed many similar features at several sites, including a complex on one island with numerous arcuate ridges, some several meters tall (Randall et al. 2010). The large horseshoe-shaped ridge at Komar (8LV290; Borremans and Moseley 1990:29) is among those with subsurface samples of Pasco pottery, as is the upper strata of Shell Mound. It is widely assumed that Pasco pottery was used well into the Weeden Island era, post A.D. 200, but with a lack of Pasco sherds at some locations with abundant Swift Creek and Weeden Island pottery (e.g., south half of Richards Island; shell stratum at Cat Island), we may eventually find out that Pasco was actually short-lived locally. Again, if the use of Pasco pottery proves to be restricted to a few centuries, and largely gone by A.D. 300 or so, the density of population in the Shell Mound area in particular was quite high.

The Weeden Island presence in the study area is pervasive and conspicuous. Its Swift Creek predecessor is not so widespread and presumably shorter-lived, ca. A.D. 150-350, while the Weeden Island tradition is presumed to have continued in "evolving" expressions for another millennium. The Yent/Green Point complexes that bridge Deptford with Weeden Island in the Panhandle region likely had parallel expressions in the Swift Creek assemblages of the study area. Unfortunately, the only secure context we have for this time frame is the Little Bradford site (8DI32), a decidedly Pasco/Deptford context. The greater Shell Mound/Cedar Key area would appear to have been the epicenter for the earliest Weeden Island developments in the study area, following on the heels of (and indeed perhaps enabled by) a history of intensive settlement by communities making Pasco and Deptford pottery. Although Swift Creek and early Weeden Island pottery lends greater visibility to land-use practices after A.D. 150, it is the addition of sand mounds to the landscape that signals a fundamental change in "tradition."

At the microscale of land use, this marked change in tradition appears to have been attended by discontinuities in the occupation of particular sites. When we map out the survey results we have from Richards Island, and add the preliminary results from survey of Deer Island, we see a pattern of variation that suggest oldest components are oriented towards the north end, whereas younger ones are more widespread but concentrated to the south. What is more, there may have been avoidance of locations of intensive occupation by prior occupants, even after centuries of abandonment. Most likely these older sites were incorporated into the land-use practices and frameworks of meaning for all who followed, and at times they appear to have been reoccupied, as at Shell Mound itself. But during some intervals of settlement sequences, certain sites may have been taboo for habitation. Groups or individuals may very well have visited these sites regularly, even doing routine chores at them, but there is no evidence yet that ring-like features and other midden ridges of the Pasco/Deptford era were occupied in ways that left the sort of Swift Creek/Weeden Island midden deposits and material culture we find only short distances away on Richards Island.

Patterns of abandonment, relocation, reoccupation, and possibly avoidance underscore the need to maintain a multiscalar perspective on land use in order to differentiate between full-blown transformations in practice and minor adjustments to the short-term changes inherent to any natural or cultural regime. Put another way, we must be able to distinguish between *site* abandonment and *regional* abandonment. As pointed out by Nelson and Hegmon (2001), site abandonment often occurs amongst people able to relocate as a means to alleviate the stresses of sedentary living. This refers not simply to the residential mobility of foragers (*sensu* Binford 1980), but rather the relocation of semi-permanent communities with considerable investment in architecture, nonportable subsistence technology, and improvements to land. It seems reasonable to presume, as in the Mimbres case outlined by Nelson and Hegmon (2001), that an environment of sometimes unpredictable events (drought, flood, freeze, etc.) would foster traditions of periodic relocation to lesson the vulnerabilities of disaster. We can add to that the uncertainty that attends changes in the distribution of communities at larger scales of analysis, and, not insignificantly, the constraints on fissioning that is materialized in the built environments of historical significance.

Built Environment. As we have noted, above-ground features consisting of shell and associate midden deposits began to take shape in the study area no later than 2000 years ago, and possibly much earlier. We are very much interested in determining when all such features began to accumulate, how long they accumulated, the sorts of activities attending their accumulation, and when they were abandoned. Given what we know about Deptford, Swift Creek, and Weeden Island settlement in the greater Gulf coast region (e.g., Stephenson et al. 2004), above-ground features in circular or semi-circular arrangements were the de facto result of life in the round. That is, they are believed to be the results of a community plan whereby domestic structures were arranged in a circle around an open area ("plaza"). Midden accumulation, in this scenario, was gradual and at first patchy, accreting discretely adjacent to each structure on the outside of the compound. Given enough time, individual household middens blended into more-or-less continuous ring-like middens. However, as big and as regular as they may be, Swift Creek and Weeden Island circular villages documented elsewhere did not usually express the sort of topographic relief we see at sites in the study area. Notably, the ones we have been able to document thus far appear to be a bit older, and perhaps closer to the shell ring traditions of the Late Archaic in form, if not also process.

Affinities with Archaic shell rings introduce the working hypothesis that shell accumulated into ridges and arcs in the study area not as gradual midden but, in some cases, as emplaced shell. The sorts of feasts Russo (2010) and Saunders (2004) infer from shell deposition at Archaic shell rings of the Atlantic coast may be implicated, but other possibilities abound, including the construction of windbreaks. Many of the horseshoe-shaped features of the study area are open to the east or southeast, opposite the prevailing winds blowing in from the Gulf. (Indeed, standing inside one at the north end of Deer Island during an approaching storm, the senior author was struck by the calmness of the enclosed space.) Given that many of these features are located on tops of relict dunes and other landforms of considerable relief (such as Richards Island and Deer Island), it seems unlikely that they were constructed to elevate houses above rising water per se (would require 3+ m of rise above present levels), although guarding against storm surge is not out of the question

Hypotheses about the ritual or ideational value of shell ridges are as easy to imagine as those implying practical utility. Without question, some of the accumulations of shell in the study area grew to enormous proportions. Shell Mound itself is a case in point. Its core appears to have accumulated relatively early (>2000 years ago) and perhaps through domestic activities, but was then “capped” by a 1.5-m layer of mostly oyster shell with scant evidence for intensive domestic activity. We do not know if human interments were emplaced in this particular stratum, but the mound in general is known to contain burials. Although some have suggested that the horseshoe-shaped form of Shell Mound was the outcome of mining that removed its central core, multiple lines of evidence suggests otherwise. Most notably, the field notes of Tallant kept at the South Florida Museum in Brandeton indicate that the center part of the mound was not only open as it is today, but was also the location of a sand mound.

The mounds of Cedar Key attest to a scale of shell (and sand) accumulation unmatched in the study area and perhaps even greater than the mounded landscape of Crystal River (Pluckhahn et al. 2010). Despite the widespread destruction of these features in the growth of the town of Cedar Key, historic references and maps can be integrated to model what the landscape may have been like before the first excavation (Chapter 2; Randall et al. 2010). We also know from early descriptions of bank profiles and roadcuts that shell mounds at Cedar Key were nicely stratified, indicative it would appear of multiple, successive, if transformative, episodes over the entire Woodland period.

Other mound complexes across the study area attest to the widespread practice of human interment in sand, but occasionally these were emplaced over shell mounds or other shell-rich deposits. The three mounds at the mouth of the Suwannee River noted by Moore (1918:568) each consisted of sand mantles over shell, one with burials in the sand stratum. And sometimes sand burial mounds were emplaced on midden deposits and then later capped with additional shell midden, such as the Lions Club mound at Cedar Key (Jones 1992).

Virtually all known sand mounds in the study area have been razed, many by looters seeking the pottery, celts, and other accoutrements of Swift Creek and Weeden Island burials. None of the sand mounds may have been more elaborate than 8LV2/7 on Graveyard Island. We know from published accounts and available collections that this was a Weeden Island facility replete with central tomb primary burials, secondary burials, and cached pottery vessels, some containing skulls. One of us (Monés) has tracked down some additional unpublished information and a collection of whole vessels at the South Florida Museum. Matching the elaborateness of the vessels, effigy pots among them, is an inventory of nonlocal goods, including a copper gorget, greenstone celts, and a 9.5 lb cube of galena.

Other mounds in the greater Lower Suwannee region suggest that some sand mounds were established for the express purpose of secondary interment. The best example perhaps is Fowler’s Landing (8LV1). Although it is 16 km up the Suwannee River and thus out of the study area proper, this mound complex reminds us of the likelihood that sand mounds established in places that became either vulnerable to environmental change (notably inundation by rising sea) or abandoned for other reasons may have been literally relocated by disinterring ancestors and reburying them in bundles at new locations.

Ultimately, sand mounds and the Swift Creek/Weeden Island rituality that surrounds them erase any doubt from a modern perspective that coastal dwellers often materialized beliefs about their world and that of their dead in durable form that forever changed the way individuals and groups experienced the landscape. The same is true of above-ground shell deposits, even if they were not emplaced for purposes other than refuse disposal. Inasmuch as sand mantles were often emplaced over shell mounds and middens, the depositional practices of the ancients and those that followed became historically linked. We have seen enough to know that none of the shell deposits of early inhabitants of the study area were likely treated indifferently by those who followed.

Interregional Networks. The last of four research topics outlined in Chapter 1 has benefited the least from fieldwork conducted to date. To a large extent, the study of interregional connections depends on analyses of extant collections, which include virtually all the nonlocal objects known for the study area. Reconnaissance and rescue operations are appropriate for locating and charactering sites, but not terribly conducive to locating those relatively rare items that link the study area to distant places. Of course, the development of a detailed culture history is requisite to any interpretation that links the goings-on of the study area to places far and wide. In the paragraphs to follow we briefly recount some of the evidence that demands greater study of the connections between local and regional histories.

Extralocal connections are evident in the earliest substantial record of human occupation in the study area, that of the Late Archaic period. As noted earlier, Bird Island has a substantial inventory of soapstone vessel sherds, geological sources of which are no closer than 600 km to the north. Private collections from several additional sites in the study area also include soapstone sherds, often in association with fiber-tempered pottery. The only local age estimate on soapstone thus far is from soot on a sherd from Bird Island (Yates 2000). At 3630±70 B.P. (cal 2195-1770 B.C.), this estimate accords well with the chronology of stone vessels and early pottery in the region (Sassaman 2006), but it is a bit early for the extralocal trade in soapstone vessels of the Poverty Point phenomenon of the Lower Mississippi River Valley. Still, western gulf coastal sites roughly this age (e.g., Elliotts Point complex [Thomas and Campbell 1991]; Claiborne [Bruseth 1991]) were arguably implicated in the genesis of Poverty Point exchange (Sassaman 2010:62-63), and we have reason to hypothesize that occurrences of soapstone in the study area were linked in some fashion with this emergent process. At the same time, age estimates for soapstone vessels in the greater Southeast include dates as late as the sixth century B.C. One assay on a sooted sherd from Johns Island at the mouth of the Chassahowitzka River (some 70 km south of the study area) is 2660±40 B.P. (cal 855-790 B.C.), well after the demise of Poverty Point exchange (Sassaman 2006). Thus, at least two distinct processes were involved in the delivery of this nonlocal product to points far to the south of geological sources and sites of manufacture. Coupled with study of the contexts and associations of soapstone vessels at study-area sites, geochemical sourcing data will help to advance insight on the patterns and processes of exchange.

By about A.D. 1, the study area was home to communities who made and used both Pasco and Deptford pottery. As noted above, these two pottery traditions trace respectively to the south and north. It follows that their convergence locally will not be understood without investigating the histories of interregional movement and influence elsewhere. Unfortunately, the Deptford tradition has not garnered as much attention as its counterparts in the Swift Creek and Weeden Island traditions that followed, and the Pasco tradition is even less well known. We certainly do not want to presume that the timing of Deptford and Pasco in the study area conforms to chronologies elsewhere, but it will take many nonlocal age estimates—along with many local age estimates—to reconstruct the sequence of developments. The closest nonlocal Pasco age estimates available are from two sites in the Withlachoochee area to the south. These estimates are in the range of cal A.D. 400-600 (Weisman 1984), a few centuries later than those we have thus far from the study area. As noted earlier, we have reason to suspect that Pasco was not widely used in the study after about cal A.D. 200-300. It will take many more assays to determine if this chronology reflects the differential persistence of Pasco to the south, a time-trangressive trend of use from north to south, or, very likely, an artifact of inadequate sampling. Whatever the case my be, our understanding of the coalescence of Deptford and Pasco traditions at sites in the study area will be requisite to any understanding of the local emergence of the Swift Creek and Weeden Island traditions.

Emergence of the Swift Creek and then Weeden Island traditions raises issues well beyond the chronology of culture change. The local manifestations of these traditions are among the many outcomes of the religious movement known as Hopewell. Nonlocal materials of ritual import (e.g., galena, copper, mica, greenstone), elaborate pottery, and mortuary mound practices serve testimony to connections or influences that ultimately trace to developments in the Hopewell heartland of the Midwest. Beyond these material parallels, the processes and patterns of extralocal connections are poorly understood. Early Swift Creek (ca. cal A.D. 100) in Florida is believed to have emerged in the Panhandle region from Deptford roots in what archaeologists refer to as Santa Rosa-Swift Creek and its Yent-Green Point complex of elaborated burial practices and Hopewell-related sumptuary items. Swift Creek is not generally believed to have extended far down the Florida peninsula, but the study area has more than a trace amount of Swift Creek pottery and a few sites with appreciable assemblages. The age of these components is currently unknown. Regionally, the Weeden Island tradition arose only a century or two after the appearance of Swift Creek culture (ca. cal A.D. 200-300), but its beginnings in the study area are likewise poorly dated. The McKeithan Weeden Island tradition was fully underway in north-central Florida after about cal A.D. 200, as was the Cades Pond tradition that apparently beget the Alachua tradition five centuries later. We thus have not only northern and southern coastal influences to investigate, but also those of interior Florida, notably up the Suwannee River.

Not since the work of Kohler (1975) at the Garden Patch site north in our study area has anyone investigated the connections between interior and coastal peoples of the

Suwannee River valley. To the extent that communities who made and used Alachua cob-marked pottery in the interior either migrated to the coast or interacted regularly with coastal communities, corn agriculture may have factored into local histories as early as A.D. 700. Yet, despite the direct evidence for corn in the cob impressions of Alachua pottery, the degree to which interior groups, let alone coastal groups, consumed corn is a matter than has yet to be resolved. We know, of course, that corn agriculture was significant to Safety Harbor communities of the Tampa Bay region after A.D. 800. But while Safety Harbor sherds, like Alachua sherds, turn up occasionally at many sites in the study area, we have no hard evidence yet to suggest corn agriculture ever made a foothold locally. We are likewise uncertain about later, historic-era occupation of the study area by native peoples, although occasional instances of Leon-Jefferson check stamped, Chattahoochee Brushed, and other contact era wares attest to the Seminole and mission presence known from cryptic historic records.

In sum, the occurrence of nonlocal material culture at sites across the study area, extending back to Late Archaic times, is accompanied by a series of transformations locally, particularly in burial practices and the built environment, that remind us of the intricate, mutually constitutive histories of local and extralocal peoples. As we move forward with research in the Lower Suwannee Survey we must strive to situate local developments in the broader arena of alliances, migrations, coalescences, and diasporas that were played out over vast geographies and varied cultural traditions. We must likewise strive to understand how large-scale and long-term processes were experienced locally, especially considering the unique rhythms and contours of local environments, including the particular histories materialized in mounds, ridges, and other places of enduring visibility.

RECOMMENDATIONS

There is clearly much to be done in the Lower Suwannee and Cedar Key refuges to achieve the level of archaeological knowledge necessary for effective management and preservation planning. Fortunately, much of the needed data on chronology, settlement distribution, and resource use can be developed from field investigations and collections research without extensive excavations and undue impact. However, the relentless forces of nature, as well as sporadic human impacts, continue to diminish the research potential of many refuge sites (and private and state inholdings), underscoring the need to continue "rescue" operations at the most vulnerable locations. In the recommendations that follow, we review the list of sites in need of rescue, and follow with recommendations for ongoing reconnaissance. Our final recommendations entail dimensions of research that will provide the contexts by which the significance of archaeological sites, per federal statute, is established.

Rescue

The list of sites currently eroding at the waters edge and subject to surge damage is long and incomplete. Below are those for which we have at least paid a visit and/or have collections donated by private citizens, who also provided good information on the rate and magnitude of erosion at several sites.

Fishbone Creek (8DI21B and 8DI21C)
Butler Island (8DI97)
Bird Island (8DI52; private inholding)
Cotton Island (8DI51; private inholding)
Shired Island (8DI7)
Big Pine Island (8DI22, 23, 24)
Little Pine Island (8DI64)
Harris Neck North (8DI39B)
Long Cabbage Key (8LV61, 8LV123)
Derrick Key (8LV122)
McCalmory Key (8LV288; state inholding)
Rattlesnake Key (8LV287)
Cedar Point Key (8LV25)
Atsena Otie (East) (8LV15, 8LV417, 8LV418, 8LV434)
Scale Key (8LV268-271)
Dog Island (8LV278)
North Key (8LV65, 8LV66A, 8LV66B
Seahorse Key (8LV64, 8LV68)

All of these sites express shoreline midden deposits that are actively eroding, but many seaward islands in the Shell Mound and Cedar Key areas (e.g., Long Cabbage Key, Derrick Key, McClamory Key, Rattlesnake Key, Dog Island) are especially vulnerable; some may contain only eroded and redeposited archaeological materials. Before committing to test-unit sampling of these scant terrestrial landforms, it would be wise to conduct some limited coring to check for intact deposits. Time is running short for any intact remnants.

Several of the low-elevation sites in the Delta area (e.g., Harris Creek North) express midden in erosional scarps but no midden exposed on landward, terrestrial surfaces. Like sites at Cat Island and Little Bradford Island, these locations may have the same storm deposits that sealed shell middens up to 40 cm deep, concealing remnants of middens revealed at that shoreline. Again, coring or shovel testing will help to establish the existence of intact portions of middens before test units are sited.

A specific proposal for a second round of rescue operations (to be issued to U.S. Fish and Water under separate cover), will entail work at sites in tracts already investigated, as well as expansion into areas yet to be investigated. On the former, we propose testing at Harris Neck North (8DI39B) in the Delta tract and at Long Cabbage Key (8LV61, 8LV123) and Derrick Key (8LV122) in the Shell Mound tract. On the latter, we propose testing at Fishbone Creek (8DI21B and 8DI21C) in the Shired Island tract. In addition, we plan to initiate testing at Bird Island (8DI52), a private inholding for which we have preliminary permission from the landowners.

Reconnaissance

Plans for continuing reconnaissance in the study area have been influenced by the results of site visits precipitated by the Deepwater Horizon oil spill of 2010. In the Shell Mound tract, Randall and Monés (personal communication, 2010) observed complexes of above-ground shell features on several islands, none of which have been adequately documented in previous surveys. Among them is Komar, just to the south of Shell Mound. A UF crew in 1989 paid a short visit to Komar and recorded some information about site 8LV290, a ridged, horseshoe-shaped midden with shell mounds on either side (Borremans and Moseley 1990:29). Randall and Monés verified the presence of the ridge and mounds but also noted additional features. Systematic survey is needed to identify all such features, and shovel tests are needed to establish the below-ground aspects of both these features and intervening areas of the island.

An even more complex array of ridges and mounds was observed by Randall and Monés at Raleigh Island to the north of Shell Mound. Two sites were previously recorded on the island (8LV293, 8LV294), but virtually nothing is known about the extent, depth, and content of either site. Systematic shovel testing is needed to complete the inventory of archaeological remains on Raleigh Island and to begin to differentiate what appears to be dozens of discrete, yet interlocking village middens.

Additional reconnaissance survey in the Shell Mound tract has already commenced at two private inholdings: Deer Island and Clark Island. Both locations house extensive subsurface midden deposits, as well above-ground features, notably a large arcuate ridge at the north end of Deer Island, dated to cal. A.D. 20-220.

Lastly, the Hog Island mounds in the Suwannee Delta (8LV26, 27, 39) have yet to be located. We therefore recommend a directed reconnaissance mission to survey the island complex, first with pedestrian survey and limited shovel tests. Systematic subsurface testing of the entire island complex should await the results of pedestrian survey, specifically the locations of the three mounds (or mound remnants) Moore observed, in order to avoid areas of possible human interment.

Additional, Problem-Specific Tasks

Shell Mound (8LV42) is the largest intact archaeological deposit in the study area and its long-term preservation is ensured through U.S. Fish and Wildlife stewardship. However, we know very little about its age, internal structure, and composition. The early work of Bullen and Dolen (1960) yielded limited information and raised more questions than it answered. We can glean from this work that the upper mantle of oyster shell contains Pasco pottery, plain sand-tempered sherds, and some St. Johns plain sherds. We also know from this work that a stratigraphic unconformity was reached at about 1.5 m below the surface that would suggest the mound summit may have been used for habitation, and that an increase in clam (spp?) points to possible changes in the local environment.

Based on these limited but tantalizing observations, we suspect that Shell Mound may have taken shape well before A.D. 1, possibly even during the prepottery era (i.e., pre-2500 cal B.C.). Repeated surface inspections on casual visits to the mound reveal virtually no pottery. As noted earlier, we have good reason to believe that Shell Mound has not been radically altered by mining in the modern era, so that its horseshoe plan—open to the east—matches the plans we see at Komar, Richards Island, Deer Island, and other sites in the immediate vicinity. In this sense, Shell Mound is the anchor of a complex of similar but smaller above-ground features whose inception in the area extends back at least 2000 years. It follows that Shell Mound is not only key to understanding the development and transformation of the built environment, but it is also possibly the longest sequence of deposition and thus our best site-specific proxy for changing environmental conditions in this locality.

We recommend very limited, strategic testing of Shell Mound to establish its basal age and sequence of deposition in its lower unit. Given the number of side-slope exposures from erosion, tree throws, and limited mining, we expect to be able to record stratigraphy of Shell Mound without having to sink a test unit into intact upslope or summit deposits. In our work on shell mounds in the middle St. Johns region of northeast Florida this approach has been dubbed "profile facing." The method involves the placement of a 2 x 2-m unit at the base of an erosional escarpment (typically resulting from mining in the St. Johns), situated sufficiently into the sideslope to enable a vertical profile of the bottom 1-2 m of mound fill. The unit is then taken down incrementally to expose subsurface deposits. A 50 x 50-cm column of bulk samples is taken from one of the sidewalls after profiles are photographed and drawn. All removed fill from level excavation is processed on site with ¼-inch hardware cloth, but bulk samples are returned to the lab for fine waterscreening to provide good materials for dating, subsistence reconstruction, and paleoecological proxies.

Coupled with limited testing at Shell Mound, we propose analysis of the extant collections from the "other" Hog Island (a.k.a. Graveyard Island, Palmetto Island, Rattlesnake Island, Pine Island, and Pine Key [Mitchem 1999:7]), to the immediate west of Shell Mound. A burial mound on Hog Island (8LV2/7) has been severely impacted by antiquarians and looters, and there may be little left of this once impressive feature. We know from historical accounts of the mound that it contained human interments and artifacts of Swift Creek and Weeden Island age. A large assemblage of pottery from this location is curated at the Florida Museum of Natural History. Museum ceramicist Ann Cordell sorted this assemblage into vessel lots years ago and now Curator Neill Wallis is analyzing some of the pottery as an extension of his established research on Swift Creek exchange and ritual (Wallis 2011). An undergraduate at the University of Florida has expressed interest in working with the Weeden Island pottery in this collection, and Wallis and Cordell have expressed support and offered assistance with this project. In addition, one of us (Monés) has tracked down an assemblage of pottery from 8LV2/7 that was unearthed by Montague Tallant in the middle part of the last century. The collection housed at the South Florida Museum in Bradenton includes notes and photographs of Tallant's excavations.

Finally, efforts to develop independent data on environmental change must commence soon. We propose in the near-term future a program of geological coring in areas adjacent to archaeological deposits to develop fine-grained profiles of changing shoreline and near-shore conditions. Basically, we propose a program of coring similar to that conducted by Wright et al. (2005) but at greater spatial and temporal resolution. Basic stratigraphic data on marsh and reef formation, transgressive shorelines, and erosional facies can be coupled with biomarkers for changing salinity and temperature to reconstruct in detail the conditions under which sites were establish, occupied, and abandoned. We propose to conduct coring in the marsh sediments of two localities: the Suwannee Delta in proximity of Cat Island and Little Bradford, and in the Shell Mound tract in the vicinity of Shell Mound, Deer Island, and Richards Island.

Specific proposals following from the recommendations outlined above will be issued to U.S. Fish and Wildlife Services in collaboration with cultural resource personnel and refuge managers. We reiterate in closing this report both the enormous potential of refuge sites for developing nuanced understanding of culture change in the context of rapid and nonlinear environmental change, as well as the pressing need to salvage information from refuge sites that are under threat of imminent destruction. A comprehensive program of investigation that includes rescue, reconnaissance, and research is required to transition from a *reactive* to a *proactive* program of cultural resource management.

REFERENCES CITED

Adams, Peter N., Neil D. Opdyke, and John M. Jaeger
2010 Isostatic Uplift Driven by Karstification and Sea-Level Oscillation: Modeling Landscape Evolution in North Florida. *Geology* 38:531-534.

Adovasio, James M., and Andrew Hemmings
2008 *The First Snowbirds: The Archaeology of Inundated Late Pleistocene Landscapes in the Northeastern Gulf of Mexico*. Ocean Explorer, National Oceanic and Atmospheric Administration (http://oceanexplorer.noaa.gov/explorations/08negmexico/welcome.html). Accessed January 21, 2011.

Ambrosino, James N., Lisa N. Lamb, Lucy B. Jones, and Paul L. Jones
2002 *An Archaeological Reconnaissance of Atsena Otie Key, Cedar Key National Wildlife Refuge, Levy County, Florida*. Panamerican Consultants, Inc., Tampa, Florida.

Archaeological Consultants, Inc.
1995 *A Cultural Resources Assessment Survey of the Suwannee Wastewater System Project Area, Dixie County, Florida*. Archaeological Consultants, Inc., Sarasota.

Balsillie, J. H., and J.F. Donoghue
2004 *High Resolution Sea-level History for the Gulf of Mexico Since the Last Glacial Maximum*. Florida Geological Survey Report of Investigations No. 103, 66 pp.

Bender, Barbara
1985 Emergent Tribal Formations in the American Midcontinent. *American Antiquity* 50:52-62.

Bergquist, Derk C., Jason A. Hale, Patrick Baker, and Shirley M. Baker
2006 Development of Ecosystem Indicators for the Suwannee River Estuary: Oyster Reef Habitat Quality along a Salinity Gradient. *Estuaries and Coasts* 29(3):353-360.

Binford, Lewis R.
1980 Willow Smoke and Dogs' Tails: Hunter-Gatherer Settlement Systems and Archaeological Site Formation. *American Antiquity* 45:4-20.

Blum, M. D., T. J. Misner, E. S. Collins, D. B. Scott, R. A. Morton, and A. Aslan
2001 Middle Holocene Sea-Level Rise and Highstand at +2m, Central Texas Coast. *Journal of Sedimentary Research* 71:581-588.

Borremans, Nina T.

n.d. Unpublished notes and records on archaeological testing at Seahorse Key and North Key. On file Florida Museum of Natural History, University of Florida, Gainesville.

1991 *The Aboriginal Cemetery at Cedar Key (8LV4): Management Report.* Institute of Archaeology and Paleoenvironmental Studies, University of Florida, Gainesville.

1993 *The Archaic Period Component at 8LV4, Cedar Key, Florida*. Institute of Archaeology and Paleoenvironmental Studies, University of Florida, Gainesville.

Borremans, Nina Thanz, and Michael E. Moseley

1990 *A Prehistoric Site Survey of the Cedar Keys Region of Coastal Levy County, Florida*. Department of Anthropology, University of Florida, Gainesville.

Brinton, Daniel G.

1859 *Notes on the Florida Peninsula, Its Literary History, Indian Tribes and Antiquities*. Joseph Sabin, Philadelphia, PA.

Brooks, Mark J., Peter A. Stone, Donald J. Colquhoun, and Jan G. Brown

1989 Sea Level Change, Estuarine Development, and Temporal Variability in Woodland Period Subsistence-Settlement Patterning on the Lower Coastal plain of South Carolina. In *Studies in South Carolina Archaeology: Essays in Honor of Robert L. Stephenson*, edited by A. C. Goodyear and G. T. Hanson, pp. 91-100. Occasional Papers, South Carolina Institute of Archaeology and Anthropology, University of South Carolina, Columbia.

Brown, Randall B., Earl L. Stone, and Victor W. Carlisle

1990 Soils. In *Ecosystems of Florida*, edited by Ronald J. Myers and John J. Ewel, pp. 35-69. University of Central Florida Press, Orlando.

Bullen Ripley P., and E. M. Dolan

1960 Shell Mound, Levy County, Florida. *The Florida Anthropologist* 13:17-23.

Calkins, W. W.

1877-1880 Notes of Personal Investigations among the Shell Mounds of Florida. *Proceedings of the Davenport Academy of Natural Sciences*, 1876-78, vol. 2, pp. 225-229. Davenport, Iowa.

Castaneda, H. and F. E. Putz

2007 Predicting Sea-Level Rise Effects on a Nature Preserve on the Gulf Coast of Florida: A Landscape Perspective. *Florida Scientist* 2:166-175.

Chen, Ellen, and John F. Gerber
1990 Climate. In *Ecosystems of Florida*, edited by Ronald J. Myers and John J. Ewel, pp. 11-34. University of Central Florida Press, Orlando.

Cordell, Ann S.
1984 *Ceramic Technology at a Weeden Island Period Archaeological Site in North Florida*. Ceramic Notes 2. Occasional Publications of the Ceramic Technology Laboratory, Florida State Museum, University of Florida, Gainesville.

Darst, Melanie R., Helen M. Light, Lori J. Lewis, and A. Alejandro Sepulveda
2003 Forest Types in the Lower Suwannee River Floodplain – A Report and Interactive Map. *Water Resources Investigations Report 03-4008*, Tallahassee, FL.

Dasovich, S. J.
1999 The Effects of Continuous Erosional Processes and Storm Damage on Coastal Site Integrity: Examples from Dixie County, Florida. *The Florida Anthropologist* 52: 267–274.

Davis, Richard A., Jr.
1997a Geology of the Florida Coast. In *The Geology of Florida*, edited by A. F. Randazzo and D. S. Jones, pp. 155-168. University Press of Florida, Gainesville.

1997b Regional Coastal Morphodynamics along the United States Gulf of Mexico. *Journal of Coastal Research* 13(3)595-604.

DePratter, Chester B., and J. D. Howard
1981 Evidence for a Sea Level Lowstand between 4500 and 2400 Years B.P. on the Southeast Coast of the United States. *Journal of Sedimentary Petrology* 51:1287-1296.

DeSantis, Larisa R. G., Smriti Bhotika, Kimberlyn Williams, and Francis E. Putz
2007 Sea-Level Rise and Drought Interactions Accelerate Forest Decline on the Gulf Coast of Florida, USA. *Global Change Biology* 13:2349-2360.

Dorian, Alan W.
1980 *Literature Search and Partial Cultural resource Inventory of the Chassahowitzka, Cedar Keys, and Lower Suwannee National Wildlife Refuges*. Archaeological Research Reports 10, Southeast Archaeology Conservation Center, Florida State University, Tallahassee.

Duobinis-Gray, Eileen and Courtney T. Hackney
1982 Seasonal and Spatial Distribution of the Carolina Marsh Clam *Polymesoda caroliniana* (Bosc) in a Mississippi Tidal Marsh. *Estuaries* 5(2):102-109.

Ecker, A.
1878 Zur Kenntniss des Körperbaues früherer Einwohner der Halbinsel Florida. *Archiv. Für Anthrop*., vol. 10, pp. 101-114.

Endonino, Jon C.
2010 *Thornhill Lake: Hunter-Gatherers, Monuments, and Memory*. Ph.D. dissertation, Department of Anthropology, University of Florida, Gainesville.

Farrell, Mark D., John Good, David Hornsby, Anthony Janicki, Rob Mattson, and Sam Upchurch
2005 *MFL Establishment for the Lower Suwannee River and Estuary, Little Fanning, Fanning, and Manatee Springs*. Technical Report, Suwannee River Water Management District.

Faught, Michael K.
2004 The Underwater Archaeology of Paleolandscapes, Apalachee Bay, Florida. *American Antiquity* 69:275–289.

Frazier, D. E.
1974 Depositional-Episodes: The Relationship to the Quaternary Stratigraphic Framework in the Northwestern Portion of the Gulf Basin. *Geological Circularion* 74(1)1-28.

Fitzgerald, Duncan M., Michael S. Fenster, Britt A. Argow, and Ilya V. Buynevich
2008 Coastal Impacts Due to Sea-Level Rise. *Annual Review of Earth and Planetary Sciences* 36:601-647.

Goggin, J. M.
1952 *Space and Time Perspectives in Northern St. Johns Archaeology, Florida.* Yale University Publications in Anthropology 47. Yale University, New Haven, Connecticut.

Goldburt, J. S.
1966 *The Archaeology of Shired Island*. Unpublished M.A. thesis, Department of Anthropology, University of Florida, Gainesville.

Goodbred, Steven L., and Albert C. Hine
1995 Coastal Storm Deposition: Salt-Marsh Response to a Severe Extratropical Storm, March 1993, West-Central Florida. *Geology* 23:679-682.

Goodbred, S. L., A. C. Hine, and E. E. Wright
1998 Sea-Level Change and Storm Surge Deposition in a Late Holocene Florida Salt Marsh. *Journal of Sedimentary Research* 68:240-252.

Hine, Albert C., Daniel F. Belknap, Joan G. Hutton, Eric B. Osking, and Mark W. Evans
1988 Recent Geological History and Modern Sedimentary Processes Along an Incipient, Low-Energy, Epicontinental-Sea Coastline: Northwest Florida. *Journal of Sedimentary Petrology* 58(4)567-579.

Ivester, A. H., D.S. Leigh, and D. I. Godrey-Smith
2001 Chronology of Inland Eolian Dunes on the Coastal Plain of Georgia, USA. *Quaternary Research* 55:293–302.

Janus Research, Inc.
2001 *Cultural Resources Assessment Survey of Four Dredge Disposal Areas, Dixie County, Florida*. Janus Research, Inc., St. Petersburg, Florida.

Jones, B. C.
1992 *Archaeological Evaluation of Lions Club Lot in Cedar Key, Florida: Salvage of Historic Burials and Preservation of Weeden Island (Pasco) Burial Area*. Florida Archaeological Reports 9. Bureau of Archaeological Research, Division of Historical Resources, Florida department of State, Tallahassee.

Jones, Paul L. and Nina T. Borremans
1991 *An Archaeological Survey of the Gulf Hammock, Florida*. Institute of Archaeology and Paleoenvironmental Studies, University of Florida, Gainesville.

Kilgen, Ronald H. and Ronald J. Dugas
1989 *The Ecology of Oyster Reefs of the Northern Gulf of Mexico: An Open File Report*. Prepared for the U.S. Department of the Interior, Fish and Wildlife Service.

Kohl, Marin
2010 Freshwater Molluscan Shells/Corbiculidae. Electronic document. http://mkohl1.net/ Corbiculidae.html, accessed May 21, 2010.

Kohler, Timothy A.
1975 The Garden Patch Site: A Minor Weeden Island Ceremonial Center on the Northern Peninsular Florida Gulf Coast. Unpublished M.A. thesis, Department of Anthropology, University of Florida, Gainesville.

Koski, Steve, Jennifer Langdale, Jecyn Bremer, Lisa O'Steen, and Pamela Vojnovski
2003 *A Cultural Resource Assessment Survey of Four Parcels and Site Evaluation Study of 8DI29, 8DI150, and 8DI165 for the Suwannee River Dredging Project, Dixie County, Florida*. Technical Report 1070, New South Associates, Inc., Stone Mountain, Georgia.

Leal, J. H.
2002 Gastropods. In *The Living Marine Resources of the Western Central Atlantic. Volume 2, Mollusks, Crustaceans, Hagfishes, Sharks, Batoid fishes and*

Chimaeras. FAO Identification Guide for Fishery Purposes, edited by K.E. Carpenter, pp. 99-147. The Food and Agriculture Organization of the United Nations, Rome.

Leonard, Lynn A., Albert C. Hine, and Mark E. Luther
1995 Surficial Sediment Transport and Deposition Processes in a *Juncus roemerianus* Marsh, West-Central Florida. *Journal of Coastal Research* 11(2)322-336.

Light, Helen M., Melanie R. Darst, Lori J. Lewis, and David A. Howell
2002 Hydrology, Vegetation, and Soils of Riverine and Tidal Floodplain Forests of the Lower Suwannee River, Florida, and Potential Impacts of Flow Reductions. *U.S. Geological Survey Professional Paper 1656A.*

Livingston, Robert J.
1990 Inshore Marine Habitats. In *Ecosystems of Florida*, edited by Ronald J. Myers and John J. Ewel, pp. 549-573. University of Central Florida Press, Orlando.

Lofaro, Ellen
2009 Zooarchaeology Report from Cat Island. Paper on file, Laboratory of Southeastern Archaeology, department of Anthropology, University of Florida, Gainesville.

Lott, Neal
1993 The Big One! A Review of the March 12-14, 1993 “Storm of the Century.” Technical Report 93-01. National Climatic Date Center Research Customer Service Group.

Lourandos, H.
l988 Palaeopolitics: Resource Intensification in Aboriginal Australia and Papua New Guinea. In *Hunters and Gatherers I: History, Evolution and Social Change*, edited by T. Ingold, D. Riches, and J. Woodburn, pp. 148-60. Berg, Oxford.

Lower Suwannee National Wildlife Refuge
2010 U.S. Fish and Wildlife. Electronic document, http://www.fws.gov/lowersuwannee. Accessed June 15, 2010.

Luer, George, D. Allerton, D. Hazeltine, R. Hatfield, and D. Hood
1986 Whelk Shell Tool Blanks from Big Mound Key (8CH10), Charlotte County, Florida: With Notes on certain Whelk Shell Tools. In *Shells and Archaeology in Southern Florida*, edited by G. Luer, pp. 92-124. Florida Anthropological Society, Publication 12. Tallahassee.

MacKenzie, Clyde L., Jr.
2004 Rangia and Marsh Clams, Rangia cuneata, R. flexuosa, and Polymesoda caroliniana, in eastern Mexico: distribution, biology and ecology, and historical fisheries. *Marine Fisheries Review*. Summer 2004.

Markewich, H.W., and William Markewich
1994 An Overview of Pleistocene and Holocene Inland Dunes in Georgia and the Carolinas – Morphology, Distribution, Age, and Paleoclimate. Submitted to U.S. Geological Survey, Bulletin 2069.

Marquardt, William H.
2010a Shell Mounds in the Southeast: Middens, Monuments, Temple Mounds, Rings, or Works? *American Antiquity* 75(3):551-570.

2010b Mounds, Middens, and Rapid Climate Change during the Archaic-Woodland Transition in the Southeastern United States. In *Trend, Tradition, and Turmoil: What Happened to the Southeastern Archaic?* edited by D. H. Thomas and M. C. Sanger, pp. 253-271. Anthropological Papers of the American Museum of Natural History, vol. 93. New York.

Marquardt, William H. (editor)
1992 *Culture and Environment in the Domain of the Calusa.* Monograph 1, Institute of Archaeology and Paleoenvironmental Studies, University of Florida, Gainesville.

McFadden, Paullette
2009 Fauna Analysis of Vertebrate Remains from Cat Island in the Lower Suwannee River Valley, Northwest Gulf Coast, Florida. Paper on file, Laboratory of Southeastern Archaeology, Department of Anthropology, University of Florida, Gainesville.

Milanich, Jerald T.
1994 *Archaeology of Precolumbian Florida*. Gainesville: University Press of Florida.

Milanich, Jerald T., Ann S. Cordell, Vernon J. Knight, Jr., Timothy A. Kohler, and Brenda J. Sigler-Lavelle
1984 *McKeithan Weeden Island: The Culture of Northern Florida, A.D. 200-900*. Academic Press, New York.

Miller, James
1998 *An Environmental History of Northeast Florida*. University Press of Florida, Gainesville.

Mitchell-Tapping, Hugh J., Aleta M. Mitchell-Tapping, Thomas J. Lee, and Cathy R. Williams
1989 *Core Evidence of Sea Level High Stands in Southwestern Florida during the Last 5,000 Years*. Estero Bay Marine Laboratory, Ft. Myers Beach, Florida.

Mitchem, Jeffrey M.
1999 C. B. Moore's Work in Central and West Florida, 1895-1921. In *The East Florida Expeditions of Clarence Bloomfield Moore*, edited by J. M. Mitchem, pp. 1-48. University of Alabama Press, Tuscaloosa.

Moore, Clarence B.
1902 Certain Aboriginal Remains of the Northwest Florida Coast, Part II. *Journal of the Academy of Natural Sciences of Philadelphia* 12:128-358.

1903 Certain Aboriginal Mounds of the Florida Central West Coast. *Journal of the Academy of Natural Sciences of Philadelphia* 12:361-438.

1918 The Northwest Florida Coast Revisited. *Journal of the Academy of Natural Sciences of Philadelphia* 16:514-580.

Montague, Clay L., and Richard G. Weigert
1990 Salt Marshes. In *Ecosystems of Florida*, edited by Ronald J. Myers and John J. Ewel, pp. 481-516. University of Central Florida Press, Orlando.

Morton, R. A., J.G. Paine, and M.D. Blum
2000 Responses of Stable Bay-Margin and Barrier Island Systems to Holocene Sea-Level Highstands, Western Gulf of Mexico. *Journal of Sedimentary Research* 70:478-490.

Myers, Ronald L., and John J. Ewel (editors)
1990 *Ecosystems of Florida*. University of Central Florida Press, Orlando.

Mykel, Nancy
1962 A Weeden Island Excavation. Paper on file, Florida Master Site Files, Survey #11936. Bureau of Archaeological Research, Division of Historical Resources, Florida department of State, Tallahassee.

National Buoy Data Center (NBDC)
2010 Historical Data. Electronic document, http://www.ndbc.noaa.gov/station_history.php?station=cdrf1. Accessed June 15, 2010.

National Climatic Data Center (NCDC)
2006 *Climate of Florida*. Climate Services Branch, Asheville, NC. Electronic document, http://coaps.fsu.edu/climate_center/specials/climateofflorida.pdf. Accessed June 15, 2010.

Nelson, H. F., and E. E. Bray
1970 Stratigraphic History of the Holocene Sediments of the Sabine-High Island Area, Gulf of Mexico. In *Deltaic Sedimentation. Modern and Ancient*, edited by J. P. Morgan and R. J. Shaver, pp. 48-77. SEPM Special Publication 15.

Nelson, M. C., and M. Hegmon
2001 Abandonment is Not as it Seems: An Approach to the Relationship between Site and Regional Abandonment. *American Antiquity* 66:213–235.

Ning, Zhu H., Thomas Doyle, and Kamran Abdollahi
2008 *Gulf Coastal Forests in a Changing Climate*. Electronic document, http://www.safnet.org/fp/documents/coastal_forests_in_changing_climate_08.pdf, accessed June 15, 2010.

Oliver-Smith, Anthony
2003 Theorizing Disasters: Nature, Culture, Power. In Culture and Catastrophe: The Anthropology of Disaster, edited by Susanna M. Hoffman and Anthony Oliver-Smith. The School of American Research Press, Santa Fe, New Mexico.

Otvos, Ervin G.
2001 Assumed Holocene Highstand, Gulf of Mexico: Basic Issues of Sedimentary and Landform Criteria. *Journal of Sedimentary Research*. 71: 645-647

2004 Holocene Gulf Levels: Recognition Issues and an Updated Sea-Level Curve. *Journal of Coastal Research* 20(3)680-699.

Pluckhahn, Thomas J., Victor D. Thompson, and Brent R. Weisman
2010 Toward a New View of History and Process and Crystal River (8CI1). *Southeastern Archeology* 29:164-181.

Randall, Asa R., Micah P. Mones, and Kenneth E. Sassaman
2010 Visit Shell City: Another Coastside Attraction. Paper presented at the 67th Annual Meeting of the Southeastern Archaeological Conference, Lexington, Kentucky.

Robbin, D. M.
1984 A New Holocene Sea-Level Curve for the Upper Florida Keys and Florida Reef Tract. In *Environments of South Florida. Present and Past II*, edited by P. J. Gleason, pp. 437-458. Miami Geological Society, Coral Gables.

Rodriguez, A. B., J. B. Anderson, F. B. Siringan, and M. Taviani
1999 Sedimentary Facies and Genesis of Holocene Sand Banks on the East Texas Inner Continental Shelf: Isolated Shallow Marine Sand Bodies. In *Society of Economic Paleontologists and Mineralogists Special Publication 64*, edited by J. Snedden and K. Bergman. pp. 165-178.

Rubin, J.

1962 Hog Island Burial Mound, LV2. Paper on file, Florida Master Site Files, Survey #11935. Bureau of Archaeological Research, Division of Historical Resources, Florida department of State, Tallahassee.

Russo, Michael

1991 *Archaic Sedentism on the Florida Coast: A Case Study from Horr's Island.* Ph.D. Dissertation, Department of Anthropology, University of Florida, Gainesville.

1996 Southeastern Archaic Mounds. In *Archaeology of the Mid-Holocene Southeast*, edited by K. E. Sassaman and D. G. Anderson, pp. 259-287. University Press of Florida, Gainesville.

2004 Measuring Shell Rings for Social Inequality. In *Signs of Power: The Rise of Cultural Complexity in the Southeast*, edited by L. Gibson and P. Carr, P., pp. 26-70. University of Alabama Press, Tuscaloosa.

2010 Shell Rings and Other Settlement Features as Indicators of Cultural Continuity between the Late Archaic and Woodland Periods of Coastal Florida. In *Trend, Tradition, and Turmoil: What Happened to the Southeastern Archaic?*, edited by D. H. Thomas and M. C. Sanger, pp. 149-172. Anthropological Papers of the American Museum of Natural History, New York.

Russo, Michael, and Greg Heide

2001 Shell Rings of the Southeast USA. *Antiquity* 75:491–492.

Sassaman, Kenneth E.

2006 Dating and Explaining Soapstone Vessels: A Comment on Truncer. *American Antiquity* 71:141-156

2009 Proposal for Sustained Archaeological Investigation in the Lower Suwannee and Cedar Key National Wildlife Refuges, Florida. Submitted to the Regional Historic Preservation Officer and Regional Archaeologist, U.S. Fish and Wildlife Services – Southeast Region.

Sassaman, Kenneth E., and Asa R. Randall

2011 Shell Mounds of the Middle St. Johns Basin, Northeast Florida. In *The Origins of Monumentality*, edited by R. Rosenswig and R. Burger. University Press of Florida, Gainesville (in press).

Saunders, Rebecca

2004 Stratigraphy at the Rollins Shell Ring Site: Implications for Ring Function. *The Florida Anthropologist* 57(4):249-270.

Scholl, D. W., F. C. Craighead, and M. Stuiver
1969 Florida Submergence Curve Revised: Its Relation to Coastal Sedimentation Rates. *Science* 163:562-564.

Schwadron, Margo
2010 *Landscapes of Maritime Complexity: Prehistoric Shell Work Sites of the Ten Thousand Islands, Florida*. Ph.D. dissertation, Department of Archaeology and Ancient History, University of Leicester.

Sears, William H.
1973 The Scared and Secular in Prehistoric Ceramics. In *Variation in Anthropology, Essays in Honor of John McGregor*, edited by D. Lathrop and J. Douglas, pp. 31-42. Illinois Archaeological Survey, Urbana.

Stapor, F. W., T. D. Mathews, and F. E. Lindfors-Kearns
1991 Barrier Island Progradation and Holocene Sea-Level History in Southwest Florida. *Journal of Coastal Research* 7:815-838.

Stearns, R. E. C.
1869 Rambles in Florida. *The American Naturalist* 3:349-356.

Stephenson, Keith, Judith A. Bense, and Frankie Snow
2002 Aspects of Deptford and Swift Creek on the South Atlantic and Gulf Coastal Plains. In *The Woodland Southeast*, edited by D. G. Anderson and R. C. Mainfort, Jr., pp. 318-351. University of Alabama Press, Tuscaloosa.

Stojanowski, C. M.
2002 Hydrodynamic Sorting in a Coastal Marine Skeletal Assemblage. *International Journal of Osteoarchaeology* 12:259-278.

Stojanowski, C. M., and G. H. Doran
1998 Osteology of the Late Archaic Bird Island Population. *The Florida Anthropologist* 51:139-145.

Tanner, William F.
2000 Beach Ridge History, Sea Level Change, and the A.D. 536 Event. In *The Years Without Summer: Tracing A.D. 536 and Its Aftermath*, edited by J. D. Gunn, pp. 89-97. British Archaeological Reports, International Series 872.

Thomas, M. A.
1990 *The Impact of Long-Term and Short-Term Sea-Level Changes on the Evolution of the Wisconsinan-Holocene Trinity/Sabine Incised Valley System, Texas Continental Shelf.* Ph.D. Dissertation, Rice University, Houston, Texas.

Thomas, M. A. and J. B. Anderson
1994 Sea-Level Controls on the Facies Architecture of Three Trinity/Sabine Incised-Valley System, Texas Continental Shelf. In *SEPM Special Publication 51*, edited by R. Boyd, B.A. Zaitlin, and R. Dalrymple. pp. 63-82.

Törnqvist, T. E., J. L. Gonzalez, L. A. Newsom, K. Van Der Borg, and A. De Jong
2002 Reconstructing "Background" Rates of Sea-Level Rise as a Tool for Forecasting Coastal Wetland Loss, Mississippi Delta. *Transaction of the American Geophysical Union* 83(46)525, 530, 531.

Toscano, M. A., and I. G. Macintyre
2003 Corrected Western Atlantic Sea-Level Curve for the Last 11,000 Years Based on Calibrated $_{14}$C Dates form *Acropora palmate* Framework and Intertidal Mangrove Peat. *Coral Reefs* 22:257-270.

Tuckey, Troy D., and Mark Dehaven
2004 Fish Assemblages found in Tidal-Creek and Seagrass Habitats in the Suwannee River Estuary. *Fishery Bulletin 104*(1)102-117.

United States Geological Survey
2009 Florida Biology: Atlantic Rangia – Rangia cuneata (marine). Electronic document, http://fl.biology.usgs.gov/pics/nonindig_misc_mollusks/bivalves/bivalves_6.html, accessed May 21, 2010.

University of Florida
2010 *Seven Soil Orders of Florida*. Electronic document, http://www.sfrd.ufl.edu/Extension/ffws/soilord.htm, accessed June 15, 2010.

USDA Natural Resources Conservation Service
1996 *Soil Survey of Levy County, Florida*. USDA Natural Resources Conservation Service, Washington, D.C.

Vogeles, A. W.
1879 Notes on a Lost Race of America. *The American Naturalist* 13(1):9-11.

Walker, S. T.
1883 The Aborigines of Florida. Annual Report of the Smithsonian Institution for 1881, pp. 677-680. Washington, D.C.

1885 Mounds and Shell Heaps on the West Coast of Florida. *Annual Report of the Smithsonian Institution for 1883*, pp. 854-868. Washington, D.C.

Walker, Karen J.
1992 The Zooarchaeology of Charlotte Harbor's Prehistoric Maritime Adaptation: Spatial and Temporal Perspectives. In *Culture and Environment in the Domain of*

the Calusa, edited by W. H. Marquardt, pp. 265-366. Monograph 1, Institute of Archaeology and Paleoenvironmental Studies, University of Florida, Gainesville.

Walker, K. J., F. W. Stapor, and W. H. Marquardt
1995 Archaeological Evidence for a 1750-1450 BP Higher-Than-Present Sea Level along Florida's Gulf Coast. *Journal of Coastal Research*, Special Issue 17, Holocene Cycles: Climate, Sea Levels, and Sedimentation 205-218.

Walker, Karen J., and William H. Marquardt (editors)
n.d. *The Archaeology of Pineland: A Coastal Southwest Florida Village Complex, A.D. 50-1700*. Monograph 4, Institute of Archaeology and Paleoenvironmental Studies, University of Florida, Gainesville.

Wallis, Neill J.
2011 *The Swift Creek Gift: Vessel Exchange on the Atlantic Coast*. University of Alabama Press, Tuscaloosa.

Weinstein, Richard A., and Karen L. Mayo
2006 *Historic Assessment and Cultural Resource Survey for the Suwannee River O&M Project's Upland Disposal Site, Dixie County, Florida*. Coastal Environments, Inc., Baton Rouge, Louisiana.

Weisman, Brent R.
1984 New Radiocarbon Dates from Withlacoochee River Shell Middens. *The Florida Anthropologist* 37(4):204-205.

Wheeler, Ryan
1998 Little Bradford Island (8LV32). Letter report on file, Florida Master Site Files, Survey #11936. Bureau of Archaeological Research, Division of Historical Resources, Florida department of State, Tallahassee.

Willey, Gordon R.
1949 *Archaeology of the Florida Gulf Coast.* Smithsonian Miscellaneous Collections 113. Smithsonian Institution, Washington, D.C.

Wright, Eric E., Albert C. Hine, Steven L. Goodbred, Jr., and Stanley D. Locker
2005 The Effect of Sea-Level and Climate Change on the Development of a Mixed Siliciclastic-Carbonate, Deltaic Coastline: Suwannee River, Florida, U.S.A. *Journal of Sedimentary Research* 75:621-635

Wyman, Jeffries
1870 Explorations in Florida. *Third Annual Report of the Trustees of the Peabody Museum of Archaeology and Ethnology*, pp. 8-9. Harvard University, Cambridge, Massachusetts.

1875 Fresh-Water Shell Mounds of the St. John's River, Florida. *Peabody Academy of Science Memoir* 4.

Yates, Wm. Brian
2000 *Implications of Late Archaic Exchange Networks in the Southeast as Indicated by Archaeological Evidence of Prehistoric Soapstone Vessels throughout Florida*. Unpublished M. A. thesis, Department of Anthropology, Florida State University, Tallahassee.

APPENDIX A
CATALOG

8DI29

Prov.	Lev/ Str	Cat #	Recov-ery	Size Grade	Material	Description	n	Wt. (g)	Notes
TU1	A	1	0.25	0.25	Pottery	Carabelle	1	37.9	
TU1	A	2	0.25	0.25	Pottery	Crumb	1	0.5	
TU1	A	3	0.25	0.25	Lithics	Chert	1	2.2	
TU1	A	4	0.25	0.25	Lithics	Metavol.	1	<0.0	
TU1	A	5	0.25	0.25	Vert Fauna	Otoliths	3	1.4	
TU1	A	6	0.25	0.25	Vert Fauna	Bone		14.1	
TU1	A	7	0.25	0.25	Marine Shell	UID	2	6.6	
TU1	A	8	0.25	0.25	Metal		21	7.1	
TU1	A	9	0.25	0.25	Glass		3	31.8	
TU1	A	10	0.25	0.25	Concretions		1	26.0	
TU1	B	1							Void - reclassified
TU1	B	2	0.25	0.25	Pottery	Sand Temp.	2	17.2	
TU1	B	3	0.25	0.25	Pottery	Crumb	5	4.6	
TU1	B	4	0.25	0.25	Lithics	Chert	1	0.5	
TU1	B	5	0.25	0.25	Vert Fauna	Otoliths	10	2.9	
TU1	B	6	0.25	0.25	Vert Fauna	Bone		47.5	
TU1	B	7	0.25	0.25	Misc. Shell		3	1.2	
TU1	B	8	0.25	0.25	Concretions		1	11.7	
TU1	B	9	0.25	0.25	Metal		31	9.3	
TU1	B	10	0.25	0.25	Glass		1	11.7	
TU1	C	1	0.25	0.25	Pottery	Crumb	1	0.4	
TU1	C	2	0.25	0.25	Lithics	Chert	1	1.3	
TU1	C	3	0.25	0.25	Soapstone	Crumb	1	1.1	
TU1	C	4	0.25	0.25	Vert Fauna	Bone		18.5	
TU1	C	5	0.25	0.25	Marine Shell	UID	1	0.1	
TU1	C	6	0.25	0.25	Metal		8	3.3	
TU1	C	7	0.25	0.25	Pebble		1	0.2	
TU1	D	1	0.25	0.25	Pottery	Deptford	1	4.0	
TU1	D	2	0.25	0.25	Pottery	Sand Temp.	1	3.8	
TU1	D	3	0.25	0.25	Pottery	Sand Temp.	1	4.9	
TU1	D	4	0.25	0.25	Pottery	Crumb	1	0.2	
TU1	D	5	0.25	0.25	Vert Fauna	Otoliths	1	1.3	
TU1	D	6	0.25	0.25	Vert Fauna	Bone		31.5	
TU1	D	7	0.25	0.25	Marine Shell	UID	2	0.2	
TU1	D	8	0.25	0.25	Concretions		2	6.3	
TU1	D	9	0.25	0.25	Metal		4	3.4	
TU1	D	10	0.25	0.25	Pottery	Ruskin Dentate	1	11.6	
TU1	E	1	0.25	0.25	Pottery	Lockloosa	1	18.5	
TU1	E	2	0.25	0.25	Pottery	Sand Temp.	1	4.8	
TU1	E	3	0.25	0.25	Pottery	Sand Temp.	2	22.8	
TU1	E	4	0.25	0.25	Pottery	Sand Temp.	3	7.6	
TU1	E	5	0.25	0.25	Pottery	Sand Temp.	11	87.5	
TU1	E	6	0.25	0.25	Pottery	Crumb	3	3.8	Rims

8DI29

Prov.	Lev/ Str	Cat #	Recov-ery	Size Grade	Material	Description	n	Wt. (g)	Notes
TU1	E	7	0.25	0.25	Pottery	Crumb	7	7.3	
TU1	E	8	0.25	0.25	Charcoal		6	1.0	
TU1	E	9	0.25	0.25	Lithics	Chert	1	30.7	
TU1	E	10	0.25	0.25	Vert Fauna	Otoliths	1	0.2	
TU1	E	11	0.25	0.25	Vert Fauna	Bone		137.1	
TU1	E	12	0.25	0.25	Marine Shell	UID	5	0.3	
TU1	E	13	0.25	0.25	Metal		69	19.9	
TU1	F	1	0.25	0.25	Lithics	Chert	2	1.8	
TU1	F	2	0.25	0.25	Pottery	Deptford	4	20.9	4 pieces crossmend - counted as 1
TU1	F	3	0.25	0.25	Pottery	Deptford	6	70.1	
TU1	F	4	0.25	0.25	Pottery	Weeden Island	3	34.4	2 pieces crossmend - counted as 1
TU1	F	5	0.25	0.25	Pottery	Sand Temp.	8	32.4	
TU1	F	6	0.25	0.25	Pottery	Sand Temp.	2	8.7	
TU1	F	7	0.25	0.25	Pottery	Sand Temp.	17	57.5	
TU1	F	8	0.25	0.25	Pottery	Deptford Lcs			
TU1	F	9	0.25	0.25	Pottery	Sand Temp.	2	3.3	Rims
TU1	F	10	0.25	0.25	Pottery	Sand Temp.	25	22.8	
TU1	F	11	0.25	0.25	Charcoal		4	0.5	nutshell
TU1	F	12	0.25	0.25	Charcoal			7.5	
TU1	F	13	0.25	0.25	Vert Fauna	Otoliths	7	4.4	
TU1	F	14	0.25	0.25	Vert Fauna	Bone		442.3	
TU1	F	15	0.25	0.25	Marine Shell	Oyster		4.9	
TU1	F	16	0.25	0.25	Misc. Rock		2	13.3	
TU1	F	17	0.25	0.25	Glass		1	0.4	
TU1	F	18	0.25	0.25	Vert Fauna	Bone Dust		2.2	
TU1	F	19	0.25	0.25	Pottery	Wakulla	1	30.9	w/spicules (St. Johns?)
TU1	F	20	0.25	0.25	Pottery	Burnished	1	6.4	
TU1	F	21	0.25	0.25	Pottery	Weeden Island Red	1	11.4	
TU1	F	22	0.25	0.25	Pottery	Ruskin Dentate	16	192.9	
TU1	G	1	0.25	0.25	Pottery	Crumb	5	8.4	
TU1	G	2	0.25	0.25	Lithics	Chert	2	<0.0	
TU1	G	3	0.25	0.25	Vert Fauna	Otoliths	8	3.1	
TU1	G	4	0.25	0.25	Charcoal		10	0.9	
TU1	G	5	0.25	0.25	Vert Fauna	Bone		301.2	
TU1	G	6	0.25	0.25	Marine Shell	Clam	2	11.1	
TU1	G	7	0.25	0.25	Marine Shell	Clam	1	7.2	
TU1	G	8	0.25	0.25	Marine Shell	Clam	10	2.2	
TU1	G	9	0.25	0.25	Marine Shell	UID	13	1.8	
TU1	G	10	0.25	0.25	Concretions		10	26.6	
TU1	G	11	0.25	0.25	Metal		1	0.1	
TU1	G	12	0.25	0.25	Pottery	Sand Temp.	1	9.9	

8DI29

Prov.	Lev/ Str	Cat #	Recov-ery	Size Grade	Material	Description	n	Wt. (g)	Notes
TU1	H	1	0.25	0.25	Pottery	Sand Temp.	1	3.9	
TU1	H	2	0.25	0.25	Vert Fauna	Otoliths	6	2.2	
TU1	H	3	0.25	0.25	Charcoal		1	<0.0	
TU1	H	4	0.25	0.25	Vert Fauna	Bone		193.7	
TU1	H	5	0.25	0.25	Marine Shell	Clam	8	3.0	
TU1	H	6	0.25	0.25	Marine Shell	UID	9	3.3	
TU1	H	7	0.25	0.25	Concretions		5	1.3	
TU1	H	8	0.25	0.25	Metal		1	0.3	
TU1	H	9	0.25	0.25	Pottery	Sand Temp.	1	22.8	
TU1	J	1	0.25	0.25	Lithics	Chert	2	3.0	
TU1	J	2	0.25	0.25	Vert Fauna	Bone	14	16.1	
TU1	J	3	0.25	0.25	Marine Shell	UID	4	1.1	
TU1	K	1	0.25	0.25	Marine Shell	Busycon	1	271.9	
TU1	K	2	0.25	0.25	Marine Shell	Crown Conch	1	60.1	
TU1	K	3	0.25	0.25	Vert Fauna	Otoliths	1	0.5	
TU1	K	4	0.25	0.25	Vert Fauna	Bone	16	3.9	
TU1	K	5	0.25	0.25	Marine Shell	Oyster	1	9.4	
TU1	K	6	0.25	0.25	Marine Shell	Clam	1	7.9	
TU1	K	7	0.25	0.25	Marine Shell	UID	5	0.9	
TU1	IV-A	1	0.25	0.25	Pottery	Ruskin Dentate	1	6.4	
TU1	IV-A	2	0.25	0.25	Lithics	Chert	2	0.6	
TU1	IV-A	3	0.25	0.25	Marine Shell	UID Conch	1	7.5	
TU1	IV-A	4	0.25	0.25	Vert Fauna	Otoliths	1	0.4	
TU1	IV-A	5	0.125	0.13	Vert Fauna	Otoliths	1	0.1	
TU1	IV-A	6	0.125	0.13	Charcoal			0.7	
TU1	IV-A	7	0.25	0.25	Vert Fauna	Bone	4	0.7	
TU1	IV-A	8	0.125	0.13	Vert Fauna	Bone		5.8	
TU1	IV-A	9	0.25	0.25	Marine Shell	UID	1	0.4	
TU1	IV-A	10	0.25	0.25	Marine Shell	UID	1	0.5	
TU1	IV-A	11	0.25	0.25	Marine Shell	Oyster	21	71.2	
TU1	IV-A	12	0.25	0.25	Marine Shell	Oyster	9	33.6	
TU1	IV-A	13	0.25	0.25	Marine Shell	Oyster		137.0	
TU1	IV-A	14	0.25	0.25	Marine Shell	UID		49.0	
TU1	IV-A	15	0.125	0.13	Marine Shell	UID		20.0	
TU1	IV-A	16			Unsorted				<1/8”

8DI29

Prov.	Lev/ Str	Cat #	Recov-ery	Size Grade	Material	Description	n	Wt. (g)	Notes
TU1	IV-B	1	0.25	0.25	Marine Shell	UID Conch	1	16.5	
TU1	IV-B	2	0.25	0.25	Pottery	Crumb	2	5.8	
TU1	IV-B	3	0.125	0.13	Lithics		2	<0.0	
TU1	IV-B	4	0.125	0.13	Vert Fauna	Otoliths	4	0.8	
TU1	IV-B	5	0.25	0.25	Charcoal		15	1.9	
TU1	IV-B	6	0.125	0.13	Charcoal			4.4	
TU1	IV-B	7	0.25	0.25	Vert Fauna	Bone		25.6	
TU1	IV-B	8	0.125	0.13	Vert Fauna	Bone		55.6	
TU1	IV-B	9	0.25	0.25	Marine Shell	UID	1	1.0	
TU1	IV-B	10	0.25	0.25	Marine Shell	Oyster	35	129.4	
TU1	IV-B	11	0.25	0.25	Marine Shell	Oyster	29	103.0	
TU1	IV-B	12	0.25	0.25	Marine Shell	Oyster		220.0	
TU1	IV-B	13	0.25	0.25	Marine Shell	Clam	3	4.9	
TU1	IV-B	14	0.25	0.25	Marine Shell	Clam	1	1.6	
TU1	IV-B	15	0.25	0.25	Marine Shell	UID		19.0	
TU1	IV-B	16	0.25	0.25	Marine Shell	UID		89.6	
TU1	IV-B	17	0.125	0.13	Marine Shell	UID		67.0	
TU1	IV-B	18	0.25	0.25	Concretions		3	4.7	
TU1	IV-B	19	0.125	0.13	Concretions		4	0.4	
TU1	IV-B	20			Unsorted				<1/8”
TU1	IV-B	21	0.25	0.25	Pottery	Sand Temp.	1	5.1	burnished inside
TU1	V-A	1	0.25	0.25	Bone Pin		1	2.2	2 pieces crossmend
TU1	V-A	2	0.25	0.25	Pottery	Crumb	4	3.4	
TU1	V-A	3	0.25	0.25	Charcoal		3	0.2	
TU1	V-A	4	0.125	0.13	Charcoal			1.0	
TU1	V-A	5	0.25	0.25	Marine Shell	UID Conch	2	13.1	
TU1	V-A	6	0.25	0.25	Vert Fauna	Otoliths	1	0.5	
TU1	V-A	7	0.125	0.13	Vert Fauna	Otoliths	1	0.2	
TU1	V-A	8	0.25	0.25	Vert Fauna	Bone		33.6	
TU1	V-A	9	0.25	0.25	Marine Shell	Oyster	68	270.1	
TU1	V-A	10	0.25	0.25	Marine Shell	Oyster	47	124.6	
TU1	V-A	11	0.25	0.25	Marine Shell	Clam	70	272.2	
TU1	V-A	12	0.25	0.25	Marine Shell	Clam	47	191.9	
TU1	V-A	13	0.25	0.25	Marine Shell	Oyster		371.0	
TU1	V-A	14	0.25	0.25	Marine Shell	Clam		662.1	
TU1	V-A	15	0.25	0.25	Marine Shell	UID		340.2	
TU1	V-A	16	0.125	0.13	Marine Shell	Clam		61.1	
TU1	V-A	17	0.125	0.13	Marine Shell	UID		234.5	
TU1	V-A	18	0.25	0.25	Concretions		6	4.0	
TU1	V-A	19	0.125	0.13	Concretions		35	1.8	
TU1	V-A	20			Unsorted			97.3	<1/8”
TU1	V-A	21	0.125	0.13	Vert Fauna	Bone		63.2	
TU1	V-B	1	0.25	0.25	Marine Shell	Crown Conch	2	77.2	

8DI29

Prov.	Lev/ Str	Cat #	Recov-ery	Size Grade	Material	Description	n	Wt. (g)	Notes
TU1	V-B	2	0.25	0.25	Charcoal			<0.0	removed for C14 dating
TU1	V-B	3	0.125	0.13	Charcoal			0.4	5 pcs. removed for C14 dating
TU1	V-B	4	0.25	0.25	Vert Fauna	Otoliths	5	2.7	
TU1	V-B	5	0.125	0.13	Vert Fauna	Otoliths	1	0.2	
TU1	V-B	6	0.25	0.25	Vert Fauna	Bone		28.7	
TU1	V-B	7	0.125	0.13	Vert Fauna	Bone		64.4	
TU1	V-B	8	0.25	0.25	Marine Shell	Oyster	35	301.5	
TU1	V-B	9	0.25	0.25	Marine Shell	Oyster	40	175.5	
TU1	V-B	10	0.25	0.25	Marine Shell	Oyster		182.7	
TU1	V-B	11	0.25	0.25	Marine Shell	Clam	56	230.9	
TU1	V-B	12	0.25	0.25	Marine Shell	Clam	36	157.5	
TU1	V-B	13	0.25	0.25	Marine Shell	Clam		483.8	
TU1	V-B	14	0.125	0.13	Marine Shell	Clam		50.4	
TU1	V-B	15	0.25	0.25	Marine Shell	UID		313.6	
TU1	V-B	16	0.125	0.13	Marine Shell	UID		179.4	
TU1	V-B	17	0.125	0.13	Concretions		29	1.2	
TU1	V-B	18			Unsorted			97.4	<1/8”
TU1	V-B	19	0.25	0.25	Shell Tool	Crown Conch	1	49.1	
TU1	V-C	1	0.125	0.13	Vert Fauna	Bone		45.3	
TU1	V-C	2	0.25	0.25	Vert Fauna	Otoliths	2	0.8	
TU1	V-C	3	0.125	0.13	Charcoal		6	0.1	
TU1	V-C	4	0.25	0.25	Marine Shell	Crown Conch	1	58.2	
TU1	V-C	5	0.25	0.25	Marine Shell	Oyster	14	125.3	
TU1	V-C	6	0.25	0.25	Marine Shell	Oyster	15	55.6	
TU1	V-C	7	0.25	0.25	Marine Shell	Oyster		205.7	
TU1	V-C	8	0.25	0.25	Marine Shell	Clam	10	45.7	
TU1	V-C	9	0.25	0.25	Marine Shell	Clam	10	38.4	
TU1	V-C	10	0.25	0.25	Marine Shell	Clam		25.1	
TU1	V-C	11	0.25	0.25	Marine Shell	UID		99.4	
TU1	V-C	12	0.125	0.13	Concretions		15	0.7	
TU1	VI	1	0.25	0.25	Vert Fauna	Bone		4.1	
TU1	VI	2	0.125	0.13	Vert Fauna	Bone		16.6	
TU1	VI	3	0.25	0.25	Marine Shell	Oyster	3	38.7	
TU1	VI	4	0.25	0.25	Marine Shell	Oyster	3	6.8	
TU1	VI	5	0.25	0.25	Marine Shell	Oyster		24.5	
TU1	VI	6	0.25	0.25	Marine Shell	Clam	1	3.0	
TU1	VI	7	0.25	0.25	Marine Shell	Clam		12.4	
TU1	VI	8	0.25	0.25	Marine Shell	UID		10.8	
TU1	VI	9	0.125	0.13	Marine Shell	UID		7.6	
TU1	VI	10	0.25	0.25	Misc. UID		1	0.2	
TU2	A	1	0.25	0.25	Pottery	Crumb	3	6.7	
TU2	A	2	0.25	0.25	Vert Fauna	Otoliths	4	2.9	

8DI29

Prov.	Lev/ Str	Cat #	Recov-ery	Size Grade	Material	Description	n	Wt. (g)	Notes
TU2	A	3	0.25	0.25	Vert Fauna	Bone	20	14.0	
TU2	A	4	0.25	0.25	Metal		15	7.7	
TU2	A	5	0.25	0.25	Glass		1	1.0	
TU2	A	6	0.25	0.25	Marine Shell	UID	1	0.1	
TU2	B	1	0.25	0.25	Pottery	St. Johns	1	3.8	
TU2	B	2	0.25	0.25	Vert Fauna	Bone		6.8	
TU2	B	3	0.25	0.25	Glass		1	1.8	
TU2	B	4	0.25	0.25	Metal		18	7.0	
TU2	C	1	0.25	0.25	Pottery	Sand Temp.	2	17.2	
TU2	C	2	0.25	0.25	Pottery	Sand Temp.	2	20.3	
TU2	C	3	0.25	0.25	Pottery	Crumb	3	4.0	
TU2	C	4	0.25	0.25	Charcoal		1	0.2	
TU2	C	5	0.25	0.25	Vert Fauna	Otoliths	1	0.1	
TU2	C	6	0.25	0.25	Vert Fauna	Bone		55.0	
TU2	C	7	0.25	0.25	Misc. Shell		2	0.5	
TU2	C	8	0.25	0.25	Marine Shell	UID	3	0.3	
TU2	C	9	0.25	0.25	Concretions		5	0.9	
TU2	C	10	0.25	0.25	Metal		32	12.3	
TU2	C	11	0.25	0.25	Pottery	Swift Creek	1	19.9	
TU2	D	1	0.25	0.25	Pottery	Historic	1	19.9	
TU2	D	2	0.25	0.25	Pottery	St. Johns	2	17.0	
TU2	D	3	0.25	0.25	Pottery	Sand Temp.	2	13.1	
TU2	D	4	0.25	0.25	Pottery	Crumb	2	1.8	
TU2	D	5	0.25	0.25	Vert Fauna	Otoliths	2	1.1	
TU2	D	6	0.25	0.25	Vert Fauna	Bone		67.7	
TU2	D	7	0.25	0.25	Misc. Shell		1	0.7	
TU2	D	8	0.25	0.25	Marine Shell	UID	1	<0.0	
TU2	D	9	0.25	0.25	Glass		1	4.9	
TU2	D	10	0.25	0.25	Metal		34	90.7	
TU2	D	11	0.25	0.25	Concretions		10	6.2	
TU2	E	1	0.25	0.25	Pottery	Crumb	5	5.8	
TU2	E	2	0.25	0.25	Vert Fauna	Otoliths	1	0.9	
TU2	E	3	0.25	0.25	Charcoal		1	<0.0	
TU2	E	4	0.25	0.25	Vert Fauna	Bone		49.1	
TU2	E	5	0.25	0.25	Marine Shell	UID	3	1.2	
TU2	E	6	0.25	0.25	Metal		3	2.9	
TU2	F	1	0.25	0.25	Pottery	Sand Temp.	1	2.0	
TU2	F	2	0.25	0.25	Pottery	Sand Temp.	3	27.3	
TU2	F	3	0.25	0.25	Lithics	Chert	1	0.1	
TU2	F	4	0.25	0.25	Charcoal		6	0.2	
TU2	F	5	0.25	0.25	Vert Fauna	Bone		66.5	
TU2	F	6	0.25	0.25	Marine Shell	UID	3	0.4	
TU2	F	7	0.25	0.25	Metal		2	3.2	
TU2	G	1	0.25	0.25	Pottery	St. Johns	1	3.0	

8DI29

Prov.	Lev/ Str	Cat #	Recov- ery	Size Grade	Material	Description	n	Wt. (g)	Notes
TU2	G	2	0.25	0.25	Pottery	Crumb	1	1.2	
TU2	G	3	0.25	0.25	Vert Fauna	Bone		38.4	
TU2	G	4	0.25	0.25	Marine Shell	UID	3	0.5	
TU2	G	5	0.25	0.25	Charcoal		1	0.3	
TU2	G	6	0.25	0.25	Metal		1	2.8	
TU2	H	1	0.25	0.25	Pottery	Sand Temp.	1	10.3	
TU2	H	2	0.25	0.25	Pottery	Sand Temp.	4	14.9	
TU2	H	3	0.25	0.25	Pottery	Crumb	2	3.1	
TU2	H	4	0.25	0.25					Cat # Void
TU2	H	5	0.25	0.25	Lithics	Chert	1	97.3	
TU2	H	6	0.25	0.25	Lithics	Chert	2	1.4	
TU2	H	7	0.25	0.25	Charcoal		12	1.8	
TU2	H	8	0.25	0.25	Vert Fauna	Otoliths	1	0.5	
TU2	H	9	0.25	0.25	Vert Fauna	Bone		159.7	
TU2	H	10	0.25	0.25	Marine Shell	Clam	1	328.4	*Mercenaria*
TU2	H	11	0.25	0.25	Marine Shell	Clam	1	374.5	*Mercenaria*
TU2	H	12	0.25	0.25	Marine Shell	UID	18	4.2	
TU2	H	13	0.25	0.25	Concretions		11	27.9	
TU2	I	1	0.25	0.25	Lithics	Chert	2	8.8	Combined with Cat #2
TU2	I	2	0.25	0.25					Item reclassified as flake - Cat # Void
TU2	I	3	0.25	0.25	Misc. Shell	Wolf	1	3.3	Terrestrial snail
TU2	I	4	0.25	0.25	Marine Shell	UID Conch	1	3.3	Conch columella
TU2	I	5	0.25	0.25	Vert Fauna	Otoliths	2	0.8	
TU2	I	6	0.25	0.25	Concretion		1	35.0	Large concrection - possible antler
TU2	I	7	0.25	0.25	Vert Fauna	Bone		114.1	
TU2	I	8	0.25	0.25	Marine Shell	UID	6	2.2	
TU2	I	9	0.25	0.25	Concretions		2	47.6	
TU2	J	1	0.25	0.25	Marine Shell	Crown Conch	1	37.9	
TU2	J	2	0.25	0.25	Vert Fauna	Otoliths	8	4.9	
TU2	J	3	0.25	0.25	Vert Fauna	Bone		168.0	
TU2	J	4	0.25	0.25	Marine Shell	UID	8	2.0	
TU2	J	5	0.25	0.25	Concretions		5	46.6	
TU2	J	6	0.25	0.25	Shell Tool	Crown Conch	2	122.9	
TU2	K	1	0.25	0.25	Vert Fauna	Bone		21.8	
TU2	K	2	0.25	0.25	Marine Shell	UID	1	0.4	
TU2	K	3	0.25	0.25	Concretions		3	2.5	
TU2	L	1	0.25	0.25	Lithics	Chert	1	5.9	
TU2	L	2	0.25	0.25	Lithics	Chert	1	0.3	
TU2	L	3	0.25	0.25	Vert Fauna	Bone	7	2.3	
TU2	IV-A	1	0.25	0.25	Vert Fauna	Otoliths	1	0.2	

8DI29

Prov.	Lev/ Str	Cat #	Recov- ery	Size Grade	Material	Description	n	Wt. (g)	Notes
TU2	IV-A	2	0.25	0.25	Charcoal		3	<0.0	
TU2	IV-A	3	0.125	0.13	Charcoal			0.3	
TU2	IV-A	4	0.25	0.25	Vert Fauna	Bone		8.0	
TU2	IV-A	5	0.125	0.13	Vert Fauna	Bone		4.0	
TU2	IV-A	6	0.125	0.13	Marine Shell	UID	1	<0.0	
TU2	IV-A	7	0.125	0.13	Misc. Shell	UID	6	0.1	
TU2	IV-A	8	0.25	0.25	Marine Shell	Oyster	24	83.7	
TU2	IV-A	9	0.25	0.25	Marine Shell	Oyster	18	58.9	
TU2	IV-A	10	0.25	0.25	Marine Shell	Oyster		365.8	
TU2	IV-A	11	0.25	0.25	Marine Shell	Clam	1	5.2	
TU2	IV-A	12	0.25	0.25	Marine Shell	Clam	18	8.4	
TU2	IV-A	13	0.125	0.13	Marine Shell	Clam	19	1.5	
TU2	IV-A	14	0.125	0.13	Marine Shell	UID		70.1	
TU2	IV-A	15	0.125	0.13	Marine Shell	Barnacles	22	0.3	
TU2	IV-A	16	0.125	0.13	Concretions		43	0.8	
TU2	IV-A	17	0.25	0.25	Metal		1	2.3	Possible nail
TU2	IV-A	18	0.125	0.13	Misc. UID		3	0.1	
TU2	IV-B	1	0.25	0.25	Marine Shell	UID Conch	1	10.7	
TU2	IV-B	2	0.25	0.25	Charcoal		5	0.4	
TU2	IV-B	3	0.125	0.13	Charcoal		23	0.3	
TU2	IV-B	4	0.25	0.25	Vert Fauna	Otoliths	2	0.1	
TU2	IV-B	5	0.25	0.25	Vert Fauna	Bone	19	3.7	
TU2	IV-B	6	0.125	0.13	Vert Fauna	Bone		11.4	
TU2	IV-B	7	0.25	0.25	Marine Shell	Oyster	33	277.3	
TU2	IV-B	8	0.25	0.25	Marine Shell	Oyster	32	111.8	
TU2	IV-B	9	0.25	0.25	Marine Shell	Oyster		229.0	
TU2	IV-B	10	0.25	0.25	Marine Shell	Clam	1	6.4	
TU2	IV-B	11	0.25	0.25	Marine Shell	Clam	1	6.8	
TU2	IV-B	12	0.25	0.25	Marine Shell	Clam	1	2.2	
TU2	IV-B	13	0.25	0.25	Marine Shell	UID	1	0.3	
TU2	IV-B	14	0.125	0.13	Marine Shell	UID		43.7	
TU2	IV-B	15	0.25	0.25	Concretions		2	1.3	
TU2	IV-B	16			Unsorted			9.9	<1/8”

8DI32									
Prov.	Lev/ Str	Cat #	Recov-ery	Size Grade	Material	Description	n	Wt. (g)	Notes
TU1	D	1							Item reclassified as Pasco
TU1	D	2	0.25	0.25	Pottery	Deptford	1	9.1	
TU1	D	3	0.25	0.25	Pottery	Sand Temp.	1	9.7	
TU1	D	4	0.25	0.25	Pottery	Pasco	3	21.8	2 pieces crossmend - counted as 1
TU1	D	5	0.25	0.25	Pottery	Crumb	1	1.4	
TU1	D	6	0.25	0.25	Vert Fauna	Bone	1	0.1	
TU1	E	1	0.25	0.25	Pottery	Pasco	5	65.0	1 crossmend
TU1	E	2	0.25	0.25	Pottery	Pasco	1	6.9	
TU1	E	3	0.25	0.25	UID		1	9.1	Possibly brick
TU1	E	4	0.25	0.25	Pottery	Sand Temp.	1	18.4	
TU1	E	5	0.25	0.25	Pottery	Sand Temp.	1	9.9	Fresh break counted As 1
TU1	E	6	0.25	0.25	Pottery	Crumb	2	2.3	
TU1	E	7	0.25	0.25	Marine Shell	UID Conch	2	18.8	
TU1	E	8	0.25	0.25	Charcoal		1	0.1	
TU1	E	9	0.25	0.25	Vert Fauna	Otoliths	1	0.4	
TU1	E	10	0.25	0.25	Vert Fauna	Bone		33.4	
TU1	E	11	0.25	0.25	Marine Shell	UID	6	13.1	
TU1	E	12	0.25	0.25	Glass		8	21.2	
TU1	E	13	0.25	0.25	Metal		33	124.1	
TU1	E	14	0.25	0.25	Pottery	Sand Temp.	1	10.0	Fresh break counted As 1
TU1	E	15	0.25	0.25	Pottery	St. Johns	1	12.8	
TU1	E	16	0.25	0.25	Pottery	Sand Temp.	3	30.6	
TU1	E	17	0.25	0.25	Pottery	Sand Temp.	1	1.9	
TU1	F	1	0.25	0.25	Pottery	Deptford	3	17.5	
TU1	F	2	0.25	0.25	Pottery	Sand Temp.	1	2.6	
TU1	F	3	0.25	0.25	Pottery	Pasco	4	145.5	
TU1	F	4	0.25	0.25	Pottery	Pasco	8	128.5	
TU1	F	5	0.25	0.25	Pottery	Crumb	3	3.5	
TU1	F	6	0.25	0.25	Vert Fauna	Bone		82.2	
TU1	F	7	0.25	0.25	Marine Shell	UID	2	4.9	
TU1	F	8	0.25	0.25	Metal		2	2.5	
TU1	F	9	0.25	0.25	Pottery	Sand Temp.	1	7.4	
TU1	F	10	0.25	0.25	Pottery	Deptford	3	29.6	
TU1	G	1							Void - reclassified
TU1	G	2	0.25	0.25	Pottery	Swift Creek	1	14.6	
TU1	G	3	0.25	0.25	Pottery	Sand Temp.	1	2.5	
TU1	G	4	0.25	0.25	Pottery	Deptford Lcs			
TU1	G	5	0.25	0.25	Vert Fauna	Bone		24.3	
TU1	G	6	0.25	0.25	Marine Shell	UID	3	0.8	

8DI32									
Prov.	Lev/ Str	Cat #	Recov- ery	Size Grade	Material	Description	n	Wt. (g)	Notes
TU1	G	9	0.25	0.25	Pottery	Sand Temp.	1	23.2	
TU1	H	1	0.25	0.25	Pottery	Swift Creek	2	19.5	
TU1	H	2	0.25	0.25	Pottery	Sand Temp.	4	29.8	
TU1	H	3	0.25	0.25	Pottery	Pasco	2	19.6	
TU1	H	4	0.25	0.25	Pottery	Pasco	5	37.1	
TU1	H	5	0.25	0.25	Pottery	Crumb	3	3.2	
TU1	H	6	0.25	0.25	Marine Shell	UID Conch	1	57.1	
TU1	H	7	0.25	0.25	Vert Fauna	Bone		114.6	
TU1	H	8	0.25	0.25	Concretions		2	0.5	
TU1	I	1							Void - reclassified
TU1	I	2							Void - reclassified
TU1	I	3							Void - reclassified
TU1	I	4	0.25	0.25	Vert Fauna	Bone		200.7	
TU1	I	5	0.25	0.25	Marine Shell	Clam	1	14.9	
TU1	I	6	0.25	0.25	Concretions		2	1.2	
TU1	I	7	0.25	0.25	Pottery	Deptford	3	25.8	
TU1	I	8	0.25	0.25	Pottery	Pasco	1	9.4	
TU1	I	9	0.25	0.25	Pottery	Pasco	1	15.1	
TU1	J	1	0.25	0.25	Pottery	Pasco	1	7.3	
TU1	J	2	0.25	0.25	Lithics	Chert	3	1.9	
TU1	J	3	0.25	0.25	Vert Fauna	Otoliths	1	1.0	
TU1	J	4	0.25	0.25	Vert Fauna	Bone		37.1	
TU1	J	5	0.25	0.25	Marine Shell	UID	4	1.3	
TU1	II-A	1	0.25	0.25	Pottery	St. Johns	1	4.2	
TU1	II-A	2	0.25	0.25	Pottery	Crumb	3	2.6	
TU1	II-A	3	0.125	0.13	Lithics	Chert	1	<0.0	
TU1	II-A	4	0.25	0.25	Charcoal			4.0	
TU1	II-A	5	0.125	0.13	Charcoal			9.2	
TU1	II-A	6	0.25	0.25	Vert Fauna	Bone		12.2	
TU1	II-A	7	0.125	0.13	Vert Fauna	Bone		29.9	
TU1	II-A	8	0.25	0.25	Paleofeces		2	0.1	
TU1	II-A	9	0.25	0.25	Marine Shell	Oyster	22	141.2	
TU1	II-A	10	0.25	0.25	Marine Shell	Oyster	38	163.0	
TU1	II-A	11	0.25	0.25	Marine Shell	Oyster		264.1	
TU1	II-A	12	0.25	0.25	Marine Shell	Clam	42	64.4	
TU1	II-A	13	0.25	0.25	Marine Shell	Clam	39	54.1	
TU1	II-A	14	0.25	0.25	Marine Shell	Clam		722.8	
TU1	II-A	15	0.125	0.13	Marine Shell	Clam		188.6	
TU1	II-A	16	0.25	0.25	Marine Shell	UID		751.1	
TU1	II-A	17	0.125	0.13	Marine Shell	UID		442.5	
TU1	II-A	18	0.25	0.25	Misc. Shell	UID	1	1.0	
TU1	II-A	19	0.125	0.13	Misc. Shell	UID		1.9	
TU1	II-A	20	0.125	0.13	Seed Pod		1	1.5	

8DI32									
Prov.	Lev/ Str	Cat #	Recov-ery	Size Grade	Material	Description	n	Wt. (g)	Notes
TU1	II-A	23	0.25	0.25	Metal		8	13.8	
TU1	II-A	24	0.125	0.13	Metal		50	4.7	
TU1	II-A	25	0.25	0.25	Glass		6	10.5	
TU1	II-A	26	0.125	0.13	Glass			2.0	
TU1	II-A	27			Unsorted			126.5	<1/8”
TU1	II-B	1	0.25	0.25	Pottery	Pasco	1	60.4	Crossmends with rim
TU1	II-B	2	0.25	0.25	Pottery	Sand Temp.	1	3.7	
TU1	II-B	3	0.25	0.25	Vert Fauna	Otoliths	2	1.9	
TU1	II-B	4	0.125	0.13	Vert Fauna	Otoliths	2	0.1	
TU1	II-B	5	0.25	0.25	Charcoal			31.2	
TU1	II-B	6	0.125	0.13	Charcoal			22.8	
TU1	II-B	7	0.25	0.25	Vert Fauna	Bone		21.1	
TU1	II-B	8	0.125	0.13	Vert Fauna	Bone		32.3	
TU1	II-B	9	0.125	0.13	Misc. Shell	Snail		0.7	
TU1	II-B	10	0.125	0.13	Misc. Shell	UID	4	<0.0	
TU1	II-B	11	0.25	0.25	Marine Shell	Oyster	91	270.4	
TU1	II-B	12	0.25	0.25	Marine Shell	Oyster	93	397.1	
TU1	II-B	13	0.25	0.25	Marine Shell	Oyster		1259.0	
TU1	II-B	14	0.25	0.25	Marine Shell	Clam	84	157.7	
TU1	II-B	15	0.25	0.25	Marine Shell	Clam	46	167.3	
TU1	II-B	16	0.25	0.25	Marine Shell	Clam		685.3	
TU1	II-B	17	0.125	0.13	Marine Shell	Clam		196.7	
TU1	II-B	18	0.125	0.13	Marine Shell	UID		489.6	
TU1	II-B	19	0.25	0.25	Historic Brick		1	181.5	
TU1	II-B	20	0.25	0.25	Glass		1	0.2	
TU1	II-B	21	0.125	0.13	Glass		2	<0.0	
TU1	II-B	22	0.25	0.25	Metal		5	11.2	
TU1	II-B	23	0.125	0.13	Metal		17	1.7	
TU1	II-B	24			Unsorted			157.3	<1/8”
TU1	II-B	25	0.25	0.25	Pottery	Pasco	1	31.3	Crossmends with Cat. #1 body sherd
TU1	II-B	26	0.25	0.25	Pottery	Deptford	1	3.3	
TU1	II-C	1	0.25	0.25	Pottery	Deptford	1	3.0	
TU1	II-C	2	0.25	0.25	Pottery	Pasco	2	7.4	
TU1	II-C	3	0.25	0.25	Pottery	Crumb	1	0.4	
TU1	II-C	4	0.25	0.25	Vert Fauna	Otoliths	7	5.3	
TU1	II-C	5	0.25	0.25	Charcoal		10	0.8	
TU1	II-C	6	0.125	0.13	Charcoal			3.7	
TU1	II-C	7	0.25	0.25	Vert Fauna	Bone		28.7	
TU1	II-C	8	0.125	0.13	Vert Fauna	Bone		71.1	
TU1	II-C	9	0.25	0.25	Marine Shell	UID	1	0.3	
TU1	II-C	10	0.125	0.13	Misc. Shell	UID	7	0.2	
TU1	II-C	11	0.125	0.13	Misc. Shell	Snail		0.9	

8DI32									
Prov.	Lev/ Str	Cat #	Recov-ery	Size Grade	Material	Description	n	Wt. (g)	Notes
TU1	II-C	14	0.25	0.25	Marine Shell	Oyster		1343.1	
TU1	II-C	15	0.25	0.25	Marine Shell	Clam	73	443.1	
TU1	II-C	16	0.25	0.25	Marine Shell	Clam	54	204.5	
TU1	II-C	17	0.25	0.25	Marine Shell	Clam		871.7	
TU1	II-C	18	0.125	0.13	Marine Shell	Clam		159.4	
TU1	II-C	19	0.125	0.13	Marine Shell	UID		672.3	
TU1	II-C	20	0.125	0.13	Marine Shell	Barnacles		1.0	
TU1	II-C	21	0.125	0.13	Concretions		10	0.6	
TU1	II-C	22			Unsorted			248.6	<1/8”
TU1	II-D	1	0.25	0.25	Pottery	Pasco	1	4.2	
TU1	II-D	2	0.25	0.25	Lithics	Chert	1	0.6	
TU1	II-D	3	0.25	0.25	Lithics	UID	1	0.6	
TU1	II-D	4	0.25	0.25	Lithics	Chert	3	0.6	
TU1	II-D	5	0.25	0.25	Vert Fauna	Otoliths	9	7.1	
TU1	II-D	6	0.125	0.13	Vert Fauna	Otoliths	3	0.5	
TU1	II-D	7	0.25	0.25	Marine Shell	Fossilized Coral	5	4.1	
TU1	II-D	8	0.125	0.13	Marine Shell	Fossilized Coral	10	0.9	
TU1	II-D	9	0.25	0.25	Charcoal		6	1.0	
TU1	II-D	10	0.125	0.13	Charcoal			1.7	
TU1	II-D	11	0.125	0.13	Misc. Shell	UID	15	0.2	
TU1	II-D	12	0.25	0.25	Misc. Shell	Snail	5	0.1	
TU1	II-D	13	0.125	0.13	Misc. Shell	Snail		1.8	
TU1	II-D	14	0.25	0.25	Marine Shell	Oyster	121	933.9	
TU1	II-D	15	0.25	0.25	Marine Shell	Oyster	105	322.8	
TU1	II-D	16	0.25	0.25	Marine Shell	Oyster		1567.3	
TU1	II-D	17	0.125	0.13	Marine Shell	UID		575.5	
TU1	II-D	18	0.25	0.25	Marine Shell	Clam	49	268.4	
TU1	II-D	19	0.25	0.25	Marine Shell	Clam	39	147.8	
TU1	II-D	20	0.25	0.25	Marine Shell	Clam		671.2	
TU1	II-D	21	0.125	0.13	Marine Shell	Clam		195.3	
TU1	II-D	22	0.125	0.13	Misc. Shell		21	0.5	
TU1	II-D	23	0.125	0.13	Marine Shell	Barnacles		4.6	
TU1	II-D	24	0.25	0.25	Vert Fauna	Bone		64.0	
TU1	II-D	25	0.125	0.13	Vert Fauna	Bone		68.5	
TU1	II-D	26	0.125	0.13	Concretions		7	0.3	
TU1	II-D	27			Unsorted			168.7	<1/8”
TU1	II-E	1	0.25	0.25	Pottery	Pasco	1	2.2	
TU1	II-E	2	0.25	0.25	Pottery	Crumb	2	0.8	
TU1	II-E	3	0.125	0.13	Lithics	Chert	4	0.4	
TU1	II-E	4	0.25	0.25	Vert Fauna	Otoliths	11	8.2	
TU1	II-E	5	0.125	0.13	Vert Fauna	Otoliths	5	0.8	
TU1	II-E	6	0.25	0.25	Charcoal		5	0.4	
TU1	II-E	7	0.125	0.13	Charcoal			3.3	

8DI32									
Prov.	Lev/ Str	Cat #	Recov-ery	Size Grade	Material	Description	n	Wt. (g)	Notes
TU1	II-E	10	0.25	0.25	Misc. Shell	Snail	3	0.1	
TU1	II-E	11	0.125	0.13	Misc. Shell	Snail		3.1	
TU1	II-E	12	0.125	0.13	Misc. Shell			1.2	
TU1	II-E	13	0.25	0.25	Marine Shell	Oyster	82	622.8	
TU1	II-E	14	0.25	0.25	Marine Shell	Oyster	65	276.2	
TU1	II-E	15	0.25	0.25	Marine Shell	Oyster		712.2	
TU1	II-E	16	0.25	0.25	Marine Shell	Clam	43	165.9	
TU1	II-E	17	0.25	0.25	Marine Shell	Clam	47	180.5	
TU1	II-E	18	0.25	0.25	Marine Shell	Clam		323.6	
TU1	II-E	19	0.125	0.13	Marine Shell	Clam		144.4	
TU1	II-E	20	0.25	0.25	Marine Shell	UID		815.4	
TU1	II-E	21	0.125	0.13	Marine Shell	UID		507.9	
TU1	II-E	22	0.25	0.25	Marine Shell	Barnacles		6.0	
TU1	II-E	23	0.125	0.13	Marine Shell	Barnacles		6.8	
TU1	II-E	24	0.25	0.25	Concretions		2	2.7	
TU1	II-E	25	0.125	0.13	Concretions		70	2.7	
TU1	II-E	26			Unsorted			110.8	<1/8”
TU1	II-E	27	0.25	0.25	Pottery	Pasco	1	5.0	
TU2	A	1	0.25	0.25	Pottery	Pasco	11	60.9	1 crossmend (counted as 1)
TU2	A	2	0.25	0.25	Pottery	St. Johns	1	7.3	
TU2	A	3	0.25	0.25	Pottery	Ruskin Dentate	1	10.0	
TU2	A	4	0.25	0.25	Pottery	Sand Temp.	3	21.4	
TU2	A	5	0.25	0.25	Pottery	Ruskin Dentate	3	34.1	
TU2	A	6	0.25	0.25	Pottery	Crumb	4	5.2	
TU2	A	7	0.25	0.25	Lithics	Chert	1	10.9	
TU2	A	8	0.25	0.25	Vert Fauna	Bone		58.9	
TU2	A	9	0.25	0.25	Glass		13	18.4	
TU2	A	10	0.25	0.25	Metal		15	18.9	
TU2	A	11	0.25	0.25	Sandstone		4	149.3	
TU2	A	12	0.25	0.25	Marine Shell	Clam	1	32.9	Possibly modified
TU2	A	13	0.25	0.25	Charcoal		3	0.8	
TU2	A	14	0.25	0.25	Pottery	Pasco	3	8.3	
TU2	A	15	0.25	0.25	Pottery	Sand Temp.	6	14.1	
TU2	A	16	0.25	0.25	Pottery	Sand Temp.	1	3.0	
TU2	B	1	0.25	0.25	Pottery	Pasco	4	54.5	
TU2	B	2	0.25	0.25	Pottery	Sand Temp.	1	28.6	
TU2	B	3	0.25	0.25	Pottery	Deptford Bold Check	1	28.1	
TU2	B	4	0.25	0.25	Pottery	Sand Temp.	4	17.1	
TU2	B	5	0.25	0.25	Vert Fauna	Bone		106.8	
TU2	B	6	0.25	0.25	Plastic		1	1.7	
TU2	B	7	0.25	0.25	Pottery	Sand Temp.	1	3.4	

8DI32									
Prov.	Lev/ Str	Cat #	Recov-ery	Size Grade	Material	Description	n	Wt. (g)	Notes
TU2	C	3	0.25	0.25	Pottery	Swift Creek	2	8.4	1 crossmends with sherd from TU2D-1
TU2	C	4	0.25	0.25	Vert Fauna	Bone		77.9	
TU2	C	5	0.25	0.25	Pottery	Pasco	1	8.9	
TU2	D	1	0.25	0.25	Pottery	Pasco	6	210.6	Concreted
TU2	D	2	0.25	0.25	Pottery	Swift Creek	1	6.5	Crossmends with 2 from TU2C-3
TU2	D	3	0.25	0.25	Pottery	Crumb	2	3.2	
TU2	D	4	0.25	0.25	Shell Tool	Crown Conch	1	54.0	Battering at base of shell
TU2	D	5	0.25	0.25	Vert Fauna	Bone		99.9	
TU2	D	6	0.25	0.25	Concretions		2	2.7	with bone
TU2	E	1	0.25	0.25	Pottery	Pasco	1	20.4	
TU2	E	2	0.25	0.25	Pottery	Sand Temp.	1	6.2	
TU2	E	3	0.25	0.25	Vert Fauna	Bone		31.1	
TU2	E	4	0.25	0.25	Concretions		14	138.1	with bone and charcoal
TU2	E	5	0.25	0.25	Pottery	Sand Temp.	1	9.3	
TU2	III-A	1	0.25	0.25	Pottery	St. Johns	1	12.8	
TU2	III-A	2	0.25	0.25	Pottery	Pasco	1	2.9	
TU2	III-A	3	0.25	0.25	Pottery	Crumb	4	2.4	
TU2	III-A	4	0.125	0.13	Pottery	Crumb	5	0.2	
TU2	III-A	5	0.25	0.25	Charcoal		19	1.9	
TU2	III-A	6	0.125	0.13	Charcoal			3.0	
TU2	III-A	7	0.25	0.25	Vert Fauna	Otoliths	1	0.6	
TU2	III-A	8	0.25	0.25	Marine Shell	Clam	2	45.5	*Mercenaria*
TU2	III-A	9	0.25	0.25	Misc. Shell		1	0.1	
TU2	III-A	10	0.125	0.13	Misc. Shell		14	0.3	Snail
TU2	III-A	11	0.25	0.25	Vert Fauna	Bone		16.0	
TU2	III-A	12	0.125	0.13	Vert Fauna	Bone		29.1	
TU2	III-A	13	0.25	0.25	Marine Shell	Clam	28	59.0	
TU2	III-A	14	0.25	0.25	Marine Shell	Clam	29	52.3	
TU2	III-A	15	0.25	0.25	Marine Shell	Clam		401.8	
TU2	III-A	16	0.125	0.13	Marine Shell	Clam		15.5	
TU2	III-A	17	0.25	0.25	Marine Shell	Oyster	121	310.3	
TU2	III-A	18	0.25	0.25	Marine Shell	Oyster	179	393.2	
TU2	III-A	19	0.25	0.25	Marine Shell	Oyster		549.3	
TU2	III-A	20	0.25	0.25	Marine Shell	UID		958.4	
TU2	III-A	21	0.125	0.13	Marine Shell	UID		543.3	
TU2	III-A	22	0.25	0.25	Metal		13	5.9	
TU2	III-A	23	0.125	0.13	Metal			6.0	
TU2	III-A	24	0.25	0.25	Glass		1	1.6	
TU2	III-A	25	0.125	0.13	Glass		4	0.1	
TU2	III-A	26	0.125	0.13	Concretions		29	0.8	
TU2	III-A	27			Unsorted			119.4	<1/8”

8DI32									
Prov.	Lev/ Str	Cat #	Recov-ery	Size Grade	Material	Description	n	Wt. (g)	Notes
TU2	III-B	2	0.25	0.25	Charcoal		2	0.3	
TU2	III-B	3	0.125	0.13	Charcoal		15	0.3	
TU2	III-B	4	0.25	0.25	Vert Fauna	Bone	78	21.4	
TU2	III-B	5	0.125	0.13	Vert Fauna	Bone		26.6	
TU2	III-B	6	0.125	0.13	Pottery	Crumb	1	0.1	
TU2	III-B	7	0.25	0.25	Marine Shell	Clam	2	88.5	*Mercenaria*
TU2	III-B	8	0.25	0.25	Misc. Shell		1	0.2	
TU2	III-B	9	0.125	0.13	Misc. Shell		9	0.1	
TU2	III-B	10	0.125	0.13	Misc. Shell			1.0	Snail
TU2	III-B	11	0.25	0.25	Marine Shell	Clam	52	233.0	
TU2	III-B	12	0.25	0.25	Marine Shell	Clam	52	182.4	
TU2	III-B	13	0.25	0.25	Marine Shell	Clam		487.6	
TU2	III-B	14	0.125	0.13	Marine Shell	Clam		8.9	
TU2	III-B	15	0.25	0.25	Marine Shell	Oyster	226	1335.9	
TU2	III-B	16	0.25	0.25	Marine Shell	Oyster	315	1160.2	
TU2	III-B	17	0.125	0.13	Marine Shell	Oyster	11	1.6	
TU2	III-B	18	0.125	0.13	Marine Shell	Oyster	1	0.1	
TU2	III-B	19	0.25	0.25	Marine Shell	Oyster		1068.1	
TU2	III-B	20	0.25	0.25	Marine Shell			549.6	
TU2	III-B	21	0.125	0.13	Marine Shell			340.3	
TU2	III-B	22	0.125	0.13	Marine Shell	Barnacles	5	0.1	
TU2	III-B	23			Unsorted			96.4	<1/8”
TU2	III-C	1	0.25	0.25	Vert Fauna	Otoliths	3	1.8	
TU2	III-C	2	0.125	0.13	Vert Fauna	Otoliths	1	0.1	
TU2	III-C	3	0.25	0.25	Charcoal		3	0.1	
TU2	III-C	4	0.125	0.13	Charcoal			1.9	
TU2	III-C	5	0.25	0.25	Vert Fauna	Bone		38.3	
TU2	III-C	6	0.125	0.13	Vert Fauna	Bone		78.3	
TU2	III-C	7	0.125	0.13	Misc. Shell		2	0.1	
TU2	III-C	8	0.125	0.13	Misc. Shell		7	0.1	
TU2	III-C	9	0.125	0.13	Misc. Shell			1.7	Snail
TU2	III-C	10	0.25	0.25	Marine Shell	Clam	4	115.9	*Mercenaria*
TU2	III-C	11	0.25	0.25	Marine Shell	Clam	120	571.6	
TU2	III-C	12	0.25	0.25	Marine Shell	Clam	175	425.7	
TU2	III-C	13	0.25	0.25	Marine Shell	Clam		1228.2	
TU2	III-C	14	0.125	0.13	Marine Shell	Clam		28.5	
TU2	III-C	15	0.25	0.25	Marine Shell	Oyster	148	1240.0	
TU2	III-C	16	0.25	0.25	Marine Shell	Oyster	138	663.0	
TU2	III-C	17	0.25	0.25	Marine Shell	Oyster		960.0	
TU2	III-C	18	0.25	0.25	Marine Shell	UID		556.3	
TU2	III-C	19	0.125	0.13	Marine Shell	UID		587.8	
TU2	III-C	20	0.25	0.25	Misc. Shell		6	3.9	
TU2	III-C	21	0.25	0.25	Marine Shell	Barnacles	14	1.8	
TU2	III-C	22	0.125	0.13	Marine Shell	Barnacles		2.0	
TU2	III-C	23	0.125	0.13	Concretions		13	0.4	

8DI32									
Prov.	Lev/ Str	Cat #	Recov-ery	Size Grade	Material	Description	n	Wt. (g)	Notes
TU2	IV-A	2	0.25	0.25	Vert Fauna	Bone		22.5	
TU2	IV-A	3	0.125	0.13	Vert Fauna	Bone		41.9	
TU2	IV-A	4	0.25	0.25	Vert Fauna	Otoliths	7	3.2	
TU2	IV-A	5	0.25	0.25	Vert Fauna	Otoliths	2	0.2	
TU2	IV-A	6	0.125	0.13	Charcoal			0.5	<0.1g pulled for C14
TU2	IV-A	7	0.25	0.25	Marine Shell	Oyster	44	217.9	
TU2	IV-A	8	0.25	0.25	Marine Shell	Oyster	40	368.9	
TU2	IV-A	9	0.25	0.25	Marine Shell	Oyster		763.2	
TU2	IV-A	10	0.25	0.25	Marine Shell	Clam	41	303.6	
TU2	IV-A	11	0.25	0.25	Marine Shell	Clam	43	212.4	
TU2	IV-A	12	0.25	0.25	Marine Shell	Clam		493.8	
TU2	IV-A	13	0.25	0.25	Marine Shell	Barnacles		2.7	
TU2	IV-A	14	0.125	0.13	Marine Shell	Barnacles		3.5	
TU2	IV-A	15	0.25	0.25	Misc. Shell		1	4.1	Wolf snail
TU2	IV-A	16	0.125	0.13	Misc. Shell		8	0.1	
TU2	IV-A	17	0.125	0.13	Marine Shell	UID		373.5	
TU2	IV-A	18	0.25	0.25	Marine Shell	UID		363.0	
TU2	IV-A	19	0.25	0.25	Concretions			1212.0	with bone and shell
TU2	IV-A	20	0.125	0.13	Concretions			157.3	with bone and shell
TU2	IV-A	21			Unsorted			71.4	<1/8”
TU2	IV-A	22	0.25	0.25	Pottery	Crumb	8	9.1	
Surf.	Surface	1			Lithic	Chert	1	8.1	

8LV137

STP#	Cat #	Material	Description	Form	Surface Treatment	N	Wt. (g)	Notes
3	1	Lithic	Chert	Flake/Shatter		1	0.1	
7	1	Lithic	Chert	Flake/Shatter		6	5.1	
9	1	Lithic	Chert	Flake/Shatter		2	0.2	
11	1	Vert. Fauna	Bone			86	45.8	
11	2	Shell Tool	Columella	Frag		1	22	Gastropod hammer frag?
11	3	Pottery	Sand Temp.	Body	Plain	17	58.6	
11	4	Pottery	Sand Temp.	Crumb	Plain	20	24.5	
11	5	Pottery	Sand Temp.	Rim	Dentate	2	12.8	
11	6	Pottery	Sand Temp.	Rim	Plain	4	8.5	
11	7	Pottery	Sand Temp.	Body	Dentate	4	11.2	Ruskin
11	8	Pottery	Sand Temp.	Body	Check Stamp	1	7.5	
11	9	Pottery	Spiculate	Body	Check Stamp	3	18.7	St. Johns
11	10	Pottery	Limestone	Body	Plain	5	24.2	Pasco
11	11	Lithic	Chert	Flake/Shatter		4	17.1	
11	12	Pottery	Spiculate	Rim	Check Stamp	1	14.7	St. Johns
11	13	Pottery	Sand Temp.	Body	Check Stamp	1	6.4	Deptford LCS
12	1	Pottery	Sand Temp.	Body	Plain	4	12.9	
12	2	Pottery	Sand Temp.	Crumb	Plain	3	2	
12	3	Pottery	Sand Temp.	Rim	Plain	1	2.9	
12	4	Pottery	Spiculate	Body	Plain	2	6.5	St. Johns
12	5	Lithic	Chert	Flake/Shatter		1	4	Flake found @90cmbs
12	6	Metal	Iron	Uid		1	1.5	
12	7	Glass		Body		1	4.4	
12	8	Hist. Button	?			1	0.3	
12	9	Lithic	Chert	Core/Tool		1	41.4	Core/tool
13	1	Pottery	Sand Temp.	Body	Plain	4	10.3	
13	2	Pottery	Sand Temp.	Crumb	Plain	8	8.4	
13	3	Pottery	Sand Temp.	Body	Punctate	1	5.4	Carabelle
14	1	Pottery	Sand Temp.	Body	Simple Stamp	1	3.9	
15	1	Vert. Fauna	Bone			10	4.3	
15	2	Lithic	Chert	Flake/Shatter		1	1.5	
16	1	Lithic	Chert	Flake/Shatter		2	6.7	
16	2	Lithic	Chert	Ppk Base?		1	1.1	
19	1	Pottery	Sand Temp.	Body	Plain	7	40.5	
21	1	Lithic	Chert	Flake/Shatter		8	4	
22	1	Pottery	Sand Temp.	Body	Check Stamp	1	15.9	Deptford LCS
24	1	Vert. Fauna	Bone			8	3	
24	2	Pottery	Sand Temp.	Body	Plain	3	18.4	
24	3	Pottery	Sand Temp.	Crumb	Plain	4	4.4	
25	1	Lithic	Chert	Flake/Shatter		3	18.7	
25	2	Pottery	Sand Temp.	Body	Plain	1	0.6	
26	1	Pottery	Sand Temp.	Body	Plain	1	8.5	
26	2	Pottery	Sand Temp.	Crumb	Plain	9	5.4	
26	3	Pottery	Sand Temp.	Rim	Plain	2	26.4	Weeden Island
26	4	Pottery	Sand Temp.	Rim	Check Stamp	1	6.4	Weeden Island
26	5	Pottery	Spiculate	Body	Plain	2	1.8	St. Johns
26	6	Lithic	Chert	Flake/Shatter		1	0.3	
27	1	Vert. Fauna	Bone			61	27.3	
27	2	Shell Tool	Shell			1	42.4	Gastropod hammer

STP#	Cat #	Material	Description	Form	Surface Treatment	N	Wt. (g)	Notes
27	3	Lithic	*Sandstone			1	27.9	Grinder frag
27	4	Pottery	Sand Temp.	Body	Plain	33	163	
27	5	Pottery	Sand Temp.	Crumb	Plain	24	28	
27	6	Pottery	Sand Temp.	Rim	Plain	1	43.7	Weeden Island
27	7	Pottery	Limestone	Body	Plain	5	14.9	Pasco
27	8	Pottery	Sand Temp.	Body	Check Stamp	3	25.3	
27	9	Pottery	Sand Temp.	Body	Comp Stamp	1	2.8	Swift Creek
27	10	Pottery	Sand Temp.	Rim	Punctate	1	8.5	Weeden Island
27	11	Pottery	Sand Temp.	Body	Punctate	1	3	
28	1	Pottery	Sand Temp.	Body	Plain	1	1.7	
28	2	Pottery		Body	Plain	1	10.5	
29	1	Pottery	Sand Temp.	Body	Plain	2	8	
29	2	Pottery	Sand Temp.	Crumb	Plain	3	2.5	
29	3	Pottery	Sand Temp.	Body	Check Stamp	1	7.3	
30	1	Pottery	Sand Temp.	Body	Plain	2	3.1	
30	2	Pottery	Sand Temp.	Body	Check Stamp	1	2.9	
31	1	Vert. Fauna	Bone			292	106.7	
31	2	Pottery	Sand Temp.	Body	Plain	12	48.3	
31	3	Pottery	Sand Temp.	Crumb	Plain	13	11.4	
31	4	Pottery	Sand Temp.	Rim	Plain	2	5.4	
31	5	Pottery	Sand Temp.	Body	Check Stamp	8	43.5	
31	6	Pottery	Sand Temp.	Rim	Check Stamp	1	33.8	
31	7	Pottery	Spiculate	Body	Plain	1	0.6	St. Johns
31	8	Pottery	Sand Temp.	Body	Comp Stamp	3	25.7	Swift Creek
31	9	Metal	Iron	Uid		1	0.7	
32	1	Pottery	Sand Temp.	Body	Plain	5	58.2	
32	2	Pottery	Sand Temp.	Crumb	Plain	31	21	
32	3	Pottery	Sand Temp.	Rim	Plain	4	5.8	
32	4	Pottery	Sand Temp.	Body	Check Stamp	1	2.7	
32	5	Pottery	Sand Temp.	Body	Comp Stamp	1	2	Swift Creek
32	6	Pottery	Sand Temp.	Body	Incised	1	6.7	
32	7	Lithic	Chert	Flake/Shatter		2	0.9	
32	8	Vert. Fauna	Bone			3	0.3	
32	9	Metal	Iron			1	0.3	
32	1	Pottery	Sand Temp.	Body	Plain	3	4.2	
34	1	Vert. Fauna	Bone			34	27.8	
34	2	Invert. Fauna	Crab Claw			1	7.8	Stone Crab Claw
34	3	Pottery	Sand Temp.	Body	Plain	14	105.3	
34	4	Pottery	Sand Temp.	Crumb	Plain	10	9.5	
34	5	Pottery	Sand Temp.	Body	Check Stamp	1	11.9	
34	6	Pottery	Sand Temp.	Rim	Comp Stamp	1	15.8	Swift Creek
34	7	Pottery	Sand Temp.	Rim	Dentate	1	63.3	
34	8	Pottery	Sand Temp.	Body	Punctate	2	3.7	
34	9	Pottery	Spiculate	Body	Plain	1	1.1	St. Johns
34	10	Pottery	Sand Temp.	Body	Burnished	1	6.6	
34	11	Lithic	Chert	Flake/Shatter		1	5.7	
35	1	Vert. Fauna	Bone			255	56.2	
35	2	Pottery	Sand Temp.	Body	Plain	17	74.3	
35	3	Pottery	Sand Temp.	Crumb	Plain	10	9.6	

STP#	Cat #	Material	Description	Form	Surface Treatment	N	Wt. (g)	Notes
35	4	Pottery	Sand Temp.	Body	Comp Stamp	3	13.4	Swift Creek
35	5	Pottery	Sand Temp.	Body	Comp/Check Stamp	1	21.4	NewRiver/Swift Creek?
35	6	Pottery	Sand Temp.	Body	Check Stamp	3	11.7	
35	7	Lithic	Sandstone			1	14.5	
36	1	Pottery	Sand Temp.	Body	Plain	7	19.5	
36	2	Pottery	Sand Temp.	Crumb	Plain	2	1.7	
36	3	Pottery	Sand Temp.	Rim	Check Stamp	1	2.7	
36	4	Pottery	Sand Temp.	Body	Comp Stamp	1	1.6	Swift Creek
36	5	Pottery	Sand Temp.	Body	*Comp/Check Stamp	1	11.5	New River/Swift Creek
36	6	Pottery	Sand Temp.	Body	Punctate	1	9.6	
36	7	Pottery	Sand Temp.	Rim	Punctate	1	2.7	
36	8	Vert. Fauna	Bone			5	0.9	
38	1	Pottery	Sand Temp.	Body	Plain	4	11	
39	1	Pottery	Sand Temp.	Body	Plain	3	8.2	
39	2	Lithic	Chert	Flake/Shatter		1	0.1	
40	1	Vert. Fauna	Bone			1	0.1	
40	2	Pottery	Sand Temp.	Body	Plain	11	37.9	
40	3	Pottery	Sand Temp.	Crumb	Plain	12	8.4	
40	4	Pottery	Sand Temp.	Body	Check Stamp	2	9.6	
40	5	Lithic	Chert	Flake/Shatter		9	7.2	
40	6	Lithic	Chert	Micro Drill		1	0.3	Micro drill
41	1	Pottery	Sand Temp.	Body	Plain	3	11	
41	2	Pottery	Sand Temp.	Crumb	Plain	3	2.5	
41	3	Lithic	Chert	Core/Tool		1	104.3	Core/tool
42	1	Vert. Fauna	Bone			1	0.7	
42	2	Pottery	Sand Temp.	Body	Plain	16	83.3	
42	3	Pottery	Sand Temp.	Rim	Plain	3	10.5	
42	4	Pottery	Sand Temp.	Crumb	Plain	15	13.2	
42	5	Pottery	Sand Temp.	Rim	Plain	2	13.6	Weeden Island
42	6	Pottery	Sand Temp.	Body	Check Stamp	1	29	
43	1	Vert. Fauna	Bone			22	31.6	
43	2	Shell Bead	Olivina?			1	12.1	Shell bead
43	3	Pottery	Sand Temp.	Body	Plain	19	148.1	
43	4	Pottery	Sand Temp.	Rim	Plain	2	11.5	
43	5	Pottery	Sand Temp.	Crumb	Plain	30	32.6	
43	6	Pottery	Sand Temp.	Body	Check Stamp	1	2	
43	7	Pottery	Sand Temp.	Rim	Plain	3	12.9	Weeden Island
43	8	Pottery	Sand Temp.	Rim	Punctate	1	12.1	Weeden Island
43	9	Lithic	Chert	Flake/Shatter		3	52.7	
44	1	Vert. Fauna	Bone			18	5.6	
44	2	Pottery	Sand Temp.	Body	Plain	7	18.6	
44	3	Pottery	Sand Temp.	Crumb	Plain	8	8.5	
44	4	Pottery	Sand Temp.	Body	Check Stamp	2	19.5	
44	5	Pottery	Sand Temp.	Rim	Check Stamp	1	27.3	Deptford LCS?
44	6	Pottery	Sand Temp.	Rim	Plain	5	10.2	
45	1	Vert. Fauna	Bone			15	10.3	
45	2	Pottery	Sand Temp.	Body	Plain	4	24.3	
45	3	Pottery	Sand Temp.	Crumb	Plain	3	2.2	
45	4	Pottery	Sand Temp.	Rim	Plain	1	1.7	

STP#	Cat #	Material	Description	Form	Surface Treatment	N	Wt. (g)	Notes
45	5	Pottery	Sand Temp.	Body	Check Stamp	10	41.1	
45	6	Pottery	Sand Temp.	Rim	Check Stamp	1	1.6	
45	7	Lithic				1	1.7	Ferrus pebble
46	1	Vert. Fauna	Bone			3	1.4	
46	2	Pottery	Sand Temp.	Body	Plain	2	4.7	
47	1	Vert. Fauna	Bone			24	14.2	
47	2	Shell Tool	Shell			2	83.2	Gastropod hammer
47	3	Shell Tool	Shell	Colum Ella		1	8.1	Shell tool frag?
47	4	Pottery	Sand Temp.	Body	Plain	34	233.6	
47	5	Pottery	Sand Temp.	Crumb	Plain	23	28.8	
47	6	Pottery	Sand Temp.	Rim	Plain	5	32.1	
47	7	Metal	Iron	Nail		2	2.7	Square nail
47	8	Pottery	Sand Temp.	Body	Dentate	2	21.7	
47	9	Pottery	Spiculate	Body	Plain	1	1.1	St. Johns
47	10	Lithic	Chert	Flake/Shatter		24	58.2	
47	11	Lithic	Chert	Micro Drill		1	0.5	Micro drill
47	12	Lithic	Chert	Core/Tool		1	34.3	Core/tool
48	1	Glass				2	4.9	
48	2	Hist. Button	?			1	0.5	
48	3	Metal	Iron	Uid		1	1	
48	4	Vert. Fauna	Bone			13	6.5	
48	5	Shell Tool	Shell			1	55.7	Gastropod hammer
48	6	Pottery	Sand Temp.	Body	Plain	5	18.7	
48	7	Pottery	Sand Temp.	Crumb	Plain	5	4.5	
48	8	Lithic	Chert	Flake/Shatter		1	2.8	
49	1	Vert. Fauna	Bone			25	8	
49	2	Pottery	Sand Temp.	Body	Plain	5	13	
51	1	Pottery	Sand Temp.	Body	Plain	1	1.4	
54	1	Vert. Fauna	Bone			23	9.6	
54	2	Pottery	Sand Temp.	Body	Plain	14	50	
54	3	Pottery	Sand Temp.	Crumb	Plain	8	6.4	
54	4	Pottery	Sand Temp.	Body	Check Stamp	3	3.7	
54	5	Pottery	Sand Temp.	Body	Punctate	1	4.6	
54	6	Pottery	Sand Temp.	Rim	Plain	1	4.6	Weeden Island
55	1	Vert. Fauna	Bone			96	34	
55	2	Pottery	Sand Temp.	Crumb	Plain	13	15.5	
55	3	Pottery	Sand Temp.	Rim	Plain	1	100.8	
55	4	Pottery	Sand Temp.	Rim	Plain	2	4.5	Weeden Island
55	5	Pottery	Sand Temp.	Body	Punctate	2	7	
55	6	Lithic	Chert	Flake/Shatter		1	3.1	
55	7	Pottery	Sand Temp.	Body	Plain	12	129.8	
56	1	Vert. Fauna	Bone			68	45	
56	2	Shell Tool	Shell			2	86.1	Gastropod hammers
56	3	Pottery	Sand Temp.	Body	Plain	33	168.7	
56	4	Pottery	Sand Temp.	Crumb	Plain	50	51.7	
56	5	Pottery	Sand Temp.	Body	Check Stamp	3	41.3	
56	6	Pottery	Sand Temp.	Rim	Check Stamp	1	1.8	
56	7	Pottery	Sand Temp.	Rim	Plain	3	6.5	
56	8	Pottery	Spiculate	Body	Plain	2	23.5	St. Johns
56	9	Pottery	Sand Temp.	Body	Comp Stamp	3	12.9	Swift Creek

STP#	Cat #	Material	Description	Form	Surface Treatment	N	Wt. (g)	Notes
56	10	Pottery	Sand Temp.	Rim	Incised	1	5.1	
56	11	Pottery	Sand Temp.	Body	Comp Stamp	1	10.9	Zoned Stamp/Incised Swift Creek
56	12	Pottery	Sand Temp.	Body	Fabric Impressed	3	42.3	
56	13	Pottery	Sand Temp.	Body	Cord Marked	1	16.5	
56	14	Pottery	Sand Temp.	Body	Punctate	3	20.5	Weeden Island
57	1	Pottery	Sand Temp.	Body	Plain	1	2.3	
60	1	Pottery	Sand Temp.	Body	Plain	1	2.7	
61	1	Pottery	Sand Temp.	Body	Plain	1	2.7	
62	1	Shell Tool	Shell			4	277.3	Gastropod hammers
62	2	Vert. Fauna	Bone			1	0.4	
62	3	Pottery	Sand Temp.	Body	Plain	2	9.3	
62	4	Pottery	Sand Temp.	Crumb	Plain	3	3.8	
64	1	Lithic	Chert	Flake/Shatter		1	1.9	
66	1	Pottery	Sand Temp.	Body	Plain	3	8.3	
66	2	Pottery	Spiculate	Body	Plain	1	1.1	St. Johns
66	3	Lithic	Chert	Flake/Shatter		1	0.2	
67	1	Lithic	Chert	Flake/Shatter		2	0.2	
69	1	Vert. Fauna	Bone			121	54.3	
69	2	Invert. Fauna				1	0.5	Stone crab claw
69	3	Shell Tool	Shell			2	123	Gastropod hammers
69	4	Pottery	Sand Temp.	Body	Plain	6	23.5	
69	5	Pottery	Limestone	Body	Plain	10	94.7	Pasco
69	6	Pottery	Grog?	Body	Plain	1	3.4	
69	7	Pottery	Limestone	Rim	Plain	1	8.1	Pasco
69	8	Lithic				1	53.7	Sandy limestone
70	1	Vert. Fauna	Bone			42	45	
70	2	Pottery	Sand Temp.	Body	Plain	19	69.9	
70	3	Pottery	Sand Temp.	Crumb	Plain	10	12	
70	4	Pottery	Sand Temp.	Rim	Plain	2	14.8	
70	5	Pottery	Spiculate	Body	Plain	1	1.9	St. Johns
70	6	Pottery	Limestone	Body	Plain	6	29.3	Pasco
70	7	Pottery	Sand Temp.	Rim	Plain	1	29.5	Weeden Island
70	8	Shell Tool	Shell			3	158.5	Gastropod hammers
70	9	Lithic	Chert	Flake/Shatter		1	2.8	
71	1	Lithic	Chert	Flake/Shatter		1	0.2	
72	1	Pottery	Sand Temp.	Body	Plain	1	5.1	

APPENDIX B
RADIOCARBON DATA

Prov.	Material	Beta Lab Number	Measured 14C Age BP	13C/12C Ratio (o/oo)	Conventional 14C Age BP	2-sigma Cal AD/BC	2-sigma Cal BP
8DI29							
TU1-VB	wood charcoal	270205	1400 ± 40	-26.3	1380 ± 40	AD 610-680	1340-1270
TU2-VIC	wood charcoal	270206	4040 ± 40	-25.4	4030 ± 40	BC 2830-2820 BC 2630-2470	4780-4770 4580-4420
8DI32							
TU1-IIE	wood charcoal	270207	1820 ± 40	-24.4	1810 ± 40	AD 120-260 AD 280-330	1830-1680 1670-1620
TU2-IVA	wood charcoal	279609	1920 ± 40	-26.2	1900 ± 40	AD 20-220	1930-1730