A MACRO- AND MICROSCOPIC ZOOARCHAEOLOGICAL EXAMINATION OF LIVING CONDITIONS ABOARD THE EMANUEL POINT WRECKS

by

Jacob Daniel Shidner

B.A., University of Florida, 2005

A thesis submitted to the Department of Anthropology
College of Arts and Sciences
The University of West Florida
In partial fulfillment of the requirements for the degree of
Master of Arts

2011

The thesis of Jacob Daniel Shidner is approved:

Gregory D. Cook, M.A., Committee Member	Date
Catherine B. Parker, M.A., Committee Member	Date
John E. Worth, Ph.D., Committee Member	Date
John R. Bratten, Ph.D., Committee Chair	Date

Accepted for the Department:

John R. Bratten, Ph.D., Chair	Date

Accepted for the University:

Richard S. Podemski, Ph.D., Dean, Graduate School	Date

ACKNOWLEDGEMENTS

This thesis could not have been written without the support and guidance of my friends and family.

My committee has been especially crucial in the development of my research. Thanks to each of you, Dr. John Bratten, Dr. John Worth, Greg Cook and Cathy Parker for introducing me to new ways of thinking about the past, and providing me with the knowledge, experience and opportunities needed to succeed in the future. And to Greg, who knew that such research could evolve from a boat-ride discussion of fleas.

Much appreciated financial support was provided toward the presentation and completion of my research by Dr. Elizabeth Benchley and the University of West Florida Archaeology Institute, as well as the University of West Florida Scholarly and Creative Activities Grant program. My eyes would also like to thank Dr. Benchley for the advanced microscope she purchased, without which none of this research would likely have gotten underway. I also owe a debt of gratitude to the staff of the University of West Florida Marine Services Center and to the staff and students of the Nautical Archaeology Field Schools for their work on the Emanuel Point II site.

I would like to thank Irvy Quitmyer at the Florida Museum of Natural History as well as several researchers at the Museum of Entomology (Florida State Collection of Arthropods) including Michael C. Thomas, G. B. Edwards, Paul E. Skelly, Jim Wiley, Gary J. Steck, and John Kingsolver. I would especially like to thank each of you for not becoming exasperated every time I asked for a second opinion on a specimen. I would also like to thank Norine Carroll for all of her help, and she is the one person who probably stressed-out as much as I did over the proper storage and curation of the microscopic remains.

The many friendships that I developed over the course of my studies were important to bringing this research to fruition, and I would like to thank several of my peers, including Colleen Lawrence, Sarah Linden, Andrew Marr, Irena Sorset, Scott Sorset, Dean Nones, Heidi Davis, and Tim Holmes.

I would like to thank my parents for all of their love and support. To my dad, Robert, to whom I attribute my interest in the maritime environment, and to my mom Sandra, whose encouragement always seemed to come at the most needed times.

Lastly, I would like to thank the two most important women in my life; my wife Ashley and my daughter Abigail. It is to them that I dedicate this thesis. To my wife and best friend, who kept me afloat when I started to sink and kept me going when I wanted to quit. To Abigail, no matter how stressful life gets, you always seem to know exactly how to make me laugh.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

A MACRO- AND MICROSCOPIC ZOOARCHAEOLOGICAL EXAMINATION OF LIVING CONDITIONS ABOARD THE EMANUEL POINT WRECKS

Jacob Daniel Shidner

In 1559 an effort was made to establish a colony in what is now Pensacola, Florida. Led by Don Tristán de Luna, the expedition met with an untimely fate and many of the vessels were lost in Pensacola Bay. The first of what are known as the Emanuel Point Shipwrecks was discovered and excavated in the mid 1990s. The second was located in 2006 and excavations are ongoing. In an effort to examine the shortcomings of current underwater archaeological methodology, sediment samples were collected from various locations during the excavation of the second Emanuel Point ship. Examined exclusively through the use of a microscope, these samples led to a largely un-analyzed data set within maritime archaeology: insects. Combined with other macro-and microscopic zooarchaeological material from both Emanuel Point ships, this data led to an examination of the living conditions aboard the two vessels, and the impact that various animals had on the daily life of the sailors and passengers in the sixteenth-century.

CHAPTER I

INTRODUCTION

Many of the world's cultures, both past and present, have a close relationship with the maritime environment, whether through subsistence, trade, or expansion. Evidence of those relationships is found in the archaeological record in the form of shipwrecks and other submerged sites, but evidence can also be found in terrestrial sites related to maritime culture (Muckelroy 1978; Westerdahl 1992; Bass 1996; Parker 1999; Cooney 2003; Phillips 2003). Shipwrecks provide insight into what life was like for those onboard, what goods and materials were traded between groups, or what was brought on a colonizing voyage to the New World. Due to the underwater environment, many shipwrecks and the artifacts they carried are usually well preserved. Items that would not normally survive in a terrestrial environment, such as wood or textiles, are generally found in very good condition in these underwater sites, such as *Mary Rose* or *La Belle* (Bruseth and Turner 2005; Rule 1983).

Underwater archaeology is a relatively new sub-discipline in the field of archaeology, as only after the invention of the Self Contained Underwater Breathing Apparatus (SCUBA) could archaeologists spend the time they needed underwater to excavate underwater sites. Before Jacques-Yves Cousteau and Emile Gagnan invented the Aqua-Lung in 1943 (Broadwater 1981:218), the recovery of artifacts from underwater sites was both time consuming and dangerous. The archaeology of underwater sites led to important advancements in the last few decades. Both theoretical and methodological advances have occurred, providing more accurate and detailed insights into the people associated with these sites. Advancements are due in a large part to specialized training that has been implemented at various universities. However, the sampling practices of underwater archaeologists have changed very little since the inception of underwater archaeology, as archaeologists have generally focused on ship structure or larger, more recognizable artifacts that can be seen with the naked eye. There are some exceptions to this, such as the work performed by Cheryl Ward Haldane (1990), who studied tiny seeds and plant remains from a Late Bronze Age ship in Turkey.

There is little consensus in sediment sample methodology in underwater archaeology: variables such as the frequency that samples should be taken and the volume of the sample vary widely if they are considered at all. While early underwater archaeologists strived to implement methods that made excavations more methodological and comparable to their terrestrial counterparts, the focus on large or glamorous artifacts narrowed their sampling practices. For example, early excavations of underwater sites used airlifts in order to carefully remove sediments from ship structure; however, they were fitted with plastic laundry baskets to catch any missed artifacts (Wilkes 1971:212-224). With such large holes in the basket, it is inevitable that many small artifacts such as beads, bones or insect parts were lost.

The studies of artifacts found in a shipwreck are just as important as the study of the ship itself, as they lend insight into the lives of the sailors and passengers. What did they subsist upon? Did they have any forms of entertainment on board? What was their cargo? What were the living conditions on board the ships? It is the study of these common, everyday artifacts, such as food remains, game pieces, beads, or even rodent and insect remains that help illustrate what life was like aboard a vessel at sea.

Zooarchaeology is an important sub-discipline to the field of archaeology. The analysis of animal bones has been used to answer questions concerning diet, animal husbandry and domestication, migration, site use, or population size, subsistence, diet, economy, hunting and butchering practices, seasonality, paleoenvironments, bone artifacts, and taxonomic identification (Cleland 1966; Chaplin 1971; Olsen 1971; Schmid 1972; Gilbert 1973; Ziegler 1973; Clason 1975; Bogan and Robison 1978; Meadow and Zeder 1978; Smith 1979; O'Connor 1996, 2000). Zooarchaeology is the study of animals in relation to archaeological sites, but it encompasses more than just a study of bones. Zooarchaeologists examine products made from animals, such as hides or tools, or even study the remains of animals that do not have bones: mollusks, such as oysters, clams and snails, have been harvested as food for thousands of years and their remains can be found in massive middens and mounds. Another invertebrate, insects, also leave their exoskeletons in the archaeological record and insects have always been used and exploited by humans (Sutton 1995). Entomology, or the study of insects, can be a useful tool in the analysis of archaeological sites. However, insects are only occasionally identified and analyzed from terrestrial archaeological sites, and the practice is even less common on underwater sites (Colyer and Osborne 1965; Graham 1965). The study of insects from archaeological sites has been recently referred to as archaeoentomology

(Bain and Prévost 2010:21). Insect remains can be used as indicators of seasonality of site use, health, origin of trade items, and subsistence patterns (Sutton 1995), as well as shipboard pests that seamen had to endure.

The study of zooarchaeological remains from shipwrecks is still a somewhat new aspect of the subfield, yet it has the potential to provide a deeper understanding of what sailors and passengers aboard ships were eating, as well answering other questions concerning life aboard ships. However, the previous zooarchaeological studies concerning shipwrecks have been limited to little more than describing what was consumed during voyages (Smith et al. 1995, 1998; Bass et al. 2004; Bruseth and Turner 2005). The most common and numerous animal remains found on shipwrecks were the remains of animals not normally eaten by the crew barring dire emergencies: namely, the common ship rat.

A zooarchaeological aspect that has been virtually ignored in maritime studies are insects. Insect remains are recovered wholly by chance, usually adhered to another artifact, sometimes *in situ* or in clusters associated with other material, or adhered to the screen. As insect parts are very small, light, and thin, they become attached to other wet materials due to the surface tension properties of water. When insect remains are recovered, there is merely a mention of their presence and identification (Bass et al. 2004; Smith et al. 1995, 1998; Bruseth and Turner 2005). There is very little information concerning the collection of small artifacts, other than in the Nautical Archaeological Society (NAS) Guide (Bowens 2009:20-22). There is also no known literature concerning the use of insect remains to answer anthropological questions on maritime sites, nor is there any work concerning the living conditions on sailing vessels, other than what has been gleamed from historical documents. This is unfortunate, as the confined shipboard environment often necessitated close contact between human and animal inhabitants, especially insects, making such a study relevant to our understanding of shipboard life. Particularly during the “Age of Exploration” and after, European vessels made extended voyages requiring greater lengths of time at sea, and issues of food preservation, hygiene and disease began playing greater roles in the maritime world.

Just as important is the need to reexamine our methods in archaeology. If we do not question the methods we use as archaeologists, then we cannot develop new and more efficient ways to recover archaeological material. This study will show that many microscopic artifacts are lost by using only one-eighth inch and even one-sixteenth inch screens, and that a standardized sediment sample strategy should be considered in underwater excavation. While this is common practice on terrestrial sites, it appears uncommon on shipwreck sites. This lack of sampling strategy may be due to the poor visibility of this material, or an assumption that microscopic data cannot answer scientific questions regarding maritime sites.

The examination of this previously unused dataset in maritime archaeology, will help to illustrate that there is a void in archaeological research that focuses on insects, and the knowledge of the human past that can be inferred from the study of their remains. While the identification and examination of insect remains is only one portion of this project, insects are a large and important factor when examining shipboard life and hygiene. The presence and abundance of various insects can provide a clearer and more precise picture of the conditions that sailors and passengers had to endure in order to survive the harsh conditions on both short and long voyages across the sea.

The information from the Emanuel Point wrecks can be used to add to an existing body of knowledge on excavated sixteenth-century shipwrecks such as the *San Pedro* (Smith 1978), the Molasses Reef wreck (Keith and Simmons 1985), the Studland Bay wreck (Thomsen 2000), the Highborn Cay wreck (Oertling 1989), the Western Ledge Reef wreck (Watts 1993), the *San Estéban* (Arnold and Weddle 1978), and the *San Juan* (Grenier et al. 2007), among others.

The Emanuel Point shipwrecks are important archaeological sites for a number of reasons. Treasure hunters have not disturbed or looted the sites and the wrecks have been excavated solely by archaeologists. This ensures that as much data as possible was collected, recorded analyzed. These two wrecks are the oldest ships excavated in the state of Florida, and they represent one of the few instances were two vessels from the same fleet have been identified and excavated. Having two wrecks from the same fleet is almost unheard of, especially from a fleet that aimed to colonize the New World. This last point may be one of the most important aspects of the Emanuel Point ships, as the period in which the Luna voyage took place is a point in time that saw sweeping changes in not only one nation, but in the entire planet. The transformation that occurred due to the expansion of Europeans throughout the world and what has been call the "Columbian Exchange" affected not only humanity but the entire planetary environment, flora and fauna included (Crosby 2003).

The purpose of this research is two-fold: the first is an evaluation of sediment samples and their benefit to underwater archaeological research; the second is an examination of the living conditions aboard two sixteenth-century Spanish shipwrecks from the failed attempt to colonize Pensacola by Don Tristán de Luna y Arellano in 1559, conducted through an analysis of macroscopic and microscopic faunal remains, including bone, insects, and other artifacts. Chapter 2 discusses the history and importance of screening methodology, zooarchaeological and archaeoentomological studies. Chapter 3 provides a brief history of the Luna expedition. Chapter 4 examines the site formation and post-depositional processes and details of the archaeological methods used in excavation on both Emanuel Point sites. Chapter 5 details the faunal remains that were recovered from both Emanuel Point sites. It is not enough to simply recover and document archaeological remains, but also to investigate and determine what the recovered remains can reveal about past human culture, therefore Chapter 6 discusses what the recovered faunal remains divulge about human maritime life, and Chapter 7 provides conclusions on this research and offers some information as to how this research can be continued and expanded upon.

CHAPTER II

FINE SCREENING, ZOOARCHAEOLOGY, AND INSECTS: THREE UNDERDEVELOPED TOPICS IN MARITIME ARCHAEOLOGY

Screening Methodology

However a site is excavated, whether by shovel, trowel, backhoe or water induction dredge, the physical material from past cultures must be separated from the matrix it is held within. The use of screens is commonplace on any archaeological site, facilitating the capture and collection of material culture while the matrix is allowed to pass through. However, the proper use of screen is not a trivial matter, it is actually quite the opposite. Much work and experimentation has been conducted in order to determine the proper usage of screens on archaeological sites, so that the most information can be collected in an efficient manner.

There is a correlation between the amount of material collected from an archaeological site and the time and money that it takes to collect and analyze that material (Reitz and Scarry 1985:12). It has been determined that the use of 1/16-in. screens in a shell midden can require five times the screening time relative to the use of 1/4-in. screens (Meighan 1969:418). Depending on research questions, budget, and time frame, archaeologists must determine how much material they can afford to collect.

The use of 1/4-in. screens has become the standard on most terrestrial archaeological sites in North America, with fine screening (1/8- and 1/16-in. mesh, flotation, sieving) reserved for random samples and features (Colyer and Osborne 1965; Thomas 1969:392-401; Osborne 1971:156; Casteel 1972:383-387; Payne 1975; Dye and Moore 1978; Kobori 1979:228-229; Reitz and Scarry 1985:12; DeMarcay and Steele 1986:250-264; Yates 1987:87; Baker et al. 1991:140-141; Shaffer 1992; Shaffer and Sanchez 1994; Quitmyer 2004; Lawrence 2010).

To fully understand the differences between standard screens and stacking sieving screens, it is necessary to convert the screen sizes from Imperial to metric. A 1/4-in. screen equals 6.35 mm, 1/8-in. screen equals 3.18 mm, and 1/16-in. screen equals 1.58 mm. The largest of the stacking sieve screens is 2 mm, the next smallest 1 mm, and the smallest is 500 µm, or 0.5 mm. The smaller two stacking sieves are both smaller than 1/16-in. screen, with the smallest having over three times smaller mesh. Unfortunately, fine screening to these screen sizes can be expensive and time consuming (Barker 1975:62; DeMarcay and Steele 1986:250-264; Kobori 1979:228-229; Payne 1975).

However, in order to obtain a complete understanding of many of the materials present in an archaeological site, fine screening is a necessity. Two examples of materials that are commonly too small to be recovered by standard screens are plant and animal remains. Many plant remains, including seeds and pollen, are much too small to be recovered by standard screening alone (Lawrence 2010, Lawrence and Shidner 2009). Even items such as a wooden rosary bead could be missed using standard practices (Lawrence and Shidner 2009:101). While animal remains are commonly recovered from archaeological sites, the remains are usually those of large mammals, and the use of fine screening should not be overlooked for the recovery of smaller remains.

Through the use of fine screening there is a dramatic increase in the number and diversity of fauna that are represented at a site, and the use of 1/4-in. screening alone may prevent the recovery of elements representing various species (Shaffer 1992; Shaffer and Sanchez 1994). Shaffer (1992) shows that 1/4-in. screening creates a bias towards larger animals that have a live mass of greater than 340 grams, as most of the remains from those animals are recovered, while remains from animals with a live mass of less than 140 grams are almost completely lost (Shaffer 1992). In another experiment, Shaffer and Sanchez (1994) illustrate that the use of 1/8-in. mesh can recover skeletal elements that would have been otherwise lost if 1/4-in. mesh was used independently, effectively reducing the bias towards larger animals. In regards to the collection of zooarchaeological materials, there needs to be a standard for how that information is collected. As Quitmyer (2004:110) notes, "the use of different gauge screens in zooarchaeological sample recovery can yield very different results." Those differences can have an affect on our interpretations, especially those related to subsistence behaviors and the environment (Struever 1968; Thomas 1969; Casteel 1972; Payne 1972; Clason and Prummel 1977; Wing and Quitmyer 1985; Shaffer 1992; Gordan 1993; Shaffer and Sanchez 1994; James 1997; Vale and Gargett 2002).

While it can be said that fine screening on terrestrial sites is somewhat common practice, the same cannot be said about maritime sites. Despite the fact that micro-remains are occasionally recovered from shipwreck sites (Bruseth and Turner 2005;

Smith et al. 1995), methods are often not taken to actively recover them. The recovery of sediment samples is not commonplace in underwater excavations, likely because the field of maritime archaeology is still young. Previous research questions in nautical archaeology have focused on the identity of the wreck or the cargo that was carried. These questions could be answered by examining the hull structure or through an analysis of the artifacts recovered during dredging. However, current research questions are beginning to look at shipwrecks in a different light, using new methods to gather new data or reexamine existing data. One of these new research pathways is thoroughly examining the relationships between people and animals on ships.

Zooarchaeology

While zooarchaeological studies have been conducted on many shipwreck sites, they have only focused on limited aspects of the human/animal relationship, specifically, human diet. However, the relationships between people and animals goes beyond simply the first using the second for food.

The complexity of zooarchaeology can be traced through disagreements over what to call the field and those who study it. This struggle for identity by zooarchaeologists is important, as it illustrates just how diverse and far-reaching the subfield can be. The subfield of zooarchaeology focuses on both zoology and archaeology and the ways in which the two subjects can be combined and the information that can be learned is seemingly limitless, the scope of which can be seen in the terminology of some published work.

One of the first clear references to the study of animal remains from archaeological sites was the term "zoologico-archaeologist" by Sir John Lubbock in reference to Steenstrup and Rütimeyer, two Europeans conducting studies on animal remains (Lubbock 1865:169). A true combination of the two fields of interest, the term shows the importance of both zoology and archaeology.

The most common term used in the Americas is zooarchaeology and its derivatives, zooarchéologie and zooarchaeología. These terms echo the anthropological viewpoint of studying animal remains from archaeological sites in order to better understand human behavior (Bobrowsky 1982; Hesse and Wapnish 1985:3; Olsen and Olsen 1981; Reitz and Wing 1999:2). With a focus on the "archaeology," the term illustrates that it is the study of animals from the material culture of the human past.

In Europe and Asia, the common term is "archaeozoology", which places the emphasis on the biology of animal remains. Interpreted literally, "archaeozoology" translates to "old zoology", or paleontology (Legge 1978). Bobrowsky (1982) argues that "archaeozoology" examines both zoological and archaeological interests, however, it can also be interpreted to be a study of animal remains with no relationship whatsoever to human behavior (Hesse and Wapnish 1985:3; Olsen and Olsen 1981; Reitz and Wing 1999:3). The research of those who conduct "archaeozoology" is generally more biological than anthropological in nature (Reitz and Wing 1999:3).

A few other terms are also used to describe the study of the interaction between animals and humans, although much less frequently. One of the terms, ethnozoology, can be defined as the study of human and animal relationships through the viewpoint of the participant rather than the observer's (Vayda and Rappaport 1968:489). Recently, it refers to the ethnographic studies of current interactions between humans and animals, but in the past it included archaeological material as well (Baker 1941; Gilmore 1946; Cleland 1966).

Another term occasionally used is "osteoarchaeology," which Uerpmann (1973:322) defines as "the study of animal bones from archaeological sites." One of the problems with the term osteoarchaeology is that it implies that only bone is included, and therefore only vertebrates are being studied. As Olsen and Olsen (1981) remark, "osteoarchaeology, by definition, must exclude insects; invertebrate shells; keratinous structures such as hoofs, horn, and tortoise shell; egg shell; hide; hair; feathers; feces; and all other nonosseous evidence pertaining to the presence and utilization of animals." Because many analysts consider both vertebrate and invertebrate important for studies such as subsistence strategies, environmental conditions, and site formation processes, the term osteoarchaeology is usually used only in reference to human bones (Reitz and Wing 1999:3).

Even though the study of faunal remains was conducted under many titles, the work was essentially the same. As Lyman (1982) examined, a random assortment of monographs with varying terms in the titles all examined the same topics: subsistence, diet, economy, hunting and butchering practices, seasonality, domestication, paleoenvironments, bone artifacts, and taxonomic identification (Cleland 1966; Chaplin 1971; Olsen 1971; Schmid 1972; Gilbert 1973; Ziegler 1973; Clason 1975; Bogan and Robison 1978; Meadow and Zeder 1978; Smith 1979; O'Connor 1996, 2000). Lyman did agree, however, that the field needed consistent nomenclature, something he had tried earlier to do himself (Lyman 1976; 1979).

While it may seem trivial to focus so much discussion on the proper name of the field, it does help show that animal remains are important as sources of both biological and anthropological data (Bobrowsky 1982; Chaplin 1965; Grayson 1979; Lawrence 1973; Lyman 1987; Ringrose 1993; Uerpmann 1973). Depending on a variety of factors, including the research questions for the particular project, the preservation and makeup of the archaeological deposit, and the experience and interests of the faunal analyst, a zooarchaeological analysis may include all invertebrate and/invertebrate remains, or focus on only one group. Specific items such as hair, hide, feathers, scales, horn, feces, isotopes, DNA, blood residue, insects, mites, or eggshell may be integral to a faunal study, or ignored on the whole (Reitz and Wing 1999:6).

Essentially, zooarchaeology and archaeozoology are alternate ways in which to view the same materials. As with all of the subfields of archaeology, it is of no real importance whether biology, archaeology, entomology, zoology, or geology dominates a study, but rather that they are combined. However, as archaeology is a sub-discipline of anthropology, the true importance is that the researcher remains aware of the human context of what is studied.

It is also important to note the distinction between two other terms, “artifacts” and “ecofacts” when referring to faunal remains. Artifacts are those remains that are modified by humans, while ecofacts are culturally relevant but have not been modified (Reed 1963:210; Binford 1964:430-432; Daly 1969; Uerpmann 1973; Legge 1978; Shackley

1981:1; Reitz and Wing 1999:2). Faunal artifacts would include any bone tools, shell jewelry, fish-bone hooks, butchered bones, even the processed animal remains found in human feces. Faunal ecofacts would include the remains of animals that were associated with people, such as livestock that died of natural causes and were simply buried, or live animals on a ship that died when it sank. Simply because an object was not modified by humans should in no manner reduce its informational worth. Some animals may be considered holy or important as sacrifices, and would never be used for food or their remains used for any purpose. Even animals that are present in the faunal assemblage without any human intent have important informational value concerning human behavior. Wherever humans make their homes, whether permanent or temporary, animals will reside as well. Gardens, trash heaps, attics, hedges, warehouses and ships can all create an inviting habitat for animals, and the remains of those animals can provide much information on the human-built environment (Reitz and Wing 1999:6-7).

The examination of faunal remains can explore many aspects of human behavior. Developing a better understanding of the interactions of humans and animals and the consequences of those interactions, for humans, animals, and the environment, is the principal purpose of zoological research. In order to develop this understanding, zooarchaeologists need to determine how the animal remains they are studying were used, and, therefore, how they were important. This determination can be difficult, as the animal remains recovered from archaeological sites are the results of many different processes, both human and non-human. The study of these processes and changes to the bone is called taphonomy. Cooked bone is distinct from uncooked bone, and even more specifically, there are differences evident in the remains after undergoing various methods of food preparation, such as fire, boiling, or smoking. The environment also plays a large part in the post-depositional development of animal remains. There are many ways to model the taphonomic history of a faunal assemblage, however, the one fact that they all share is a successive loss of the integrity of the information provided from the remains (Clark and Keitze 1967; Meadow 1980; Davis 1987:22; Lyman 1987, 1994; Noe-Nygaard 1988:112, Scudder et al. 1996; Reitz and Wing 1999:110; O'Connor 2000:19).

O'Connor (2000:19-21) does an excellent job describing the various processes and factors acting on animal remains, and they will be listed and described here. There are seven subdivisions of the taphonomic processes acting on animal remains. From the birth of the animal to the publication of the zoological data, these processes are biotic processes, thanatic processes, perthotaxic processes, taphic processes, anataxic processes, sullegic processes, and trephic processes.

Biotic processes are the characteristics of the natural and human environments that influence the presence and quantity of animals at a particular location at a given time. Biotic processes would include factors such as climate, rainfall, vegetation growth or even the introduction of domesticated livestock. Biotic processes are all of the process that occur prior to the death of the animal, and include many of the human activities that are the focus of the study of archaeology.

Thanatic processes are the processes that bring about the death of the animal, as well as the deposition of their remains. At an archaeological site, death and deposition are usually the result of human activity; however, they could also be the result of other predators, old age or disease. The thanatic processes are a reflection of the decisions that humans or other predators make in the action of killing the animal, and the evidence of those processes can be used to infer those decisions.

Perthotaxic processes are those which result in the movement or destruction of animal remains before they are fully placed into the depositional matrix. These processes include weathering, bone removal, fluvial action, the effects of scavengers, or a shipwreck event or the relocation of a trash midden.

Taphic processes are the collection of physical and chemical agents which act upon bones after burial, and bring about changes to the bone and how it is preserved. Factors such as soil acidity, moisture, or the formation of concreted artifacts in salt water are all taphic factors.

Anataxic processes are those that re-expose the animal remains to factors such as fluvial action, weathering, trampling, or wave and tidal patterns. These processes can either hasten or halt the changes conducted by taphic process. They may not have the same result as is caused by perthoraxic process, as the condition of the remains have changed since they were deposited into the depositional layer.

Sullegic processes are those resulting from archaeological activities, which result in unintentional or deliberate selective recovery or non-recovery of bones, such as sampling decisions. The actions of the excavator are also sullegic processes, such as bone breakage through inexperience or mishandling.

Trephic processes are the decisions made during analysis or curation related to sorting, recording, and publication. Factors such as the experience of the analyst, the quality of the comparative collection, or whether or not the remains can be identified, or if the analysis is ever published.

However definitive and clear-cut these processes may seem, it should be noted that in many cases these processes merge with one another, and the evidence of these steps may not be so easily divided. It is also possible that some of these steps may be skipped altogether, or their impact is so minimal that no evidence is left in the physical record.

It is a combination of the processes that determine what material is left in, preserved in, and found in the archaeological record. These processes have a significant impact on our interpretation of the archaeological record, and understanding these taphonomic processes is important to properly interpreting the data recovered from an archaeological site. Being able to identify the differences between a cut from a trowel and one from a stone tool, or the evidence from fire burning versus natural drying can mean a significant difference in interpreting the use of the animal, and the site in general. While it may be difficult for a zooarchaeologist to determine the various processes that animal remains have undergone, doing so is an important element of zooarchaeological research, especially for determining how an animal was used.

One of the principal utilizations of animals is simply for nutrition. One of the reasons that animals were domesticated was to provide a more constant, reliable source of food. The nutritional uses of animals form the basis of subsistence strategies, as well as economic and other cultural institutions. Determining the correlation between animal remains and nutritional use is one of the primary goals for a zooarchaeologist, however, some of these uses may leave little to no evidence in the archaeological record. Many tissues, such as muscle, brains, eggs, and viscera can be used as food, but leave little to no evidence. Antlers, with are generally interpreted as ornaments or tools, are also consumed for medicinal purposes (Reitz and Wing 1999:7).

Another utilization of animals is for work purposes. Various species have been bred for transportation, plowing, and even for the purpose of controlling other animals. Domesticated dogs aid in hunting and guard duty, while pigs have been trained to gather truffles. These animals may be so valuable to their owners that they are not slaughtered until they are old, if at all. It is also possible that their remains may be discarded in special locations, places that archaeologists do not commonly excavate.

Humans have found many non-dietary uses for various parts of an animal's carcass. Hair, hide, and wool can provide clothing, carrying devices, shelter, or tools, such as traps, watercraft, or rope. Clam and conch shells can be used as tools after they meal they provide has been consumed. Animals also provide materials such as oil, fat, and glue. Some animals provide manure, which can be used as fertilizer or fuel. Many of the uses may leave little to no direct evidence in the archaeological record, but they are important to human society nonetheless.

Animals have also been important to people for various cultural reasons, such as religious beliefs or social comfort. Many people have pets for emotional support (Gade 1977; Serpell 1989,1996; Redford and Robinson 1991). Religious beliefs place much significance in different animals for different purposes, resulting in different outcomes. For instance, in Hinduism, the cow is believed to be sacred as the source of all food, and as the symbol of life, may never be killed. Cats were revered in ancient Egypt, for they were essential in controlling pest populations. Animals also relate to our superstitious beliefs; many people believe in the power of luck provided by a rabbit, even carrying a foot around with them as a charm.

While zooarchaeology has been used to examine many of the topics listed previously, the majority of these issues have only been addressed in the examination of terrestrial sites. In regards to maritime sites, zooarchaeology has been used solely to answer questions concerning diet, essentially recreating the menu from which sailors and passengers ate (Bruseth and Turner 2005:123-127; Childs 2007: 90-92; Rodgers 2003:69-78; Smith et al. 1995: 75-81). Publications concerning the animal remains from shipwreck sites usually provide only a list of what identified species were recovered, generally followed by a brief description of their use as food.

However, on a ship just as on land, there were many other relationships occurring other than the ones for nutritional purposes. The purpose and use of a ship sometimes changed with each voyage, and so did its cargo, including the type and number of animals carried aboard. While some ships were used for war, others were used to establish colonies in the New World, and others to facilitate trade. It was these uses that dictated how many animals were to be on board the vessel and how they were to be used. For instance, on a warship cattle may be used for fresh meat for officers or the sick, while on a colonizing vessel the cattle may be needed for the destination, such as to work the plow, and not consumed on the voyage.

Many of the animals on board a ship were unintentional passengers. These pests may include rats, mice, birds, insects, or shipworms. Brought aboard and unable to leave, these animals would have created a home in their new environment, living off of edible cargo and the remains left by the people onboard, or in the case of teredos, the structure of the ship itself. Inhabiting unused or unseen portions of the ships, these populations likely thrived, and while their presence was certainly known, there was very little that could be down to cull their populations. However, it is likely that the need for a ships' cat was an answer to thriving rodent populations aboard sailing vessels.

No matter their purpose or use, live animals must have certain needs met in order to survive, including fresh water and food. In the cases of the various pests on board, they would feed off the scraps thrown away by the humans, and probably drink any rainwater that collected in the holds. The domesticated animals could not fend for themselves, however. They would have needed a supply of food and fresh water supplied every day, and their living areas would need to be cleaned in order to keep the area habitable for animal and human alike. No matter how clean the animal areas were kept, however, it is unlikely that any of the people aboard were able to forget about the non-human passengers aboard.

Insects

One collection of animals that are generally ignored or forgotten in zooarchaeological studies is the taxonomic class Insecta. The presence of insects in an archaeological context depends mainly on the preservation and makeup of the archaeological deposit. The best environment for the recovery of insect remains from a terrestrial site would be a dry and protected site. On a maritime site a stable, anaerobic environment that generally preserves bone well also preserves insects. Insects, however, are very fragile, and can easily be destroyed by wave action or even gentle dredging, and insects with hard exoskeletons are more likely to survive than those with soft-bodies (Sutton 1995:265).

Under the Linnaean system of classification, insects belong to the phylum Arthropoda and the class Insecta. The class Insecta includes beetles, flies, roaches, ants, wasps, and butterflies, just to name a few. Commonly believed to be insects, spiders, mites, ticks, and scorpions are not, and instead belong to the class Arachnida.

While insects are only recently being examined in archaeological contexts, ethnographers, however, have been examining the importance of the interaction between people and insects for some time. For example, in early studies of the San, the dietary use of insects is mentioned, but they are not examined in detail (Lee 1965, 1972; Silberbauer 1972; Tanaka 1976). Lee (1965:87-90) lists 69 identified species in the !Kung diet, but does not elaborate, and Tanaka (1976:110) stated that the San eat insects but did not identify or discuss the insects. Early San research illustrates that the people do eat insects, but exactly how important insects are to their diet is unknown.

In recent decades there has been an emergence in two subfields of ethnography that have led to greater understanding of human-insect interactions: ethnobiology and cultural entomology (Morris 1979; Hogue 1987; Bird-David 1990; Capinera 1993; Cherry 1993; Abram 1996; van Huis 1996; Lauck 1998; Morris 1998, 2004; Latham 1999; Ingold 2000). These studies have shown that people's relationships with insects, and with animal life more generally, is “always one that is complex, diverse and multifaceted, and even contradictory” (Morris 2004:1).

Perhaps the failure to capture the significance of insects in anthropology can be traced to the Western aversion to insects (Holt 1885; Bodenheimer 1951:146; Sutton 1995:255-257; Morris 2008:6). It is also quite possible that many anthropologists do not understand or are unaware of the role that insects play, and have played, in human society. Insects can be a source of food for some cultures and can play essential roles in other aspects of human society, such as art, oral tradition, social structure, and amusement (Bodenheimer 1951; Posey 1986:102-109). Insect art can consist of carvings (Jones et al. 1967), jewelry (McGregor 1943:281), rock art (Shafer 1986), decorations on ceramic vessels and basketry (Rodek 1932). Insects are present as key figures in oral traditions (Mooney 1900; Bushnell 1910) and insect-named clans (Berndt and Berndt 1964) and totems (Spencer and Gillen 1899) have been reported in Australia. They have also been used in puberty rites, as natural pest controls (Strong 1929:176; Blackburn 1976:78; Posey 1986:106), as well as a producer of trade goods such as silk (Posey 1986) and honey (Sutton 1995:256). People have kept insects as pets (Pemberton 1990a) and used them in games (Pemberton 1990b). The Navajo used insects as food, as well as for human and veterinary medicine, in witchcraft and in sand paintings and oral traditions (Wyman and Bailey 1964:27).

Archaeologists rarely seek insect remains (Sutton 1995:264). However, there have been a few examinations of the relationships between insects and past cultures by archaeologists. In the Wetherhill Mesa excavations of 1961 and 1962, sampling was conducted in the hopes of recovering insect remains (Colyer and Osborne 1965; Graham 1965). Nearly all of the insects identified at the Wetherhill Mesa site were pests of stored foods, and some were wood borers found in structural timbers. Both of these insect types had a major impact on the human population at the site, and the entomological study of their remains led to understandings of the seasonality of the site as well as a deeper understanding of the tree-felling practices and timber work of the Native Americans who occupied the site.

Insects were recovered from excavations of a Roman site at Alcester, England (Osborne 1971). Samples of unsorted material excavated from a small muddy pit that contained many scraps of leather were examined in the lab and were found to have large pieces of bone and roughly 100 identifiable species of insects (Osborne 1971:157-158). These insects provide insight into the identity of the feature as a refuse-pit, as almost all of the species are found in accumulations of decaying vegetable matter or dung. The remaining insects were pests associated with stored products and woodborers. The conclusion this led to was that the pit was a refuse-pit into which the floor sweepings of a leather-goods factory were placed, along with dung and general domestic garbage.

Insects were also recovered from a bone-filled refuse pit at a Late Prehistoric site in the Bighorn Basin, Wyoming (Chomko and Gilbert 1991). During excavations, it was determined that the pit was in danger of being eroded away, so it was decided that best course of action was to dig a small trench around the pit and then fill the trench with plaster. Once the plaster had dried, the pit could be removed as a single unit. This allowed researchers to work as cautiously as they needed without the fear of erosion. The discovery of fly pupal casings in relation to the other material excavated from the pit helped the archaeologists create a very detailed reconstruction of the site. They were able to determine exactly what the pit was, when it had been placed into the ground, and how long it had been exposed to air before it was buried. This information was only available due to the discovery of insect remains, and the careful excavation of the feature that left their provenience intact.

The three previous studies have one factor in common: the material was not sorted in the field, but rather it was examined in the lab. Most insect studies are the result of fine-screen analyses, whether the researcher is specifically looking for insects or not. While some published literature explains that the authors were sampling to find insects in particular, other literature does not. In any case, it appears straightforward, that in order to recover insect remains in quantities large enough to be indicative of past populations, fine screening must occur on archaeological material.

A recent study shows how insect remains can provide a more thorough understanding of the impact humans have on their surrounding environment (Bain and Prévost 2010). Archaeoentomological material recovered from across the Ferryland site provides evidence for deforestation and land transformation, food storage and diet, and the transportation of various vertebrate and invertebrate species from the Old World to the New World.

The recovery of grasshopper remains from Lakeside Cave (Madsen and Kirkman 1988) drives home the need for fine screening on archaeological sites. Excavating with 1/4-in. mesh, only 28 grasshopper parts were recovered. When the use of 1/8-in. mesh was employed, recovery increased to 1750 parts, and with 1/16-in. mesh 8772 grasshopper parts were recovered Madsen and Kirkman 1988:600). With an estimated 200,000 minimum individuals on the site the authors determined that they were a food source for the inhabitants of the cave (Madsen and Kirkman 1988:600). Without the use of fine screening, it is likely that the insects would have been looked upon as pests or intruders, and likely not having a strong association with the human population inside the cave.

While insects are occasionally found on shipwrecks (Bruseth and Turner 2005:126; Smith et al. 1995: 85-6), they are usually found adhered to other objects, and never in quantities indicative of their populations on board the ship. In order to conduct a thorough zooarchaeological examination of any site, whether terrestrial or maritime, it is important that fine screening, the recovery of insects and an examination of all of the many aspects of the human/animal relationship are central to the research design. These three factors are essential to moving beyond the zooarchaeological thinking that the only animals aboard sailing vessels with anthropological value were either food products or carried as cargo.

CHAPTER III

THE TRISTÁN DE LUNA EXPEDITION: FROM NECESSITY TO DESTRUCTION

Immediately following Christopher Columbus's voyage in the late 15th century, many European nations viewed the New World as a land of expansion and possibility, ripe with resources and opportunities. Probably no one understood this more that King Felipe II of Spain. After the expeditions of Spanish explorers such as Juan Ponce de Leon, Alonzo Álvarez de Pineda, Lucas Vázquez de Ayllón, Pánfilo de Narváez , and Hernando de Soto, much of the New World had been explored, and the Spanish had a significant presence it the New World, especially in South America and the Caribbean. They did not, however, have a strong presence in the North America continent, even though they claimed the southeast region as their own, calling it *La Florida*.

In his letters to the King, Dr. Pedro de Santandar provided reasons for Spain to establish colonies in *La Florida*, stating the colonies' purpose would be "to provide security for shipping, to prevent vassals of another king from occupying the lands, to extend the Spanish colonial reach, to convert souls, and to furnish an outlet for the poor Spaniards of Spain, New Spain, and Peru who had no income" (Hoffman 1990:150). King Felipe knew that other European nations were infringing on Spanish territories, as he stated in a letter to Velasco dated December 29, 1557, "the French came quite near to

Santa Elena nearly every year to buy from the Indians gold, pearls, marten skins, and other things" (Priestley 1936:57–8).

La Florida was strategically important to the Spanish, as its location was a critical part of the shipping route, the *Carrera de Indias*. This round-trip voyage from Spain to the colonies of South America and the Caribbean basin allowed for delivering and trading goods, bringing much-desired treasure back to Spain (Haring 1964; Peterson 1975; Andrews 1978; Phillips 1986:4; Scott-Ireton 1998:34-37; Smith 1988:85). These ships, following trade winds and currents, traveled through the Gulf of Mexico, where they entered the Florida Straits. Sailing south of Florida, the pilots rode the Gulf Stream north between North America and the Bahamas, eventually hitting the North Atlantic Current, which carried them back to the Iberian Peninsula. While this route was fairly straightforward, it was also extremely treacherous. Ships were vulnerable to attack from hostile parties, and the reefs and shallows created natural perils to navigation, hazards that sank many sailing vessels in the centuries of travel from the New World to the Old World.

The ownership of the newly-discovered lands in the Western Hemisphere was in continual dispute between the major European powers during the sixteenth century. The Franco-Spanish War ended with the Treaty of Cateau-Cambrésis in 1559, however, harassment by French privateers continued after the Treaty was signed (Andrews 1978:64, 1984:118-119). During the same month in which Luna's settlers arrived in Pensacola, September 1559, the French government drafted official plans for a methodical attack on the Indies in order disrupt Spain's primary source of income, treasure (Newton 1967:58). The French also declared that before a claim of possession in the New World would be recognized, occupation by a colonizing nation was necessary (Hoffman 1990:126).

It became imperative that in order for the Spanish to protect their holdings in *La Florida*, they needed to establish a permanent colony. King Felipe II of Spain decided that it would be best to establish a colony on the Atlantic coast of *La Florida* (Priestley 1936:47). This colony could be connected via land routes with many other smaller colonies, and would provide the necessary base to expand Spanish influence in *La Florida*. King Felipe decided early on that the colony on the Atlantic coast would be at Santa Elena, a location discovered in 1526 during Ayllón's expedition. However, the exact location of Santa Elena was unknown, other than the accounts from those who had traveled with Soto (Velasco 1558:259).

King Felipe II wrote in 1557 to the Viceroy of New Spain, Luis de Velasco, to appoint a governor who would found the colony of Santa Elena (Felipe II: 1557:43-47). Viceroy Velasco selected Don Tristán de Luna y Arellano, "an experienced conquistador, nobleman, and personal friend" as *adelantado* of *La Florida* (Scott-Ireton 1998:43). Luna was a solid choice for the position, as he had accompanied Cortés in 1530 to Mexico and Coronado on explorations of the American southwest (Priestley 1936:43), and was also independently wealthy.

Luna was given authority of all of *La Florida*, which extended to the Atlantic Ocean and consisted of the entire American southeast. While the King had ordered only the establishment of Santa Elena, Velasco charged Luna with establishing three colonies in order to protect *La Florida*: in Ochuse (Pensacola, Florida), in the inland province of Coosa (northern Alabama/Georgia), and on the Atlantic coast at Santa Elena (Parris Island, South Carolina) (Milanich and Milbrath 1989:124).

To scout the region for the ideal location of the Gulf coast colony, a single ship commanded by Juan de Rentería sailed out of Veracruz sometime in 1558 to identify inlets and possible ports along the Gulf of Mexico. According to Gonzalo Gayón, who served as pilot for Rentería and later as chief pilot for Luna, they discovered the port of Polonza (Pensacola, Florida), the port of Filipina (Mobile, Alabama), the coast of Apalache, and the Costa de Médanos (Padre Island, Texas) (Weddle 1985: 259, 264). It was suggested to the King that the best place to establish the colony on the Gulf of Mexico would be a location discovered by Soto, the Ochuse River, at the port of Polonza. This location was ideal “because it offers the best entry into *La Florida* if that country is ever to be colonized” and it could “provide shelter there for ships in time of need” (Canillas and Rangel 1557:265). The presence of a good, safe harbor was of high importance to the Spanish, as the right harbor could make or break the chances of the colony’s survival, as well as its productivity in the future.

Recent investigations into the composition of the fleet has shed new light onto what ships may have sailed in the expedition. Through the examination of government records, Dr. John Worth (2009:84-88) has been able to determine exactly which ships were at Luna’s disposal, including a number of ships that shared the same names (Table 1).

Urca ***Jesús*** – Flagship (lost in hurricane)
Tonnage: 570 tons
Crew: 40-50 (estimated)
Owner: Francisco de Ecija
Master: Diego López
Pilot: Alonso Beltrán
Notes: Leased Jan. 24, 1559 for Luna expedition;
crew discharged Sept. 9, 1559 in Pensacola.

Galleon ***San Juan de Ulua*** – Vice Flagship (lost in hurricane)
Tonnage: not less than 220 tons
Crew: 45
Owner: Spanish Crown
Master: Pedro de Andonasgui
Pilot: Diego Perez
Notes: Bought February 22, 1559 for Luna expedition.

Galleon ***San Juan de Ulua*** (returned before hurricane)
Tonnage: unknown
Crew: unknown
Owner: Spanish Crown
Master: Hernán Pérez
Pilot: Constantín de San Remo
Notes: Built for expedition;
returned to Mexico Aug. 25-Sept. 9, 1559;
crew discharged Sept. 10, 1559 in Veracruz;
led subsequent relief efforts.

Ship ***San Andrés*** (lost in hurricane)
Tonnage: 492 ½ tons
Crew: 33 (estimated)
Owner: Salvador Hernández
Master: Alonso Moraño
Pilot: Francisco Martín
Notes: Leased Jan. 24, 1559 for Luna expedition;
crew discharged Sept. 9, 1559 in Pensacola.

Ship ***Santi Espiritu*** (lost in hurricane)
Tonnage: unknown
Crew: 18 (estimated)
Owner: Spanish Crown
Master: Juan de Puerta
Pilot: Juan Valenciano
Notes: Bought Feb. 14, 1559 for Luna expedition;
crew discharged Sept. 13, 1559 in Pensacola.

Ship ***San Amaro*** (lost in hurricane)
Tonnage: 145 tons
Crew: 18 (estimated)
Owner: Felipe Boquín
Master: Christóbal de Escobar
Pilot: Antón Mançera
Notes: Leased Jan. 25, 1559 for Luna expedition;
crew discharged Sept. 13, 1559 in Pensacola.

Ship ***Santa María de Ayuda*** (lost in hurricane)
Tonnage: 100 tons
Crew: 17 (estimated)
Owner: Antón Martín
Master: Lazaro Morel
Pilot: Antón Martín Cordero
Notes: Leased Jan. 23, 1559 for Luna expedition.

Caravel ***Santi Espiritu*** (survived hurricane)
Tonnage: 242 tons
Crew: 24-25 (estimated)
Owner: Alonso Carillo
Master: Alonso Carillo
Pilot: Gonzalo Gayón
Notes: Leased Jan. 24, 1559 for Luna expedition.

Bark ***Corpus Cristi*** (survived hurricane)
Tonnage: unknown
Crew: 11 (estimated)
Owner: Spanish Crown
Master: Francisco de Guadalupe
Pilot: Christóbal Rodriguez
Notes: Bought May 20, 1559 for Luna expedition;
crew discharged Sept. 19, 1559 in Pensacola.

Bark ***San Luís Aragón*** (survived hurricane)
Tonnage: unknown
Crew: unknown
Owner: Spanish Crown
Master: Hernán Rodríguez
Pilot: Gaspar González
Notes: Built for expedition;
returned to Mexico Sept. 29-Oct. 5, 1559.

Bark ***La Salvadora*** (lost in hurricane)
Tonnage: unknown
Crew: 10 (est.)
Owner: Spanish Crown
Master: Vicente Fernández
Pilot: Vicente Fernández
Notes: Built for expedition;
crew discharged Sept. 11, 1559 in Pensacola.

Table 1. The Fleet of Tristán de Luna. (Adapted from Worth 2009:85).

In preparation for the voyage, an assemblage of ships, both old and new, was put together. In total, the fleet consisted of 11 ships (Luna y Arellano 1561:7; Worth 2009:87). Financial documents indicate that six of these vessels were royally-owned, while the other five were privately-owned and leased for the expedition (Worth 2009:87).

In a letter to the King, Velasco stated that he had constructed "six large barks of one hundred tons each made for one hundred men and four pieces of artillery each" and "when laden they will navigate in four palms of water" (Velasco 1558:257). This shallow draught was necessary so that the vessels could enter the rivers and bays of *La Florida*. Of those six vessels, it appears that only four were intended for the expedition with Luna, their names in the documents are *San Luís Aragón*, *La Salvadora*, *San Juan de Ulúa*, and an unnamed frigate. Those four were the vessels built specifically for this voyage, and were built in the New World (Smith et al. 1995:12, Worth 2009:87). However, only three of these ships actually departed with the fleet, as it appears the unnamed frigate was never a part of the expedition and was not paid for its services. It has been theorized that this unnamed frigate was not finished by the time the fleet was to set sail, forcing the "last-minute" acquisition of the *Corpus Christi* (Worth 2009: 87).

Through the examination of financial records, Worth (2009) has been able to distinguish between the different 11 ships, even noting that some of the ships shared the same name. With payments going to two different masters and two different pilots of *San Juan de Ulua*, Worth was able to prove that there were two distinct galleons sailing with the name *San Juan de Ulua*. One of these ships was built specifically for the expedition, while the other was an older ship leased for the voyage.

The fleet was comprised of a variety of vessels, including an urca, two galleons, a caravel, four *naos* or *navios*, and three small *barcas*. The urca, a massive cargo vessel named *Jesús* was the flagship of the fleet, with the older galleon *San Juan de Ulua* acting as the vice-flagship. *Naos* and *navios* are both terms for types of transport or cargo vessels. The diversity of the fleet "reflected both the expedient nature of the vessel construction, selection, and acquisition process during the previous year, as well as the diverse needs of the colonizing fleet" which would need to carry a mixture of colonists and cargo across the Gulf of Mexico, as well as through the shallow bays and rivers along the coast (Worth 2009:87).

During April and May of 1559, this large fleet of diverse ships was loaded in the Veracruz port of San Juan de Ulúa with 1,500 people, made up of entire families of settlers including women and children, slaves, soldiers, priests, artisans, craftsman, Aztecs and Tlaxcalans (Priestly 1928:xxxiv; Smith et al. 1995:4). In a letter to the King, Velasco makes note of the breakdown of soldiers going on the voyage, stating that "five hundred Spaniards will go, four hundred of them soldiers, two hundred being mounted and two hundred on foot armed with arquebuses and crossbows" (Velasco 1558:257).

As Luna's primary mission was establish a thriving colony, they would also need "the materials and supplies necessary to construct an entire Spanish town at Pensacola, including residences for the colonists, a governor's mansion, storehouses, and a jail" (Velasco 1559a:19-33). The governor's mansion was to be known as the "king's house," and was to be built like a fortress and situated away from the rest of the village (Priestly 1928:xxxii).

The ships also carried with them the live animals and processed food supplies necessary for both the journey across the Gulf of Mexico, as well as for establishing the colony including “corn, biscuit, bacon, dried beef, cheese, oil, vinegar, wine, and some live cattle to multiply in the land” as well as “many tools for building and digging in order to sow” (Montalván 1561:285).

In the historical documents, there is mention of livestock being brought as supplies, but the only animals specifically mentioned are cattle and horses. An unknown number of cattle were brought for the colony. Two hundred and forty horses were brought on the voyage, almost half of which died during the two-month journey. In a letter from Viceroy Velasco to King Felipe relating the events of the fleet, Velasco conveys how 100 horses were cast into the sea, while the rest were let ashore in Mobile to finish the journey on foot (Priestly 1928:271). However likely it was that other animals were brought on the expedition, cattle and horses were the only creatures mentioned by name in the documents.

Luna’s fleet set sail from the New Spain port of San Juan de Ulúa, the harbor of Vera Cruz, Mexico, on June 11, 1559. For seventeen days, the ships followed a fair wind, and on June 28 the pilots determined their longitude as being the same as the Rio del Espiritú Santo, what is today known as the Mississippi River, at a calculated latitude of 27° 15”. The ships then traveled southwest to the reefs of Alacrán off of the Yucatan peninsula. The fleet caught a wind to the northeast for eight days, and on July 12 they sighted land, likely Cape St. George or Cape San Blas. They anchored there for five days in order to collect fresh water, wood, and grass for the horses. The ships then continued westward, sending a frigate ahead to search for Ochuse. Apparently the pilot of the frigate failed to recognize the bay, as they missed it and instead anchored in the Bahía Filipina (Mobile Bay). Believing that the port of Ochuse was the better of the ports along the coast, Luna sent a frigate east to find it. As only 130 of the horses had survived the trip across the Gulf, the remaining horses were sent ashore from the ships along with some of the soldiers, in order to make the remainder of the voyage across land (Priestly 1928:273).

The fleet left Filipina on August 9, and the entered the port of Ochuse on the day of Our Lady of August, which could either be August 15, or the vigil of that feast day on the 14th. For this reason, as well as to honor the king, Luna renamed Ochuse the Bahía de Santa Maria Filipina. While relating the arrival of the fleet to the King, Velasco described the port as such:

> It is one of the best ports to be found in the discovered part of the Indies; the lowest water it has at the entrance is eleven cubits, and inside it has a width of three leagues fronting the spot where the Spaniards now are. The entrance over the bar is half a league wide, and has very good marks at the entrance, there being a reddish ravine at the eastern side, dividing the bay. The ships can anchor in four or five fathoms a crossbow shot from land. The port is so secure that no wind can do them any damage at all. There are some few Indian huts, which seemed to be for fisherman. The country is apparently very good. It has many walnuts, grapes, other trees, which bear fruit, and much forest, much game and wild fowl, and many fish of numerous varieties and good. They also found a cornfield (Priestly 1928:275).

The entire voyage across the Gulf of Mexico was made in two months, and "they arrived safely without losing a man or a ship," however the death of nearly half the horses was no small loss (Montalván 1561:285).

After the ships anchored in the port, the colonists went ashore to begin construction of the town. The plan for the town was "no more than one hundred and forty house-lots" with forty house-lots for the plaza, a monastery, a church, and the governor's mansion (Priestly 1928:225). The remaining one hundred lots were for the one hundred families to occupy the town. The plaza was to be large enough to hold and protect all of the town's residents in the case of attack, with the town's four gates visible from the central plaza. Luna placed the town on "a high point of land which slopes down to the bay where the ships come to anchor," likely to help in the defense of the town if needed (Luna y Arellano 1559a:211).

Until the storehouses were built ashore, the ships anchored in the harbor would act as storage facilities. "More than half of the supplies, and all of the tools and arms" had been taken ashore with the soldiers, colonists, and horses (Montalván 1561:285). No mention is made of the rest of the livestock, but it should be safe to assume that they were taken ashore as well, as it would have done them well to be able to free range, rather than be cooped aboard the vessels.

Luna sent the newly constructed galleon *San Juan* back to Veracruz on August 25th to report on the safe arrival of the fleet and to ask for more supplies, especially more horses. Two ships were fully loaded with supplies and prepared for a voyage to Spain for the purpose of enlisting more friars and to bring additional colonists (Priestly 1928:xxxv).

During the night of Monday, the 19th of September, a storm hit the colony, forever sealing the fate of Luna's expedition. Not just any storm, but a strong tropical cyclone, better known as a hurricane, swept into the bay destroying most of the 10 ships anchored within. As Luna wrote to the King, "there came up from the north a fierce tempest, which, blowing for twenty-four hours from all directions until the same hour as it began, without stopping but increasing continuously, did irreparable damage to the ships of the fleet" (Luna y Arellano 1559b:245). The winds and storm surge that accompanied the hurricane broke moorings, snapped anchor chains, and drove the ships into the shallows of the bay, breaking them open and spilling their contents into the salt water. Only one caravel and two barks, the three smallest and most maneuverable of the fleet, survived the carnage (Luna y Arellano 1559b:245). Of the seven ships destroyed in the harbor, one was driven ashore "into a clump of brushwood an arquebuse shot's distance from shore, and left there unhurt" (Priestly 1928:xxxvi). Apparently, little harm came to that particular vessel, "for not a pin was missing" (Priestly 1928:xxxvi).

Luna states to the King that "[There was] great loss by many seaman and passengers, both of their lives as well as their property" but makes no mention of any specific persons. Dávila Padilla noted that Brother Bartolmé Mateos, who was on one the ships ready to sail to Spain, was lost with all on board when the vessel opened (Priestly 1928:xxxvi).

After the storm had passed, the colonists salvaged any materials that they could from the wrecks, and Velasco (1559b:79) suggested that Luna and the colonists construct a frigate and small foist from any salvageable and usable parts of the sunken ships. As most of the supplies of the colony were stored in the vessels anchored in the bay, the loss of the ships and the materials stored within meant certain doom for the colony. Even a considerable portion of the supplies that had been brought to shore had apparently been ruined by the storm, soaked with rain or destroyed by wind (Montalván 1561:285). The fleet had brought enough supplies to last seven to eight months, and the destruction of the storm decimated their supplies (Hoffman 1990:156). Without the necessary food and supplies to support the colonists, Luna was forced to move inland in search of Native Americans who could help them survive while waiting for help from New Spain. However, there was little to send of consequence in Vera Cruz, and few ships with which to send them (Priestly 1928:xxxvii). There were not the necessary supplies inland either, as the vast numbers of Native Americans that had been spoken of by previous explorers were no longer there (Priestly 1928:xxxviii).

Luna's expedition was a well-planned, royally financed, and organized venture that was intended to become the first Spanish colony in *La Florida*. Without the destruction caused by the hurricane, it is likely that Luna's colony would have been a success, but with the passing of one storm, the history of Spain and their presence in the New World was forever changed.

CHAPTER IV

THE EMANUEL POINT SITES AND ARCHAEOLOGICAL METHODOLOGY

The research population for this study is comprised of all of the remains recovered from both Emanuel Point vessels that provide either direct or indirect evidence of any and all animals aboard the wreck. While this certainly includes the physical faunal remains, other artifacts may provide insight into the presence of animals whose remains are no longer present.

The same taphonomic processes that were listed in Chapter 2 in regards to zooarchaeological remains apply to other archaeological remains as well. The recovered material from the Emanuel Point wrecks is but a small sample of the material carried on the vessels before they sank. The processes that are acting on the Emanuel Point wrecks can be grouped into three main categories for better discussion: (1) the pre-depositional factors, (2) the post-depositional and site formation processes, and (3) the methodology utilized in the excavation of the two wrecks. These three categories are comprised of the taphonomic processes described in Chapter 2.

There are both similarities and differences between the two wrecks in all three categories, and in order for an extensive analysis to be conducted; these similarities and differences must be discussed.

Pre-Depositional Factors

As previously mentioned, there is very little information about what animals were brought on the expedition, other than horses and cattle, and little mention is made of how the cargo was divided amongst the ships, only that the *San Andrés* was hired to carry horses and supplies (Collis 2008:43). However, the differences in the ships themselves may suggest that they carried different kinds, or at the very least, varying amounts of animal cargo.

Based on excavations as of 2009, it is thought that the Emanuel Point II ship is “significantly” smaller than the Emanuel Point I ship (Cook 2009:97) (Table 2). The preserved hull of Emanuel Point I extends 34.5 m (Smith et al. 1998:61), whereas for Emanuel Point II it runs approximately 20 m (Cook 2009:97). The keelson on the Emanuel Point II vessel is also smaller, measuring half that of the keelson on the Emanuel Point I vessel in its molded dimension (Cook 2009:97). According to comparisons with historical documents, Emanuel Point I appears to be one of the larger vessels in the fleet, a likely candidate being the previously sailed flagship *San Juan de Ulua* (Collis 2008, Worth 2009:88), while Emanuel Point II is likely one of the smaller vessels in the fleet (Worth 2009:88). The basis for these tentative identifications is from reconstructions of tonnage and crew size.

	Emanuel Point I	Emanuel Point II
Preserved Hull Length	34.6 meters	23 meters
Keel	29 cm molded	27 cm molded
	22 cm sided	30 cm sided
Keelson	34 cm molded	15 cm molded
	22 cm sided	20 cm sided
Frames	16 cm molded	16-18 cm molded
	19-22 cm sided	18-22 cm sided
	41-45 cm on center spacing	40-45 cm on center spacing
Hull Planking	5.5 cm x 25 cm	5.5 cm 23 cm
Ceiling Planking	6 cm x 19 cm	5 cm x 19 cm
Lead Sheathing	Present	Present

Table 2. Scantling Comparisons from the Emanuel Point Wrecks.

As the two ships were of different sizes, it is possible that they served different purposes in the fleet, and may have carried different cargo. However, without any further evidence for support, it cannot be said that animals varied from ship to ship. The types of ships chosen, as well as the number, all played a part in determining the types and numbers of animals present in the archaeological record, and should be considered part of the biotic process, although an indirect one.

Many other biotic processes played a direct part in determining the types and quantities of animals on the Emanuel Point ships. The first would be the overall decision of which animals to bring on the voyage altogether, as the expedition planners would have chosen the animals best suited to establishing a colony in the New World. Factors influencing this decision might include hardy animals that would thrive in the area or animals desired by the upper class as luxury items. The next biotic process would have been the distribution of the animals, whether each species was dispersed evenly amongst the fleet, or if species were placed together for ease of feeding and care. Another possible biotic process would be the decision to leave certain animals aboard the ships while anchored in the bay instead of bringing them ashore.

Thanatic processes would have been acting on the faunal remains in several manners. The most obvious example would be the hurricane sinking the ships of the fleet and killing any animals still aboard. However, many of the remains recovered from the Emanuel Point wrecks did not come from animals killed during the hurricane, but rather were the inedible food remains accumulated during the voyage (or previous voyages). The act of butchering these animals for consumption is a thanatic process as well. The hurricane actually had a role in two different taphonomic process, as a thanatic process killing any live animals, and as a perthotaxic process redistributing any stored food and food remains aboard the ship.

As the ships in the fleet sank close to shore and in relatively shallow water, the survivors were able to salvage any usable items from the various wrecks. This included any material goods as well as usable ship structure. Even though the colonists were facing starvation, it is unlikely that much of the food remains would have been salvaged, and the same could be said for any animals that died during the storm. Both likely would have been ruined beyond use or salvation. However, as the salvagers worked among the wreck, it is highly probable that they disturbed the animal remains, likely shifting or breaking bones and crushing insects. These actions, combined with wave and tidal actions acting upon the wrecks, would be considered perthotaxic actions and would affect the quality of the remains.

Post-Depositional Factors and Site Formation Processes

Both ships lie along the same 4 m depth contour just off of Emanuel Point in Pensacola Bay: the sandbar upon which the ships were grounded and subsequently smashed during twenty-four hours of destructive rain and wind. As the two ships are only a few hundred yards from one another, many of the same post-depositional factors are likely to have occurred on each wreck.

For over 450 years, the changing environment of the bay took its toll on the ships' remains. Only the lower hulls of the ships remained, covered and protected from the elements by the ballast stones that were carried to make the ship more stable as it sailed. These stones were further encased in a layer of mollusks, such as oysters and barnacles, which in securing themselves to the stable ballast stones, also helped to protect the remains of the two vessels (Figure 1). Fine-grained sediments, such as silt, sand, and clay,then filled in the small gaps and created an anaerobic environment, which is essential for the preservation of biological remains. Independent microbial analyses show that the environment is "less aerobic with depth, resulting in diminished microbial richness and diversity" (Lawrence 2010:233). The covering of the wreck by oyster and barnacles, combined with the protective ballast, also likely helped to protect the site during periods of re-exposure, such as when hurricanes and other strong storms shift the sands in the bay.

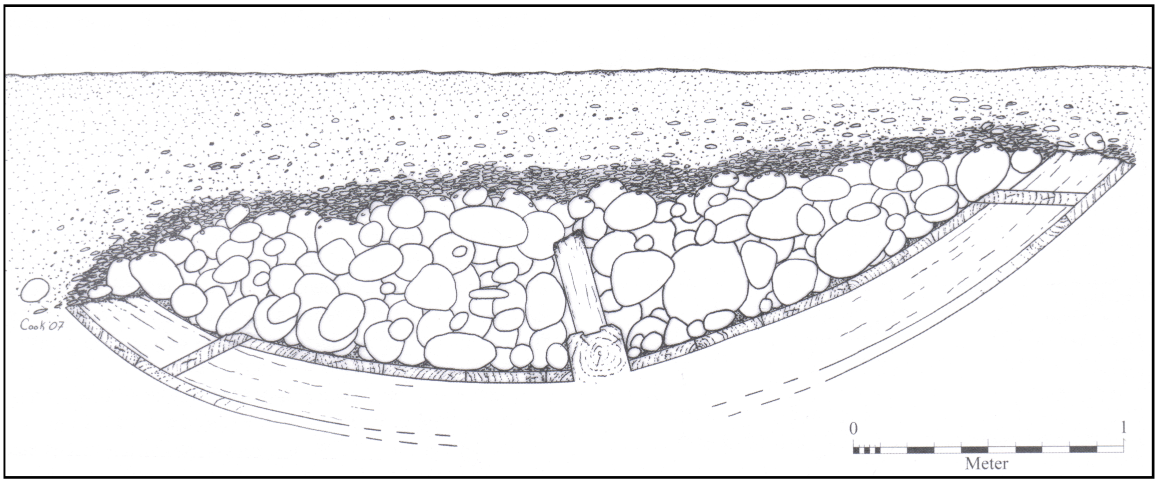

Figure 1. Profile of the hull at the midships trench on Emanuel Point II, illustrating site stratigraphy. Drawing by Gregory Cook, Archaeology Institute, University of West Florida.

The materials found on a ship, and in turn, on a shipwreck, can create a unique environment that can alter faunal material. The scientific and methodological excavation of shipwrecks and submerged maritime sites is a fairly new field, and "relatively little taphonomic research has been conducted on vertebrate assemblages" from these types of sites (Baker 1995:1). Many factors can affect bones in terrestrial environments, including pH, salts, temperature, and bacterial action (Lyman 1994:417). It should be safe to postulate that the same factors would have similar affects on submerged bone, to a different, as of yet unknown, degree. In a terrestrial environment where moisture is insufficient to flush the salts from the matrix, salts can coat the surface of the bone, making identification difficult (Lyman 1994:420). However, in a maritime environment, salts stay soluble in the water, and do not accumulate on the surface of faunal material. Temperature fluctuations are not as dramatic in oceans and lakes as they are in dry soils, where the shifts in temperature can cause bone to crack and split. Generally, in maritime environments bone becomes a sponge-like material, as the organic component ossein is broken down by various micro-organisms and acids destroy the inorganic material composed of calcium phosphate and various fluorides and carbonates (Hamilton 1998:15).

It appears that the most important factor in the preservation of the faunal material from the two wrecks may the creation of the anaerobic environment. This environment prevented bacteria from deteriorating many of the biological portions of the wreck, including the faunal remains and various botanical remains, such as seeds, rope, and the ships themselves.

Ferrous metal artifacts from the shipwrecks also had a taphonomic impact on the faunal material. Ferrous metal artifacts incur taphonomic changes of their own in certain environments, specifically the creation of a concretion. The corrosion of metals submerged in seawater is a complex process, and is only generally explained here. Basically, as metals corrode in salt water, a change in the local pH occurs. This results in the formation of calcium carbonate and magnesium hydroxide. These two products mix with sand, marine life, and other artifacts in the creation of a hard, dense encrustation around the artifact, known as a concretion (Hamilton 1998:41). Any nearby faunal material is incorporated in the concretion, and metallic salts and minerals from both the metal and ocean are incorporated into the bone, speeding up the natural fossilization process by quickly mineralizing the bone.

Surface staining occurs on much of the vertebrate faunal remains. Most material is stained brown or black, presumably from marine sediments or nearby iron, while some a reddish-orange due to iron. These stains are not harmful to the composition of the bone, but can make the identification of features such as cut marks or cooking indicators difficult, and most stains must be removed prior to identification and analysis.

Archaeological Methods of the Emanuel Point Wrecks

While both pre- and post-depositional factors may be beyond the control of archaeologists, the methodology of archaeological excavation is not. The proper use of methods can help to prevent the breaking and destruction of faunal remains after removal from the site. Both Emanuel Point wrecks were excavated using similar methods. It is also important to note that both sites were discovered and worked entirely by archaeologists, allowing for consistency in the methods and practices.

Archaeological Methods Employed on Emanuel Point I (8ES1980)

The Emanuel Point I shipwreck site was located in 1992 by the Florida Bureau of Archaeological Research. After archaeologists conducted a magnetometer survey and discovered an anomaly, initial dives revealed a low mound of ballast stones, usually indicative of ship-related behavior. Initial excavations on the site were conducted in one-meter square test units in order to determine the nature of the site. Once the site had been determined to be a shipwreck and not merely a ballast pile, later excavations were conducted using two-meter squared units. All of the excavation units were divided into quads to make locating and measuring artifacts and features more exact.

Divers used water induction dredges, trowels, and brushes to excavate specific areas of the site (Smith et al. 1998:7). A water induction dredge is driven by a gaspowered pump on the surface that forces seawater though a hose to a dredge-head held by the diver. This dredge-head redirects the flow of water past the nozzle opening and into another hose, referred to as the exhaust hose. As the water moves past the nozzle, it creates suction, allowing the archaeologist to remove sediment and small material from the site as it is slowly and methodically exposed. The sediment is directed with the flow of water through the exhaust hose, which runs to the surface and empties into a 1/4th-in. (6.35 mm) screen on a floating work platform. When divers were working between the ship's frames, 1/16th-in. (1.58 mm) mesh was placed in the screen in order to recover smaller objects (Smith et al. 1995:23). Dredged material was deposited onto the screens where it was sorted by hand. Large items were collected by hand, including large shells that were then reexamined on the surface in case any cultural material had been mistaken as shell (Smith et al. 1998:7).

Twenty-eight two-meter squared units and seven one-meter squared units were excavated over the two excavation campaigns (Scott-Ireton 1998:19-20; Smith et al. 1998:6, 29-30). Excavations of Emanuel Point I uncovered the bow, amidships, and stern of the vessel (Figure 2). From these excavations, over 3,600 individual artifacts were recovered, identified, and cataloged. The excavations of the wreck were conducted in two separate operations, and various researchers identified the faunal remains.

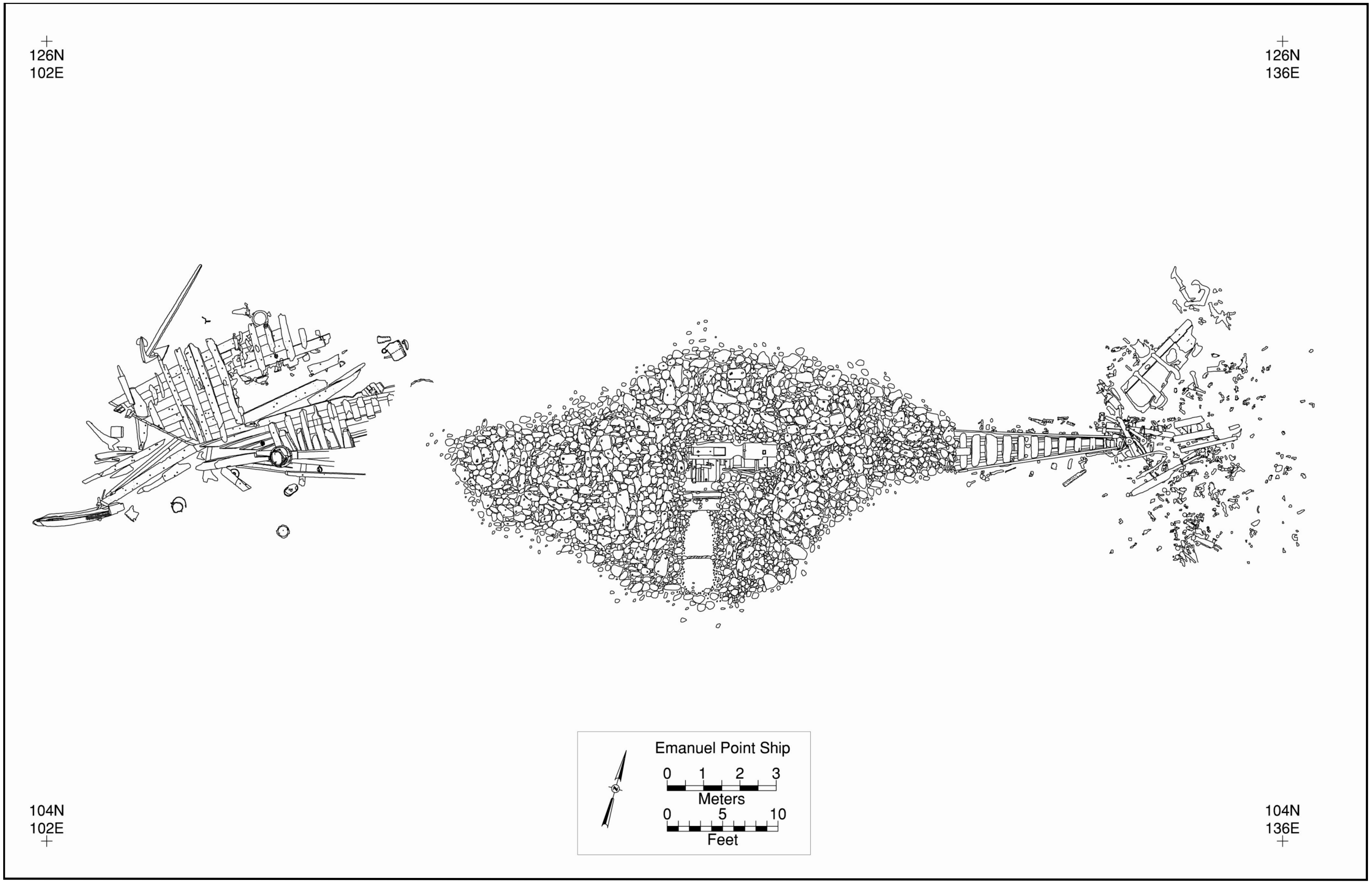

Figure 2. Emanuel Point I site plan. Courtesy of Florida Bureau of Archaeology.

During the first campaign, from 1992 to 1995, a total of 339 complete or fragmented bones were recovered (Smith et al. 1995:75). Any obvious rodent remains were sent for identification to Dr. Phillip L. Armitage, an expert in the fuanal analysis of rodents, with non-rodent faunal being sent to Barry W. Baker and Amy Lee Presley at Texas A&M University. Information such as sex, age, and taphonomic processes (burning, cut marks, rodent gnawing, and breakage) was recorded for all materials (Armitage 1995a, 1995b; Baker 1995; Presley 1995:1).

During the second campaign, from 1997 to 1998, 563 vertebrate remains were recovered (Smith et al. 1998: 114). These were divided into two categories: 1) 169 fish remains and, 2) 394 remains from combination of all others. It was determined that all of the fish were likely intrusive to the site, as none exhibited any butchering marks (Smith et al. 1998:114). A large majority of the bones were found in two clusters in the bow, one at the extreme end of the bow near the anchor, the second between one of the cauldrons and a collapsed barrel (Smith et al. 1998:114).

This cauldron, along with several other items thought to be related to on-board food preparation, were found in an area of the bow believed to be the ships' galley, or perhaps a storage area for galley equipment. In total, 3 cauldrons, a copper saucepan, a bronze mortar, a small pestle that did not match the mortar, and a copper funnel were recovered and believed to be associated with cooking activities, with animal bones being recovered from inside the largest of the cauldrons (Smith et al. 1998:88-89). Rodgers (2003:134-150) examined the materials recovered from the wreck and analyzed their usefulness as cooking equipment.

It is unclear exactly how many insect remains were recovered during the excavations of Emanuel Point I. The artifact inventory of the first field session states that eight insect parts were cataloged in 1993, and three cataloged in 1994 (Smith et al. 1995:163,180). None were cataloged in 1995 (Smith et al. 1995:194). However, a picture of the insect remains (Smith et al. 1995:figure 50) clearly shows more insect remains for artifact 08,831 than are listed in the artifact inventory (Smith et al. 1995:163). Therefore, it is believed by this author that the inventory lists only the number of identified fragments. Only one insect fragment was recovered during the second field session (Smith et al. 1998:209).

Archaeological Methods Employed on Emanuel Point II (8ES3345)

The Emanuel Point II shipwreck site was located during the 2006 University of West Florida summer field school (Cook 2009:93). Numerous anomalies were located during a magnetometer survey, and during an investigation of one of the anomalies a submerged ballast pile was located. Testing investigations started immediately following the discovery of the site, and extensive excavations have taken place in the 2007, 2008, and 2009 field schools (Cook 2009:93; Lawrence and Shidner 2009:101; Lawrence 2010:27). Just as on Emanuel Point I, the excavations on Emanuel Point II have focused on the bow, stern, and midships (Figure 3).

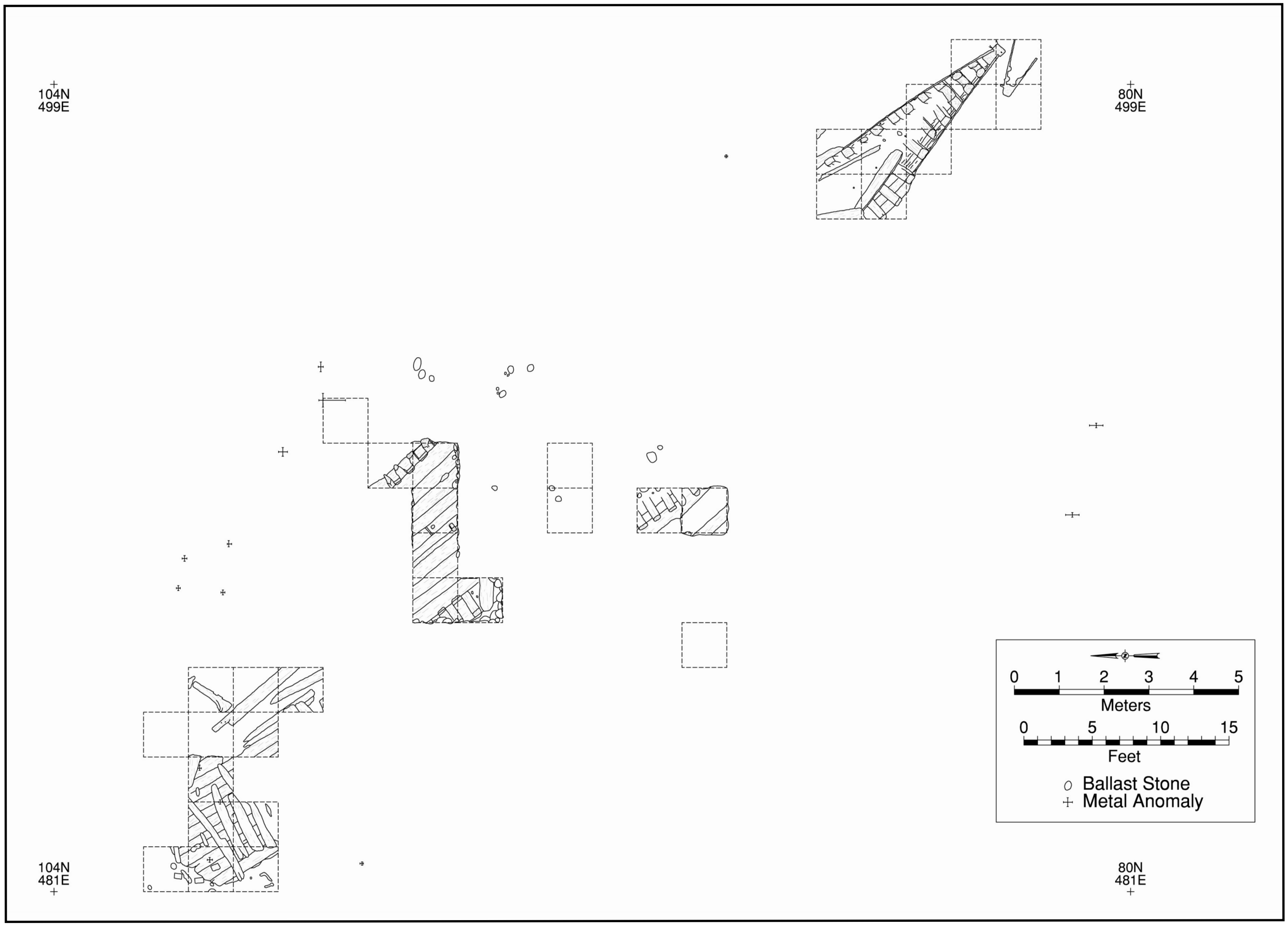

Figure 3. Emanuel Point II site plan, as of 2010. Courtesy of the University of West Florida Archaeological Institute.

Unlike Emanuel Point I, this second site has been excavated solely using one meter square units, however many of the same recovery techniques have been employed between the two sites. Excavations are conducted using the same tools, including hands, trowels, brushes and induction dredges.

One difference in the archaeological methods of the two sites is the collection of artifacts in the dredge exhaust. On Emanuel Point I, the dredge exhaust deposited excavated material directly onto a screen at the surface. On Emanuel Point II, the material is collected in a laundry-style mesh bag at the end of the hose while still underwater. The mesh bag contained roughly 1/4-in. (6.35 mm) holes, and collected any cultural material too large to pass through while allowing sand and other sediments to flow freely through. One of the benefits of this change was that it helped to keep the water column from becoming excessively murky due to falling sediments from the surface screen. The mesh bag method was modified and improved during the 2008 field school by the use of two bags at the end of the exhaust hose, which helped reduce the size of the overall mesh openings in order to capture smaller material. This adjustment was the result of excavators discovering a small wooden rosary bead while sorting dredge material. This bead was small enough to have passed through the mesh, however fortunately it was caught up in other material and recovered. While doubling the bags effectively reduced the size of the holes, due to the flexibility of the mesh the openings are not always consistent. Also, the bags tend to form a layer of shell and sediment that acted as a barrier of sorts, effective in capturing material smaller than the holes in the bags.

A second change in the methodology occurred during the excavations of Emanuel Point II. During the 2006 through 2008 field seasons the sorting of dredge material was done by depositing the dredge exhaust bags directly onto large trays or tables. Excavators sorted the material by hand each day, removing any cultural material. Once the material was sorted, tentative identifications were given to the material, it was then cataloged and placed in labeled artifact bags. This procedure was modified slightly in the 2009 field season; instead of placing dredge material on tables or trays, it was placed onto 1/16-in. (1.58 mm) screen. In addition, the dredge material was gently rinsed with running water to facilitate the removal of wet sediments that tend to clump and obscure artifacts. Instead of having divers catalog and bag all material at the end of each day, sorted material was sent to the University of West Florida Archaeological Conservation Laboratory to be identified and cataloged. This change allowed more time and energy for archaeologists to inspect the dredge spoil for cultural material. It also permitted the recovered material to be examined in a controlled setting by experienced researchers, allowing for accurate identifications and a reduced number of misidentifications. The use of screens and running water, commonly used on terrestrial sites to recover small artifacts, as well as the shifting of some of the post-sorting work to the lab seems to have made an improvement on the collection of material from Emanuel Point II.

The Collection of Sediment Samples on the Emanuel Point Wrecks

During the work conducted on Emanuel Point II, excavations have included the collection of sediment samples for a more extensive survey of the wreck. These samples were fine screened, with the anticipation of recovering artifacts not usually captured during standard dredging techniques.

Between 2006 and 2008 sediment samples were collected from areas of the site that were judged to have been less disturbed by tidal fluctuations or recent sediment deposition. Divers collected these sediment samples by hand, filling one-gallon zip-top plastic bags as fully as possible. Having the bags as full as possible ensured that all of the samples collected contained an equivalent amount of sediment to within a reasonable degree of accuracy. These samples were taken primarily from areas covered by significant layers of ballast, as well as alongside the hull in the bow, stern, and amidships areas. In 2009, sediment samples were collected in the stern and amidships areas at various depths in the site (excavations on the bow were deemed complete in 2008). Samples were taken at the surface, at mid-depth, and along the hull at various points at the site.

During the course of research, it was discovered that several sediment samples had been collected during the excavations of Emanuel Point I. These samples had been vacuumed-sealed and were in the archaeological collections at the University of West Florida. These samples were of various sizes, but none quite as large as the samples recovered from Emanuel Point II. No paperwork was located concerning the collection of the sediment samples, and the only provenience information was the unit number written on the bags or the tags within. One of the samples had more detailed information: a very small sample was collected at the scarf connecting the stem to the keel. Although collected differently than the samples from Emanuel Point II, their inclusion into this study was essential in order to provide a complete faunal assessment on both Emanuel Point ships.

The Collection of Control Cores on Emanuel Point II

In addition to the sediment samples collected within the Emanuel Point II site, four control samples were collected in the form of cores off of the site. The purpose of these cores was to determine the presence and quantity of any intrusive objects, such as plants and animals that may show up on the site.

In order to provide accurate provenience to the test cores, it was necessary to determine exactly where they were to be placed according to the site plan. When the site was first discovered, it was determined that excavations were to be conducted from a baseline established across the site. The baseline became a set of points from which all measurements were taken, including the establishment of excavation units. This baseline is tied into the geographic area through an arbitrary offsite datum point whose Global Position System (GPS) location is known. Using the base line, which runs ten degrees off north to south along the site, which runs northwest to southeast, the cores were placed 100 meters due east and west of both the north and south endpoints of the baseline (Figure 4). By using the established grid system, and by ensuring the cores were in the desired location, it was possible to assign unit coordinates to the cores.

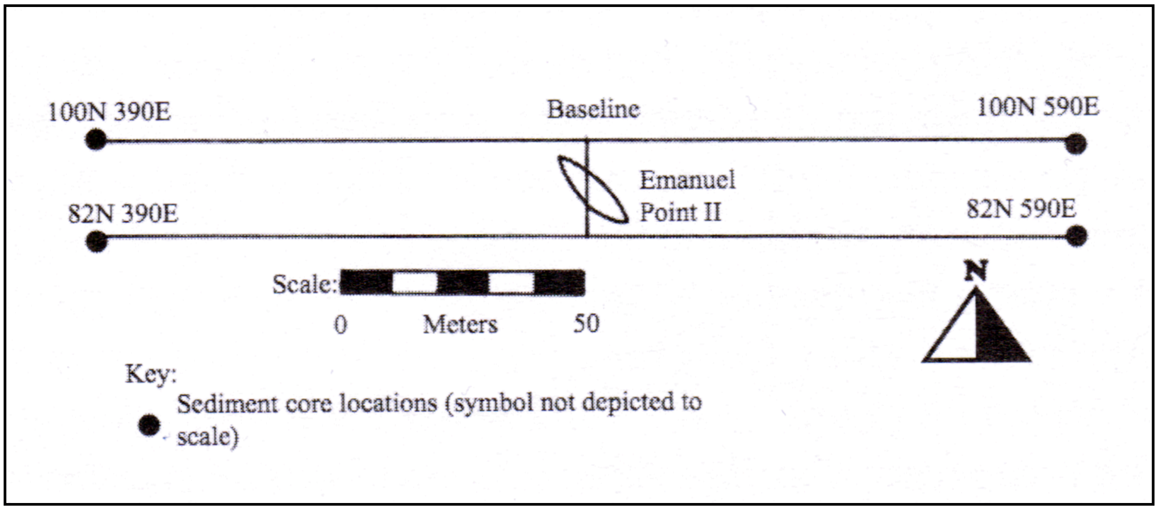

Figure 4. Control core locations in relation to the Emanuel Point II shipwreck site. (Adapted from Lawrence and Shidner 2009:103). Drawing by Colleen Reese Lawrence.

The cores were taken by manually driving a 7.6 cm aluminum pipe 1 meter into the bottom of the bay. As the deepest areas of the hull excavated thus far were 1.3 m below the surface, it was deemed that 1 m should satisfy the research needs. The aluminum pipes were cut to roughly 1.5 m long, and a line was made delineating the pipe at 1 m. Each pipe was also marked to indicate the end that was to enter the sediment. In order to create a solid hammering surface, a wooden block was cut with a circular notch to fit the end of the pipe, allowing the block to seat snugly on the pipe. A hole was drilled in the center of the notch to allow water to escape the pipe as it was driven into the bay floor. The core was pushed into the sediment as far as possible by hand, with the rest of the distance finished with the assistance of a large hammer. This method resulted in a half-meter of pipe, full of water, exposed above the bay floor. A sponge was inserted into the pipe down to the sediment to prevent the water from sloshing inside the pipe and disturbing the sediment. Once the sponge was in place, a plumbing pressure plug was fitted into the pipe, which created a vacuum and prevented the sediment from falling out of the pipe upon removal from the bay bottom. A second plug was inserted into the other end of the pipe once the entire core had been removed. When both plugs were in place, the core could then be lifted to the surface and transported to the Archaeological Conservation Laboratory for further study. Once safely in the lab, the core could then be carefully extruded from the pipe and then divided into 10 cm sections for vertical provenience.

The Fine Screening of Sediment from the Emanuel Point Wrecks

Sediment samples collected from both Emanuel Point sites, as well as the cores taken from the Emanuel Point II site, were screened and evaluated in the same manner. Since the sediment samples from Emanuel Point I had been dried and vacuum-sealed for over a decade, great care was taken in their sorting. However, after initial testing, it was found that treating the material in the same manner as the Emanuel Point II samples had no negative effects on the material. Five of the the sediment samples from the 2009 Emanuel Point II field season were split into two, with one of the halves being used for flotation for a paleobotanical analysis (Lawrence 2010). However, all non-botanical materials from the sediments were returned to the author for inclusion in this research.

Initially, the samples were examined under a Leica EZ4 D stereomicroscope without first being sorted. One spoonful of material was removed directly from the zip-top bag and placed under the microscope for examination. However, this process literally created a headache for the author, as the microscope constantly needed to be refocused to examine objects of various sizes. After a little trial and error, it was found that the best method was to first screen the samples through a set of three stacking copper screens. The largest mesh of the stacking screen was 2 mm, the second middle screen was 1 mm, and the smallest was 500 µm (0.5 mm). The screens were then placed into a large plastic container, so that all material that washed through the screens was collected, ensuring that no material was lost. This process effectively sorted the material into four sizes, and each size could then be examined separately under the microscope so as to avoid a constant and continuous refocusing. Using this sorting procedure also made artifact identification much simpler, since all of the material was roughly the same size, and any object that was not sand could be quickly identified based upon its shape and/or color.

The material was placed into the top screen using a large plastic spoon. It was found that the process was generally more efficient if only one or two large spoonfuls (approximately 30 cubic cm) were placed into the screen at one time. Water was slowly poured over the material in the screen, so that the sediment was gently washed. Even though only a small amount of material was screened at a time, the stacking screens still tended to clog with sediment. After every third or fourth spoonful, the screens would need to be separated, and the sorted material removed from each screen and placed into separate plastic containers. The process could then be repeated without the screens becoming clogged.

The largest of the four sizes, the 2 mm screen, captured material large enough to be observed and identified with the naked eye. This material was placed onto a large tray and sorted with the use of a large tabletop magnifying glass with a built-in halogen light.

This allowed the material to be examined quickly, and ensured that no material was overlooked, as some of the objects tended to adhere to one another.

The next two sizes, the 1 mm and 500 µm, which contained the large majority of recovered artifacts, were examined under the microscope to properly determine what was cultural material. Using a plastic spoon, the author placed one spoonful of the sorted sample on a Petri dish and examined under a dissecting microscope. The author slowly and methodically sorted through the material with a dental pick or the tip of a bamboo skewer, and any artifacts were removed and sorted based on their visible type, such as bone, insect, plant or unidentified. If the artifact could be identified more specifically, such as mammal bone or fish bone, or was a specific part of an insect, such as the complete head or abdomen, it was then sorted further.

The final and smallest size sorted was the material that flowed through all three screens and collected in the plastic container. In order to examine the sediment under the microscope, it first needed to settle. As this material was extremely small and fine-grained, the settling process usually took a few days. Once the solid material had settled to the bottom of the container, the water from the screening process could be carefully removed and separated from the very fine sediment. Both the water and the fine sediment were examined, and not one single object was found in either, indicating that the 500 µm screen was sufficient in capturing all of the cultural material from the excavations.

As artifacts of this size and nature have rarely been recovered from a maritime site in this manner, issues concerning the storage and conservation of such artifacts have seldom, if ever, been encountered by maritime archaeologists before. It was found early on in the process of sorting though the sediment samples that any recovered artifacts could not be stored in small plastic bags. Apparently the weight of the bag alone is enough to damage some of the small, fragile remains; several of the first remains recovered were later found destroyed after lying in bags, on a tray, for a few short weeks. The plastic bags also presented another problem: when removing an artifact and the water form a bag in order to examine the artifact, the sides of the bag tend to squeeze together, which can damage the artifact. Storing the artifacts in small glass vials with leak-proof screw tops easily rectified this problem.

Another problem encountered was bacteria and algae growth. Normally, artifacts recovered from salt water are stored in constantly changing fresh-water baths, which removes chlorides from the objects--chlorides which will damage the artifacts as they dry during the process of conservation. Growth of bacteria and algae can be controlled through various chemicals and have very little impact on the artifacts themselves. However, it was found that materials recovered from the sediment samples are so small that they are actually devoured by the bacteria and algae, and can be destroyed if either are allowed to grow.

Therefore, all faunal remains from the samples, such as bone and insect remains, were placed in 70% ethyl alcohol. Any of the plant remains and the unidentified artifacts were stored in tap water however, as alcohol would desiccate the plant tissue and might do unforeseen damage to any unidentified specimens. To further ensure that no algae growth would occur, the utmost care was taken to keep the samples out of the light whenever possible.

Most of the material recovered from the 2 mm screen, such as olive jar fragments, brass pins, rodent bones, and wood, had been previously recovered on the Emanuel Point Wrecks. However, nearly all of the material found in the 1 mm and 500 µm screens had not been encountered previously and further added to our understanding of life aboard the ships.

It is important to note that while the differences between the two sites described in this chapter, including the size of the vessels the vessels and excavation techniques, as well as the changes implemented during the excavations of Emanuel Point II, had little impact on this study. This research is not necessarily a comparison of the two individual wrecks to one another, but rather an examination of the fauna aboard the ships as a whole, combining the datasets of the two ships into a larger dataset with the goal of examining human and animal interactions aboard the colonization fleet in general. The inclusion of sediment samples from Emanuel Point I, although much smaller in size and quantity than their counterparts from the Emanuel Point II site, allowed for a microscopic analysis to be conducted, which added to the overall faunal data from that site. When compared to the smaller Emanuel Point II, Emanuel Point I had a greater number of large vertebrate remains associated with it, probably due to the excavation of the galley area. Most of these remains are very likely food remains, and not the remains of live animals kept on board. However, the overall quantities of animals on the wrecks, while important to understanding conditions aboard the vessels, are not being compared to one another, but rather used in conjunction with one another to illustrate a larger picture.

CHAPTER V

FAUNAL REMAINS RECOVERED FROM THE EMANUEL POINT WRECKS

The two Emanuel Point sites have yielded many types of faunal remains, both vertebrate and invertebrate. Following standard zooarchaeological practices, all faunal remains were identified to the lowest possible taxon using the vertebrate comparative zooarchaeological collections at Texas A&M University, the University of West Florida, the Florida Museum of Natural History, and the invertebrate comparative collections at the Museum of Entomology (Florida State Collection of Arthropods). Several widely recognized published references were also used in this process to help visually identify faunal remains, especially insects and teeth (Ryder 1969; Borror and White 1970; Gorham 1991; Castner 2000; Hillson 2005).

The vertebrate material recovered from Emanuel Point I were identified immediately following the two separate excavation campaigns. Barry W. Baker and Anna Lee Presley analyzed the non-rodent materials from the first campaign using the Zooarchaeological Research Collection at Texas A&M University, and Dr. Philip L. Armitage identified the rodent material using his personal comparative collection (Armitage 1995a, 1995b; Baker 1995; Presley 1995; Smith et al. 1995:75). This author, however, also visually verified the identifications made by Baker, Presley, and Armitage and the population estimations reported. The materials from the second campaign appear never to have been officially identified, but were given tentative identifications in the University of West Florida's laboratory by Catherine Parker at the University of West Florida. An overwhelming majority of these bones were butchered or fragmented, and appear to represent food supplies for the fleet, supporting the theory that these remains were recovered in or near the ship's galley area. Consisting mostly of fragments and not of the skeletal elements normally used to determine minimum numbers of individuals, a majority of the remains recovered from the second Emanuel Point I field session do not contribute to the population size calculations. Any identified specimens that could be used in the population analysis were included, and a survey of the faunal materials by the author indicated that no new taxa were recovered in the second excavation session.

Catherine Parker identified the Emanuel Point II vertebrate material from the 2006 and 2007 field sessions, and part of the material from the 2008 field session. The author identified the faunal material from the 2009 field session, as well as the remaining taxa recovered in 2008. The material was identified using comparative collections from the University of West Florida and the Florida Museum of Natural History.

Invertebrate remains recovered during dredging operations on Emanuel Point I were sent for identification to Dr. Horace Burke at the Entomology department at Texas A&M University. Cockroach remains were sent to the United States Department of Agriculture research station in Gainesville, Florida for further identification. The author identified all remains recovered from the sediment samples of both sites, using the comparative collections at the Florida Museum of Natural History for vertebrates and the Museum of Entomology (Florida State Collection of Arthropods) for invertebrates.

Various invertebrate specialists were consulted to verify the author's identifications, as well as to assist in identifying difficult specimens.

All taxa represented on Emanuel Point I were also recovered on Emanuel Point II, as well as taxa unique to the second site. To determine the approximate population size for each of the faunal types recovered from the Emanuel Point wrecks, a few different zooarchaeological calculations were conducted. The first was to determine the Number of Identified Specimens (NISP) for each type. The NISP represents both the number of recovered specimens positively identified to taxon, as well as the maximum number of individuals for each group represented in the sample, as it is possible that each remain came from a different individual. The second calculation was to determine an estimate for the Minimum Number of Individuals (MNI) represented in the sample. The MNI estimates were calculated by determining the frequency of paired elements, coupled with observations of size, epiphyseal fusion, tooth eruption, and tooth wear.

Vertebrate Remains Recovered from Emanuel Point I

At least 10 individual taxa are represented in the faunal assemblage, from 4 classes: Mammalia (mammals), Aves (birds), Osteichthyes (bony fishes), and Elasmobranchiomorphi (sharks) (Smith et al. 1995:75). Only five were identified to species, with many of the remains being too fragmented or degraded for such specific identification (Table 3). However, many of the remains that were more generally identified likely represent these species. It was determined that the fish and shark remains were intrusive to the site, and not associated with the colonizing venture. These remains will be discussed at the end of the chapter along with the intrusive remains from Emanuel Point II. A complete listing of the faunal remains recovered from Emanuel Point I can be found in the two published site reports (Smith et al. 1995; Smith et al. 1998).

Emanuel Point I	**Vertebrate Remains**	
Species	Number of Identified Specimens (NISP)	Minimum Number of Individuals (MNI)
Chicken (*Gallus gallus*)	9	2
Cow (*Bos taurus*)	46	1
Pig (*Sus scrofa*)	7	2
Black Rat (*Rattus rattus*)	228	21
House Mouse (*Mus musculus*)	2	2
Indeterminate Mammal (Class Mammalia)	168	N/A
Indeterminate Bird (Class Aves)	3	N/A
Indeterminate Vertebrate (Subphylum Vertebrata)	200	N/A

Table 3. Vertebrate Species Identified on Emanuel Point I.

A large number of fragmented remains were recovered, especially during the second field session. Many of these fragmented remains exhibit spiral fractures, which suggest they were broken while they still contained a fair amount of collagen--implying the animal was butchered quickly after its death. It is to be expected that many of the remains would be in a degraded and fractured condition, considering the violence of the wrecking event and the amount of the time the artifacts were submerged. Very few of the larger animal remains were recovered complete from either wreck; most appeared to be butchered food remains or otherwise broken by an undetermined force. However, many of the smaller animal remains were intact, especially the more robust skeletal elements such as femora.

Chicken (*Gallus gallus*)

Nine bones were identified as chicken, with two very different tibiae providing a MNI of two. One of the coracoids shows a transverse cut mark along its shaft (Figure 5), indicating that the birds were used as a food source during the voyage (Baker 1995).

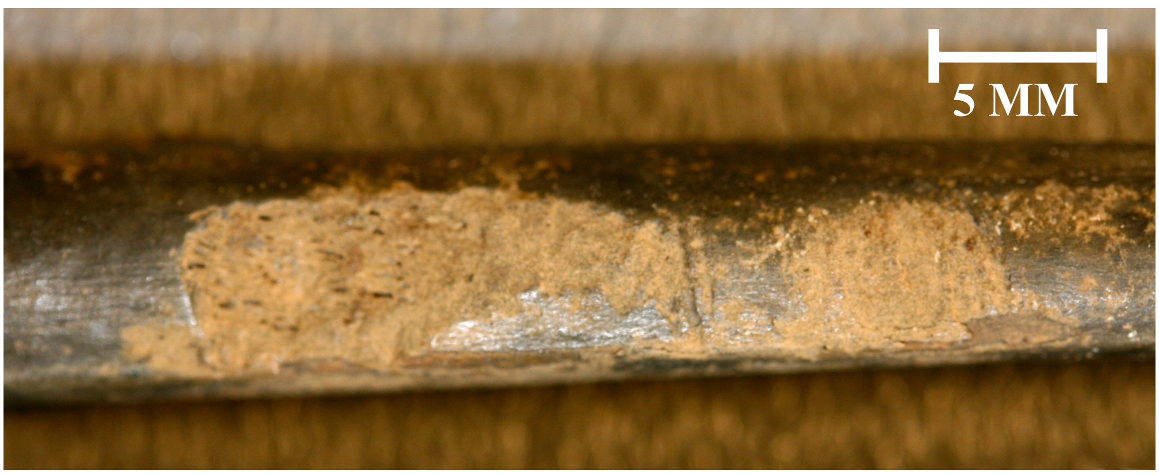

Figure 5. Cut marks on chicken remains recovered from Emanuel Point I. Photo by author, 2010.

Cow (*Bos taurus*)

Four vertebral ends of rib bones, two thoracic vertebrae, one rib epiphysis, and thirty-nine rib remains were identified as *Bos taurus*, representing a MNI of one. One additional rib fragment was identified as an indeterminate species of *Bos*, however, that does not alter the MNI. Many cut or fractured rib remains were recovered during both field sessions that are very likely representative of *Bos taurus* (Figure 6); however, it would be near impossible to determine the species from only a fragmented piece of rib. It is also almost impossible to determine species from only a fragmented piece of rib. To further complicate identification and analysis, it is also difficult to visually discern the difference between rib body fragments of cow (*Bos taurus)* and of the horse (*Equus caballus*). As previously mentioned, a large number of the colony's horses died during the voyage (Priestly 1928:271); and it is not known if any of those remains were used as food. Many sub-adult specimens were identified, including partially fused and unfused epiphyses (Baker 1995). Baker (1995) also notes that bovid elements appear smaller that modern cattle, a trend noted at other New World Spanish sites (Reitz and Ruff 1994).

Figure 6. Cow rib recovered from Emanuel Point I. Note the cut marks on the left end of the bone. Photo by author, 2010.

Cattle were popular livestock in the New World, and in 1602 a report states that every family in St. Augustine had 4 to 10 cows (Arnade 1959:9). They were allowed to roam free, expected to fend for themselves over the wild Florida landscape (Reitz and Scarry 1985:70).

Pig (*Sus scrofa*)

Seven bones were identified as *Sus scrofa*, with another specimen identified as an indeterminate species of *Sus*. At least two individual pigs are present in the faunal assemblage. Many indeterminate remains, such as fragmented and cut bones, are likely associated with *S. scrofa*, but this association cannot be conclusive. Identified remains include a premolar, tibia, humerus, and a positively identified rib fragment.

One reason that swine were popular for the Spanish explorers is that they require little care. It was common practice for the Spaniards to release both hogs and cattle during their expeditions to create wild foraging populations, which could then support survivors from wrecked ships or hungry members of future expeditions (Reitz and Scarry 1985:69). Pigs tended to fare much better than cattle in this manner of animal husbandry, as cattle require more nutritious feed for proper weight gain (Reitz and Scarry 1985:70).

Black Rat (*Rattus rattus*)

In total, 228 vertebrate specimens were identified as *Rattus rattus*, the black rat and a MNI of 21 was determined based on skeletal elements (Armitage 1995a:6, 23). Preservation of these remains is amazingly good; however, many of the more fragile bones were broken in antiquity, compared to the more robust bones recovered. For example, 80% of the scapulae are broken, compared to only 4.8% of the femora (Armitage 1995a:2). The greatest damage was observed in the crania, as no intact or even partially intact specimens were recovered. Species determination was made possible by the appearance of the temporal ridges on the neurocranium, the shape of the mandibular diastema, and comparison of the anatomical features of the postcranial elements (Armitage 1995a:5).

House Mouse (*Mus musculus*)

Two bones were identified as house mouse in the faunal assemblage--left tibiae, indicating that at least two mice were present on the ship. As the ships originated from Spain and Mexico, it is likely that these very small mammals are of the subspecies *Mus musculus domesticus*, whose origins include Western Europe, Africa, and the Americas (Armitage 1995b; Berry 1981:92).

Indeterminate Rodent Feces

Many remains identified as preserved rodent feces were recovered from the Emanuel Point I sediment samples. All of these feces were uniform in shape, with an oblong cylindrical form and varying only slightly in size. The destruction of a few samples revealed their contents to contain various insect parts and a few contained what appeared to be seeds. As there is not much difference between the fecal size of rats and mice, it is impossible to determine exactly which species the excrement pellets are from. However, based on the size variance in the remains, it is likely that the remains represent both species as well as the various levels of growth represented in the skeletal remains.

Indeterminate Vertebrate Remains

Recovered from the Emanuel Point I site were a number of vertebrate remains of indeterminate origin. Of the 371 indeterminate vertebrate remains, 168 are identifiable as mammalian, 3 as bird, and 200 are completely unidentifiable. Two of the mammalian bones were identified as Order Artiodactyla, and based upon their size and morphology likely represent at least one goat, sheep, or deer.

Three specimens were identified as being in the Class Aves. Originally identified as being from a bird larger than chicken, it is more likely that the remains represent at least one larger-than-average chick or hen, or perhaps a rooster. However, as it is difficult to discern the difference between chicken and turkey (*Meleagris* sp.) from such fragmented remains, the possibility of the specimen belonging to a member of the genus *Meleagris* cannot be ruled out. Turkey is native to the New World and remains of that species have been recovered from the 16th-century Spanish colony in St. Augustine as well as from the early 17th-century English colony in Jamestown (Bruce 1895:116, Schorger 1966; Reitz and Scarry 1985:74-75).

Vertebrate Remains Recovered from Emanuel Point II

At least 17 taxa were identified from the Emanuel Point II vertebrate remains, representing 5 classes: Mammalia (mammals), Aves (birds), Reptilia (reptiles) Osteichthyes (bony fishes), and Elasmobranchiomorphi (sharks). Thirteen different species were recognized, and eleven of those were positively identified (Table 4). Most of these remains were recovered during dredging excavations (Appendix A), however vertebrate remains were also recovered in the sediment samples from both Emanuel Point I (Appendix B) and Emanuel Point II (Appendix C). As many of the remains are highly degraded, it is likely that many of the more generally identified specimens also belong to

Emanuel Point II	Vertebrate Remains	
Species	Number of Identified Specimens (NISP)	Minimum Number of Individuals (MNI)
Chicken (*Gallus gallus*)	61	4
Cow (*Bos taurus*)	1	1
Pig (*Sus scrofa*)	23	3
Black Rat (*Rattus rattus*)	149	11
House Mouse (*Mus musculus*)	32	4
Goat (*Capra hircus*)	1	1
Goat (*Capra hircus*) or Sheep (*Ovis aries*)	4	1
Cat (*Felis catus*)	4	2
Pond Turtle (Family Emydidae)	1	1
Hardhead Catfish (*Arius felis*)	2	1
Indeterminate Serranid (Family Serranidae)	4	1
Triggerfish (Family Balistidae)	1	1
Indeterminate Bony Fish (Class Osteichthyes)	4	1
Indeterminate Mammal (Class Mammalia)	119	N/A
Indeterminate Bird (Class Aves)	23	N/A
Indeterminate Vertebrate (Subphylum Vertebrata)	91	N/A

Table 4. Vertebrate Species Identified on Emanuel Point II.

these species. Unlike specimens from Emanuel Point I, some of these recovered fish remains recovered exhibit cut marks, indicating their association with the wreck. However, many more did not exhibit any evidence of human modification, and therefore are likely intrusive to the site.

Many of the remains from Emanuel Point II exhibit similar kinds of fracturing as do those from Emanuel Point I, however, the number of fractured remains from the Emanuel Point I site far exceeds those examples from Emanuel Point II.

Chicken (*Gallus gallus*)

Sixty-one specimens were identified as chicken on the second Emanuel Point wreck. A MNI of 4 represents 1 juvenile and at least 3 adults. Of the adult remains, at least 1 egg-laying female was identified (specimen 08W-1533-001), based upon the change in the bone structure within the core of the bone, as calcium and other minerals are taken from the bird's body during egg production (Taylor and Moore 1954; Whitehead 2004; Irvy Quitmyer 2010 pers. comm.).

Cow (*Bos taurus*)

Only one specimen recovered from Emanuel Point II could be positively identified as cow, one rib fragment, which had an intact ventral articulation necessary for identification. While other remains are likely further evidence for cattle, they could not be positively identified as such and result in a MNI of one.

Pig (*Sus scrofa*)

Twenty-three specimens were identified as pig from the second Emanuel Point wreck, including teeth, scapulae, vertebrae, and several unfused epiphyses. Based on the development and size of the elements, it was deduced that at least three individuals are represented in the sample, one very young, possibly newborn (Figure 7), one juvenile and one adult.

Figure 7. Right radius from a very young, possibly newborn pig. Photo by author.

Black Rat (*Rattus rattus*)

A total of 149 different skeletal elements were identified as black rat from the Emanuel Point II site. Compared to the rodent remains recovered from Emanuel Point I, the remains recovered from Emanuel Point II are in much better condition and exhibit less degradation and fracturing. This variance may be due to the different site conditions on Emanuel Point II allowing for better preservation of fuanal material. Unlike on Emanuel Point I, many of the cranial elements were found intact or mostly intact, including mandibles containing teeth and a few nearly complete crania being recovered (Figure 8).

Figure 8. Mostly intact Black rat skull recovered from Emanuel Point II. Photo by Author, 2010.

Rat remains recovered from Emanuel Point II represent all stages of the animals' life, from infancy to advanced age. One exceptionally, small intact rib was determined to be from a rat only a few weeks old, an age when it was still feeding off of its mother. Juvenile remains were also recovered, including unfused bones and epiphyses and unworn teeth. These features are indicative of animals that are self-sustaining, yet still growing. Other remains, such as fully-fused bones and well-worn teeth, are indicative of adult specimens. Evidence of scavenging and cannibalism are also present in the rat remains, as a few of the identified specimens showed evidence of gnawing, indicating that the animal died and that its carcass became a meal for others within the colony before the ship sank.

Based upon the recovered remains and the age of the specimens before they died, at least 11 individuals are present in the assemblage: 9 adult, 3 juvenile, and 1 neonate.

House Mouse (*Mus musculus*)

Thirty-two remains were identified as house mouse, all of which were recovered in the sediment samples. The remains recovered include teeth, tail bones, and foot bones. At least 4 mice were present on the ship, based on the recovery of three fused right humeri from adult specimens, and one unfused radius from a juvenile. A very worn molar was also recovered, likely indicating that at least one of the adults was of advanced age (Figure 9).

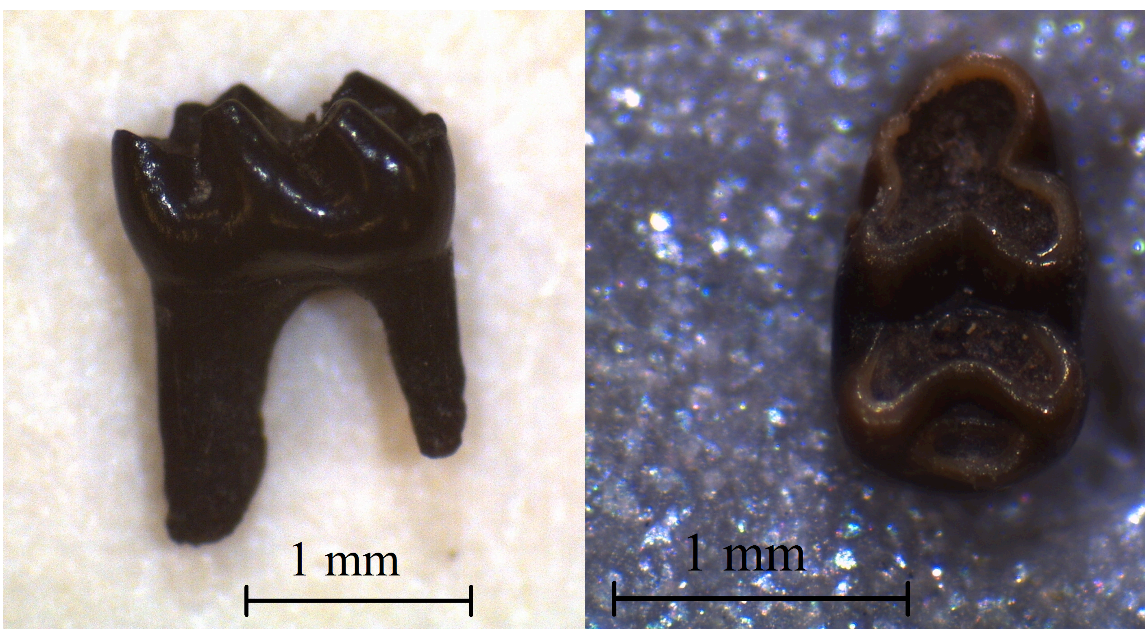

Figure 9. Two different House mouse molars recovered from Emanuel Point II sediment samples. Molar on the right shows a high level of wear, indicative of a mature specimen. Photos by author, 2010.

It should be noted that two of the specimens show evidence of what could be heat alteration. However, it could not be determined whether the staining was indicative of burning or a combination of bone deterioration and sediment staining.

Indeterminate Rodent Feces

Hundreds of samples identified as preserved rodent feces were also recovered from the Emanuel Point II sediment samples. These remains are exactly the same in size and appearance as those reported in the Emanuel Point I assemblage.

Goat (*Capra hircus*) and/or Sheep (*Ovis aries*)

Four faunal specimens were recovered from the Emanuel Point II wreck which indicate the presence of either goat and/or sheep aboard ship. As it can be difficult to determine the difference between the skeletal elements of sheep and goat from fragmented remains and a small sample size, it cannot be determined to which species three of the bones--two ribs and a femur--belong. Teeth, however, can be used to positively distinguish the two species, and a molar recovered from the site was identified as goat, concluding that at least one goat (MNI=1) was present in the colonizing attempt. It is still possible that sheep may have been aboard, however.

Sheep and goats did not flourish well in Florida. The French brought sheep with them to Fort Caroline and Menédez brought both sheep and goats to St. Augustince, but none thrived (Laudonnière 1975:142; Lyon 1976:183;1977; Reitz and Scarry 1985:70-71). Colonists did not like sheep because the animals could not defend themselves against wolves and wild dogs; they also would not reproduce freely due to stress (Thompson 1942:211). Goats fared better as they could defend themselves against carnivores (Bonner 1964).

Cat (*Felis catus*)

The remains of two cats were recovered from the wreck. One vertebra, part of a left mandible, and an incisor from an adult cat (Figure 10) and a second vertebra from a juvenile feline were identified. The age of the adult cat was unable to be determined, but based on the morphology of the bone and the lack of any deformities or signs of disease; it was still in its prime. Based on the size and development of the kitten vertebra, the younger feline was between 3 to 5 months old.

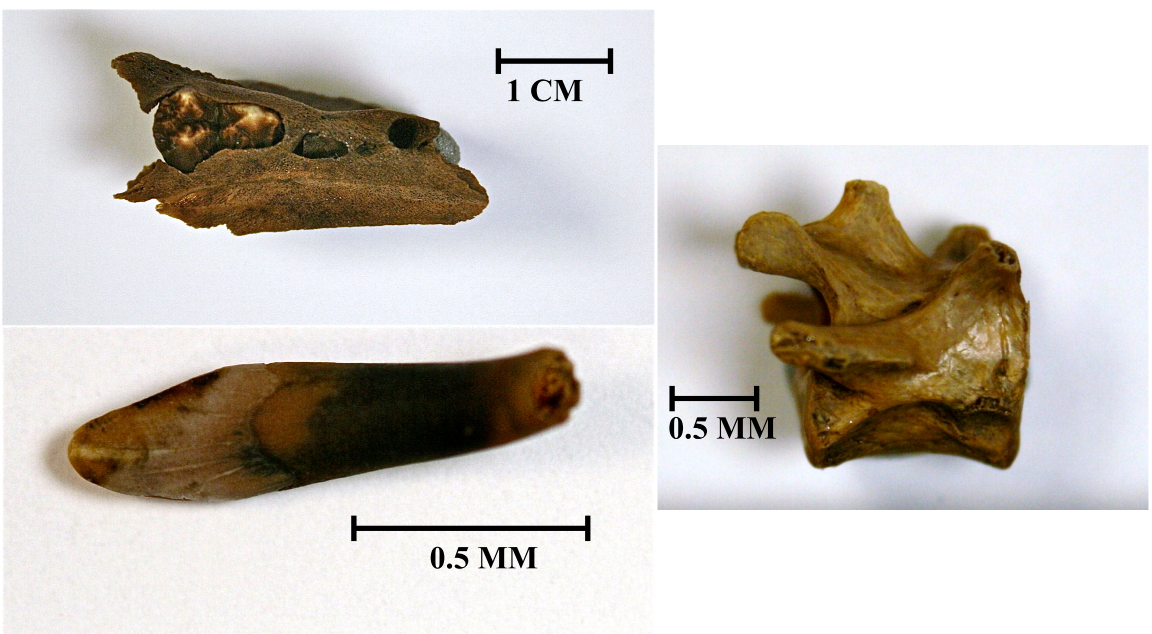

Figure 10. Adult cat remains recovered from Emanuel Point II. Top Left: Mandible with erupting teeth. Bottom Left: Incisor. Right: Vertebra. Photos by author, 2010.

Pond Turtle (Family Emydidae)

The humerus of one small turtle was found, belonging to an unidentified member of Family Emydidae (Figure 11). This family represents approximately 80 species throught Europe, Africa, Asia, and the Americas (Allaby 2009:217). Pond turtles are all aquatic or semi-aquatic, with most inhabiting fresh water and a few preferring brackish estuaries. None of the species, however, inhabit salt water, indicating that this specimen is associated with the site, likely as evidence of a fresh food source.

Figure 11. Pond turtle humerus recovered from Emanuel Point II. Photo by author, 2010.

Hardhead Catfish (*Arius felis*)

Two bones from the top portion of a hardhead catfish skull were recovered. This bony fish is generally abundant along the shorelines of the Western Atlantic Ocean and the Gulf of Mexico. Along the top of the cranial remains are cut marks, evidence that the fish was caught and cleaned by someone aboard the vessel before it sank. Easily caught in shallow water, hardhead catfish are edible, yet difficult to clean and prepare (Horst and Lane 2007).

Indeterminate Serranid (Family Serranidae)

Four unique skeletal components from a member of the Serranidae family were recovered, representing an MNI of one. The Serranids consist of over 400 species, including the sea basses and groupers, and at least 47 of those species reside along the eastern Gulf of Mexico (Nelson 2006:346). While species of the Serranidae family range in size from 3 cm in length to 3 m, based on the size and shape of the remains from the Emanuel Point II site they are representative of a specimen likely around 50 cm. Each of these remains, which appear to be from the same individual, exhibit cut marks along the surface. According to Horst and Lane (2007), all of the Serranids currently fished have excellent taste and edible meat.

Triggerfish (Family Balistidae)

One triggerfish vertebra displaying cut marks was identified in the assemblage. The Balistidae family consists of about 40 species, three of which reside throughout the Gulf of Mexico. The three species range anywhere from 1 to 5 pounds in weight, and each are fished for their good flavor and high nutritional value. They are, however, difficult to clean (Horst and Lane 2007).

Indeterminate Bony Fish

Four bones from fish of indeterminate species, all showing evidence of rodent gnawing, were recovered from the site. This evidence indicates that the fish remains were on the ship and part of the rodent's diet before the ship sank. It is uncertain whether or not these bones are from any of the previously identified fish species, or from other unidentified species.

Indeterminate Vertebrate Remains

Recovered from the Emanuel Point II site were a number of vertebrate remains of indeterminate origin. Of the 233 indeterminate vertebrate remains, 119 are identifiable as mammalian, 23 as bird, and 91 are completely unidentifiable. The bird remains are most likely chicken, but as mentioned before, the possibility of any representing a turkey species cannot be ruled out.

Invertebrate Remains Recovered from Emanuel Point I

Four different types of insects were identified from Emanuel Point I, but a large number of specimens were unidentifiable (Table 5).

Emanuel Point I	**Invertebrate Remains**	
Species	Number of Identified Specimens (NISP)	Minimum Number of Individuals (MNI)
American Cockroach	Unknown total, 7 mouthparts recovered from sediment samples	4
Hide Beetle (Family Dermestidae)	Unknown total, 14 elytra recovered from sediment samples	6
Weevil (*Sitophilus* sp.)	51	31
Darkling Beetles (Family Tenebrionidae)	1	1
Indeterminate Invertebrates	76	N/A

Table 5. Invertebrate Remains Identified from Emanuel Point I.

<u>American Cockroach (*Periplaneta americana*)</u>

An unknown number of cockroach remains were recovered from the first Emanuel Point site during dredging operations. Various parts, including the wing, pronotum (thoracic segment), and ootheca (egg case) were identified at the U.S.D.A. research station in Gainesville, Florida (Smith et al. 1995:85).

More cockroach parts were identified in many of the sediment samples. A large majority of these cockroach remains were wing fragments, but 7 mouthparts were also collected (Figure 12), along with a small number of egg sacs and legs (Paul E. Skelly 2010, pers. comm.). Using the mouthparts, a MNI of 4 was determined for Emanuel Point I, however it is obvious from the amount of wing fragments that the population was much larger.

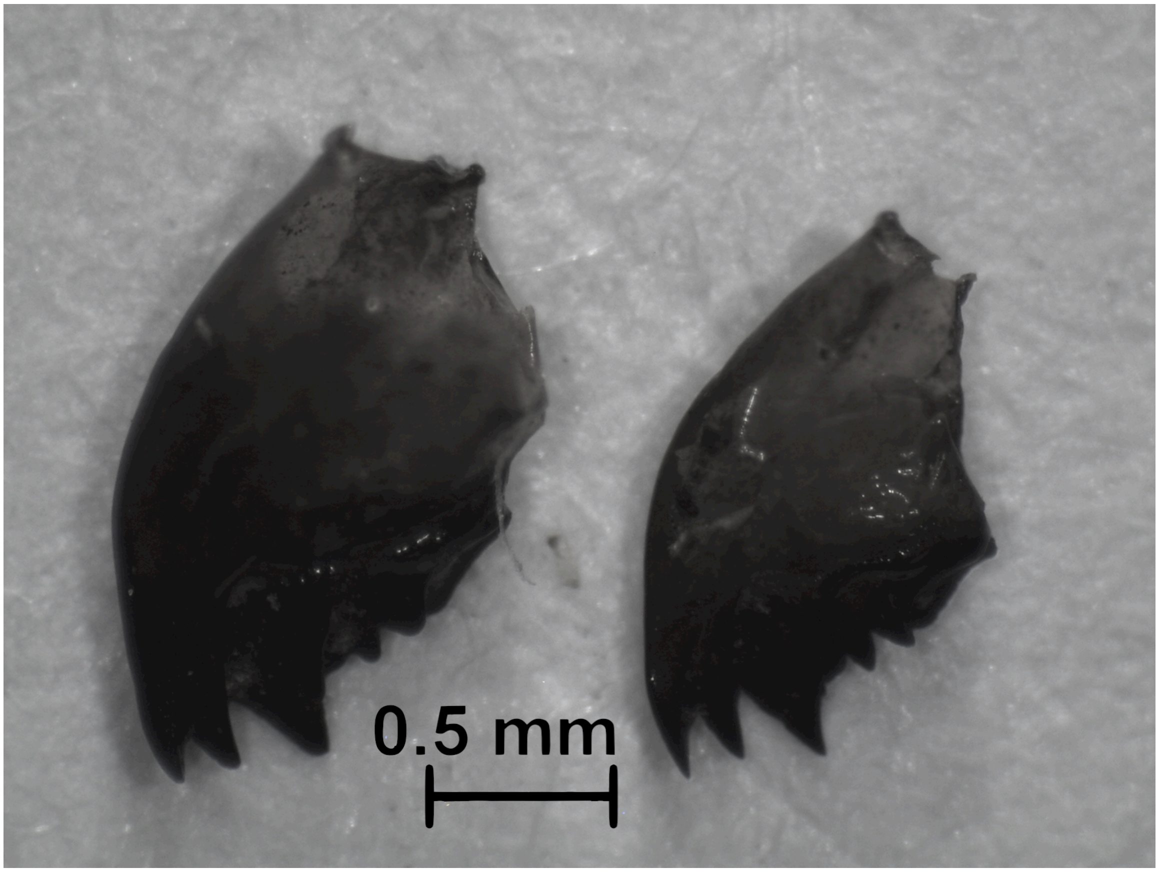

Figure 12. Cockroach mouthparts recovered from Emanuel Point sediment samples.

The name “American Cockroach” is a misnomer in indicating the insects origin, as it is believed the species originated in Africa and made its way to the New World on sailing vessels (Cornwell 1968:53). *P. Americana* prefers warm, moist environments and feeds on just about any biological material.

Skin Beetle (Family Dermestidae)

An unknown number of elytra (wing covers) of a species of Dermestes were also recovered in the dredge spoil of Emanuel Point I, most likely representing the species *Dermestes maculates,* commonly known as the hide beetle (Smith et al. 1995:85).

Another 14 Dermestes remains were recovered from the Emanuel Point I sediment samples, including heads, prothorax, and larva fragments, providing and MNI of 6.

As larvae, Dermestidae (Figure 13) are scavengers of both plant and animal materials but are especially abundant on drying skin, feathers, fur, and other proteinaceous substances. Dermestids also feed on grains (Arnett et al. 2001:228-232). Pupating larva are known to bore into many solid materials, including wood. “One of the interesting facts about the dermestid is the ability of this pupating grub to bore through the hardest material--even through the mortar and stonework of walls; lead pipes, cables, and electrical fuses have proven notably vulnerable to them” (Timm 1982:82). In 1593 a ship carrying a cargo of dead penguins nearly sank hen the hull was made unseaworthy after hundreds of thousands of pupating Dermestids bored tunnels into the wooden hull (Hakluyt 1927:256; Quinn 1975:37; Timm 1982:18).

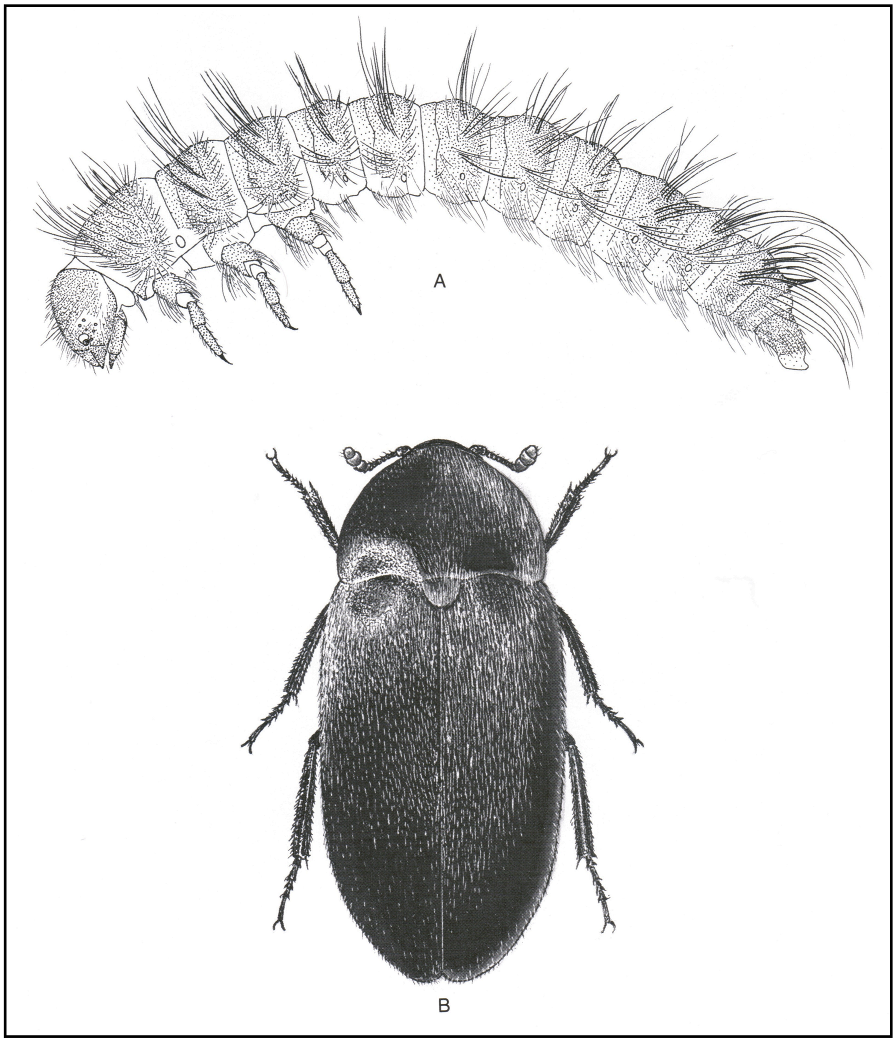

Figure 13. Black larder beetle, *Dermestes ater*. A: larva. B: adult. (Adapted from Gorham 1991:562).

Weevil (*Sitophilus* sp.)

Fifty-one different specimens representing a MNI of thirty-one were recovered from the sediment samples of Emanuel Point I. Various parts were identified as a species of *Sitophilus* (Figure 14), including heads, multiple prothorax, and even one intact specimen missing only its legs.

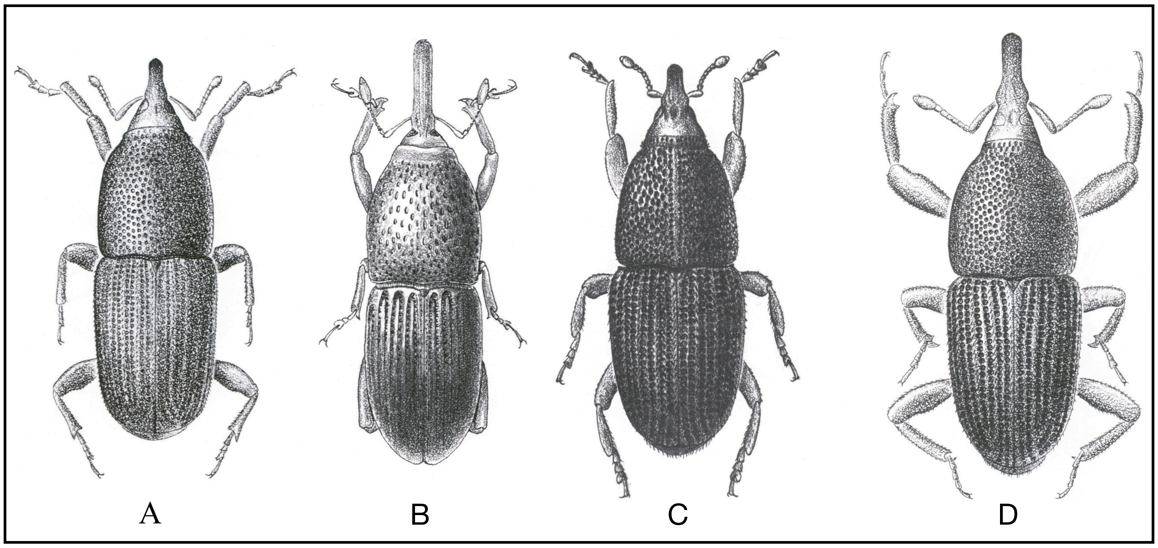

Figure 14. Weevils, Genus *Sitophilus*.. A: tamarind weevil, *Sitophilus linearis*. B: granary weevil, *Sitophilis granarius*. C: rice weevil, *Sitophilus oryzae*. D: maize weevil, *Sitophilus zeamais*. (Adapted from Gorham 1991:607, 608).

Many of the differences in the five species of *Sitophilus* are minute, and difficult to discern from just fragments or parts. However, it appears that there is some variety in the remains, indicating the likely presence of at least three species. All of the species feed on important crops, including wheat, rice, maize, tamarind, oats, rye, barley, dried beans, and nuts. Weevil larvae develop inside a seed kernel, and have been known to develop in hard-caked flour. The adult female eats a cavity into a seed and then deposits a single egg in the cavity, sealing it in with bodily secretions. The larva develops within the seed, hollowing it out while feeding and then pupates within the hollow husk (Arnett et al. 2001:722).

Darkling Beetles (Family Tenebrionidae)

One prothorax of Tenebrionidae was recovered on Emanuel Point I. With over 20,000 species and a variety of habitats, most members of this insect family feed on decaying vegetation, fungi, seeds, and other organics; while others feed on stored products such as grains and flour (Arnett et al. 2001:463-509). Members of the genus Tenebrio are pests of stored grains, and their larvae are referred to as mealworms (Figure 15).

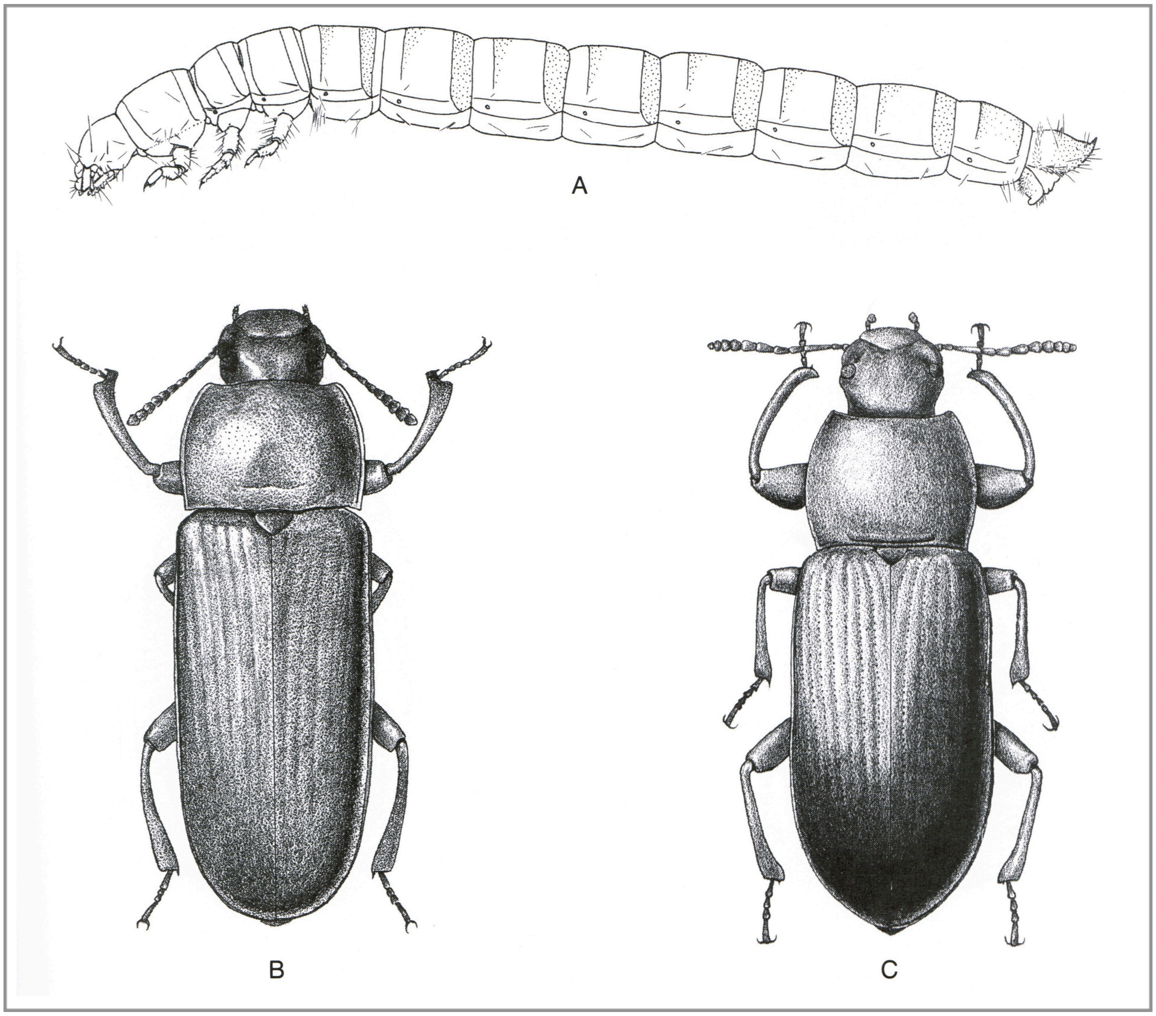

Figure 15. Mealworms, Tenebrionidae. A: yellow mealworm, *Tenebrio molitor*, larva. B: yellow mealworm adult. C: dark mealworm adult. (Adapted from Gorham 1991:593).

Indeterminate Insects

Seventy-six insect remains that could not be identified with any high degree of certainty were recovered from the sediment samples. A number of remains were recovered whose identity could be narrowed to specimens of elytra and heads of members of the Order Coleoptera. However, more specific identifications could not be made. While several different specimens were noticed, especially in regards to the elytra, specific identification could not be made with such few parts. Of the indeterminate remains recovered, 39 could be classified as Coleoptera, with a MNI of 22.

Invertebrate Remains Recovered from Emanuel Point II

At least 28 different species of invertebrate were identified from Emanuel Point II (Table 6). Sixteen of these species were recognized as individual species of hide beetle, but only two could be definitely identified to a particular species.

Emanuel Point II	Invertebrate Remains	
Species	Number of Identified Specimens (NISP)	Minimum Number of Individuals (MNI)
American Cockroach (*Periplaneta americana*)	1671	71
Hide Beetle (Family Dermestidae)	779	145
Dermestes maculatus	12	12
Dermestes lardarius	11	11
Weevil (*Sitophilus* sp.)	232	132
Darkling Beetles (Family Tenebrionidae)	65	65
Drugstore Beetle (*Stegobium paniceum*)	15	15
Rove Beetles (Family Staphylinidae)	1	1
Grain Beetle (*Oryzaephilus* sp.)	9	9
Ladybird Beetle (Family Coccinellida)	1	1
Scuttle Fly (Family Phoridae)	421	421
Fruit Fly (*Drosophila* sp.)	301	301
Blowfly (Calliphoridae) or Flesh fly (Family Sarcophagidae)	1	1
Big Headed Ant (*Pheidole* sp.)	1	1
Indeterminate Spider	1	1
Indeterminate Invertebrates	2,861	N/A

Table 6. Invertebrate Remains Identified from Emanuel Point II.

American Cockroach (*Periplaneta americana*)

During excavations from 2006 through 2009, 117 cockroach parts were recovered from the dredge spoil. Most of these specimens were wing fragments, but some egg case fragments and thoracic fragments were also recovered. In the sediment samples, a total of 1,554 cockroach remains were recovered and identified, including wing fragments, egg case fragments, thoracic fragments, and mouthparts. Using the mouthparts, a MNI of 71 was determined for the cockroach population aboard Emanuel Point II.

Skin Beetle (Family Dermestidae)

The dredge spoil from Emanuel Point II provided 4 dermestid wings, and another 775 parts from the same family were recovered from the sediment samples, including wings, prothoraxes, and larval fragments. A MNI of 145 was determined based on the number of prothoraxes recovered, but that number does not factor in the presence of the larval stage, for which a MNI could not be determined, as the larval remains recovered were of a type that were unusable for population estimates.

Two species of skin beetle were identified from the sediment samples: *Dermestes maculates* (MNI=12), commonly known as the hide beetle; and *Dermestes lardarius* (MNI=11), referred to as the larder beetle (Figure 16). Over 14 other unique species of skin beetle were observed in the materials from Emanuel Point II; positive identification, however, could not be made from the only the elytra (Dr. John M. Kingsolver 2010, pers. comm.).

Figure 16. *Dermestes* elytra identified from Emanuel Point II. Photo on left is the hide beetle (*D. maculatus*). Photo on right is the Larder beetle (*D. lardarius*). In each photo the left two wings show outer surface and the right wing show inner surface. Photo by author, 2010.

The dermestid larval fragments were identified to genus, as the presence of small posterior protrusions known as urogomphi occur only on the genus *Dermestes* (Gorham 1991:126).

Weevil (*Sitophilus* sp.)

Two hundred and thirty-two specimens representing a MNI of one hundred and thirty-two of the various *Sitophilus* species were recovered, including heads, prothoraxes, intact specimens, and larval fragments.

Darkling Beetles (Family Tenebrionidae)

A total of 65 prothoraxes were recovered and indentified as members of the Tenebrionidae family, representing a MNI of the same number. With over 20,000 species and a variety of habitats and diets in this insect family, it is impossible to determine a specific species from only the thoraxes recovered. However, there is great variety in the remains recovered, indicating that multiple species are represented in the site (Figure 17).

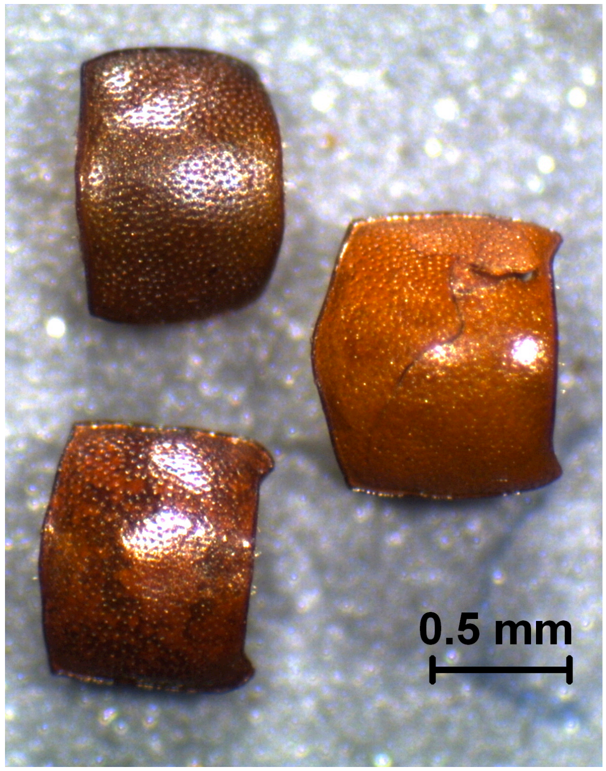

Figure 17. Tenebrionidae thoraxes, each likely representing different species. Photo by author, 2010.

Drugstore Beetle (*Stegobium paniceum*)

Fifteen elytra were identified as remains of the species *Stegobium paniceum*, representing an MNI of fifteen (Figure 18). The larvae of the Drugstore Beetle are serious pests of stored products, feeding on a variety of plant and animal products including flours, dry mixes, breads, cookies, chocolates, and spices (Arnett et al. 2001:245-260). They also feed on non-food products such as wool, hair, leather, and horn. They have a worldwide distribution but are more abundant in warm climates or in structures such as the hold of a ship (John M. Kingsolver 2010, pers. comm.).

Figure 18. Left: Drugstore Beetle, *Stegobium paniceum*, adult. (Adapted from Gorham 1991:561). Right: Elytra recovered from Emanuel Point II. Left two wings show outer surface, right wing show inner surface. Photo by author, 2010.

Rove Beetles (Family Staphylinidae)

Most adults and larvae of Family Staphylinidae are predatory on other invertebrates, but some larvae are known to feed on decaying vegetation. Some species occupy the dung of ungulates and eat fly eggs and larvae or other beetles. While most rove beetles eat flies and fly larvae, it is generally the habitat that changes between species; some rove beetles hunt their prey in decaying fruits, others in carrion (Arnett and Thomas 2001:272). One single abdomen belonging to a member of the Staphylinidae family was recovered from Emanuel Point II (Figure 19).

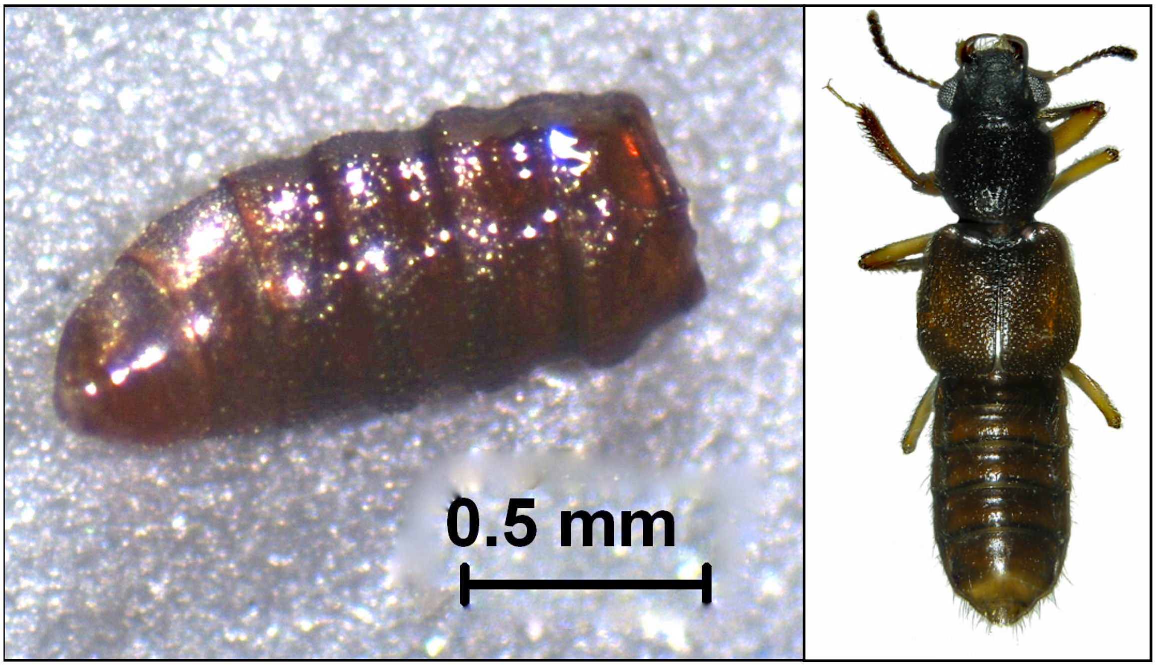

Figure 19. Rove beetle (Family Staphylinidae). Left: specimen recovered from Emanuel Point II. Right: *Bledius* sp. for comparison. Photos by author, 2010.

Grain Beetle (*Oryzaephilus* sp.)

Nine prothoraxes were recovered from the sediment samples from Emanuel Point II, representing a MNI of nine. The prothorax of the three species of *Oryzaephilus* is extremely distinctive and provides one of the species with its common name, the saw-toothed grain beetle. However, differences between the three species exist only in the head structure of these insects (Figure 20), and no head elements were identified in this assemblage. All species infest flour, fruits, nuts, rice, sugar, spices, herbs, dried meats, chocolate, bread, and other foodstuffs. Only two species of this genus, however, would thrive in a tropical climate and survive in the hold of a ship, *O. Mercator* and *O. surinamensis* (Michael C. Thomas 2010, pers. comm.).

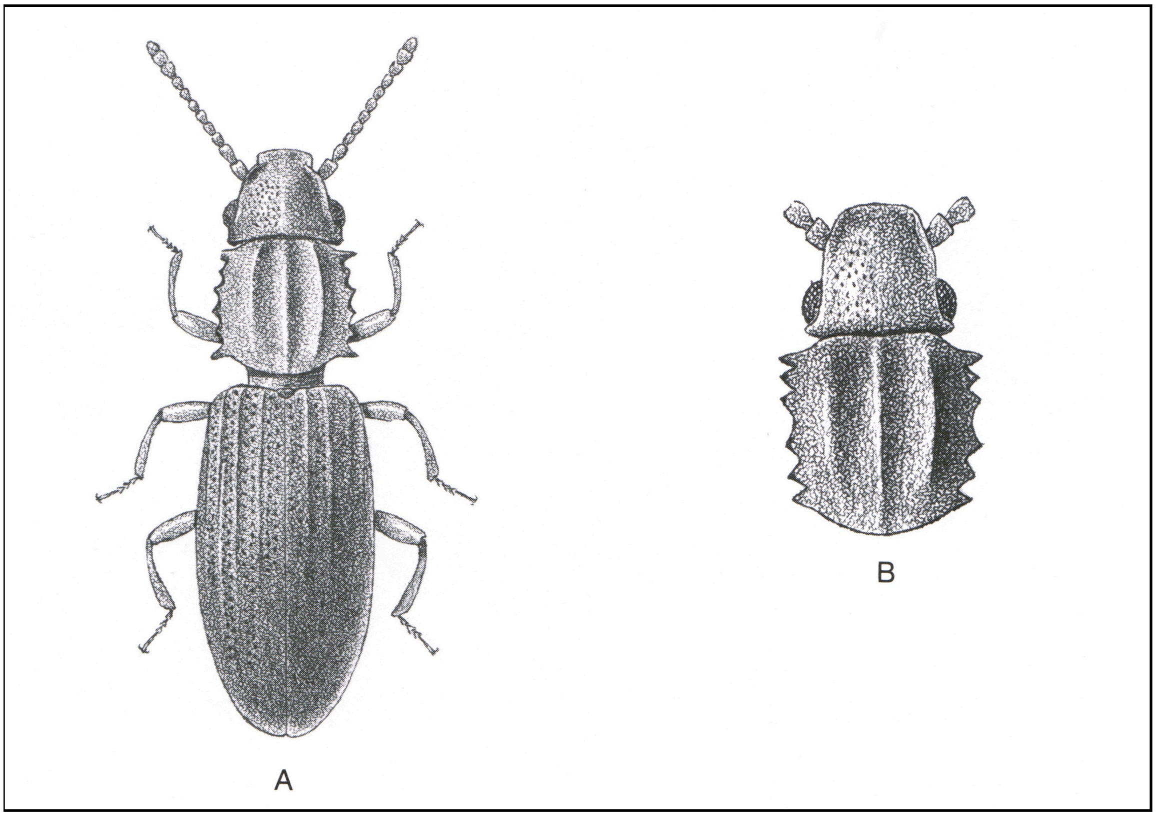

Figure 20. Grain beetles, *Oryzaephilus*. A: Sawtoothed grain beetle, *O. surinamensis*. B: Merchant grain beetle, *O. mercator.* Differences in species only occur in the head. (Adapted from Gorham 1991:547).

Ladybird Beetle (Family Coccinellida)

One small fragment of a member of Family Coccinellida (MNI=1), the ladybird beetle (also commonly referred to as the ladybug) was recovered from Emanuel Point II, and without the characteristic spots the fragment would have been completely unidentifiable (Figure 21). While the fragment could represent any number of species in this insect family, the coloring and size of the specimen suggest that two species are more likely: the squash lady beetle, *Epilachna borealis*, and the Mexican bean beetle, *Epilachna varivestis* (Michael C. Thomas 2010, pers. comm.). Unlike most of the Coccinellidae, which are carnivorous and feed upon aphids, scales and other small insects, Mexican bean beetle adults feed on various beans; and Squash lady beetles feed on squash, pumpkin, and cantaloupe. Many of these botanical products were either listed as provisions in historical documents relating to the Luna expedition or were recovered during excavations (Lawrence 2010:35-47).

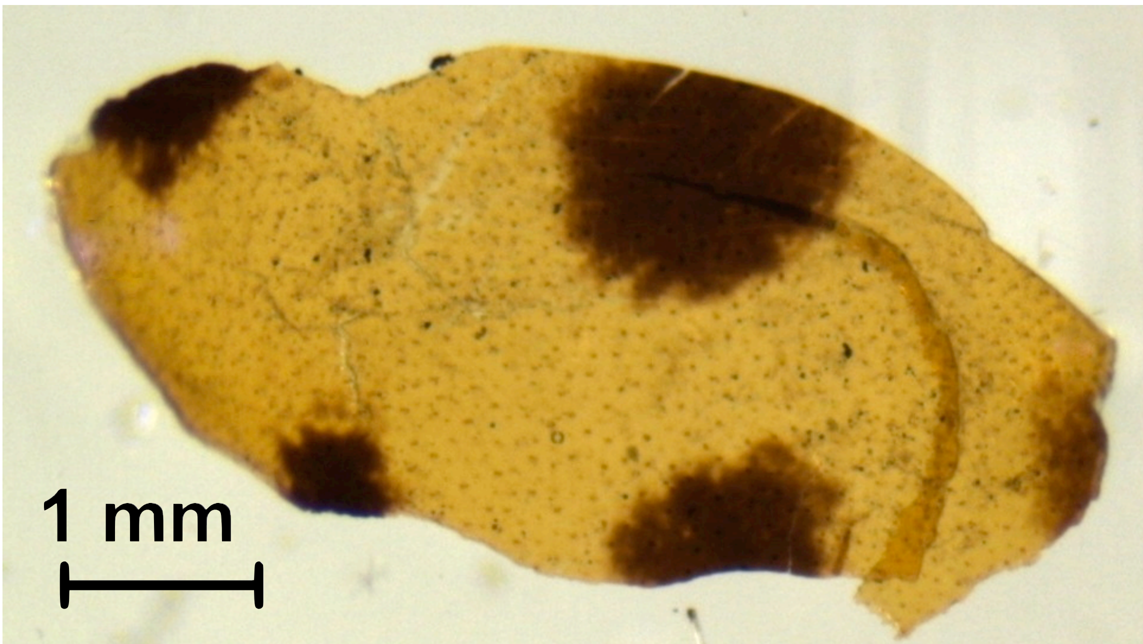

Figure 21. Coccinellida fragment recovered from Emanuel Point II. Photo by author, 2010.

Scuttle Fly (Family Phoridae)

Many pupae cases from at least three species of fly were recovered from the sediment samples of Emanuel Point II (Gary J. Steck 2010, pers. comm.). These cases (Figure 22) contain the fly as it transforms from the larva stage (maggot) to the adult (fly).

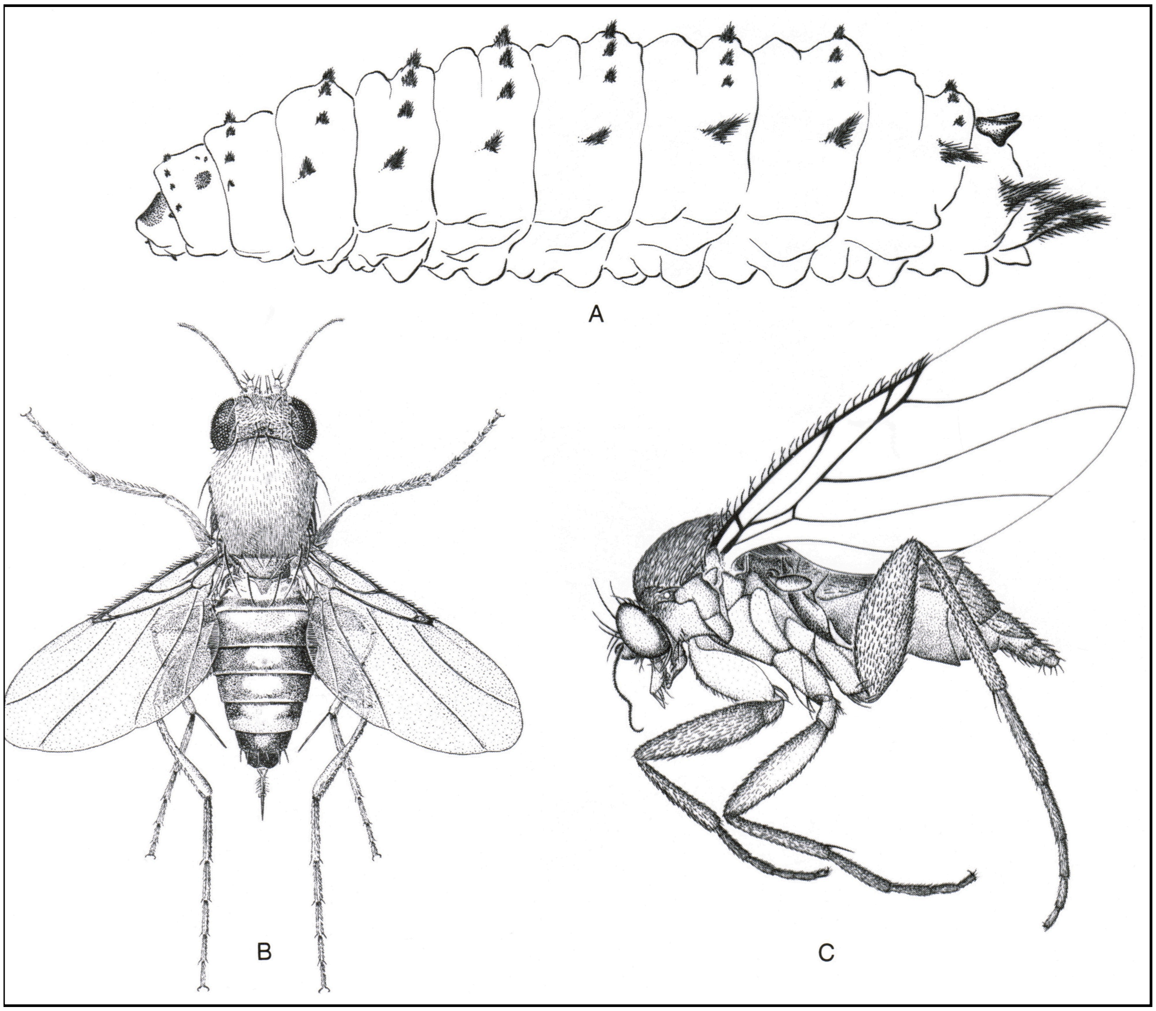

Figure 22. Scuttle flies, Phoridae. A: *Megaselia* sp. larva. B: *Megaselia scalaris* adult, dorsal view. C: *Megaselia* sp. adult, lateral view. (Adapted from Gorham 1991:620).

Most of the cases were found opened, suggesting that the adult fly had emerged before the ship sank (Figure 23). The most abundant number of larval cases (MNI of 421) were from one or more of the approximately 4,000 species of Scuttle Fly, which live and breed in decaying vegetable matter as well as dung.

Figure 23. Scuttle Fly (Phoridae) larva casings recovered from Emanuel Point II. Ventral view on the left, dorsal view on the right. Photo by author, 2010.

Fruit Fly (*Drosophila* sp.)

In addition to the Scuttle Fly, there were at least 301 individuals of the more than 1,500 species of Fruit fly (*Drosophila* sp.) who feed and reproduce on fruit, with some species preferring fresh fruit and others rotten (Markow and O'Grady 2006:13). It is impossible to determine a specific species based on only the pupae cases, and it is highly likely that the *Drosophila* population on the ship was a mixture of various species. While most of the cases were broken open, indicating the fly hatched before the vessel sank, some of the casings were still intact, and the remains of the metamorphosing fly can still be seen inside (Figure 24).

Figure 24. Fruit fly (*Drosophila* sp.) larva casings recovered from Emanuel Point II. Right photo shows remains of metamorphosing fly still inside. Photos by author, 2010.

Blowfly (Family Calliphoridae) or Flesh fly (Family Sarcophagidae)

A single, much larger casing was also recovered, and is likely that of either a Blowfly or Flesh fly (Figure 25). Both flies produce larva that feeds on carrion and dung. Calliphoridae adults are commonly shiny with metallic coloring, often have blue, green or black thoraxes and abdomen. Sarcophagidae adults have black and gray longitudinal stripes on the thorax and checkering on the abdomen. Blowfly eggs are usually yellowish or white in color and look like rice balls when laid. Flesh flies, however, give birth to live young, and the different species which make up this family all prefer dead animals in varying states of decomposition.

Figure 25. Larva casing recovered from Emanuel Point II, likely belonging to either a Blowfly (Family Calliphoridae) or Flesh fly (Family Sarcophagidae). Photo by author, 2010.

Big Headed Ant (*Pheidole* sp.)

The only completely intact insect recovered was a Big-Headed Ant (*Pheidole* sp.) recovered from Emanuel Point II (MNI =1). Because of the abnormally large head of the major workers (Figure 26), members of this genus are easy to spot; but with over 1,000 species, narrowing the identification any further is difficult with a degraded specimen (Jim Wiley 2010, pers. comm.). Depending upon the species, the food supply of these ants aboard ship could have been either seeds or other insects.

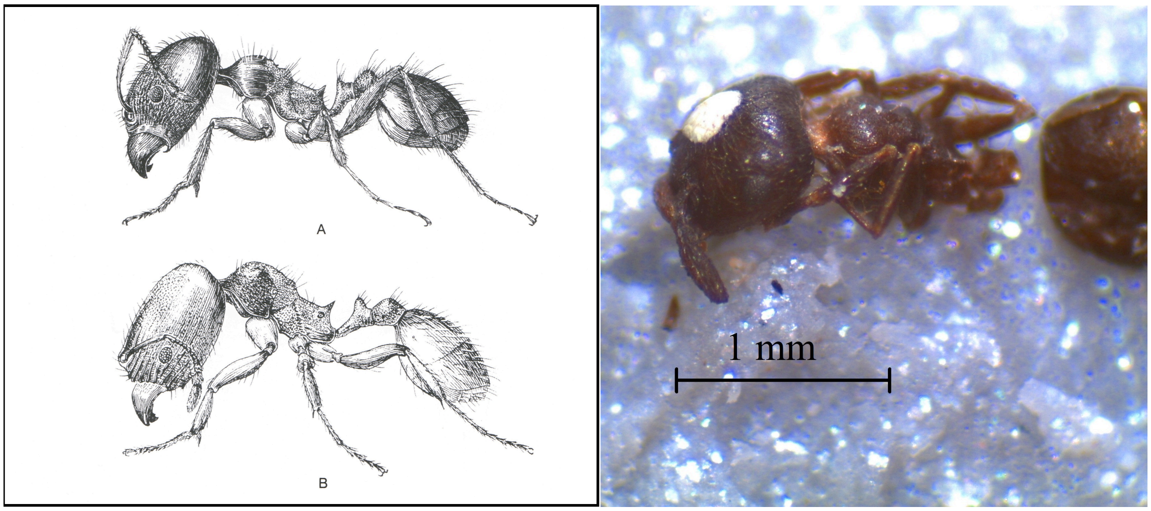

Figure 26. Big Headed Ants, *Pheidole* sp. A: *Pheidole dentata*. B: *Pheidole floridana*. (Adapted from Gorham 1991:641). Photo illustrates specimen recovered from Emanuel Point II. Photo by author, 2010.

Spider Chelicerae (Order Araneae)

One of the most interesting finds from Emanuel Point II is the chelicerae, or jaw, from an unidentified web-weaving spider (G. B. Edwards 2010, pers. comm.). Clearly visible is the fang from which the spider would have injected poison into its victim, as well as the cheliceral teeth used for gripping and crushing prey (Robinson 2005:405) (Figure 27). Based on the number of insect specimens recovered from the wreck, the spider would have had no shortage of food, and would likely have found a safe habitat away from people down in the dark hold of the ship.

Figure 27. Spider chelicerae recovered from Emanuel Point II. Note the fang on the left and the cheliceral teeth just to the right. Photo by author, 2010.

Wooden Lice Comb

As described in historical literature, the sailors and passengers aboard sailing vessels had to deal with the presence of fleas, ticks, lice and bedbugs on a regular basis (Pérez-Mallaína 1998:32). While not direct evidence for these tiny pests, a wooden comb recovered from Emanuel Point II (Figure 28) suggests that those written observations were, in fact, based on the realities of shipboard life. One side of the comb has larger, more widely space teeth associated with a standard comb, while the other side of the comb has smaller, more tightly packed teeth associated with a comb for removing insects (and their eggs) from hair.

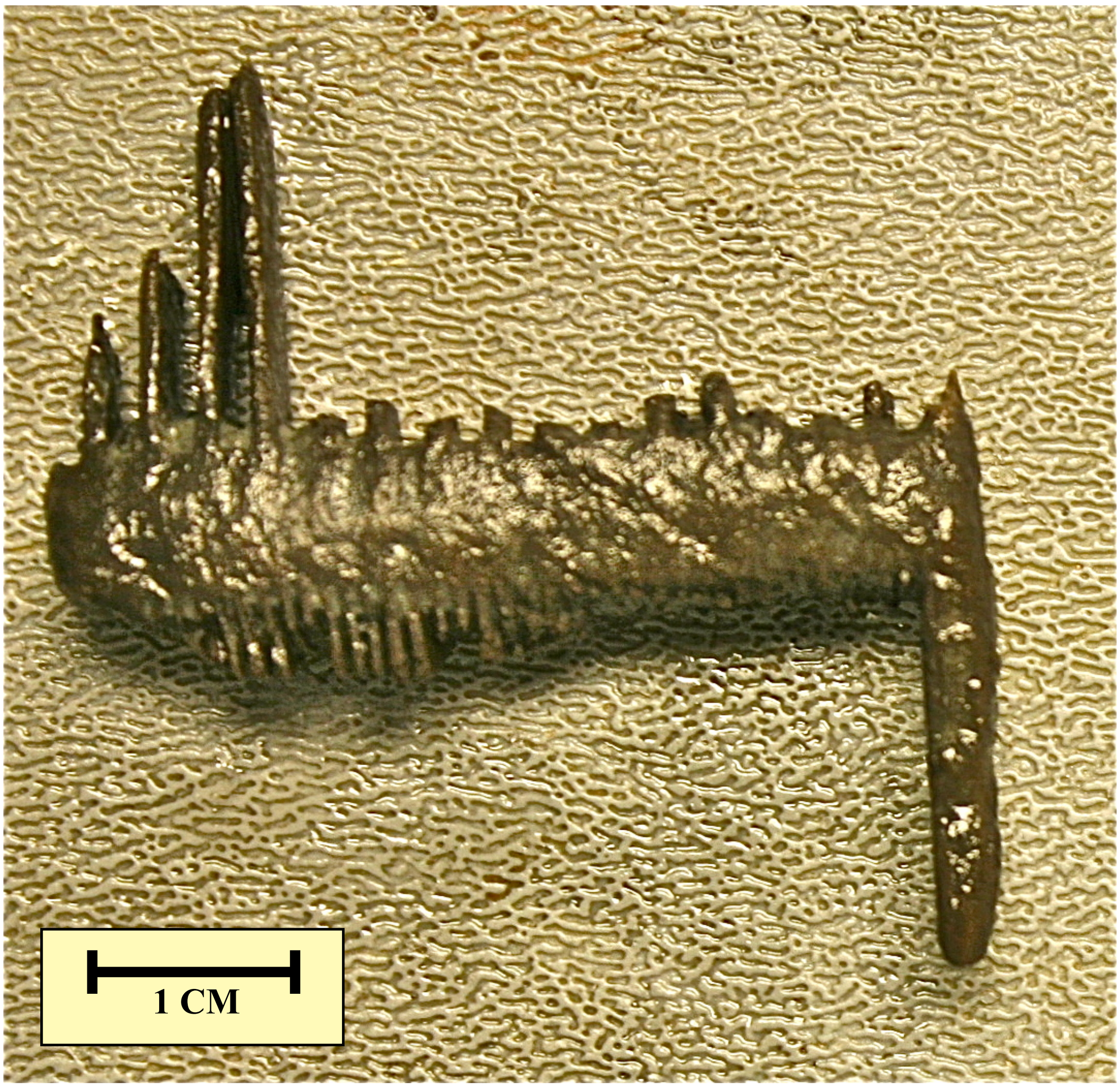

Figure 28. Wooden lice comb recovered from Emanuel Point II. Photo by author, 2010.

Indeterminate Insects

Much like the assemblage of the first Emanuel Point site, there were insect remains that could not be identified in the second wreck's assemblage, as well. In total, 2,861 insect specimens could not be identified with any degree of certainty; however, 2,081 of those remains could be narrowed to the order Coleoptera.

Unassociated Remains

Once a wreck site is created, it becomes the habitat and feeding grounds for many aquatic creatures. It is expected that many of these animals will die over during the time between the actual sinking event and any archaeological excavation. The burden of proof is therefore on the archaeologist to show that recovered remains of these types of animals are associated with the site. Such proof is the presence of cultural or biological modifications, such as cut marks, drill holes, or evidence of non-aquatic animal modification, such as rodent gnawing.

Many remains were recovered from both Emanuel Point wreck sites that were considered intrusive and unassociated with either site. Both sites contained a large number of fish remains, including shark vertebrae and teeth, the teeth and mouth-combs of skates or rays, and the bones and scales of various types of fish. Bones from a sandpiper (Family Scolopacidae) were recovered from the Emanuel Point I site. One bone from a sea turtle (Family Cheloniidae), as well as the spines of a sea urchin (Class Echinoidea) were recovered during the Emanuel Point II excavations.

Some invertebrate remains that were recovered at the two sites, such as coral, mollusks, and the casings from Teredo worms are not included in this study, for while they may be associated with the shipwrecks, they did not contribute to the daily life of the sailors or colonists aboard the vessels.

CHAPTER VI

A DISCUSSION ON THE COLLECTION OF SEDIMENT SAMPLES AND THEIR FINE SCREENING FROM THE EMANUEL POINT WRECKS

This research investigates whether cultural material is being lost through dredging, and if so, what that material can tell us about the Luna expedition. The recovery of zooarchaeological material demonstrates that material is indeed being missed, so the next step is to determine what this material can reveal about the past.

This discussion is therefore divided into two parts: 1) an evaluation of sediment samples and their benefit to underwater archaeological research; and 2) an examination of what the zooarchaeological materials recovered from the sites can tell us about life aboard 16th-century Spanish sailing vessels.

As the archaeological methods concerning sediment samples differed so greatly between the two Emanuel Point sites, it is nearly impossible to compare the frequencies of remains and populations between the two vessels. Therefore, this study will simply examine the animal types recovered, and how they may have impacted the sailing experience, using the two vessels together as one large data set.

The Collection of Sediment Samples and Fine Screening

The collection of sediment samples from both Emanuel Point sites yielded many new species and added to the understanding of previously identified species. However, some issues need to be discussed concerning the manner in which sediment samples are collected.

During the excavation of Emanuel Point I, collection of sediment samples was not a principal aspect of the research design. Samples appear to only be taken near significant structures, such as the keel scarf, or after finding large artifacts such as noteworthy olive jar sherds. In addition, many of the samples were of various sizes. Some of the smallest samples consisted of only 25 to 30 ml of sediment, while others contained 5 to 6 liters of sediment. The inconsistency in the size of the samples makes it almost impossible to accurately determine how the materials are dispersed throughout the site, as well as determining the frequency of remains contained from one sample to another.

Another issue that should be addressed is the storage of sediment samples. The samples collected from Emanuel Point I were vacuum dried and stored for examination to be conducted at a later date, as they were taken for the collection and testing of pollen, therefore it did not matter that the samples were dried (John Bratten, pers. comm. 2011). This process left the sample in a condition best described as very hard and solid as a brick, with the material almost glued together. Much care had to be taken with the material to ensure it was not damaged during rehydration. Normally rehydrating dried samples should not be attempted, however the Emanuel Point I samples were essentially bricks, and could not be evaluated without carefully rehydrating. While damage to the material appeared to be minimal, there was a noticeable difference in the condition of the material compared to the still wet samples collected from Emanuel Point II. Many of the insect remains were cracked, deformed, or broken. Rehydration in ethyl alcohol seemed to rejuvenate the material, making it more pliable and allowing the remains to spring back and retake their original shape and appearance.

The point being made is not meant to be overly critical of the methods and practices used during the excavation of Emanuel Point I, as the discoveries made during this research were likely not even thought of, but rather the point is to show what should be done in the future. While it is excellent that sediment samples were collected and stored for research, it is the author's opinion that in forthcoming research any wet samples be examined immediately to ensure that damage does not occur to any of the material that may be within, especially material more susceptible to damage by drying, such as small ceramics and botanical remains. If samples must be archived for future research, a way should be found to keep the material wet during storage.

There are also lessons to be learned from the storage issues encountered during this research. All recovered faunal material must be stored in alcohol. Either ethyl alcohol or isopropyl alcohol is suitable for the storage of both vertebrate and invertebrate remains, and will ensure that bacteria and algae do not destroy the small and fragile specimens. It is also necessary to store the material in leak proof vials to help protect the artifacts, as storage in plastic bags can lead to the destruction of the enclosed specimens. Screw top glass vials seem to be the best answer, as they allow for quick viewing of the material while still contained within, and also allow for easy retrieval of the specimens for further examination.

It should be clear that based on the materials recovered from fine screening that at least some material--especially zoological--is being missed through the use of dredging alone. It is also important to understand just how much material is being completely lost. Since much of the data necessary for this evaluation does not exist for Emanuel Point I, this analysis can only be applied to the Emanuel Point II site.

By averaging the final bottom measurements for each 1 by 1 unit excavated from 2006 through 2009, it is possible to obtain an estimate of how much material was excavated. As final bottom measurements are rarely level due to obstructions such as ballast stones or the curvature of the vessel, it is difficult to determine an exact volume for a unit. Using the average of the five bottom measurements allows for a determination of volume that should be fairly accurate. Based on that data, approximately 11,834.0 liters of sediment were excavated from the 19 1 by 1 units on Emanuel Point II from 2006 through 2009 (Table 7).

Emanuel Point II	Unit Depth Measurements and Average Depth					
Unit Number	Depth Measurement (in cm)					Average Depth (in cm)
	North-West Corner	North-East Corner	Center	South-West Corner	South-East Corner	
83N 499E	57	64	70	56	61	61.6
83N 500E	50	55	53	56	52	53.2
84N 499E	57	77	64	52	59	61.8
84N 500E	74	65	62	62	64	65.4
85N 498E	34	78	31	33	26	40.4
85N 499E	47	30	49	49	26	40.2
86N 497E	83	90	80	80	80	82.6
87N 497E	76	65	64	93	86	76.8
87N 498E	80	80	86	86	85	83.4
90N 487E	64	61	59	57	62	60.6
93N 490E	90	94	95	90	90	91.8
93N 491E	115	120	116	120	123	118.8
96N 477E	61	59	59	59	69	61.4
99N 486E	40	49	49	49	43	46.0
100N 485E	35	36	30	23	20	28.8
100N 486E	79	79	82	50	81	74.2
101N 485E	39	39	44	44	43	41.8
101N 486E	45	49	55	54	NA	50.8
102N 485E	45	39	46	47	42	43.8

Table 7. Depth Measurements and Average Depth from Emanuel Point II Excavations from 2006-2009.

As all of the sediment samples collected were the same size, it is also possible to determine the volume of material removed and fine screened. Every sediment sample was collected in a one-gallon zip top bag, and each bag was filled to capacity. With 1 gallon equaling 3.8 liters, and 19 sediment samples collected across the site, it was determined that approximately 72.2 liters of material were recovered as samples on Emanuel Point II.

To clearly understand the importance of the collection and fine screening of sediment samples from shipwreck sites, some quantities need to be discussed and only a few comparisons be made. Compared to the 6,660 insect remains and 31 individual types/species recovered from the Emanuel Point II sediment samples, only 117 cockroach pieces and 4 beetle wings were recovered from dredging. While dredging accounted for the majority of the vertebrate remains (78.6%), a large number were still recovered in the sediment samples.

As calculated above, about 11,834.0 liters of sediment were excavated on Emanuel Point II from 2006 through 2009, with 72.2 liters of that being sediment samples and 11,761.8 liters excavated though dredging. This means that the fine screening of sediment samples accounts for 98.22% of all insect remains and 94.55% of all insect types/species recovered. Sediment samples account for 84.90% of all faunal materials recovered from Emanuel Point II, including 21.4% of the vertebrate remains. Astonishingly, the sediment samples account for only 0.6% of the total material excavated.

Fine screening of sediment samples also saw an increase in the observed rodent population of the site, particularly the mice. Of the *Mus musculus* remains recovered from Emanuel Point II, 82.3% were recovered from the sediment samples, including all of the teeth, which were essential in determining the age range of the population. Of the unidentified rodents, 53.8% were collected from the sediment samples, while *Rattus rattus* observed the smallest increase, with 5.4% of the black rat remains coming from the sediment samples.

As a result of this research, it was clearly evident that those rodent bones which were *not* recovered in the dredge spoil from either Emanuel Point site were the exact elements recovered from the sediment samples taken from Emanuel Point II, including caudal vertebrae (tail), tarsal (hind feet), carpal (front feet), and small vertebrae (Figure 29).

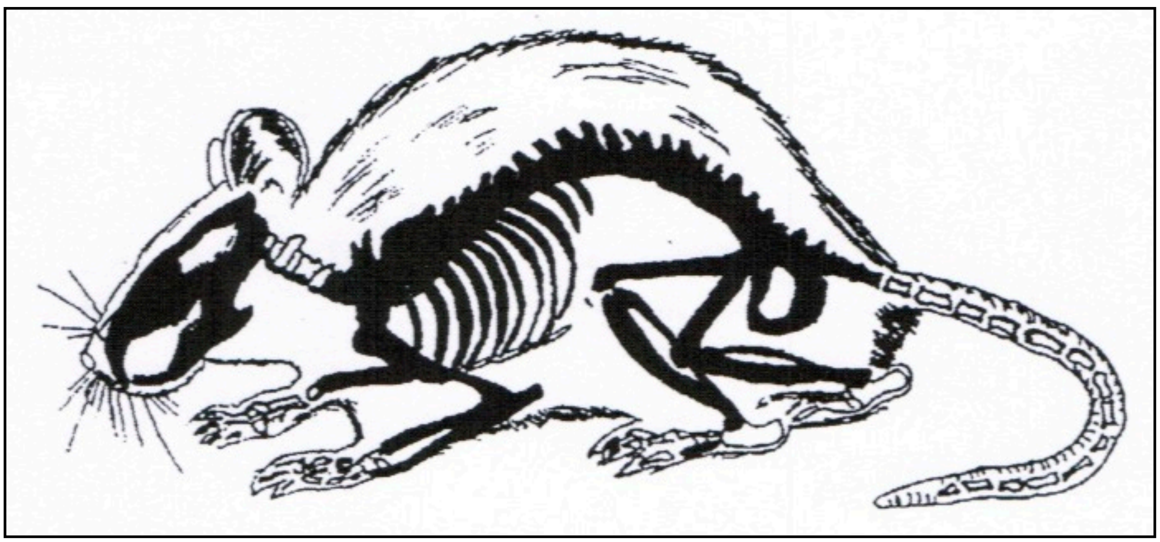

Figure 29. Drawing of rat skeleton showing highlighted bones that were recovered from dredging. The remainder of the skeleton, including vertebrae, tarsal, carpal, and tail bones was recovered from sediment samples. (Adapted from Smith et al. 1995:80).

Another type of evidence indicating the presence of rodents was recovered entirely through the use of fine screening: fecal material. As much as can be determined, fecal material has never been recovered or identified from a shipwreck previously. Fecal material was recovered from both Emanuel Point sites, found in 7 of the 9 Emanuel Point I samples, and in 12 of the 19 Emanuel Point II samples. Thousands of the fecal pellets were identified from just one of the Emanuel Point II samples, which allowed for the destruction of a large number of pellets in order to determine their contents. This research step led to their positive identification and later provided insight into the diet of the shipboard rodents.

The use of fine screening also helped to reduce the bias towards larger animals that is inherent with dredging and the exclusive use of large-mesh screens. Of the 1,448 total vertebrate remains recovered from Emanuel Point II in total, 305 were recovered from the sediment samples, accounting for 21% of the faunal assemblage. These small remains would have been lost altogether, leaving the assemblage comprised mainly of the remains of larger vertebrates and diminishing the presence of smaller faunal species. While it is apparent that the one taxa that benefited the most from the increase in representation, the bony fishes, is the taxa that is generally not considered part of the archaeological record for a shipwreck site. Scientific research has proven time and again, however, that it is vastly more important to collect material and find some of it intrusive than to not collect the material at all.

Control Cores

Very little material was recovered from the four control cores that were collected outside of the assumed site boundary for Emanuel Point II, and only a small fraction of that material represented zoological remains. The only vertebrate taxa represented were the Osteichthyes, and based on the nearly perfect condition of the remains and lack of taphonomic staining, the various unidentified fish to which they belong died only within the last few years. Some aquatic invertebrate fragments were recovered in the cores, and all were the various remains of small shrimp.

Each core contained approximately 4.53 liters of sediment, or about 18% more than was contained in each sediment sample. However, none of the remains recovered from the two Emanuel Point sites were found in the cores, suggesting that the material recovered from the sites are localized and therefore adding to the conviction that they are associated with the site.

Time Use and Cost Effectiveness of Fine Screening

Once it was determined that approximately 30 cubic centimeters was the ideal amount of sediment to run through the stacking screens at one time, the process became simple and methodical. It took an average of thirty minutes to screen the material, sorting it into four subsamples that could then be examined individually.

The easiest, and therefore the fastest, subsample to examine was the material that gathered in the 2 mm screen. Examining, sorting, and cataloging the largest material took about five to thirty minutes, usually dependent on the amount of vertebrate material in the sample.

Material that collected in the 1 mm screen consisted mostly of the larger insect specimens, such as bodies, the larger beetle wings, and cockroach wing fragments. It took anywhere from 2 man-hours to 32 man-hours to examine, sort, and catalog the material.

The subsample that took the greatest amount of time to sort was the 500 µm screen. It provided the greatest amount of zooarchaeological material as well as capturing all of the sand from the samples. It took about 4 hours to sort through a sample that had little to no cultural material, and the most prolific sample took about 120 hours to work through.

The final subsample, the material that passed through all three screens, was the only one to have absolutely no cultural material in any of the samples. Not including the time needed for the silty sediment to settle in the batches, it took 2 to 8 hours to sort through the sediment and examine the water.

The amount of time needed to fully analyze a sediment sample, including examining, sorting, bagging, and cataloging varied from sample to sample, as some of the samples were more bountiful in zooarchaeological material than others. Some of less abundant samples, such as those from Emanuel Point I or those collected at the surface of Emanuel Point II, were fully completed in about eight man-hours, while some of the more plentiful samples took about 160 man-hours to finish. Most of the sediment samples required about 32 man-hours to fully analyze.

A point should be made on the collection and identification of insect remains. Normally, only a small sample of material would identified, collected, and conserved from an archaeological site. There is just no need for boxes stuffed with non-diagnostic flakes or ceramics to occupy valuable space in collection facilities when metric data such as the number present and total weight will usually suffice. However, for this research it was necessary to keep as much of the material as possible, as it was impossible to determine what materials were from the same species during the sorting process. It was only after sorting and during identification at the Museum of Entomology (Florida State Collection of Arthropods) was it possible to determine just what had been recovered in the sediment sample. It is the authors recommendation that the same process be followed in future studies, that is, keep as much of the material as possible while sorting, and discard only those materials that are so visibly damaged that they are unable to be fully identified. A full count of those discarded materials should still be recorded, with an identification being made as best as possible.

Sample Placement and Prolificness

It should be noted that some of the samples provided much more cultural material than others. Because of the manner in which the Emanuel Point II ship settled during and after it sank, the stern of the vessel is deeper than the rest of the ship. This allowed a large portion of the bilge material, which included much of microfaunal remains, to flow to the stern and settle. Therefore, the sediment sample that was collected at the bottom of the excavation unit at the stern (09W-1683 and its offshoot 09W-1758) was concentrated with microfaunal remains. This one sample provided more faunal remains than most of other samples combined.

Samples collected near the surface of the bay floor had noticeably less material than those located deeper in the sediment, likely due to their exposure to tidal changes and shifting sediments. Materials located within the ballast of the vessel were provided greater protection from the elements, evidence of which can be seen by a higher concentration of fuanal remains in both the dredge material and sediment samples.

This is not to say that the other samples are of no importance, but rather it shows the importance of sampling the bilge, which would capture many of the microscopic animals and artifacts present on a ship throughout its voyage. While many of the samples did not provide as much information on the faunal assemblage of the vessel as the sample from the bilge, they did provide data on the vertical stratigraphy of the site and helped to provide a more thorough zooarchaeological understanding of the site.

CHAPTER VII

DISCUSSIONS ON THE RELATIONSHIPS BETWEEN HUMANS AND ANIMALS ABOARD THE EMANUEL POINT SHIPS

Many of the examinations into the animal remains aboard sailing vessels focus on the use of animals for food, whether as dried and preserved specimens or as fresh meat that was possibly butchered on board. While many of the large vertebrate remains are likely evidence of food, especially those recovered from Emanuel Point I, the majority of the animal remains recovered were actually from unintentional passengers aboard the ships. Therefore, it is necessary to examine the faunal remains in a new light, looking at how the living animals aboard the vessels impacted the daily lives of the sailors and colonists.

Life at Sea

Space on the ships in the Luna fleet was at a premium. With 11 ships ranging in tonnage from about 50 to 70 tons up to the 570-ton *Jesús,* the entire fleet carried 1,500 colonists and soldiers, 240 horses, and an unknown quantity of cattle, sheep, pigs, goats, chickens, and other supplies, living space would have been cramped and uncomfortable. In order to transport 1,500 colonists aboard 11 ships, the smallest ships would have each needed to carry around 100 people; and as Pérez-Mallaína (1998:131) points out, they would be "crowded together for months at a time, without using water for anything but drinking."

Pérez-Mallaína (1998:130-132) determined the dimensions for a ship of 106 tons and examined the areas of living space, calculating the habitable space to be between 150 and 180 square meters. Further reducing this available space are objects such as chests and crates containing supplies, as well as necessary sailing items such as masts, stoves, capstans and other nautical gear (Figure 30). Therefore, each person would have been afforded about 1.5 square meters of space on board (Pérez-Mallaína 1998:131). That space was further reduced, however, as it had to be shared with the other living creatures being transported.

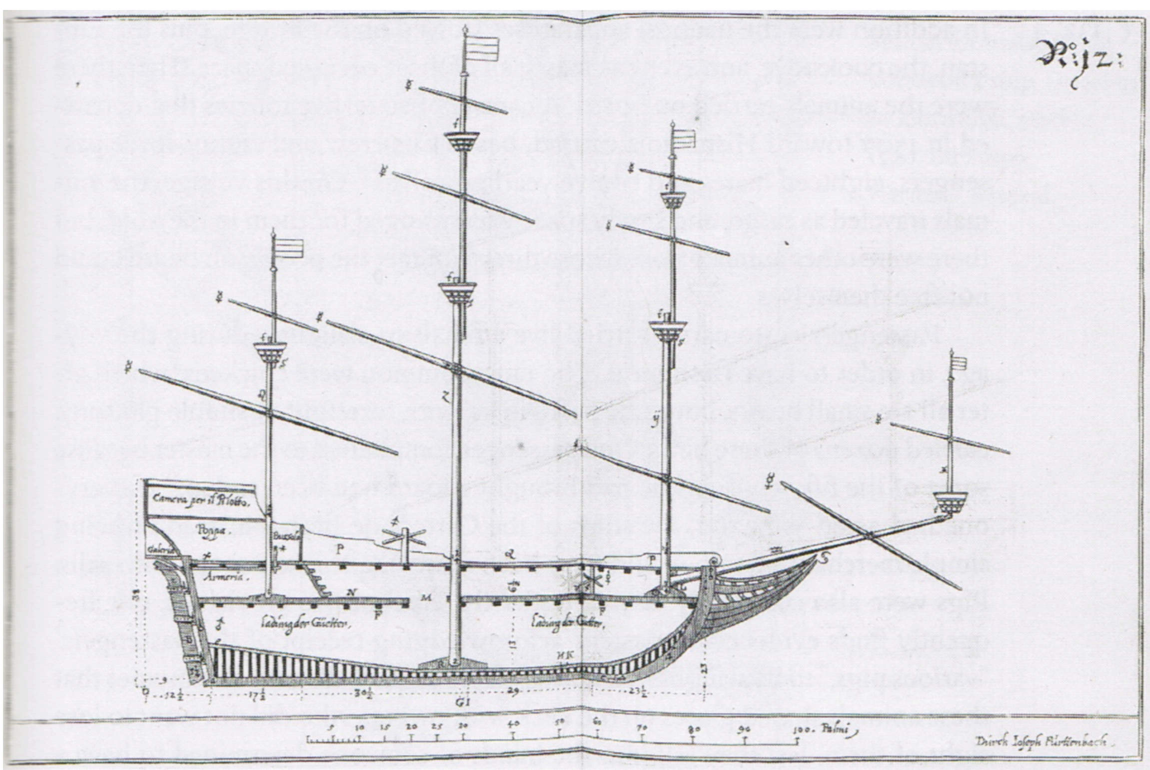

Figure 30.The physical space in which the crews lived and worked. (Adapted from Pérez-Mallaína 1998:131).

The Transportation of Livestock

A great deal of space aboard ship would have been designated to store provisions for the livestock, as well. No mention is made in the records about the amount of provisions actually required for animals, but considering the number of animals needed to establish the colony, the amount of food and water required would have easily surpassed that required for the human passengers. Ships traveling from New England to the West Indies during the 17th century carried anywhere from 200 to 500 pounds of hay per animal, and 10 to 15 bushels of oats for each horse. A ship carrying 50 horses would need 10 to 12 tons of hay and 500 bushels of oats, all in addition to adequate provisions for the crew and passengers (Hawke 1989:154). In addition, livestock required large amounts of water, especially horses, which require an average of 8 gallons of water per day, and nearly double during hot weather--such as during the middle of summer in the tropics, not to mention the environment in the hold of a sailing vessel. If the water became foul or tainted, the horses could easily develop gastro-intestinal problems, which left untreated, often result in death (Belschner 1969:237). One of the stops that the Luna fleet made in their voyage was along the Gulf Coast of Florida. For five days, the crew collected fresh water, wood, and grass for the livestock (Priestly 1928:xxxiv; Milanich and Milbrath 1989:125).

Aboard the Luna vessels, we have an idea of the types and numbers of animals that were brought along for the creation of the colony. From the historical documents, it is known that 240 horses were spread among the fleet (Priestly 1928:271). From the archaeological assemblage, we have a minimum number of individuals that were present on the two ships. The archaeological record likely does not provide an accurate representation of the animal populations carried across the Gulf, as it would have been a priority to unload the livestock once reaching shore in order for them to graze and improve their health, and therefore they would not have been on the vessels when the hurricane hit. Most of the livestock would have had little trouble making the voyage across the Gulf. There are many historical references to cattle, pigs, goats, and chickens on ships, usually providing fresh food for the voyage (Rediker 1993:160; Pérez-Mallaína 1998:132). The livestock for the Luna expedition were intended for the colony, and probably were not used for shipboard provisioning. Still, given their decades of experience in livestock transportation, it was probably relatively easy for the Spanish colonists to move and care for most animals aboard the ships.

Horses, however, are a different story. Horses are deceptively delicate and prone to injury. They were transported in a suspended position by a system of slings (Figure 31), with hobbles on the front and hind legs to prevent injury during travel by keeping the legs from contacting the deck (Milanich and Milbrath 1989:125).

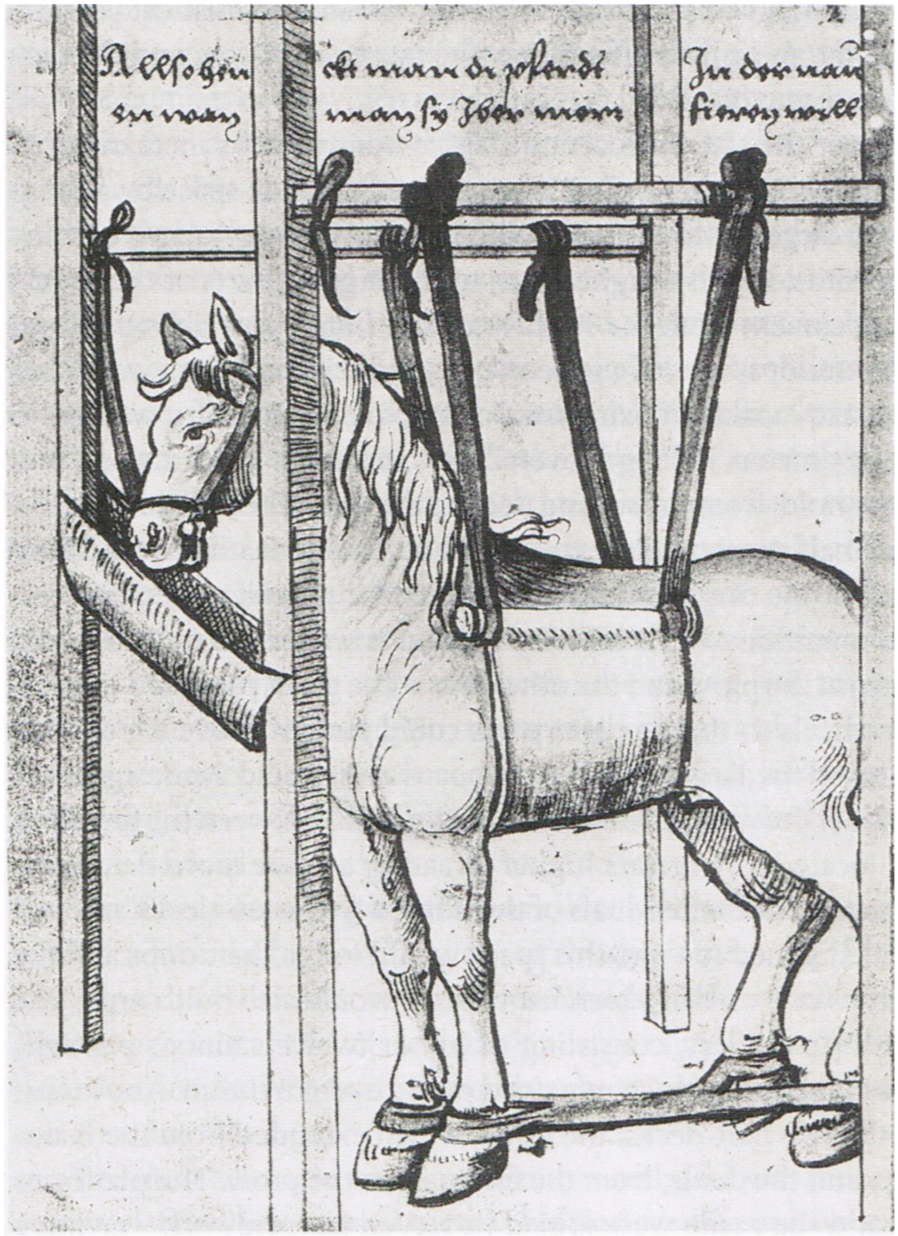

Figure 31. System for transporting horses on a ship using a system of slings and hobbles. (Adapted from Pérez-Mallaína 1998:133).

Suspension in this manner increased pressure to their stomachs, often resulting in internal damage as the horses' weight shifted with the motion of the vessel. Horses were also unable to exercise, and that lack of physical activity only added to the stress of transport and resulted in a decline in health. It is probably that this method of transport which led to the death of 110 of the horses, and created the need to off-load the surviving horses near the modern city of Mobile to continue the final leg of the journey overland. Cattle and goats were probably transported in much the same manner as horses, or possibly housed in pens on the deck (Scott-Ireton 1998:65). Being heartier animals, they likely made the trip with relatively few issues, yet still required large amounts of fodder and water.

During the voyage, while space was probably arranged for most of the livestock in the hold, they would have required constant care. It is highly unlikely that any of the passengers would have been able to ignore or forget about their presence. Knowing that the livestock required large amounts of food and water to survive, it should be understood that waste would accumulate in the holds after being processed through the animal. The hold of a sailing vessel is hot and damp, and likely created a certain unpleasant stench even when empty. Add to that odor a mixture of horse, cattle, pig, chicken, and goat feces, and one could imagine the ships' hold would become nauseatingly pestilential, probably requiring cleaning at least a few times each day. Of course, no matter how often the hold was cleaned, the smell would never disappear. As the water seeped between the planks, it gathered up particles of trash and feces, which eventually accumulated in the bilge of the ship. As Pérez-Mallaína (1998:140) explained, "the moment most dreaded by all on board was when the bilge pumps were engaged to extract water that had filtered down to the bottom of the ship. Totally corrupted, it came out fuming like hell and reeking like the devil."

In addition to cleaning up animal feces, their vomitus had to be taken care of as well. It appears that domesticated animals are just as susceptible to seasickness as humans. One sailor referenced a trio of hogs aboard his ship, stating “the roughness of the weather made them so sick, that no man could forbear laughing to see them go reeling and spewing about the deck” (Teonge 1825:270). All of this vomit and fecal matter only added to what was already an unhygienic environment. Crammed together like sardines in a can, and with fresh water being designated solely for consumption, bathing and washing clothes was out of the question for any of the passengers on the Luna expedition--which was just as well, because salt water residue is known to cause serious skin rashes and itching (Pérez-Mallaína 1998:140). On a two-month voyage through the hot and humid tropics, the average person can sweat out about 1.5 liters of moisture every hour if they are not acclimated (Knochel 1974:843), no doubt leading to a collection of sailors and colonists that can only be described as filthy and disgusting. When one understands exactly how unsanitary the ship actually was, it is surprising that none of the passengers on Luna’s ships succumbed to serious illness and died en route.

Diet

Quite a lot of information is known about Spanish diet in the 16th-century, both at sea and on terrestrial sites (Reitz and Scarry 1985; Deagan 1995; Rodgers 2003). A sizable majority of the large vertebrate remains from the two sites included in this study are likely the discarded trash of meals consumed during the voyage, and possibly even previous voyages. However, much of the material recovered from the first Emanuel Point ship were likely remains from stored food products, especially those found in the remains of barrels in the galley area. Some of the smaller vertebrate remains were also indicative of food remains.

One pond turtle, while having no physical indication of butchering or cooking, can be viewed as evidence of fresh food supplementing the mariners' diet. Members of this reptilian family are not found in salt water; therefore, this specimen must have been collected while ashore. It is possible that the turtle came from Mexico or even Europe, and it is even possible the turtle was kept as a pet, but this is highly unlikely. All pond turtles are aquatic or semi-aquatic, so for them to be transported alive, they would need a habitat containing fresh water. Seeing how difficult fresh water was to come by on ship, this type of turtle would make a poor choice of pet for the voyage, as it would have died shortly after leaving port. The same could be said for transporting the turtle alive in order to provide fresh meat for a meal. Pond turtles are also relatively small; so preserving the meat would be a difficult and very inefficient process. Therefore, the only plausible answer for the presence of the fresh-water turtle remains aboard ship is that the remains point to evidence of fresh food being captured during an expedition ashore. Capture would have taken place when the fleet stopped for supplies along the coast or while anchored in Pensacola Bay. According to Reitz and Scarry (1985:81), the Spanish left baskets under logs to catch basking turtles; specifically turtles of the family Emydidae. Joutel mentions eating freshly captured turtles during the La Salle expedition in Texas, and stated that the turtles often had eggs inside them that were useful for thickening sauces (Foster 1998:128).

Fish remains are extremely common on shipwreck sites. In fact, they are probably the most common animal remain recovered from any maritime site. However, fish remains that are found in good context and can be positively associated with a particular site are extremely rare. Even though Joutel noted “seamen ate almost entirely salted fish,” it is difficult to associate fish remains with a maritime site unless there is evidence of alteration or modification, or the species are native from a different region other than where the ship sank (Foster 1998: 51). Another problem with fish remains is that the bones exhibiting cut marks are generally not those diagnostic elements that are used by researchers to make a positive identification (Willis et al. 2008:1438). Even with out cut marks however, it still may be possible to determine an association with the wreck for some elements of bony fish. On *La Belle*, for example, a fish was found concreted in a cask and was determined to be part of the ships’ provisions (Bruseth and Turner 2005:125). No fish were determined to be associated with the first Emanuel Point site; however, a few specimens from the second site were identified which did exhibit cut marks: elements of a hardhead catfish, a triggerfish, and a member of the Serranidae family showed clear evidence of butchering. The remains of a different unidentified fish showed evidence of rodent gnawing, placing it on the ship as well. All of the identified fish are found in the Gulf of Mexico, and could have been captured at anytime on the voyage, and both the catfish and the Serranid could have been captured while the ships were anchored in the bay. Either way, the remains provide rare physical evidence of what historical documents have been telling researchers for some time: sailors caught and ate fresh fish to supplement their diet.

Sailing with Rodents

The presence of cat remains in this study poses a very interesting quandary. Did the felines belong to the ship, members of the crew so to speak, or, were they a pet to one of the colonists? There is no available evidence that supports a definitive answer; but either way, the purpose of cats aboard ships was likely the same: elimination of rodents that would have feasted upon the grains and stored products so vital to the success of the colony. Assuming that the felines died during the sinking event, and not during the voyage, the recovery of cat remains form the second Emanuel Point shipwreck would seem to suggest that the cats were more a part of the ships' crew than associated with the colonizing effort. Cats are highly territorial; even if the animals belonged to one or more of the colonists, it would make sense that they remained aboard the ship to help protect the food stores from the rodents and to take advantage of enclosed shelter. With the ships acting as storage facilities for the food, which was necessary until structures were erected on land, it would have been imperative for the stored goods to be protected from scavengers already living aboard the ships.

Another point to address regarding the cats is their age. While the adult cat, likely a few years old, is perfectly suited to curtailing the rodent population, the second cat, at only a few months, was probably not. The kitten was between 1 and 3 months old when it was brought on the voyage, meaning the animal was essentially helpless. At that age, it would likely still be nourished by its mother's milk. The age of the kitten suggests that perhaps cats were being allowed to breed on the ship, in order to increase their numbers and be better able to combat the rodent infestation. It may also suggest forward planning on the part of the colonists. Knowing that they needed to build storehouses for their food products, and that those structures would certainly become infested with rodents, they may have decided to bring along kittens to curtail that infestation. Hopefully the young cats would grow up in these new surroundings and be even more protective of "their" territory.

As evidenced by the high number of rodent remains recovered from both sites, it is obvious that rodent infestations could have decimated the stored products if left unchecked. However, cats being of Oriental origin and still fairly rare in Europe in the 16th-century, many times a ship's crew had to form hunting parties to deal with the rodent menace themselves (Pérez-Mallaína 1998:132). With that in mind, it might be suggested that the presence of multiple cats on the Luna voyage illustrates the planners' desire to take extra precautions to protect the food stores, and points to just how serious the success of the colony was to Spain.

As Armitage (1994:238) proclaims, "the black rat is the quintessential example of a mammalian commensal 'weed species' that has thriven due to its opportunistic lifestyle, and spread globally by its close, unwelcome association with mankind." As contemporary sources reveal, rats were an everyday occurrence on European ships sailing across the sea in the 16th and later centuries. As Armitage (1995a:23) explains "In modest numbers these vermin were merely a nuisance to mariners; the greatest damage done by them on ships resulted from the gnawing into the casks of stored foodstuffs and contaminating the contents within with their urine and feces." Large populations of rodents on ships were a very serious threat to the various stored products onboard, including grains, hay, meat, seeds, beans, and even items such as leather and rope. Apparently, they were also a threat to everyone sailing, as they were known to "turn and challenge their hunters like wild boars" (Pérez-Mallaína 1998:132). When populations surged, they became an even greater threat. A rat plague overwhelmed a returning Spanish fleet in 1622, and on one ship alone more than one thousand rats were reportedly killed while in port at Havana. Later, when the same ship was at sea several thousand more rats were destroyed (Phillips 1986:157)

It is not possible to determine precisely what the size of the rodent population was on either ship, as the rat remains undoubtedly underestimate the actual number of inhabitants. Certainly many of the rodents attempted to escape the sinking ship by swimming ashore. Those that survived possibly caused more problems for the colonists after the hurricane subsided. While some of the rat bones in this study are likely from animals that drowned during the sinking, some could be the remains of rodents that died during a previous voyage, or earlier in this final voyage, of the ship. Rats may have also died from natural causes; of predations from the cats aboard ship; or as a result of being hunted or poisoned by the crew. Rodent bodies could have easily lain undiscovered in the bilges or amongst the cargo in the hold.

The fact that only one species of rat was identified on ships of the Luna fleet is not unexpected, as the other species of commensal rat, *Rattus norvegicus* (the brown or Norway rat), did not appear on board European sailing ships until the mid to late 18th century (Atkinson 1973; Armitage 1989:154, 1993, 1994:236, 1995a:24). However, it is somewhat surprising that a colony of smaller house mice made their home aboard the vessels, as they would have been heavily predated by the larger, more established rats (Armitage 1995b:1). While “infestation by rats keeps down mouse numbers by some extent, …situations where rats can live usually provide conditions for a large population of mice” (Berry 1981:93). It is likely that the mice, being somewhat smaller, found areas within the vessel that the rats could not enter.

One interesting aspect was observed and reported on concerning some of the rat remains from the first Emanuel Point site. According to Armitage, several bones from immature rats are “noticeably stunted and have a distinctive, abnormally flaring/cup-like outgrowth of the end of the shaft” and “these pathological changes are generally associated with rickets” (Figure 32) (Armitage 1995a:20). Rickets is a disease caused by Vitamin D deficiency, usually due to inadequate sun exposure or dietary insufficiencies, which results in growth retardation, muscle weakness, skeletal deformities, hypocalcemia, tetany, and seizures (Holick 2006:2062). The presence of rickets was not verified for the materials analyzed from Emanuel Point II, however, many similarities to the Emanuel Point I specimens were noticed, and it is very possible that a number of the specimens from the second site also show evidence of the disease. This uncertainty is due to the zooarchaeological inexperience of the author, as it would take someone with significant experience and specialization in rodent remains to make that determination (Irvy Quitmyer 2010, pers. comm.). However, the presence of rickets is not surprising considering the environment and diet of the rodent populations. Hiding from the sailors, the rats would have stayed below decks--rarely, if ever, making it up on deck during the day. Their diet, which consisted mostly of scraps and garbage, would have been low in many vitamins and minerals, possibly leading to the development of rickets.

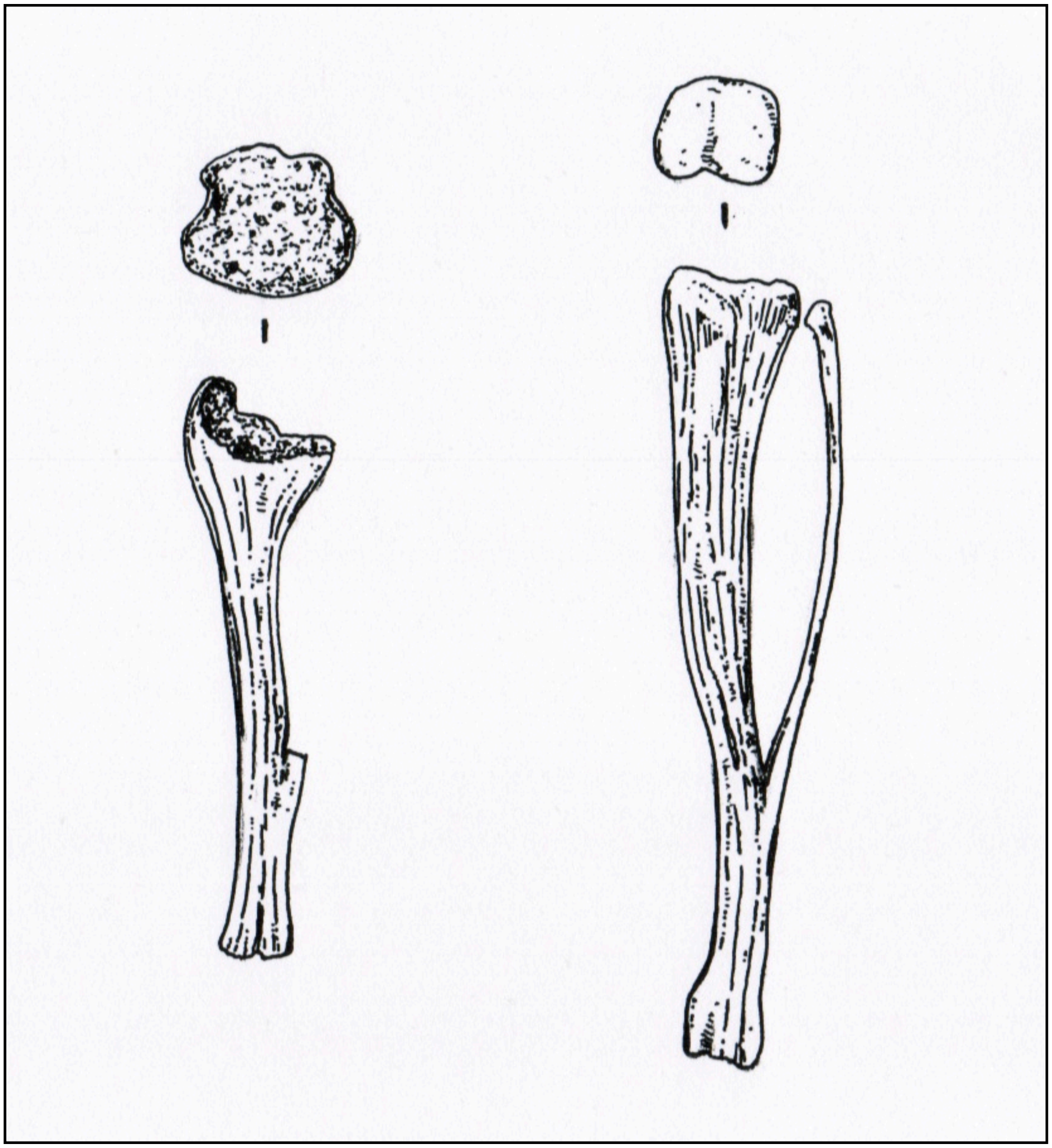

Figure 32. Black rat tibae. Healthy modern specimen (right) compared with specimen (00,401.02) from Emanuel Point I (left) showing pathological changes suggestive of rickets. Both immature specimens. Drawings by Kate Armitage. (Adapted from Smith et al. 1995:80).

Examination of the rodent fecal remains provides insight into the life and diet of the two of the most abundant mammals on the ships. While it is evident that the two different rodent species were making meals of the discards from human meals and from various stored products, it is also apparent that they were consuming some of their other sailing companions: insects. The abundance of insect parts in the recovered fecal matter suggests that insects may have comprised the largest portion of the rodent diet, as each fecal pellet contained a number of insect components.

Insects

The presence of insects on ships is a topic that has never really been examined in much detail, especially in regards to the archaeological record. Examination of sediment samples provides a much clearer picture of the infestation present on early sailing vessels.

All of the insects identified from the Emanuel Point sites are classified as pests of stored products including grains, vegetables, meats, hides and other materials. Every one was probably brought aboard unintentionally, as it is very likely that the warehouses and markets where the materials were purchased for the expedition were infested as well. Even today, all of these species are known to be nuisances to crops, warehouses, manufacturing facilities, and homes.

Very few references are made in the historical records in regard to insects. The references that are made, however, provide interesting insight into the impact insects had on humans aboard ship. Lice, cockroaches, and bedbugs seem to be the insects that had the most impact on sailors, as they are the few mentioned by name.

Lice plagued the men sailing with Columbus and Drake (Morison 1974:97,640). As Eugenio de Salazer describes, there are "lice so large that some of them get seasick and vomit up pieces of flesh from apprentice seamen" (Pérez-Mallaína 1998:133). Another contemporary notes "any crewman surely would have had more lice in his waistcoat than coins in his purse" (Pérez-Mallaína 1998:132).

According to Bass et al. (2004:283) "methods of removing lice have changed little over the ages." In fact, tools similar to the ones used 500 years ago are still used today. Combs used for the removal of adult lice and nits (lice eggs) are usually two sided, with coarse combs on one and tightly packed combs on the other. The smaller, finer teeth on the second side were especially for removing the insect and its eggs. It's also likely the comb was used to remove fleas, which were also a bane to the mariners. No mention is made whether a poison is applied to the infested areas to kill the pests before the comb is used, as is done in recent times. Constructed of wood, horn, tortoiseshell, bone or ivory, lice combs have been recovered from a number of shipwreck sites, including *Vasa, Mary Rose, Serçe Limani*, and others (Marsden 1972:91,94; Green 1973:287; Dethlefsen et al. 1977:321; Price and Muckelroy 1977:216-217, 1979:319; Piercy 1978:305; Lyon 1980:341; Crump 1988:49,51; L'Hour and Veyrat 1989:293; Martin and Parker 1999: 139; Bass et al. 2004:283). Eighty-two wooden combs were recovered on the Mary Rose, a few of which were singularly enclosed in neatly fitting leather cases (Rule 1983:200).

The wooden comb recovered from Emanuel Point II would have been just the tool a sailor would use to remove the pesky bugs from their heads and beards. Although no mention is made in the historical record, it was probably one device of personal hygiene that every shipboard traveler had in his (or her) possession.

Bedbugs also helped to degrade the quality of life on sailing vessels. During the time of the Luna expedition, the majority of the ships' crew slept on sacks full of straw, a prime habitat for many pests, including bedbugs (Pérez-Mallaína 1998:137). Regarding bedbugs, Miguel de Cervantes complains about them adding to the misery of shipboard life, "where most of the time bedbugs mistreat you" (Pérez-Mallaína 1998:134). To make matters worse for colonists on the Luna voyage, those same straw sleeping pads were probably taken ashore and used, taking any insect inhabitants along to continue the torture.

Other invertebrates were pests on the ships as well, including fleas, ticks, and mites. Fleas, ticks and mites would have certainly been carried aboard on any livestock, possibly on any mammals recovered during hunting expeditions, or on the rats and cats aboard. Mites can also be pests of many plant species. Concerning the Luna expedition, there is no reason to think that fleas, ticks, lice, bedbugs or mites were not present on all of the vessels, as they certainly were a common problem for unwashed populations confined in close quarters, such as sailing vessels. It is not surprising that direct evidence for lice, fleas, ticks or mites were not recovered from the site; as soft-bodied insects, any that did not hitch a ride to shore would have quickly deteriorated in the water after the ship sank, leaving no evidence of their presence.

Another well-known unwanted traveler on sailing vessels was the cockroach. As Eugenio de Salazar described on one of his travels, "[this ship] has an enormous profusion of game birds--cockroaches--which are called "curianas" here" (Pérez-Mallaína 1998:133). Along with the Emanuel Point ships, cockroaches were also recovered from

La Belle, *San Antonio*, and *San Esteban*, (Peterson 1977:734; Durden 1978:407; Roth 1981:1; Crump 1988:64; Bruseth and Turner 2005:126). Originally believed to be brought over from Africa during the slave trade, the recovery of cockroach remains from these wrecks confirms that these insects were introduced to the New World much earlier.

The number of cockroach remains recovered from the Emanuel Point ships suggests that it was one of the most populous creatures on the ships, especially Emanuel Point II. The cockroach's diet would have consisted of any discarded trash from the sailors, as well as any decaying material such as vegetable matter and dung. Egg cases recovered illustrates that there was a breeding population on the ships, probably established on the maiden voyage of each vessel. It is also expected that the cockroach, being opportunistic feeders, would have been in constant contact with the humans on the ship, especially after the sun had set and their chance of survival had increased. One contemporary notes that "a friend of mine was marked for life by these things on board a ship coming home from Jamaica" (Kingsley 1870:148). As another sailor details

> In some ships infested with these insects, sailors frequently complain of having their toe and finger nails, and the hard parts of the soles of the feet and palms of the hands nibbled by them. The men have exhibited to me their nails and skin, which had the appearance of having been attacked. I can vouch for the following, as I was the unhappy subject of it. On returning home from a shooting excursion in salt swamps in tropical Australia, with my feet blistered and sodden, I was put to sleep in a room swarming with cockroaches (the small species). The night was intensely hot, and my feet were exposed. I had slept soundly for some hours,

> when an intolerable itching and irritation about my feet woke me. I felt these objectionable insects running over and gnawing at my feet. On striking a light, I found they had attacked the skin, and entirely eaten it away from a large blister, leaving a raw place as large as a shilling. I slept again, and in the morning found they had completed the work, and established a painful sore. The whole of the hard skin on the heel was also eaten down the pink flesh. The nails were not attacked. I have now, at a distance of four years' time, bluish scars on the skin (Nicols 1870:108).

Another insect is referenced in historical documents and this particular insect had less impact on the sailors and more on the structural integrity of the vessel itself. In 1593 a ship carrying a cargo of dried penguins for food nearly sank after the hull was made unseaworthy after hundreds of thousands of pupating Dermestids bored tunnels into the wooden hull (Hakluyt 1927:256; Quinn 1975:37; Timm 1982:18). While ships' outer hulls were sheathed with lead or wood to protect them from the "insidious sea worm," *teredo navalis,* that bored in from the sea, little could be done to deal with damage from dermestids that bored through the hull from the inside (Rediker 1993:160, Andrew Marr 2011, pers. comm.).

The archaeological record, thanks to the fine screening of sediment samples, shows that there were quite a few different invertebrates making a habitat on sailing vessels. The presence of these animals illustrates that while the majority of interactions between humans and invertebrates revolved around a handful of species, there were quite a few more that impacted the sea voyage.

Most of the remains represent pests of stored products. Weevils, Darkling beetles, Drugstore beetles, Rove beetles, and Grain beetles all feed on many of the dried products that would have been stored in casks in the hold, such as grains, rice, sugar, flour and bread. In large numbers, they could have decimated the stored products, and in modest populations they would have infested many of the containers, spoiling the contents in the process. Weevils in particular can do serious damage to stored goods, as their larvae develop inside seeds.

The fragment of Coccinellida adds some interesting insight into the food products aboard. While any number of species of the Family Coccinellida could have been aboard, the Mexican bean beetle and Squash Lady Beetle stand above the rest. The coloring and sizing of the remains more closely match these two species. Also supporting this possible identification is that these two species are some of the few in the family that are not carnivorous. Concerning those carnivorous species, no evidence of their prey has been found within the site, although it is certainly possible that the prey was present on the ship and 1) simply has not been recovered or identified, or 2) were not preserved, as they were soft bodied insects. However, the primary food sources for both the Mexican bean beetle and the squash lady beetle have been recorded in both the historical and archaeological record. These bugs are voracious eaters, and in humble numbers can reduce crops to useless piles of vegetable matter (Michael C. Thomas 2010, pers. comm.).

It is difficult to speculate what kind of impact the single Big Headed ant had with people on board. If it was a species that feed on seeds or grains, then it had much the same impact as the beetles on the ship. If it was a species that fed on other insects, it may have been more a godsend to the people than anything, helping to control the populations of the other insects. Unlike some other ants, the Big Headed ant generally does not bite or sting humans unless the nest is disturbed, and even then, the bite is not painful (Jim Wiley 2010, pers. comm.).

Grains were not the only food products at risk. Other insects, such as the three separate species of fly recovered from Emanuel Point II, infest many of the animal products carried aboard. Spoiled meats would be a prime candidate for maggot infestation, as well as any animals that may have died on the ship during the voyage, such as horses or rodents. Flies also feed on decaying vegetable matter and dung, and with fecal material flowing down to the bilge of the ship, it is likely the fly infestation could never be eradicated. The number of recovered fly casings is astounding; with over 700 casings recovered from only a small portion of the ship, it is likely that the flies were the most populated species on the ship.

With such a large population of flies on the ship, it comes to no surprise that the remains of at least one spider were recovered. While the spider is unidentified, it was determined to be from a web-weaving variety, which means that it would have had plenty of prey to feast on. With plenty of beams and timbers to attach a web, there would have been ample dark, relatively quiet and undisturbed spots in the hold of the ship for the spider to catch prey. With so many flies, it is difficult to image that only one spider was on the vessel, but with only the single specimen recovered, it is impossible to speculate as to the true spider population on the ship.

For the most part, it is unlikely that the majority of the insect pests recovered from the two sites caused much harm to the sailors and passengers, but they were probably more of a nuisance, constantly infesting the stored food products. However, it should be noted that the ingestion of many of these insects could lead to serious illness. While no mention is made in the historical documents about illness or disease in regard to insect consumption, it is hard to imagine that not one of the fifteen hundred colonists on the voyage suffered any ill effects due to swallowing a bug, and it is likely that some of the more seasoned sailors shared their experiences with the novice travelers. Therefore, it is imperative to discuss the possibilities of disease here.

Animals and Disease

According to Pelzer and Currin (2009) "zoonotic diseases are diseases that can be transmitted from animals to humans and from humans to animals." Many animals are vectors for various diseases, and many of these diseases can seriously impact humans, especially in a confined environment with unhygienic living conditions and poor medical care. While there is absolutely no evidence for disease in either the written or archaeological records concerning the Luna expedition, many of the animals recovered from the two sites are known transmitters of serious diseases that affected sailors on other voyages. It is also unlikely that 1,500 people sailed for two months across the Gulf of Mexico during the middle of summer without a single instance of disease. Therefore, it is important to at least mention many of the diseases that could have affected the travelers.

Possibly one of the most dangerous animals in regards to disease is the louse. During the 19th century more passengers died on Atlantic crossings due to lice-born typhus than any other malady (Maddocks 1981:152). Epidemic typhus, also known as "ship fever," is a form of typhus transmitted by *Pediculus humanus*, the human body louse. The disease itself is caused by the bacteria *Rickettsia prowazekii,* which is picked up by the louse when it feeds on an infected human. The bacteria grow in the louse's gut and are excreted in its feces. Infestations of lice lead to rashes and itching, and when an uninfected person scratches the louse bite the infected feces are rubbed into the skin (Romoser 2004:61).

Fleas, ticks, and mites can also be disease vectors. Murine typhus is very similar to epidemic typhus, except that the bacterium *Rickettsia typhi* is transmitted to man through fleas and their feces (Azad 1990:553). Ticks are known vectors of many diseases, and can even transmit multiple diseases with one bite. Examples of tick-borne diseases include Anaplasmosis, Babesiosis, Ehrlichiosis, Lyme disease, Rickettsiosis, Rocky Mounted Spotted Fever, and Tularemia, among others (Centers for Disease Control 2011a).

According to Baumholtz et al. (1997: 93) "there are two areas of concern with regard to cockroaches and the potential for causing disease in humans: the allergic reactions, including lung and skin reactions, and the vector potential of cockroaches for a variety of organisms." Roaches are possible vectors for dozens of bacteria, including Bubonic plague *(Pasteurella pestis),* diarrhea *(Shigella paradysenteriae),* typhoid fever *(Salmonella typhosa),* dysentery *(Shigella alkalescens),* urinary tract infection (P.

aeruginosa), leprosy *(Mycobacterium leprae),* nocardiosis *(Actinomyces* spp.), food poisonings *(Clostridium perfringens, Escherichia coli, Streptococcus faecalis, P. aeruginosa),* gastroenteritis *(Salmonella schottmuelleri, S. bredeney, S. oranienburg),* and abscesses *(Staphylococcus aureus)* (Baumholtz et al. 1997: 94).

Cockroaches have also been shown to be capable of acquiring, maintaining, and excreting a number of viruses, fungi, protozoa, and helminths. To be fair to the roach, a number of diseases have been falsely accredited to them, including cancer, beriberi, scurvy and malaria (Baumholtz et al. 1997: 95). Actually, while it is possible for cockroaches to act as vectors for all of the materials previously listed, there is no proof of cockroaches as vectors of human disease. However, they do pose a serious threat to people for a variety of reasons, including food contamination, bites, and allergic reactions (Baumholtz et al. 1997: 95). Baumholtz et al. (1997:94) also state "that cockroaches can acquire and excrete bacteria is undisputed…[however] the evidence for cockroaches acting as vectors for…disease transmission remains circumstantial."

Weevils are not known vectors of any disease, however, they can be dangerous if ingested. During serious weevil infestations, complete removal of the bugs may have been impossible, and ingestion would have been inevitable. Weevils of the genus Sitophilus have a symbiotic relationship with the bacterium *Escherichia coli* (*E. coli*), which can easily be passed to humans (Heddi et al. 1998).

Rats can be a host for a wide range of endoparasites including bacteria, protozoa, viruses, and helminthes as well as ectoparasites including ticks, mites, and fleas. These ectoparastites can be vectors for disease as well, transmitting Murine typhus, Plague, Rickettisalpox and other diseases as previously mentioned. Rodent bites can transmit a whole host of bacteria and viruses, causing diseases such as rat-bite fever, while rodent feces contaminating human food transmits bacteria, helminthes, and viruses, and rat urine can transmit Salmonella and Leptospirosis (Armitage 1989:152; Centers for Disease Control 2011b, 2011c).

While cats can carry disease, the health benefits of cats (especially in reducing rodent populations) outweigh the possibility of disease transmittal. One of the most common diseases transmitted from cats is cat scratch disease, also known as cat scratch fever. Other diseases include Leptospirosis, campylobacteriosis, and cryptosporidiosis. Tapeworms and roundworms are common in cats, especially those infested with fleas. Toxoplasmosis is a parasite carried illness transmitted through feline feces. Cats are also vulnerable to rabies, a deadly virus transmitted through bites. Cats are also vulnerable to ectoparasites, such as fleas, ticks, and mites, which are known to transmit disease (Centers for Disease Control 2011d).

Cows, pigs, sheep, goats, and chickens can all transmit a host of diseases to people. Usually diseases from livestock are transmitted through fecal material, but it is also possible to obtain many diseases through improperly cooked meats. Cows can transmit *E. coli*, anthrax, brucellosis, cryptosporidiosis, dermatophilosis, giardiasis, leptospirosis, listeriosis, pseudocowpox, Q fever, rabies, ringworm, salmonellosis, tuberculosis, and vesicular stomatitis (Pelzer and Currin 2009; Centers for Disease Control 2011e). Most of the diseases are transmitted through feces, urine, and blood, with which the sailors would have been in constant contact during the voyage as they cleaned the holds. Pigs can transmit Leptospirosis, yersiniosis, ringworm, salmonella, toxoplasma, campylobacter, influenza, streptococcus and rabies (Poljak 2009).

Zoonotic diseases in sheep and goats include tuberculosis, brucellosis, ringworm, Q fever, chlamydophila, leptospirosis. Orf is a viral infection that causes skin lesions around the face, mouth, and udder of the animals.

Rabies, arboviral encephalitis, salmonella, cryptosporidiosis, clostridium difficile, giardiasis, leptospirosis, anthrax, ringworm, morbillibirus, and staphylococcus can all be transmitted to people from horses (Weese 2002). Infections from trauma due to kicking are common with horses, a likely reason securing the feet during transport in order to protect both the horses and sailors.

While the transmission of some of these diseases is rare today, it is difficult to say what diseases were transmitted and how often during the 16th century, especially on a sailing vessel. The transmission of zoonotic diseases from animals is primarily by direct contact, through contaminated bedding or materials, oral ingestion, or inhalation. On a ship in the 16th century, all of these modes of contact were likely for every passenger on a daily basis. Poor hygiene and living conditions only magnified conditions for contact and disease. Medical practices and the knowledge of disease transmission were essentially non-existent at the time. The usual way to prevent the transmission of many of these diseases would be to wash one's hands after contact with the animals or their waste. However, on a sailing vessel of the period, it is unlikely that hand washing was common practice, as it would have been unheard of at the time and seen as a waste of valuable drinking water.

CHAPTER VIII

CONCLUSIONS ON THE FINE SCREENING AND ZOOARCHAEOLOGICAL ANALYSIS OF THE EMANUEL POINT WRECKS

The Emanuel Point wrecks are important archaeological sites for a number of reasons. They represent one of the few instances where two vessels from the same fleet have been identified and excavated. They are the oldest ships excavated in the state of Florida, with those excavations conducted solely by archaeologists. Treasure hunters have not disturbed nor looted the sites, resulting in artifact recovery that is systematic, methodical and documented, leading to a more complete understanding of the vessels and cargo, and in turn, the people aboard these ships in 1559. Treasure hunters tend to destroy the actual vessel in order to more easily obtain goods that can be sold. The Emanuel Point vessels themselves are physical records of shipbuilding practices that have been largely forgotten and were often poorly documented, if at all. Careful excavation of the ships' timbers helps archaeologists to understand the designs and methods employed in ship construction and the changes that occurred in over time. These changes helped bring about the "Age of Discovery," a period that led to unprecedented change in the global world. During and following the European "discovery" of the New World, changes that occurred both culturally and ecologically have had consequences spanning centuries, and have impacted the entire planet in both positive and negative ways.

One undeniable outcome of this research is a more complete understanding of the importance of integrating sampling and fine screening into underwater archaeological research. A substantial amount of faunal and floral material was recovered during the process, furthering our understanding of life aboard sailing ships. The use of sediment samples and fine screening is the maritime equivalent to flotation sampling on terrestrial sites, a necessity when examining many anthropological questions pertaining to ecological matters.

Many changes were implemented in the excavation methodology of Emanuel Point II, changes which were decided improvements over the excavation of Emanuel Point I. However, it is not being said that the methods employed on Emanuel Point I were inadequate; it is simply that archaeological practices evolve over time, ensuring that as much data as possible is gleaned from the archaeological destruction of a site. In order to collect more and more data from a site, methods must continue to evolve, especially in maritime archaeology. To obtain a better understanding of the people in the past that sailed on ships or worked in any other aspect of the associated terrestrial maritime landscape, new methods must be used and new questions must be asked. Regarding future archaeological work, a great thing was done during the investigation of Emanuel Point I: over half of the site was left unexcavated for future research, allowing subsequent researchers with new methods and questions the ability to apply them to Emanuel Point I (Smith et al. 1998: 171).

It is important that sediment samples are included in the research design of maritime excavations, and that the collection of these samples is carried out in a planned manner. While the most fruitful samples for the collection of insect remains may be samples taken from the bilge or in the lowest section of the vessel when it sank, the idea is not to dredge an entire unit to collect a sediment sample only at the bottom, but rather to collect samples at intervals throughout the excavation of the unit. Collecting samples at various depths allows for a more thorough recovery of small vertebrates and invertebrates, as well as other small-scale remains--items such as beads and pins. That is not to say, however, that sediment samples should not be collected in association with artifacts, as samples taken in this manner can be often used to answer questions directly related to the associated artifact. It is also essential for the samples to be of consistent size. Consistency allows for comparisons to be made, not only from one part of a ship to another, but if methods are standardized, comparisons could be made from one vessel to another. It would be interesting to discover, for example, if the quantities or percentages of artifacts are similar between ships of different nationalities, or between ships that serve different purposes.

It is not being suggested that all excavation be conducted through fine screening, but rather that fine screening become a regular and planned-for process to be considered for any maritime excavation. Fine screening is time and labor intensive, and in turn, costly. However, much data can be gained from a few dozen well-placed samples, and when collected in the places to maximize their effectiveness, such as in the bilge or the lowest portions of the hull, the information collected is well worth both the time and effort.

It would be interesting to see what comparisons could be made when fine screening is applied to other shipwreck sites. Does the nationality or origin of the ship alter the numbers of animal classes or species represented on board? Does the length of the voyage change the types of animals present? Does the purpose of the voyage affect the makeup of the animal cargo? Mariners of different cultures would likely carry different food stores, reflecting their own cultural traditions. Cargo is usually specific to the purpose of the voyage, whether for establishing a colony, to supply a warship, or as the payload of a cargo ship ferrying goods from port to port. Any variation in cargo may lead to a different collection of species within the vessel. Of course, it is also just as likely that the types of pests present on sailing vessels is common across all vessels, no matter the nationality, type of vessel, or purpose of the voyage. As discussed earlier, many of the species recovered from the Emanuel Point wrecks feed on a variety of biological materials.

This aim of this research was to address two questions concerning the Emanuel Point sites: 1) whether cultural material is being lost through dredging; and 2) what that lost material can tell archaeologists about the people aboard the vessels. The first question was answered in the affirmative; with over 84.9% of all faunal material being recovered in the sediment samples, material is undeniably being lost. The second question is somewhat more difficult to answer.

It would be unwise to assume that all of the remains recovered from the two Emanuel Point Ships were on the ships for the Luna expedition; animal remains included. It is highly likely that these ships were previously sailed, and some materials would have accumulated in the holds of the ships. However, it should be safe to surmise that certain specific remains are associated with the expedition, such as the barrels of food remains found on Emanuel Point I and an overwhelming majority of the rodent and insect remains found on both vessels. It is important to note, however, that even without association to this one particular voyage, the animal remains still provide insight into the day-to-day impact that animals had on humans sailing in the 16th century.

When animal remains are recovered from a shipwreck it is generally safe to assume that they must be associated with the ship. The exception to that assumption, of course, is that elements of fish and other aquatic species must have evidence of butchery or gnawing to support that association. However, a deeper question remains, how can we be sure that any of the animal remains are associated?

It is necessary to establish whether or not any of the animals could be found naturally in this underwater context. Is it possible any of the animals spend any part of their life in the ocean, such as to feed or reproduce? Is it possible that the animals died near the shore and for some reason their remains sank and settled among the shipwrecks? Is there any other plausible explanation for the recovery of these remains?

The answer to all of these questions is no. None of the non-fish species recovered, either vertebrate or invertebrate, spend any portion of their life in the ocean for any reason. None of the insects have aquatic life stages, let alone marine life stages. Because of the high number of remains recovered within the site, and absolutely zero remains recovered in the control cores, it is extremely unlikely that the remains arrived on the ocean floor naturally. It is all but impossible that mass migrations and subsequent deaths occurred for each of the recovered species, resulting in the deposition of their remains only on the two wreck sites with a complete absence elsewhere.

The only explanation that justifies such a substantial recovery of diverse, terrestrial animal remains is that they are associated with the ships and that they were physically aboard the sailing vessels prior to the ships' sinking in 1559.

Looking at the life of a sailor and passenger on a 16th-century Spanish sailing vessel brings to light some of the hardships they had to deal with, and the impact that animals had on the experience. Life was bad enough with out adding animals to the mix. As Miguel de Cervantes (Pérez-Mallaína 1998:133-134) complained, it was a "strange life in these floating dwellings, where most of the time the bedbugs mistreat you, the galley slaves rob you, the sailors offend you, the rats destroy you, and the motion of the sea wears you out." While it has been known for some time that the living conditions aboard early sailing vessels were far from desirable, understanding the exact impact and its severity has always been ambiguous.

Very few species have been described as unwanted passengers on ships, and while those listed earlier are probably the worst in terms of impact and severity, understanding the complete picture is not possible without having all of its parts. While many of the insects found on the ship may have had very little impact on the sailors, the sheer number of types and individuals of pests present on the ship magnifies the force of that impact. It is likely that not a moment could go by without having to swat a fly away from the face, or pull a maggot or weevil out of one's food, or glimpse a rat scurry off with a scrap from an unprotected meal. How many times did cockroaches crawl across a sleeping colonist causing a fitful, restless night; or bedbugs and lice causing unbearable itching?

With regard to insects, the data gathered through the use of sediment samples paints a much different picture of the animal life aboard the ships compared to what was recovered through standard dredging excavations, especially in regard to insects. It is difficult enough to imagine people sharing space in the small confines of a 16th-century sailing vessel with a few dozen cattle or horses, let alone that everything on the ship, including the food and sleeping area, was (or soon would be) infested with insects. Many of the insects described here were, and still are, vectors for disease; and when added to the biological processes of the various livestock, the ship was a breeding ground of filth and pathogens.

It should be clear that the collection and fine screening of sediment samples is necessary in order to more fully comprehend the processes occurring on a ship, especially in regards to the biota. The sheer number of species collected from such a small amount of sediment demonstrates just how much material is being missed through dredging alone. The fine screening of underwater sediments can ensure that all material is collected, recorded, and studied.

Finally, it is apparent from this research that the fine screening of sediment samples and the analysis of microscopic materials from shipwrecks is a rich field of archaeological research awaiting further study. Very little research has addressed the impact of insects on human society, with even less conducted in the maritime aspects of human culture. It is hoped that this research will prove the importance of fine screening archaeological material, and encourage more research of animals--especially insects-- in regard to their impact impact on human life. By having a better understanding of the forces acting on human society, especially in the closed confines of a ship, we can gain a better understanding of the changes in culture and society that have occurred throughout history.

REFERENCES

Abram, David
1996 *The Spell of the Sensuous*. Random House, New York, NY.

Allaby, Michael
2009 *Oxford Dictionary of Zoology*. Oxford University Press, UK.

Andrews, Kenneth R.
1978 *The Spanish Caribbean: Trade and Plunder 1530-1630*. Yale University Press, New Haven, CT.

1984 *Trade, Plunder, and Settlement: Maritime Enterprise and the Genesis of the British Empire, 1480-1630*. Cambridge University Press, NY.

Armitage, Philip L.
1989 Ship Rats, Salted Meat and Tortoises: Selected Aspects of Maritime Life in the "Great Age of Sail" (1500-1800s). *Bermuda Journal of Archaeology and Maritime History* 1:143-149.

1993 Commensal Rats in the New World, 1492-1992. *Biologist* 49(4):174-178.

1994 Unwelcome Companions: Ancient Rats Reviewed. *Antiquity* 68:231-240.

1995a Report on the Black Rat Bones from the Emanuel Point Shipwreck, Pensacola Bay, Florida. Manuscript on file, Bureau of Archaeological Research, Tallahassee, FL.

1995b Report on the Bones of House Mouse from the Emanuel Point Shipwreck, Pensacola Bay, Florida. Manuscript on file, Bureau of Archaeological Research, Tallahassee, FL.

Arnade, Charles W.
1959 *Florida on Trial: 1593-1602*. University of Miami Hispanic American Studies 16. University of Miami Press, Coral Gables, FL.

Arnett, Ross H., Jr., and Michael C. Thomas (editors)
2001 *American Beetles, Volume I: Archostemata, Myxophaga, Adephaga, Polyphaga: Staphyliniformia*. CRC Press LLC, Boca Raton, FL.

Arnett, Ross H., Jr., Michael C. Thomas, Paul E. Skelly, and J. Howard Frank (editors)
2001 *American Beetles, Volume II: Scarabaeoidea through Curculionoidea*. CRC Press LLC, Boca Raton, FL.

Arnold, J. Barto and Robert Weddle
1978 *The Nautical Archaeology of Padre Island*. Academic Press, New York, NY.

Atkinson, I. A. E.
1973 Spread of the Ship Rat (Rattus rattus L.) in New Zealand. *Journal of the Royal Society of New Zealand* 3(3):457-472.

Azad, A. F.
1990 Epidemiology of Murine Typhus. *Annual Review of Entomology* 35:553-570.

Baker, Barry W.
1995 Emanuel Point Shipwreck Faunal Analysis. Manuscript on file, Bureau of Archaeological Research, Tallahassee, FL.

Baker, Barry W., Brian S. Shaffer, K.D. Sobolik, and D. Gentry Steele
1991 Faunal Analysis, Part I: Analysis of the Vertebrate Faunal Remains. In *Alabonson Roan: Early Ceramic Period Adaption to the Inland Coastal Prairie Zone, Harris County, Southeast Texas*, H. Blaine Ensor and David L. Carlson, editors, pp. 139-161. Repots of Investigations No. 8. Archaeological Research Laboratory, Texas A&M University, College Station.

Baker, Frank Collins
1941 A Study of the Ethnozoology of the Prehistoric Indians of Illinois. *Transactions of the American Philosophical Society* 32(1):51-77.

Bain, Allison and Marie-Annick Prévost
2010 Environmental Archaeology and Landscape Transformation at the Seventeenth-Century Ferryland Site, Newfoundland. *Historical Archaeology* 44(3):21-35.

Barker, G.
1975 To Sieve or Not to Sieve. *Antiquity* 49:61-63.

Bass, G. (editor)
1996 *Ships and Shipwrecks of the Americas*. Thames and Hudson, New York, NY.

Bass, George, Sheila Matthews, J. Richard Steffy and Frederick H. van Doorninck Jr.
2004 *Serçe Limani: An Eleventh-Century Shipwreck* Volume I: The Ship and Its Anchorage, Crew, and Passengers. Texas A&M University Press, College Station, TX.

Baumholtz, Michael A., Lawrence Charles Parish, Joseph A. Witkowski, and William B. Nutting
1997 The Medical Importance of Cockroaches. *International Journal of Dermatology*, 36:90-96.

Belschner, Herman G.
1969 *Horse Diseases*. Angus and Robertson, Sydney, Australia.

Berndt, Ronald M., and Catherine H. Berndt
1964 *The World of the First Australians*. Ure Smith, Sydney, Australia.

Berry, R. J.
1981 Town Mouse, Country Mouse: Adaptation and Adaptability in *Mus domesticus* (*M. musculus domesticus*). *Mammal Review* 11(3):91-136.

Binford, Lewis R.
1964 A Consideration of Archaeological Research Design. *American Antiquity* 29(4): 425-441.

Bird-David, Nurit
1990 The Giving Environment. *Current Anthropology* 31:189-196

Blackburn, Thomas
1976 A Query Regarding the Possible Hallucinogenic Effects of Ant Ingestion in South-Central California. *The Journal of California Anthropology* 3:78-81

Bobrowsky, Peter T.
1982 Olsen and Olsen's Identity Crisis in Faunal Studies. *American Antiquity* 47(1): 180-183.

Bodenheimer, Friedrich Simon
1951 *Insects as Human Food: A Chapter of the Ecology of Man*. W. Junk, The Hague.

Bogan, Arthur E., and Neil D. Robison (editors)
1978 A History and Selected Bibliography of Zooarchaeology in Eastern North America. *Tennessee Anthropological Association Miscellaneous Paper* No.

Bonner, James C.
1964 *A History of Georgia Agriculture, 1732-1860*. University of Georgia Press, Athens.

Borror, Donald J. and Richard E. White
1970 *A Field Guide to Insects: America North of Mexico*. Houghton Mifflin, New York, NY.

Bowens, Amanda (editor)
2009 *Underwater Archaeology: The NAS Guide to Principles and Practice*.. Wiley-Blackwell, West Sussex, UK.

Broadwater, J.
1981 Underwater Archaeology: The Challenge Before Us. Paper presented at The Proceedings of the Twelfth Conference on Underwater Archaeology.

Bruce, Philip Alexander
1895 *Economic History of Virginia in the Seventeenth Century*. Macmillian, New York, NY.

Bruseth, James E. and Toni S. Turner
2005 *From a Watery Grave: The Discovery and Excavation of La Salle's Shipwreck, La Belle*. Texas A&M University Press, College Station.

Bushnell, David I.
1910 Myths of the Louisiana Choctaw. *American Anthropologist* 12:526-535.

Canillas, Pedro Rodríquez and Rodrigo Rangel
1557 The Alcalde Mayor and Vicar of Pánuco to His Majesty, Pánuco, April 25, 1557. In *The Luna Papers, 1559-1561, Volume 2*, edited and translated by Herbert I. Priestley, pp. 265-267. 1928. The Florida State Historical Society. Deland Florida. Reprinted 2010 by University of Alabama Press, Tuscaloosa.

Capinera, J. L.
1993 Insects in Art and Religion: The American Southwest. *American Entomologist* 37:221-229.

Casteel, R. W.
1972 Some Biases in the Recovery of Archaeological Faunal Remains. *Proceedings of the Prehistoric Society* 38:328-388.

Castner, James L.
2000 *Photographic Atlas of Entomology and Guide to Insect Identification*. Feline Press, Gainesville, FL.

Centers for Disease Control and Prevention
2011a Tickborne Diseases of the U.S. Centers for Disease Control and Prevention, Atlanta, GA. <http://www.cdc.gov/ticks/diseases/>. Accessed May 9, 2011.

2011b Diseases Directly Transmitted by Rodents. Centers for Disease Control and Prevention, Atlanta, GA. <http://www.cdc.gov/rodents/diseases/direct.html>. Accessed May 9, 2011.

2011c Diseases Indirectly Transmitted by Rodents. Centers for Disease Control and Prevention, Atlanta, GA. <http://www.cdc.gov/rodents/diseases/indirect.html>. Accessed May 9, 2011.

2011d Diseases From Cats. Centers for Disease Control and Prevention, Atlanta, GA. http://www.cdc.gov/healthypets/animals/cats.htm. Accessed May 9, 2011.

2011e Diseases From Farm Animals. Centers for Disease Control and Prevention, Atlanta, GA. < http://www.cdc.gov/healthypets/animals/farm_animals.htm>. Accessed May 9, 2011.

Chaplin, Raymond Edwin
1965 Animals in Archaeology. *Antiquity* 39:204-211.

1971 *The Study of Animal Bones from Archaeological Sites*. Seminar Press, London, UK.

Cherry, Ron
1993 Insects in the Mythology of Native Americans. *American Entomologist* 39:16-21.

Childs, David
2007 *The Warship Mary Rose: The Life and Times of King Henry VIII's Flagship.* Chatham Publishing, London, England.

Chomko, Stephen A. and B. Miles Gilbert
1991 Bone Refuse and Insect Remains: Their Potential for Temporal Resolution of the Archaeological Record. *American Antiquity* 56:680-686.

Clark, John and Kenneth K. Keitze
1967 Paleoecology of the Lower Nodular Zone, Brule Formation in the Big Badlands of South Dakota. In *Oligocene Sedimentation, Stratigraphy, and Paleoclimatology in the Big Badlands of South Dakota*, John Clark, James R. Beerbower, and Kenneth K. Keitze, editors, pp. 111-137. Fieldiana Geology Memoir 5, Chicago IL.

Clason, A. T. (editor)
1975 *Archaeozoological Studies*. North Holland, Amsterdam, NY.

Clason, A. T. and W. Prummel
1977 Collecting, Sieving and Archaeozoological Research. *Journal of Archaeological Science* 4:171-175.

Cleland, Charles E.
1966 *The Prehistoric Animal Ecology and Ethnozoology of the Upper Great Lakes Region*. University of Michigan Museum of Anthropology, Anthropological Papers No. 29.

Collis, James Daniel
2008 Empire's Reach: A Structural and Historical Analysis of the Emanuel Point Shipwreck. Master's Thesis, Department of Anthropology, The University of West Florida, Pensacola.

Colyer, Marilyn and Douglas Osborne
1965 Screening Soil and Fecal Samples for Recovery of Small Specimens. *Memoirs of the Society for American Archaeology*, No. 19, Contributions of the Wetherill Mesa Archaeological Project:186-192.

Cook, Greg
2009 Luna's Ships: Current Excavation on Emanuel Point II and Preliminary Comparisons with the First Emanuel Point Shipwreck. *The Florida Anthropologist* 62 (3-4):93-99.

Cooney, G.
2003 Seeing Land from the Sea. *World Archaeology* 35(3):323-328.

Cornwell, Peter
1968 *The Cockroach*. Hutchinson, London, UK.

Crosby, Alfred W.
2003 *The Columbian Exchange: Biological and Cultural Consequences of 1492*, 30th Anniversary Edition. Praeger, Westport, CT.

Crump, Donald J.
1988 *Hidden Treasures of the Sea*. National Geographic Society, Washington DC.

Daly, Patricia
1969 Approaches to Faunal Analysis in Archaeology. *American Antiquity* 34(2): 146-153.

Davis, Simon J. M.
1987 *The Archaeology of Animals*. Yale University Press, New Haven CT.

Deagan, Kathleen
1995 *Puerto Real: The Archaeology of a Sixteenth-Century Spanish Town in Hispaniola*. University Press of Florida, Gainesville.

DeMarcay, Gary B. and D. Gentry Steele
1986 The Value of Fine Screening on Inland Based Hunter-Gatherer Habitation Sites. In *Archaeological Investigations at 41 LK 201, Choke Canyon Reservoir, Southern Texas*, by Cheryl Lynne Highley, pp. 250-264. Choke Canyon Series No. 11. Center for Archaeological Research, University of Texas, San Antonio.

Dethlefsen, Edwin S., Ellen Davison, and D. Lynn Buchman
1977 The Stonewall Wreck: Interim Report on a 17th Century Spanish Vessel Wrecked off Bermuda. *International Journal of Nautical Archaeology* 6(4):315-329.

Durden, Christopher J.
1978 Fossil Cockroaches from 1554 Spanish Shipwreck. In *The Nautical Archaeology of Padre Island: The Spanish Shipwrecks of 1554*, J. Barto Arnold III and Robert Weddle, Appendix H, pp. 407-416. Academic Press, New York NY.

Dye, David H. and Katherine H. Moore
1978 Recovery Systems for Subsistence Data: Water Screening and Water Flotation. *Tennessee Anthropologist* 3:59-69.

Felipe II, King of Spain
1557 The Order of the Audiencia Enclosing that of His Majesty for Don Tristán, Valladolid, December 29, 1557. In *The Luna Papers, 1559-1561, Volume 2,* edited and translated by Herbert I. Priestley, pp. 257–261. 1928. The Florida State Historical Society. Deland, Florida. Reprinted 2010 by University of Alabama Press, Tuscaloosa.

Foster, William C. (editor)
1998 *The La Salle Expedition to Texas: The Journal of Henri Joutel, 1684-1687*. Johanna S. Warren, translator. Texas State Historical Commission, Austin.

Gade, Daniel W.
1977 Animal/Man Relationships of Neotropical Vertebrate Fauna in Amazonia. *National Geographic Society Research Reports*, 1977 Projects 18:321-326.

Gilbert, B. Miles
1973 *Mammalian Osteo-Archaeology: North America*. Missouri Archaeological Society, Columbia.

Gilmore, Raymond M.
1946 To Facilitate Cooperation in the Identification of Mammal Bones from Archaeological Sites. *American Antiquity* 12(1):49-50.

Gordan, Elizabeth A.
1993 Screening Size and Differential Faunal Recovery: A Hawaiian Example. *Journal of Field Archaeology* 20:453-459.

Gorham, J. Richard (editor)
1991 *Insect and Mite Pests in Food: An Illustrated Key*. U.S. Department of Agriculture, U.S. Government Printing Office, Washington, D.C.

Graham, Samuel A.
1965 Entomology: An Aid in Archaeological Studies. *Memoirs of the Society for American Archaeology*:167–174.

Grayson, Donald K.
1979 On the Quantification of Vertebrate Archaeofaunas. In *Advances in Archaeological Method and Theory*, Michael B. Schiffer, editor, Vol. 2, pp. 199-237. Academic Press, New York, NY.

Green, Jeremy N.
1973 The Wreck of the Dutch East Indiaman the *Vergulde Draeck*, 1656. *International Journal of Nautical Archaeology* 2(2):267-289.

Grenier, Robert, Marc-André Bernier and Willis Stevens (editors)
2007 *The Underwater Archaeology of Red Bay: Basque Shipbuilding and Whaling in the 16th Century*. Parks Canada, Ottowa, Ontario.

Hakluyt, Richard
1927 *Hakluyt Voyages: A Selection of the Principal Voyages, Traffiques, and Discoveries of the English Nation by Richard Hakluyt, 1552-1616*, edited by Laurence Irving. Alfred A. Knopf, New York, NY.

Haldane, Cheryl Ward
1990 Shipwrecked plant remains. *The Biblical Archaeologist* 53(1):55-60.

Hamilton, Donny L.
1998 Methods of Conserving Underwater Archaeological Material Culture. Conservation Files: ANTH 605, Conservation of Cultural Resources I. Nautical Archaeology Program, Texas A&M University, College Station <http://nautarch.tamu.edu/class/ANTH605>. Accessed 25 October 2010.

Haring, Clarence Henry
1964 *Trade and Navigation Between Spain and the Indies in the Time of the Hapsburgs*. Peter Smith, Gloucester, Massachusetts.

Hawke, David Freeman
1989 *Everyday Life in Early America*. Harper and Row, New York, NY.

Heddi, Abdelaziz, Hubert Charles, Chaqué Khatchadourian, Guy Bonnot, and Paul Nardon
1998 Molecular Characterization of the Principal Symbiotic Bacteria of the Weevil *Sitophilus oryzae:* A Peculiar G + C Content of an Endocytobiotic DNA. *Journal of Molecular Evolution* 47:52-61.

Hesse, Brian, and Paula Wapnish
1985 *Animal Bone Archaeology: From Objectives to Analysis*. Taraxacum, Washington, DC.

Hillson, Simon
2005 *Teeth*. Cambridge University Press, UK.

Hoffman, Paul E.
1990 *A New Andalucia and a Way to the Orient: The American Southeast During the Sixteenth Century*. Louisiana State University Press, Baton Rouge.

Hogue, Charles L.
1987 Cultural Entomology. *Annual Review of Entomology* 32:181-199.

Holt, Vincent M
1885 *Why Not Eat Insects?* Pryor Publications, Yokletts, UK.

Holick, Michael F.
2006 Resurrection of Vitamin D Deficiency and Rickets. *Journal of Clinical Investigation* 116(8):2062-2072.

Horst, Jerald and Mike Lane
2007 *Anglers Guide to Fishes of the Gulf of Mexico*. Pelican, Gretna Lousiana.

Ingold, Tim
2000 *The Perception of the Environment*. Routledge, London, UK.

James, Steven R.
1997 Methodological Issues Concerning Screen Size Recovery Rates and Their Effects on Archaeofaunal Interpretations. *Journal of Archaeological Science* 24:385-397.

Jones, A. C., Weaver, J. R., and Stross F. H.
1967 Note on Indian Wood Carving in the Form of a Grasshopper Found in Lovelock Cave, Nevada. In Papers on Great Basin Archaeology, pp. 123-128. University of California Archaeology Survey Reports No. 70. Berkeley.

Keith, Donald H. and Joe J. Simmons
1985 Analysis of Hull Remains, Ballast, and Artifact Distribution of a 16th-Century Shipwreck, Molasses reef, British West Indies. *Journal of Field Archaeology* 12:411-424.

Kingsley, C.
1870 Cockroaches. *Nature*, 3(60):148.

Knochel, James P.
1974 Environmental Heat Illness: An Eclectic Review. *Archives of Internal Medicine* 133:841-864.

Kobori, Larry S.
1979 Differential Bone Recovery Experiment. In *Ezra's Retreat: A Rockshelter/Cave Site in North Central Great Basin*, By James C. Bard, Colin I Busby, and Larry S. Kobori, pp. 228-229. Center for Archaeological Research, University of California, Davis.

Latham, Paul
1999 Edible Caterpillars of the Bas Congo Region. *Antenna* 23(3):134-139.

Lauck, Joanne Elizabeth
1998 *The Voice of the Infinite in the Small*. Swan Raven, Mill Spring, NC.

Laudonnière, René
1975 *Three Voyages.* Charles E. Bennett, translator. University of Florida Press, Gainesville.

Lawrence, Barbara
1973 Problems in the Inter-Site Comparison of Faunal Remains. In *Domestikationsforschung und Gerschichte der Haustiere*, J. Matolsci, editor, pp. 397-401. Akadémai Kiadó , Budapest, Hungary.

Lawrence, Colleen Lynne Reese
2010 An Analysis of Plant Remains from the Emanuel Point Shipwrecks. Master's Thesis, Department of Anthropology, The University of West Florida, Pensacola.

Lawrence, Colleen Reese and Jacob D. Shidner
2009 Recovery Techniques and Preliminary Analysis of Plant and Animal Remains from the Emanuel Point II Shipwreck. *The Florida Anthropologist* 62(3-4):101-107.

Legge, Anthony J.
1978 Archaeozoology—Or Zooarchaeology. In Research Problems in Zooarchaeology, D.R. Brothwell, Kenneth D. Thomas, Juliet Clutton-Brock, editors, pp. 129-132. Institute of Archaeology Occasional Publication No. 3, University of London, UK.

Lee, Richard B.
1965 Subsistence Ecology of !Kung Bushmen. Ph.D. dissertation, University of California, Berkeley.

1972 The !Kung Bushmen of Botswana. In Hunters and Gatherers Today, M. G. Bicchieri, editor, pp. 326-368. Holt, Rinehart, and Winston, New York, NY.

Lubbock, John (Lord Avebury)
1865 *Prehistoric Times, as Illustrated by Ancient Remains, and the Manners and Customs of Modern Savages*. Williams and Norgate, London, UK.

L'Hour, Michel and Elisabeth Veyrat
1989 A Mid-15th Century Clinker Boat Off the North Coast of France, the Aber Wrac'h Wreck: A Preliminary Report. *International Journal of Nautical Archaeology* 18(4): 285-298.

Luna y Arellano, Don Tristán
1559a Don Tristán de Luna y Arellano to His Majesty, Mexico, 1 May 1559. In *The Luna Papers: 1559-1561, Volume 2*, edited and translated by Herbert I. Priestley, pp. 211–213. 1928. The Florida State Historical Society, Deland, Florida. Reprinted 2010 by University of Alabama Press, Tuscaloosa.

1559b Don Tristán de Luna y Arellano to His Majesty, Port of Santa María, September 24, 1559. In *The Luna Papers: 1559-1561, Volume 2*, edited and translated by Herbert I. Priestley, pp. 245–247. 1928. The Florida State Historical Society, Deland, Florida. Reprinted 2010 by University of Alabama Press, Tuscaloosa.

1561   Don Tristán de Luna y Arellano Concerning What Happened in La Florida. In *The Luna Papers: 1559-1561, Volume 2*, edited and translated by Herbert I. Priestley, pp. 245–247. 1928. The Florida State Historical Society, Deland, Florida. Reprinted 2010 by University of Alabama Press, Tuscaloosa.

Lyman, R. Lee
1976   A Cultural Analysis of Faunal Remains from the Alpowa Locality. Master's thesis, Washington State University, Pullman.

1979   Faunal Analysis: An Outline of Method and Theory with Some Suggestions. *Northwest Anthropological Research Notes* 13:22-35.

1982   Nomenclature in Faunal Studies: A Response to Olsen and Olsen. *American Antiquity* 47(1):179-180.

1987   Zooarchaeology and Taphonomy: A General Consideration. *Journal of Ethnobiology* 7(1):93-117.

1994   *Vertebrate Taphonomy*. Cambridge University Press, UK.

Lyon, D. J.
1980   The Goodwins Wreck. *International Journal of Nautical Archaeology* 9(4): 339-350.

Lyon, Eugene
1976   The Enterprise of Florida. University Press of Florida, Gainesville.

1977 St. Augustine 1580: The Living Community. *El Escribano* 14:20-33. St Augustine Historical Society.

Maddocks, Melvin
1981   *The Atlantic Crossing*. Time-Life Books, Alexandria, VA.

Madsen, David B and James E. Kirkman
1988   Hunting Hoppers. *American Antiquity* 53:593-604.

Markow, Therese Ann, and Patrick M. O'Grady
2006 Drosophila: A Guide to Species Identification and Use. Academic Press, Boston, MA.

Marsden, Peter
1972 The Wreck of the Dutch East Indiaman *Amsterdam* Near Hastings, 1749: An Interim Report. *International Journal of Nautical Archaeology* 1:73-96.

Martin, Colin and Geoffrey Parker
1999 *The Spanish Armada*. Mandolin, New York NY.

McGregor, John C.
1943 Burial of an Early American Magician. *Proceedings of the American Philosophical Society* 86:270-298.

Meadow, Richard H.
1980 Animal Bones: Problems for the Archaeologist Together with Some Possible Solutions. *Paléorient* 6:65-77.

Meadow, Richard H., and Melinda A. Zeder (editors)
1978 Approaches to Faunal Analysis in the Middle East. *Peabody Museum Bulletin* No. 2, Cambridge, MA.

Meighan, Clement. W.
1969 Molluscs as Food Remains in Archaeological Site. In Science in Archaeology, 2nd edition, Don Brothwell and Eric Higgs, editors, pp. 415-422. Thames and Hudson, London.

Milanich, Jerald T. and Susan Milbrath (editors)
1989 *First Encounters: Spanish Explorations in the Caribbean and the United States, 1492-1570*. The University of Florida Press, Gainesville.

Montalván, Alonso de
1561 Testimony and Report Given by Certain Soldiers Concerning What Happened on the Journey to La Florida Which was Made by Don Tristán de Luna y Arellano by Order of the Viceroy of New Spain, Don Luis de Velasco, 11 August 1561. In *The Luna Papers: 1559-1561, Volume 2*, edited and translated by Herbert I. Priestley, pp. 281–301. 1928. The Florida State Historical Society, Deland, Florida. Reprinted 2010 by University of Alabama Press, Tuscaloosa.

Mooney, James
1900 Myths of the Cherokee. In 19th Annual Report of the Bureau of American Ethnology for the Years 1897-1898, part 1, Washington, DC, pp 3-548.

Morison, Samuel Eliot
1974 *The European Discovery of America: The Southern Voyages, A.D. 1492-1616*. Oxford University Press, New York, NY.

Morris, Brian
1979 Symbolism and Ideology: Thoughts on Navaho Taxonomy and Symbolism. In *Classifications in Their Social Context*, Roy F. Ellen and David Reason, editors, pp. 117-138. Academic Press, New York, NY.

1998 *The Power of Animals*. Berg, Oxford, UK.

2004 *Insects and Human Life*. Berg, Oxford, UK.

2008 Insects as Food Among Hunter-Gatherers. *Anthropology Today* 24(1):6-8.

Muckelroy, Keith
1978 *Maritime Archaeology*. Cambridge University Press, UK.

Nelson, Joseph S.
2006 *Fishes of the World*. 4th Ed. Wiley, New York, NY.

Newton, Arthur Percival
1967 *The European Nations in the West Indies, 1493-1688*. Barnes & Noble, Inc., New York.

Nicols, Arthur
1870 The Cockroach. *Nature*, 3:108.

Noe-Nygaard, N.
1988 Taphonomy in Archaeology with Special Emphasis on Man as a Biasing Factor. *Journal of Danish Archaeology* 6:7-52.

O'Connor, Terry P.
1996 A Critical Overview of Archaeological Animal Bone Studies. *World Archaeology* 28(1):5-19.

2000 *The Archaeology of Animal Bones*. Texas A&M University Press, College Station.

Oertling, Thomas J.
1989 The Highborn Cay Wreck: The 1986 Field Season. *International Journal of Nautical Archaeology* 18:244:253.

Olsen, Stanley J.
1971 Zooarchaeology: Animal Bones in Archaeology and Their Interpretation. *Addison-Wesley Module in Anthropology* No. 2.

Olsen, Sandra L., and John W. Olsen
1981 A Comment on Nomenclature in Faunal Studies. *American Antiquity* 46:192-194.

Osborne, P. J.
1971 An Insect Fauna from the Roman Site at Alcester, Warwickshire. *Britannia* 2:156-165.

Parker, A. J.
1999 A maritime cultural landscape: the port of Bristol in the Middle Ages. *International Journal of Nautical Archaeology* 28(2):323-342.

Payne, Sebastian
1972 Partial recovery and Sample Bias: The Results of Some Sieving Experiments. In *Papers in Economic Prehistory*, E. S. Higgs, editor, pp. 49-64. Cambridge University Press, UK.

1975 Partial Recovery and Sample Bias. In *Archaeozoological Studies*, A. T. Clason, editor, pp.7-17. American Elsevier.

Pelzer, Kevin D. and Nancy Currin
2009 Zoonotic Diseases of Cattle. Virgina Coopertive Extension, Virginia Tech and Virginia State University. Publication 400-460. < http://pubs.ext.vt.edu/400/400-460/400-460.html>. Accessed May 9, 2011.

Pemberton, R. W.
1990a The Selling of Gamposocieis gratiosa Brunner (Orthoptera: Tettigoniidae) as Singing Pets in China. *Pan-Pacific Entomologist* 66:93-95.

1990b The Korean Water Beetle Game. *Pan-Pacific Entomologist* 66:172-174.

Peterson, Mendel
1975 *The Funnel of Gold: The Trials of the Spanish Treasure Fleets*. Little, Brown, Boston, Massachusetts.

1977 Reach for the New World. In *National Geographic*, pp. 724-767. vol. 152.

Pérez-Mallaína, Pablo E.
1998 Spain's Men of the Sea: Daily Life on the Indies Fleets in the Sixteenth Century. Carla Rahn Phillips, translator. Johns Hopkins University Press, Baltimore, Maryland.

Phillips, Carla Rahn
1986 *Six Galleons for the King of Spain: Imperial Defense in the Early Seventeenth Century*. The Johns Hopkins University Press, Baltimore, Maryland.

Phillips, T.
2003 Seascapes and Landscapes in Orkney and Northern Scotland. *World Archaeology* 35(3):371-384.

Piercy, Robin C. M.
1978 Mombasa Wreck Excavation: Second Preliminary Report, 1978. International Journal of Nautical Archaeology 7(4):301-319.

Poljak, Zvonimir
2009 Zoonotic Diseases From Pigs. *Proceedings of the 2009 London Swine Conference: Tools of the Trade,* J.M. Murphy, editor, pp. 95-194. <http://www.londonswineconference.ca/proceedings/2009/2009.pdf>. Accessed May 9, 2011.

Posey, Darrell A.
1986 Topics and Issues in Ethnoentomology with Some Suggestions for the Development for Hypothesis-Generation and Testing in Ethnobiology. *Journal of Ethnobiology* 6:99-120.

Presley, Anna Lee
1995 Analysis of Faunal Remains from the Emanuel Point Shipwreck. Manuscript on file, Bureau of Archaeological Research, Tallahassee, Florida.

Price, Richard and Keith Muckelroy
1977 The Kennemerland Site: The Third and Fourth Seasons 1974 and 1976, An Interim Report. *International Journal of Nautical Archaeology* 6(3):187-218.

1979 The Kennemerland Site: The Fifth Season, 1978. An Interim Report. *International Journal of Nautical Archaeology*. 8(4):311-320.

Priestly, Herbert Ingram
1928 *The Luna Papers, 1559-1561: Volumes I & II.* Florida State Historical Society, Deland, Florida. Reprinted 2010 by University of Alabama Press, Tuscaloosa.

1936 *Tristán de Luna: Conquistador of the Old South, a Study of Spanish Imperial Strategy*. The Arthur H. Clark Co., Glendale, California

Quinn, David Beers
1975 *The Last Voyage of Thomas Cavendish, 1591-1592: The Autographed Manuscript of his own Account of the Voyage Written Shortly Before his Death*. University of Chicago Press, Chicago.

Quitmyer, Irvy R.
2004 What Kind of Data are in the Back Dirt? An Experiment on the Influence of Screen Size on Optimal Data Recovery. *Archaeofauna* 13:109-129.

Redford, Kent H. and John G. Robinson
1991 Subsistence and Commercial Uses of Wildlife in Latin America. In *Neotropical Wildlife Use and Conservation*, John G. Robinson and Kent H Redford (editors), pp. 6-23. University of Chicago Press, IL.

Rediker, Marcus
1993 *Between the Devil and the Deep Blue Sea*. Cambridge University Press, UK.

Reed, Charles A.
1963 Osteoarchaeology. In *Science in Archaeology*, Don Brothwell and Eric S. Higgs, editors, pp. 204-216. Basic Books, New York, NY.

Reitz, Elizabeth J., and B. Ruff
1994 Morphometric Data fro Cattle from North America and the Caribbean Prior to the 1850s. *Journal of Archaeological Science* 21:699-713.

Reitz, Elizabeth J., and Margaret Scarry
1985 Reconstructing Historic Subsistence with an Example from Sixteenth-Century Spanish Florida. Special Publication Series, Number 3. Society for Historical Archaeology. Braun-Brumfield, Inc., Ann Arbor, Michigan.

Reitz, Elizabeth J., and Elizabeth S. Wing
1999 *Zooarchaeology*. Cambridge University Press, UK.

Ringrose, Trevor J.
1993 Bone Counts and Statistics: A Critique. *Journal of Archaeological Science* 20(2): 121-157.

Robinson, William H.
2005 *Handbook of Urban Insects and Arachnids*. Cambridge University Press, UK.

Rodek, H. G.
1932 Arthropod Designs on Prehistoric Mimbres Pottery. Annals of the Entological Society of America 25:688-693.

Rodgers, Ree Rebecca
2003 Stale Bread and Moldy Cheese: A Historical and Archaeological Study of Sixteenth-Century Foodways at Sea Using Evidence Collected from the Emanuel Point Shipwreck. Master's thesis, Department of History, The University of West Florida, Pensacola.

Romoser, William S.
2004 Introduction to Arthropods: Systematics, Behavior and Ecology. In Medical Entomology: A Textbook on Public Health and Veterinary Problems Caused by Arthropods, Bruce F Eldridge and John D. Edman, editors, pp. 53-97. Kluwer Academic Publishers, Norwell, MA.

Roth, Louis M.
1981 Introduction. In *The American Cockroach*, William J. Bell and K.G. Adiyodi, editors, pp. 1-13. Chapman and Hall, New York, NY.

Rule, Margaret
1983 *The Mary Rose: The Excavation and Raising of Henry VIII's Flagship.* Conway Maritime Press, London UK.

Ryder, Michael L.
1969 *Animal Bones in Archaeology*. Blackwell Scientific Publications, Oxford, UK.

Schmid, Elisabeth
1972 *Atlas of Animal Bones*. Elsevier Publishing Company, Amsterdam, NY.

Schorger, A.W.
1966 *The Wild Turkey: Its History and Domestication*. University of Oklahoma Press, Norman.

Scott-Ireton, Della Aleta
1998 An Analysis of Spanish Colonization Fleets in the Age of Exploration Based on the Historical and Archaeological Investigation of the Emanuel Point Shipwreck in Pensacola Bay, Florida. Master's thesis, Department of History, The University of West Florida, Pensacola.

Scudder, Sylvia J., John E. Foss, and Mary E. Collins
1996 Soil Science and Archaeology. *Advances in Agronomy* 57:1-75.

Serpell, James
1989 Pet-Keeping and Animal Domestication, a reappraisal. In *The Walking Larder: Patterns of Domestication, Pastoralism, and Predation*, J. Clutton-Brock (editor), pp. 10-21. Unwin Hyman, London, UK.

1996 *In the Company of Animals*. Cambridge University Press, UK.

Shackley, Myra
1981 *Environmental Archaeology*. Allen and Unwin, London, UK

Shafer, Harry J.
1986 *Ancient Texans: Rock Art and Lifeways Along the Lower Pecos*. Texas Monthly Press, San Antonio.

Shaffer, Brian S.
1992 Quarter-Inch Screening: Understanding Biases in Recovery of Vertebrate Faunal Remains. *American Antiquity* 57(1):129-136.

Shaffer, Brian S. and Julia L. J. Sanchez
1994 Comparison of 1/8"- and 1/4"-Mesh Recovery of Controlled Samples of Small-to-Medium-Sized Mammals. *American Antiquity* 59(3):525-530.

Silberbauer, George B.
1972 The G/wi Bushmen. In Hunters and Gatherers Today, M. G. Bicchieri, editor, pp. 326-368. Holt, Rinehart, and Winston, New York, NY.

Smith, George S.
1979 Mammalian Zooarchaeology, Alaska. *Anthropology and Historic Preservation Cooperative Studies Unit Occasional Paper* No. 18. University of Alaska, Fairbanks.

Smith, Roger C.
1978 New World Shipwrecks, 1500-1800: A Compendium of Sites Salvaged or Excavated. State of Florida, Division of Archives, History and Records Management, Tallahassee, FL.

1988 Treasure Ships of the Spanish Main: The Iberian-American Maritime Empires. In *Ships and Shipwrecks of the Americas: A History Based on Underwater Archaeology*, George F. Bass, editor, pp. 85-106. Thames and Hudson, New York, NY.

Smith, Roger C., James Spirek, John Bratten, and Della Scott-Ireton
1995 *The Emanuel Point Ship: Archaeological Investigations, 1992-1995*, Preliminary Report. Florida Department of State, Division of Historical Resources, Bureau of Archaeological Research, Tallahassee, Florida.

Smith, Roger C., John R. Bratten, J. Cozzi, and Keith Plaskett
1998 *The Emanuel Point Ship. Archaeological Investigations 1997-1998.* Florida Department of State, Division of Historical Resources, Bureau of Archaeological Research, Tallahassee, Florida.

Spencer, W. Baldwin and Francis James Gillen
1899 The Native Tribes of Central Austraila. Macmillan, London, UK.

Strong, William Duncan
1929 *Aboriginal Society in Southern California*. University of California Publications in American Archaeology and Ethnology 26.

Struever, S.
1968 Flotation Techniques for the Recovery of Small-scale Archaeological Remains. *American Antiquity* 33:353-362.

Sutton, Mark Q.
1995 Archaeological Aspects of Insect Use. *Journal of Archaeological Method and Theory* 2(3):253-298.

Tanaka, J.
1976 Subsistence Ecology of the Central Kalahari San. In *Kalahari Hunter-Gatherer's*, Richard B. Lee and Irven DeVore, editors, pp. 98-119. Harvard University Press, Cambridge, MA.

Taylor, T. G. and J. H. Moore
1954 Skeletal Depletion in Hens Laying on a Low-calcium Diet. *British Journal of Nutrition* 8:112-124.

Teonge, Henry
1825 *The Diary of Henry Teonge: A Chaplain on Board His Majesty's Ships Assistance, Bristol, and Royal Oak 1675-1679*. S and R Bentley, London, UK.

Thomas, David Hurst
1969 Great Basin Hunting Patterns: A Quantitative Method for Treating Faunal Remains. *American Antiquity* 34:392-401.

Thompson, James Westfall
1942 *History of Livestock Raising in the United States, 1607-1860*. Report of the U.S. Department of Agriculture, Washington D.C.

Thomsen, Mikkel
2000 The Studland Bay Wreck, Dorset, UK: Hull Analysis. *The International Journal of Nautical Archaeology* 29:61-85.

Timm, Robert M.
1982 Dermestids. Field Museum of Natural History Bulletin, 53(2):14-18.

Uerpmann, Hans-Peter
1973 Animal Bone Finds and Economic Archaeology: A Critical Study of "Osteo-Archaeological" Method. *World Archaeology* 4(3):307-322.

Vale, Deborah and Robert H. Gargett
2002 Size Matters: 3-mm Sieves Do Not Increase richness in a Fish Bone Assemblage from Arrawarra I, an Aboriginal Australian Shell Midden on the Mid-North Coast of New South Wales, Australia. *Journal of Archaeological Science* 29:57-63.

van Huis, A.
1996 The Traditional Use of Arthropods in Sub-Saharan Africa. *Proceedings of the Section Experimental and Applies Entomology of the Netherlands Entomological Society* 7:3-20.

Vayda, Andrew P., and Roy A. Rappaport
1968 Ecology, Cultural and Noncultural. In *Introduction to Cultural Anthropology: Essays in the Scope and Methods of the Science of Man*, James A. Clifton, editor, pp. 477-497. Houghton-Mifflin, Boston, MA.

Velasco, Luís de
1558 Extract of a Letter from Don Luís de Velasco to his Majesty, Mexico, September 30, 1558. In *The Luna Papers, 1559-1561, Volume 2,* edited and translated by Herbert I. Priestley, pp. 257–261. 1928. The Florida State Historical Society. Deland, Florida. Reprinted 2010 by University of Alabama Press, Tuscaloosa.

1559a The Instructions of the Viceroy to Don Tristán, Mexico, 3 April 1559. In *The Luna Papers: 1559-1561, Volume 1*, edited and translated by Herbert I. Priestley, pp. 19-33. 1928. The Florida State Historical Society, Deland, Florida. Reprinted 2010 by University of Alabama Press, Tuscaloosa.

1559b Don Luis de Velasco to Don Tristán de Luna y Arellano, Mexico, 25 October 1559. In *The Luna Papers: 1559-1561, Volume 1*, edited and translated by Herbert I. Priestley, pp. 57-79. 1928. The Florida State Historical Society, Deland, Florida. Reprinted 2010 by University of Alabama Press, Tuscaloosa.

Watts, Gordan P., Jr.
1993 The Western Ledge Reef Wreck: a Preliminary Report on Investigation of the Remains of a 16th Century Shipwreck in Bermuda. *The International Journal of Nautical Archaeology* 22:103-124.

Weddle, Robert S.
1985 *Spanish Sea: The Gulf of Mexico in North American Discovery, 1500-1685*. Texas A&M University Press, College Station, Texas.

Weese, J. S.
2002 A Review of Equine Zoonotic Diseases: Risks in Veterinary Medicine. Proceedings of the Annual Convention of the American Association Equine Practitioners 2002, pp. 362-369. <http://www.ivis.org/proceedings/aaep/2002/contents.pdf> Accessed May 9, 2011.

Westerdahl, Christer
1992 The Maritime Cultural Landscape. *The International Journal of Nautical Archaeology* 21:5-14

Whitehead, C.C.
2004 Overview of Bone Biology in the Egg-Laying Hen. *Poultry Science* 83:193-199.

Wilkes, B. S. J.
1971 *Nautical Archaeology: A Handbook*. David & Charles, Newton Abbot.

Willis, Lauren M., Metin I. Eren and Torben C. Rick
2008 Does Butchering Fish Leave Cut Marks? *Journal of Archaeological Science* 35:1438-1444.

Wing, Elizabeth S. and Irvy R. Quitmyer
1985 Screen Size for Optimal Data Recovery: A Case Study. In *Aboriginal Subsistence and Settlement Archaeology of the Kings Bay Locality, Vol. 2: Zooarchaeology*, W.H. Adams, editor, pp. 49-58. Reports of Investigations No. 2, Department of Anthropology, University of Florida, Gainesville.

Worth, John E.
2009 Documenting Tristán de Luna's Fleet, and the Storm that Destroyed It. *The Florida Anthropologist* 62(3-4):83-92.
Wyman Leland C. and Flora L. Bailey
1964 *Navaho Indian Ethnoentomology*. University of New Mexico Publications in Anthropology No. 12.

Yates, B. C.
1987 Appendix C: Faunal Data from 41CO141. In *Test Excavations at 41CO141 Ray Roberts Reservoir, Cooke County, Texas*, pp. 133-146. Institute of Applied Sciences, North Texas State University, Denton.

Ziegler, Alan C.
1973 Inference from Prehistoric Faunal Remains. *Addison-Wesley Module in Anthropology* No. 43.

Appendixes

Appendix A

Zooarchaeological Remains Recovered From 2006-2009 Emanuel Point II Excavations By Dredge

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
06W-0038	tooth	UID Shark	Superorder Selachimorpha	1	Test Unit C	0-10 cmbs
07W-0062	ulna	Chicken	*Gallus gallus*	2	96N 491E	30-40 cmbs
07W-0076	epiphysis, unfused	UID Mammal	UID Mammalia	1	96N 491E	30-40 cmbs
07W-0127	cranium fragments	UID Fish	UID Osteichthyes	2	96N 491E	N/A
07W-0142	vertebra	Cat	*Felis catus*	1	96N 491E	50-60 cmbs
07W-0163	UID bone fragment	UID Mammal	UID Mammalia	2	96N 491E	60-70 cmbs
07W-0164	exoskeleton fragment	American Cockroach	*Periplaneta americana*	2	96N 491E	60-70 cmbs
07W-0186	humerus	Pond turtle	Family Emydidae	1	96N 490E	20-30 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
07W-0188	spine	UID Fish	UID Osteichthyes	1	96N 490E	10-20 cmbs
07W-0198	UID bone fragment	UID Mammal	UID Mammalia	1	90N 490E	40-50 cmbs
07W-0206	UID bone fragment	UID Large Mammal	UID Mammalia	1	90N 490E	30-40 cmbs
07W-0226	innominate	Black rat	*Rattus rattus*	1	90N 490E	60-70 cmbs
07W-0231	auditory bulla	UID Mammal	UID Mammalia	1	90N 490E	40-50 cmbs
07W-0239	right femur; proximal epiphysis, unfused	Pig	*Sus scrofa*	1	96N 489E	90-110 cmbs
07W-0243	rib or scapula fragment	UID Large Mammal	UID Mammalia	1	96N 488E	70-80 cmbs
07W-0256	scale	UID Fish	UID Osteichthyes	1	96N 490E	50-60 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
07W-0257	radius	Chicken	*Gallus gallus*	1	90N 490E	50-60 cmbs
07W-0286	rib fragment	UID Mammal	UID Mammalia	1	90N 490E	50-60 cmbs
07W-0290	UID bone fragment	UID Mammal	UID Mammalia	1	90N 490E	60-70 cmbs
07W-0291	radius	UID Bird	UID Bird	1	90N 490E	50-60 cmbs
07W-0330	UID bone fragment	UID Bird	UID Bird	1	90N 490E	50-60 cmbs
07W-0361	vertebra	Chicken	*Gallus gallus*	1	90N 490E	70-90 cmbs
07W-0407	UID bone fragment	UID Large Mammal	UID Mammalia	2	96N 489E	40 cmbs
07W-0410	vertebra	UID Shark	Superorder Selachimorpha	1	91N 490E	30-50 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
07W-0417	UID bone fragment	UID Mammal	UID Mammalia	3	96N 489E	30-40 cmbs
07W-0425	rib fragment	Pig	*Sus scrofa*	1	91N 490E	30-40 cmbs
07W-0428	partial jaw	UID Fish	UID Osteichthyes	1	96N 489E	30-40 cmbs
07W-0443	rib fragment	UID Mammal	UID Mammalia	1	96N 489E	N/A
07W-0454	vertebra	UID Shark	Superorder Selachimorpha	1	96N 489E	50-70 cmbs
07W-0482	vertebra	UID Mammal	UID Mammalia	1	96N 489E	60-70 cmbs
07W-0490	rib fragment	UID Mammal	UID Mammalia	1	91N 490E	40-50 cmbs
07W-0515	UID bone fragment	UID Large Mammal	UID Mammalia	1	91N 490E	30 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
07W-0516	epiphysis, unfused	UID Large Mammal	UID Mammalia	1	96N 489E	50-70 cmbs
07W-0522	scapula	Chicken	*Gallus gallus*	1	91N 490E	60-70 cmbs
07W-0524	cranium fragments	UID Fish	UID Osteichthyes	2	91N 490E	60-70 cmbs
07W-0529	vertebra, unfused	UID Large Mammal	UID Mammalia	1	96N 489E	50-70 cmbs
07W-0535	UID bone fragment	UID Large Mammal	UID Mammalia	2	96N 489E	80-100 cmbs
07W-0539	partial tibia	Pig	*Sus scrofa*	1	96N 489E	90-110 cmbs
07W-0540	vertebra	UID Fish	UID Osteichthyes	1	102N 482 E	10-30 cmbs
07W-0544	partial skull, molars	Black rat	*Rattus rattus*	1	96N 489E	90-110 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
07W-0545	scapula or innominate fragment	UID Large Mammal	UID Mammalia	1	96N 489E	90-110 cmbs
07W-0550	scale	UID Fish	UID Osteichthyes	1	96N 489E	90-110 cmbs
07W-0561	UID bone fragment	UID Large Mammal	UID Mammalia	1	96N 489E	100 cmbs
07W-0579	UID bone fragment	UID Large Mammal	UID Mammalia	1	96N 489E	100 cmbs
07W-0584	cranium fragment	UID Fish	UID Osteichthyes	1	96N 488E	80-90 cmbs
07W-0587	spine	UID Fish	UID Osteichthyes	1	96N 488E	0-20 cmbs
07W-0595	rib fragment	UID Large Mammal	UID Mammalia	1	96N 488E	30-40 cmbs
07W-0601	ulna	Chicken	*Gallus gallus*	1	96N 488E	35-45 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
07W-0605	vertebra; fragment	UID Mammal	UID Mammalia	1	96N 488E	45-55 cmbs
07W-0614	UID bone fragment	UID Mammal	UID Mammalia	1	96N 488E	55-70 cmbs
07W-0616	costal cartilage, fragment	UID Large Mammal	UID Mammalia	1	96N 488E	55-70 cmbs
07W-0618	UID bone fragment	UID Mammal	UID Mammalia	4	96N 488E	55-70 cmbs
07W-0620	incisor; intact	Cat	*Felis catus*	1	96N 488E	55-70 cmbs
07W-0621	costal cartilage	UID Mammal	UID Mammalia	5	96N 488E	55-70 cmbs
07W-0622	costal cartilage	UID Mammal	UID Mammalia	1	96N 488E	70-80 cmbs
07W-0629	cervical vertebra	Chicken	*Gallus gallus*	1	96N 488E	70-80 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
07W-0632	cranium fragment	UID Mammal	UID Mammalia	1	96N 488E	70-80 cmbs
07W-0638	scapula; glenoid fossa and portion of neck	Pig	*Sus scrofa*	1	96N 488E	85 cmbs
07W-0639	right innominate	Black rat	*Rattus rattus*	1	96N 488E	80-90 cmbs
07W-0640	tarsometatarsus	Chicken	*Gallus gallus*	1	96N 488E	80-90 cmbs
07W-0642	UID bone fragment	UID Mammal	UID Mammalia	1	96N 488E	80-90 cmbs
07W-0644	pelvis or head of rib, fragment	UID Mammal	UID Mammalia	1	96N 488E	80-90 cmbs
07W-0651	rib fragment	UID Mammal	UID Mammalia	1	91N 490E	N/A
07W-0654	rib fragment	UID Large Mammal	UID Mammalia	2	96N 488E	80 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
07W-0658	UID bone fragment	UID Large Mammal	UID Mammalia	1	96N 488E	80 cmbs
07W-0672	fibula	UID Mammal	UID Mammalia	1	100N 483E	40-50 cmbs
07W-0678	epiphysis, unfused	Pig	*Sus scrofa*	1	96N 488E	90-100 cmbs
07W-0682	scapula	UID Large Mammal	UID Mammalia	1	96N 489E/96N 490 cmbs	90-100 cmbs
07W-0683	exoskeleton; claw fragment	Crab	Family Portunidae	1	96N 489E/96N 490 cmbs	90-100 cmbs
07W-0701	1 scapula fragment; 1 rib fragment	Pig	*Sus scrofa*	2	96N 491E	N/A
07W-0706	right humerus	Pig	*Sus scrofa*	1	96N 489E	N/A
07W-0716	UID bone fragment	UID Bone	UID Vertebrata	2	95N 488 E	10-20 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
07W-0717	vertebra	UID Fish	UID Osteichthyes	1	95N 488 E	10-20 cmbs
07W-0721	scapula	UID Large Mammal	UID Mammalia	1	95N 488 E	40-50 cmbs
07W-0725	UID bone fragment	UID Mammal	UID Mammalia	1	95N 488 E	60-70 cmbs
07W-0729	UID bone fragment	UID Mammal	UID Mammalia	1	95N 488 E	60-70 cmbs
07W-0731	rib fragment	UID Large Mammal	UID Mammalia	1	95N 488 E	70-80 cmbs
07W-0735	left calcaneus; distal epiphysis, unfused	Pig	*Sus scrofa*	1	95N 488 E	70-80 cmbs
07W-0739	spine	UID Fish	UID Osteichthyes	1	95N 488 E	80-90 cmbs
07W-0740	rib fragment	Pig	*Sus scrofa*	1	95N 488 E	80-90 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
07W-0741	rib fragment	Pig	*Sus scrofa*	1	95N 488 E	80-90 cmbs
07W-0742	UID fragment; possible scapula	UID Fish	UID Osteichthyes	1	95N 488 E	80-90 cmbs
07W-0743	indeterminate epiphysis; partially fused	Pig	*Sus scrofa*	1	95N 488 E	80-90 cmbs
07W-0747	radius	Pig	*Sus scrofa*	1	95N 488 E	90-100 cmbs
07W-0759	indeterminate fragment, possible mandible	UID Mammal	UID Mammalia	2	95N 488 E	90-100 cmbs
07W-0761	1 tibia/fibula, fused; 1 femur	Black rat	*Rattus rattus*	2	95N 488 E	90-100 cmbs
07W-0762	UID bone fragment; possible rib	UID Mammal	UID Mammalia	1	95N 488 E	90-100 cmbs
07W-0764	humerus	Chicken	*Gallus gallus*	1	96 N trench	N/A

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
07W-0766	epiphysis of long bone; possibly femur	UID Mammal	UID Mammalia	1	96 N trench	N/A
07W-0911	cranium fragment	UID Mammal	UID Mammalia	1	96N 488E	65-75 cm
07W-0912	UID bone fragment	UID Fish	UID Osteichthyes	1	96N 488E	65-75 cm
07W-0913	1 costal cartilage fragment, 1 rib fragment	UID Large Mammal	UID Mammalia	2	96N 488E	65-75 cm
07W-0944	mandible, fragment with molar	Cat	*Felis catus*	1	96N 490E	40-50 cmbs
07W-0945	rib fragment	UID Mammal	UID Mammalia	1	96N 490E	40-50 cmbs
07W-0946	rib fragment	UID Mammal	UID Mammalia	1	90N 490E	50-60 cmbs
07W-0947	caudal vertebra	UID Fish	UID Osteichthyes	1	96N 490E	70-90 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
07W-0948	phalanx	UID Bird	UID Bird	1	96N 489E	110-110 cmbs
07W-0949	vertebra	UID Shark	Superorder Selachimorpha	1	96N 489E	110-110 cmbs
07W-0950	spine	UID Fish	UID Osteichthyes	1	96N 489E	110-110 cmbs
07W-0951	cranium fragments	UID Fish	UID Osteichthyes	2	96N 489E	110-110 cmbs
07W-0952	rib fragment	UID Mammal	UID Mammalia	1	91N 490E	N/A
07W-0953	rib	UID Fish	UID Osteichthyes	1	91N 490E	30-50 cmbs
07W-0954	spine	Jackfish	Family Carangidae	2	91N 490E	30-50 cmbs
07W-0955	rib fragment	UID Mammal	UID Mammalia	3	91N 490E	30-50 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
07W-0956	left tibia, intact; left fibula, broken; unfused	Black rat	*Rattus rattus*	2	96N 489E	90-110 cmbs
07W-0957	left scapula; juvenile	Pig	*Sus scrofa*	1	96N 489E	90-110 cmbs
07W-0958	UID bone fragment	UID Mammal	UID Mammalia	2	96N 489E	90-110 cmbs
07W-0959	right humerus; proximal epiphysis, unfused	Pig	*Sus scrofa*	1	96N 489E	90-110 cmbs
07W-0960	carpal/tarsal	UID Mammal	UID Mammalia	1	96N 489E	90-110 cmbs
07W-0961	UID bone fragment	UID Mammal	UID Mammalia	1	96N 489E	90-110 cmbs
07W-0962	rib fragment	UID Mammal	UID Mammalia	1	96N 490E	70-80 cmbs
07W-0963	long bone fragment	UID Bird	UID Bird	1	96N 489E	30-40 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
07W-0964	abdominal vertebra	Jackfish	Family Carangidae	1	96N 489E	80-100 cmbs
07W-0967	rib fragment	Pig	*Sus scrofa*	1	96N 488E	80-90 cmbs
07W-0968	fish spine	UID Fish	UID Osteichthyes	1	96N 488E	70-80 cmbs
07W-0969	vertebra	UID Shark	Superorder Selachimorpha	1	96N 488E	35-45 cmbs
07W-0970	vertebra	UID Fish	UID Osteichthyes	1	96N 488E	35-45 cmbs
07W-0971	UID bone fragment	UID Bone	UID Bone	4	96N 488E	45-55 cmbs
07W-0972	UID bone fragment	UID Shark	Superorder Selachimorpha	1	96N 488E	55-70 cmbs
07W-0973	caudal vertebra; epiphysis, unfused	UID Mammal	UID Mammalia	2	96N 488E	55-70 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
07W-0974	thoracic vertebra	Pig	*Sus scrofa*	1	96N 488E	70-80 cmbs
07W-0975	UID bone fragment	UID Mammal	UID Mammalia	1	95N 488 E	70-80 cmbs
07W-0976	dentary	UID Fish	UID Osteichthyes	1	95N 488 E	80-90 cmbs
07W-0977	left humerus	Pig	*Sus scrofa*	1	96N 488E	35-45 cmbs
07W-0979	unfused epiphysis	UID Mammal	UID Mammalia	1	96N 488E	80-90 cmbs
07W-0980	dentary	Jackfish	Family Carangidae	1	96N 488E	65-75 cm
07W-00981	UID bone fragment	UID Fish	UID Osteichthyes	1	96N 488E	65-75 cm
07W-00983	rib fragment	UID Large Mammal	UID Mammalia	1	95N 488 E	40-50 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
08W-1087	UID bone fragment	UID	UID Vertebrata	1	87N 497E	10-20 cm
08W-1090	UID bone fragment	UID Fish	UID Osteichthyes	15	87N 497E	20-30 cm
08W-1099	UID bone fragment	UID Fish	UID Osteichthyes	1	100N 486E	40-50 CM
08W-1116	UID bone fragment	UID	UID Bone	1	100N 486E	50-60 cm
08W-1128	UID bone fragment	UID	UID Bone	2	87N 497E	50-60 cm
08W-1129	tooth comb	Stingray	Family Dasyatidae	1	87N 497E	50-60 cm
08W-1146	UID bone fragment	UID Fish	UID Osteichthyes	1	87N 497E	60-70 cm
08W-1159	operculum	UID Fish	UID Osteichthyes	1	100N 486E	60-80 cm

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
08W-1161-002	UID bone fragment	UID Fish	UID Osteichthyes	9	87N 497E	60-80 cm
08W-1164	pelvis fragment	Chicken	*Gallus gallus*	1	87N 497E	60-80 cm
08W-1177	tooth; unerupted (juvenile) incisor	Pig	*Sus scrofa*	1	100N 496E	60-80 cm
08W-1249	bone fragment	UID Fish	UID Osteichthyes	4	87N 497E	80-100 cm
08W-1301	vertebra, juvenile	Pig	*Sus scrofa*	1	86N 497E	40-60 cm
08W-1302-004	bone fragment	UID Bone	UID	1	86N 497E	40-60 cm
08W-1306-001	right sesamoid	Chicken	*Gallus gallus*	1	86N 497E	40-60 cm
08W-1306-002	vertebra	UID shark	Superorder Selachimorpha	1	86N 497E	40-60 cm

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
08W-1318-001	left ulna	Chicken	*Gallus gallus*	1	87N 498E	20-40 cm
08W-1318-002	UID bone fragment	UID Fish	UID Osteichthyes	1	87N 498E	20-40 cm
08W-1340	UID bone fragment	UID	UID Bone	1	87N 498E	40-60 cm
08W-1342-001	right ulna	Chicken	*Gallus gallus*	1	87N 497E	40 cm
08W-1342-002	UID bone fragment	UID Fish	UID Osteichthyes	1	87N 497E	40 cm
08W-1342-003	UID bone fragment	UID Mammal	UID Mammalia	1	87N 497E	40 cm
08W-1345	ARTIFACT LOST					
08W-1348	UID bone fragment	UID Fish	UID Osteichthyes	1	93N 491E	0-20 cm

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
08W-1352	UID bone fragment	UID Bone	UID	1	87N 498E	40-60 cm
08W-1377	UID bone fragment	UID Fish	UID Osteichthyes	2	87N 498E	60-80 cm
08W-1389	UID bone fragment	UID Mammal	UID Mammalia	3	93N 491E	60-80 cm
08W-1409	barb	Stingray	Family Dasyatidae	1	86N 497E	60-80 cm
08W-1410	UID bone fragment; probable cow	UID Large Mammal	UID Mammalia	1	86N 497E	60-80 cm
08W-1415	tooth	Shark	Superorder Selachimorpha	1	87N 497E	100-120 cm
08W-1416	coracoid, juvenile	Chicken	*Gallus gallus*	1	87N 497E	100-120 cm
08W-1423	tooth; upper left 2nd molar	Goat	*Capra hircus*	1	87N 497E	100-120 cm

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
08W-1425	scale	UID Fish	UID Osteichthyes	1	87N 497E	100-120 cm
08W-1426	exoskeleton fragment	American Cockroach	*Periplaneta americana*	1	87N 497E	100-120 cm
08W-1435	mouthplate	Puffer Fish	Family Tetraodontidae	1	93N 491E	100-120 cm
08W-1438	UID bone fragment	UID Fish	UID Osteichthyes	11	86N 497E	60-80 cm
08W-1446	scale	UID Fish	UID Osteichthyes	1	86N 497E	60-80 cm
08W-1453	rib	Black Rat	*Rattus rattus*	2	86N 497E	60-80 cm
08W-1457-001	cranium fragment	Hardhead Catfish	*Arius felis*	2	93N 491E	100-120 cm
08W-1457-002	right humerus	Chicken	*Gallus gallus*	2	93N 491E	100-120 cm

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
08W-1461	UID bone fragment	UID	UID Bone	1	93N 491E	100-120 cm
08W-1466-001	UID bone fragment	UID Fish	UID Osteichthyes	8	87N 497E	100-120 cm
08W-1466-002	tooth comb	Stingray	Family Dasyatidae	1	87N 497E	100-120 cm
08W-1466-003	femur; fragment	Chicken	*Gallus gallus*	2	87N 497E	100-120 cm
08W-1469	exoskeleton fragment	American Cockroach	*Periplaneta americana*	1	87N 497E	100-120 cm
08W-1476	UID bone fragment	UID Fish	UID Osteichthyes	2	87N 497E	100-120 cm
08W-1477-001	long bone fragment	UID Bird	UID Aves	1	86N 497E	60-80 cm
08W-1477-002	UID bone fragment	UID Fish	UID Osteichthyes	11	86N 497E	60-80 cm

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
08W-1485-001	left femur; juvenile	Black Rat	*Rattus rattus*	1	86N 497E	60-80 cm
08W-1485-002	UID bone fragment	UID Fish	UID Fish	3	86N 497E	60-80 cm
08W-1485-003	UID bone fragment	UID Bone	UID Vertebrata	2	86N 497E	60-80 cm
08W-1485-004	UID bone fragment	UID Mammal	UID Mammalia	1	86N 497E	60-80 cm
08W-1486	scale	UID Fish	UID Osteichthyes	1	86N 497E	60-80 cm
08W-1490	UID bone fragment	UID Mammal	UID Mammalia	2	93N 491E	100-120 cm
08W-1492	exoskeleton fragment	American Cockroach	*Periplaneta americana*	1	93N 491E	100-120 cm
08W-1494-001	UID bone fragment	UID Fish	UID Osteichthyes	10	93N 491E	100-120 cm

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
08W-1494-002	tooth; incisor	UID Rodent	Family Muridae	1	93N 491E	100-120 cm
08W-1494-003	long bone fragment, mid-shaft	UID Bird	UID Aves	1	93N 491E	100-120 cm
08W-1507	exoskeleton fragment	American Cockroach	*Periplaneta americana*	1	93N 491E	100-120 cm
08W-1526-001	vertebra	UID Fish	UID Osteichthyes	1	87N 497E	110-120 cm
08W-1533-001	carpometacarpus, female	Chicken	*Gallus gallus*	1	87N 497E	100-120 cm
08W-1533-002	UID bone fragment	UID Fish	UID Osteichthyes	3	87N 497E	100-120 cm
08W-1534	exoskeleton fragment	American Cockroach	*Periplaneta americana*	1	87N 497E	100-120 cm
08W-1551	tibia	Chicken	*Gallus gallus*	1	87N 498E	80-100 cm

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
08W-1561	rib, left anterior; ventral end	Cow	*Bos taurus*	1	87N 498E	40-60 cm
08W-1566	UID bone fragment	UID Bone	UID Vertebrata	2	87N 498E	40-60 cm
09W-2006	coracoid; juvenile	Chicken	*Gallus gallus*	3	85N 499E	40-60 cmbs
09W-2007	rib; neonate/juvenile	Black Rat	*Rattus rattus*	1	85N 499E	40-60 cmbs
09W-2008	UID bone fragment	UID Fish	UID Osteichthyes	1	85N 499E	40-60 cmbs
09W-2009	UID bone fragment	UID Fish	UID Osteichthyes	1	85N 499E	40-60 cmbs
09W-2010	scale	UID Fish	UID Osteichthyes	1	85N 499E	40-60 cmbs
09W-2013	exoskeleton fragment	American Cockroach	*Periplaneta americana*	1	85N 499E	40-60 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
09W-2018	UID bone fragment	UID Fish	UID Osteichthyes	1	85N 499E	40-60 cmbs
09W-2019	UID bone fragment	UID Fish	UID Osteichthyes	1	85N 499E	40-60 cmbs
09W-2020	UID bone fragment	UID Bone	UID Vertebrata	1	85N 499E	40-60 cmbs
09W-2021	UID bone fragment	UID Bone	UID Vertebrata	1	85N 499E	40-60 cmbs
09W-2026	vertebra	UID Fish	UID Osteichthyes	1	93N 490E	40-60 cmbs
09W-2031	synsacrum	Chicken	*Gallus gallus*	1	93N 490E	40-60 cmbs
09W-2033	barb	Sea urchin	Class Echinoidea	3	93N 490E	40-60 cmbs
09W-2040	pelvis fragment	Chicken	*Gallus gallus*	1	93N 490E	40-60 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
09W-2042	tooth; upper incisor	Black Rat	*Rattus rattus*	1	93N 490E	40-60 cmbs
09W-2043	UID bone fragment	UID Fish	UID Osteichthyes	1	93N 490E	40-60 cmbs
09W-2045	femur	Chicken	*Gallus gallus*	1	93N 490E	40-60 cmbs
09W-2046	skull	Black Rat	*Rattus rattus*	1	93N 490E	40-60 cmbs
09W-2048	pelvis fragment	Chicken	*Gallus gallus*	1	93N 490E	40-60 cmbs
09W-2059-001	right femur	Black Rat	*Rattus rattus*	1	85N 499E	65-90 cmbs
09W-2059-002	UID bone fragment	UID Bird	UID Aves	11	85N 499E	65-90 cmbs
09W-2059-003	sternum fragment	UID Bird	UID Aves	1	85N 499E	65-90 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
09W-2059-004	right humerus	Black Rat	*Rattus rattus*	1	85N 499E	65-90 cmbs
09W-2059-005	right tibia	Black Rat	*Rattus rattus*	1	85N 499E	65-90 cmbs
09W-2059-006	femur; distal epiphysis, juvenile	Black Rat	*Rattus rattus*	1	85N 499E	65-90 cmbs
09W-2059-007	left femur, juvenile	Black Rat	*Rattus rattus*	1	85N 499E	65-90 cmbs
09W-2059-008	3 ribs; 1 tooth, lower incisor	Black Rat	*Rattus rattus*	4	85N 499E	65-90 cmbs
09W-2059-009	UID bone fragment	UID Bone	UID Vertebrata	1	85N 499E	65-90 cmbs
09W-2059-010	UID epiphysis	UID Bird	UID Aves	1	85N 499E	65-90 cmbs
09W-2059-011	phalanx	UID Bird	UID Aves	1	85N 499E	65-90 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
09W-2059-012	left femur	Black Rat	*Rattus rattus*	1	85N 499E	65-90 cmbs
09W-2059-013	auditory bulla	Black Rat	*Rattus rattus*	1	85N 499E	65-90 cmbs
09W-2059-014	left radius	Black Rat	*Rattus rattus*	1	85N 499E	65-90 cmbs
09W-2059-015	left humerus	Black Rat	*Rattus rattus*	1	85N 499E	65-90 cmbs
09W-2059-016	left humerus	Black Rat	*Rattus rattus*	1	85N 499E	65-90 cmbs
09W-2059-017	UID bone fragment	UID Fish	UID Osteichthyes	20	85N 499E	65-90 cmbs
09W-2059-018	1 humerus, 4 femur fragments, 1 bone fragment	Chicken	*Gallus gallus*	6	85N 499E	65-90 cmbs
09W-2059-019	scale	UID Fish	UID Osteichthyes	3	85N 499E	65-90 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
09W-2059-020	left mandible	Black Rat	*Rattus rattus*	1	85N 499E	65-90 cmbs
09W-2059-021	scapula	Black Rat	*Rattus rattus*	3	85N 499E	65-90 cmbs
09W-2059-022	sacrum, juvenile	Black Rat	*Rattus rattus*	1	85N 499E	65-90 cmbs
09W-2059-023	UID bone fragment	UID Fish	UID Osteichthyes	6	85N 499E	65-90 cmbs
09W-2079	UID bone fragment	UID Fish	UID Osteichthyes	1	93N 490E	ballast, unknown depth
09W-2080	UID bone fragment	UID Bone	UID Vertebrata	1	93N 490E	ballast, unknown depth
09W-2086	rib	UID Fish	UID Osteichthyes	1	93N 490E	ballast, unknown depth
09W-2087	spine	Stingray	Family Dasyatidae	1	93N 490E	ballast, unknown depth

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
09W-2088	UID bone fragment	UID Fish	UID Osteichthyes	1	93N 490E	ballast, unknown depth
09W-2090	1 left femur; 1 left innominate	Black Rat	*Rattus rattus*	2	93N 490E	ballast, unknown depth
09W-2093	exoskeleton fragment	American Cockroach	*Periplaneta americana*	1	93N 490E	40-60 cmbs
09W-2094	scale	UID Fish	UID Osteichthyes	1	93N 490E	40-60 cmbs
09W-2106	UID bone fragment	UID Fish	UID Osteichthyes	1	93N 490E	55-69 cmbs
09W-2107	UID bone fragment	UID Fish	UID Osteichthyes	1	93N 490E	55-69 cmbs
09W-2108	dentary	UID Fish	UID Osteichthyes	1	93N 490E	55-69 cmbs
09W-2109	rib	UID Fish	UID Osteichthyes	1	93N 490E	55-69 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
09W-2110	UID bone fragment	UID Fish	UID Osteichthyes	1	93N 490E	55-69 cmbs
09W-2111	caudal vertebra	Black Rat	*Rattus rattus*	1	93N 490E	55-69 cmbs
09W-2112	UID bone fragment	UID Bone	UID Vertebrata	1	93N 490E	55-69 cmbs
09W-2115	exoskeleton fragment	American Cockroach	*Periplaneta americana*	3	93N 490E	55-69 cmbs
09W-2124	UID bone fragment	UID Bone	UID Vertebrata	1	93N 490E	40-60 cmbs
09W-2129	UID bone fragment	UID Bone	UID Vertebrata	2	93N 490E	40-60 cmbs
09W-2130	sacral vertebra	Chicken	*Gallus gallus*	1	93N 490E	40-60 cmbs
09W-2135	lumbar vertebra; juvenile	Cat	*Felis catus*	1	93N 490E	40-60 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
09W-2136	mouthplate	Puffer Fish	Family Tetraodontidae	1	85N 499E	20-40 cmbs
09W-2137	UID bone fragment	UID Bone	UID Vertebrata	1	93N 490E	40-60 cmbs
09W-2138	vertebra	Shark	Superorder Selachimorpha	1	85N 499E	20-40 cmbs
09W-2139	UID bone fragment	UID Fish	UID Osteichthyes	3	93N 490E	40-60 cmbs
09W-2140	UID bone fragment	UID Bird	UID Vertebrata	1	93N 490E	40-60 cmbs
09W-2147	tibia/fibula	Black Rat	*Rattus rattus*	1	93N 490E	40-60 cmbs
09W-2151	vertebra	Black Rat	*Rattus rattus*	1	93N 490E	40-60 cmbs
09W-2152	UID bone fragment	UID Fish	UID Osteichthyes	1	93N 490E	40-60 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
09W-2154	exoskeleton fragment	American Cockroach	*Periplaneta americana*	19	85N 499E	60-80 cmbs
09W-2160-002	exoskeleton fragment	American Cockroach	*Periplaneta americana*	1	85N 499E	60-80 cmbs
09W-2160-003	UID bone fragment	UID Bone	UID Vertebrata	2	85N 499E	60-80 cmbs
09W-2161	UID bone fragment	UID Bone	UID Vertebrata	1	93N 490E	40-60 cmbs
09W-2162	UID bone fragment	UID Bone	UID Vertebrata	1	93N 490E	40-60 cmbs
09W-2170	UID bone fragment	UID Bone	UID Osteichthyes	1	85N 499E	60-80 cmbs
09W-2181	scale	UID Fish	UID Osteichthyes	1	93N 490E	40-60 cmbs
09W-2183-002	rib	Black Rat	*Rattus rattus*	1	85N 499E	20-30 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
09W-2185	UID bone fragment	UID Bone	UID Vertebrata	2	85N 499E	20-40 cmbs
09W-2186	exoskeleton fragment	American Cockroach	*Periplaneta americana*	2	93N 490E	40-60 cmbs
09W-2200	exoskeleton fragment	American Cockroach	*Periplaneta americana*	2	93N 490E	43-58 cmbs
09W-2226	scale	UID Fish	UID Osteichthyes	1	93N 490E	58-59 cmbs
09W-2227	UID bone fragment	UID Bone	UID Vertebrata	1	93N 490E	38-59 cmbs
09W-2230	left scapula	Black Rat	*Rattus rattus*	1	93N 490E	38-59 cmbs
09W-2231	UID bone fragment	UID Bone	UID Vertebrata	2	93N 490E	38-59 cmbs
09W-2232	UID bone fragment	UID Bone	UID Vertebrata	1	93N 490E	38-59 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
09W-2234	UID bone fragment	UID Bone	UID Vertebrata	1	93N 490E	38-59 cmbs
09W-2235	exoskeleton fragment	American Cockroach	*Periplaneta americana*	7	85N 499E	65-90 cmbs
09W-2238	exoskeleton fragment	American Cockroach	*Periplaneta americana*	1	85N 499E	60-80 cmbs
09W-2247	skull/cranium fragment	UID Fish	UID Osteichthyes	5	85N 499E	60-80 cmbs
09W-2255	exoskeleton fragment	American Cockroach	*Periplaneta americana*	4	84N 499E	5-33 cmbs
09W-2262	femur; distal unfused	Goat or Sheep	*Capra hircus* or *Ovis aries*	1	93N 490E	52-54 cmbs
09W-2264	UID bone fragment	UID Bone	UID Vertebrata	1	93N 491E	103-122 cmbs
09W-2265	UID bone fragment	UID Fish	UID Osteichthyes	1	93N 490E	52-54 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
09W-2270	exoskeleton fragment	American Cockroach	*Periplaneta americana*	3	93N 490E	52-54 cmbs
09W-2280	exoskeleton fragment	American Cockroach	*Periplaneta americana*	7	85N 499E	82-162 cmbs
09W-2284	vertebra; sub-adult	Pig	*Sus scrofa*	3	85N 499E	60-80 cmbs
09W-2285	1 femur; 1 coracoid; 9 long-bone fragments	Chicken	*Gallus gallus*	12	85N 499E	60-80 cmbs
09W-2286	2 left mandible fragments; 1 right mandible fragments; all juvenile	Black Rat	*Rattus rattus*	3	85N 499E	60-80 cmbs
09W-2287	vertebra	Triggerfish	Family Balistidae	1	85N 499E	60-80 cmbs
09W-2293	UID bone fragment	UID Bone	UID Vertebrata	8	85N 499E	60-80 cmbs
09W-2294	vertebra	Chicken	*Gallus gallus*	5	85N 499E	60-80 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
09W-2300	UID bone	UID Bone	UID Vertebrata	1	84N 499E	28-77 cmbs
09W-2301	UID fish bone, dorsal fin	UID Fish	UID Osteichthyes	6	85N 499E	60-80 cmbs
09W-2302-001	exoskeleton fragment	American Cockroach	*Periplaneta americana*	15	84N 499E	28-77 cmbs
09W-2303-002	exoskeleton fragment	Beetle Wings	Coleoptera	3	84N 499E	28-77 cmbs
09W-2304	exoskeleton fragment	American Cockroach	*Periplaneta americana*	2	93N 490E	52-75 cmbs
09W-2305	possible toe, large mammal	UID Large Mammal	UID Mammalia	1	84N 499E	28-77 cmbs
09W-2306	1 left femur; 2 right tibia, fibula broken; 1 left radius, 1 rib; 2 metatarsus; 1 carpal; 8 bone fragment	Black rat	*Rattus rattus*	16	85N 499E	28-77 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
09W-2307	possible tooth; indeterminate	UID Mammal	UID Mammalia	1	84N 499E	28-77 cmbs
09W-2309	1 left ulna; 1 right ulna	House Mouse	*Mus musculus*	2	84N 499E	28-77 cmbs
09W-2310	UID bone fragment	UID Mammal	UID Mammalia	6	84N 499E	28-77 cmbs
09W-2311	UID bone fragment	UID Bone	UID Vertebrata	1	84N 499E	28-77 cmbs
09W-2312	2 teeth: lower incisors; 1 left mandible, 4 UID bone fragment	Black Rat	*Rattus rattus*	7	84N 499E	28-77 cmbs
09W-2313	UID bone fragment	UID Bird	UID Aves	3	84N 499E	28-77 cmbs
09W-2314	caudal vertebra	Black Rat	*Rattus rattus*	5	84N 499E	28-77 cmbs
09W-2325	UID bone fragment	UID Fish	UID Osteichthyes	30	85N 499E	60-80 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
09W-2327	vertebra	Mullet	Family Mugilidae	15	85N 499E	60-80 cmbs
09W-2328	vertebra; fragment	UID Fish	UID Osteichthyes	21	85N 499E	60-80 cmbs
09W-2331	spine	UID Fish	UID Osteichthyes	26	85N 499E	60-80 cmbs
09W-2332	3 right femurs, 2 right humerii; 2 bone fragments	Black Rat	*Rattus rattus*	7	85N 499E	60-80 cmbs
09W-2340	UID bone fragment	UID Fish	UID Osteichthyes	27	84N 499E	28-77 cmbs
09W-2341	vertebra	UID Fish	UID Osteichthyes	1	84N 499E	11-33 cmbs
09W-2343	scale	UID Fish	UID Osteichthyes	2	93N 490E	52-75 cmbs
09W-2353	scale	UID Fish	UID Osteichthyes	1	83N 500E	20-40 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
09W-2354	UID bone fragment	UID Fish	UID Osteichthyes	1	83N 500E	20-40 cmbs
09W-2357	rib	Goat or Sheep	*Capra hircus* or *Ovis aries*	1	84N 499E	36 cmbs
09W-2364	UID bone fragment	UID Bone	UID Vertebrata	1	83N 499E	21-40 cmbs
09W-2367-003	UID bone fragment	UID Bone	UID Vertebrata	1	83N 499E	21-40 cmbs
09W-2390	UID bone fragment	UID Bone	UID Vertebrata	2	90N 487E	40-60 cmbs
09W-2395	UID bone fragment	UID Fish	UID Osteichthyes	1	96N 477E	20-40 cmbs
09W-2396	UID bone fragment	UID Fish	UID Osteichthyes	1	96N 477E	20-40 cmbs
09W-2397	UID bone fragment	UID Fish	UID Osteichthyes	2	96N 477E	20-40 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
09W-2399	UID bone fragment	UID Bone	UID Vertebrata	1	83N 500E	40-60 cmbs
09W-2401	scale	UID Fish	UID Osteichthyes	1	83N 500E	40-60 cmbs
09W-2408	UID bone fragment	UID Bone	UID Vertebrata	2	90N 487E	40-60 cmbs
09W-2414	Rib	Goat or Sheep	*Capra hircus* or *Ovis aries*	1	83N 499E	0-33 cmbs, outside hull
09W-2415	UID bone fragment	UID Fish	UID Osteichthyes	1	83N 499E	0-33 cmbs
09W-2416	UID bone fragment	UID Bone	UID Vertebrata	1	83N 499E	0-33 cmbs
09W-2417	UID bone fragment	UID Bone	UID Vertebrata	1	83N 499E	0-33 cmbs
09W-2425	scale	UID Fish	UID Osteichthyes	1	83N 500E	38-56 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
09W-2426	UID bone fragment	UID Fish	UID Osteichthyes	2	83N 500E	38-56 cmbs
09W-2429	tooth comb	Stingray	Family Dasyatidae	1	83N 500E	38-56 cmbs
09W-2440	mouthplate	Puffer Fish	Family Tetraodontidae	1	84N 500E	0-34 cmbs
09W-2441	UID bone; possible long bone fragment	UID Mammal	UID Mammalia	1	84N 500E	0-34 cmbs
09W-2442	UID bone fragment	UID Fish	UID Osteichthyes	2	96N 477E	0-20 cmbs
09W-2451	spine	Stingray	Family Dasyatidae	1	84N 499E	24-77 cmbs
09W-2463	4 ribs; 1 right mandible fragment	Black Rat	*Rattus rattus*	5	93N 491E	81-103 cmbs
09W-2464	UID bone fragment	UID Bone	UID Vertebrata	1	93N 491E	81-103 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
09W-2471	exoskeleton fragment	American Cockroach	*Periplaneta americana*	5	93N 491E	81-103 cmbs
09W-2478	UID bone fragment	UID Fish	UID Osteichthyes	3	93N 491E	81-93 cmbs
09W-2483	UID bone fragment	UID Fish	UID Osteichthyes	11	93N 491E	81-103 cmbs
09W-2502	UID bone fragment	UID Fish	UID Osteichthyes	2	84N 500E	0-34 cmbs
09W-2509	UID bone fragment	UID Bone	UID Vertebrata	1	90N 487E	40-60 cmbs
09W-2511	exoskeleton fragment	American Cockroach	*Periplaneta americana*	4	84N 499E	56-77 cmbs
09W-2514-001	UID bone fragment	UID Mammal	UID Mammalia	2	84N 499E	56-77 cmbs
09W-2514-002	UID bone fragment	UID Fish	UID Osteichthyes	3	84N 499E	56-77 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
09W-2514-003	phalanx	Chicken	*Gallus gallus*	1	84N 499E	56-77 cmbs
09W-2514-004	2 right femora; dorsal portion, incomplete	House Mouse	*Mus musculus*	2	84N 499E	56-77 cmbs
09W-2515	exoskeleton fragment	American Cockroach	*Periplaneta americana*	5	84N 499E	56-77 cmbs
09W-2521	UID bone fragment	UID Fish	UID Osteichthyes	1	85N 500E	ballast, unknown depth
09W-2522-001	left femur	Black Rat	*Rattus rattus*	1	84N 500E	unknown
09W-2522-002	UID bone fragment	UID Fish	UID Osteichthyes	2	84N 500E	unknown
09W-2527	UID bone fragment	UID Bone	UID Vertebrata	1	84N 499E	34-61 cmbs
09W-2530-001	1 rib; 1 right tibia w/ broken fibula; 1 UID bone fragment	Black Rat	*Rattus rattus*	3	93N 490E	70-93 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
09W-2530-002	UID bone fragment	UID Fish	UID Osteichthyes	2	93N 490E	70-93 cmbs
09W-2530-003	ulna	House Mouse	*Mus musculus*	1	93N 490E	70-93 cmbs
09W-2530-004	UID bone fragment	UID Mammal	UID Mammalia	3	93N 490E	70-93 cmbs
09W-2532	exoskeleton fragment	American Cockroach	*Periplaneta americana*	7	93N 490E	70-93 cmbs
09W-2537	UID bone fragment	UID Bone	UID Vertebrata	1	90N 487E	0-26 cmbs
09W-2538	spine	UID Fish	UID Osteichthyes	1	90N 487E	0-26 cmbs
09W-2539	UID bone fragment	UID Bone	UID Vertebrata	1	90N 487E	0-26 cmbs
09W-2546	spine	UID Fish	UID Osteichthyes	1	93N 491E	78-107 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
09W-2547	UID bone fragment	UID Fish	UID Osteichthyes	1	93N 491E	78-107 cmbs
09W-2548	spine	UID Fish	UID Osteichthyes	1	93N 491E	78-107 cmbs
09W-2549	UID bone fragment	UID Fish	UID Osteichthyes	1	93N 491E	78-107 cmbs
09W-2550	scapula fragment	Black Rat	*Rattus rattus*	1	93N 491E	78-107 cmbs
09W-2551	tibia	Black Rat	*Rattus rattus*	1	93N 491E	78-107 cmbs
09W-2552	rib	Black Rat	*Rattus rattus*	1	93N 491E	78-107 cmbs
09W-2557	rib fragment, possibly cow	UID Mammal	UID Mammalia	1	90N 487E	0-20 cmbs
09W-2558	1 shaft fragment; 3 bone fragment	Chicken	*Gallus gallus*	4	90N 487E	0-20 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
09W-2567	right femur	Black Rat	*Rattus rattus*	1	90N 487E	0-20 cmbs
09W-2572	femur fragment	UID Bird	UID Aves	1	90N 487E	0-20 cmbs
09W-2573	UID bone fragment	UID Bird	UID Aves	2	90N 487E	0-20 cmbs
09W-2574	vertebra	UID Mammal	UID Mammalia	1	90N 487E	0-20 cmbs
09W-2580	UID bone fragment	UID Bone	UID Vertebrata	1	90N 487E	0-20 cmbs
09W-2584-001	1 caudal vertebra; 1 rib	Black Rat	*Rattus rattus*	2	93N 491E	92-106 cmbs
09W-2584-002	UID bone fragment	Sea Bass	Family Serranidae	4	93N 491E	92-106 cmbs
09W-2584-003	UID bone fragment	UID Fish	UID Osteichthyes	6	93N 491E	92-106 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
09W-2584-004	UID bone fragment	UID Bone	UID Vertebrata	4	93N 491E	92-106 cmbs
09W-2592	scale	UID Fish	UID Osteichthyes	3	93N 491E	92-106 cmbs
09W-2593	UID bone fragment	UID Fish	UID Osteichthyes	9	93N 491E	78-107 cmbs
09W-2596	UID bone fragment	UID Fish	UID Osteichthyes	1	90N 487E	78-107 cmbs
09W-2601	UID bone fragment	UID Fish	UID Osteichthyes	8	93N 491E	78 cmbs
09W-2604	UID bone fragment	UID Fish	UID Osteichthyes	1	90N 487E	40-60 cmbs
09W-2609	UID bone fragment	UID Fish	UID Osteichthyes	1	93N 491E	38-99 cmbs
09W-2610	UID bone fragment	UID Fish	UID Osteichthyes	5	93N 491E	38-99 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
09W-2611	exoskeleton fragment	American Cockroach	*Periplaneta americana*	3	93N 490E	67-83 cmbs
09W-2612	vertebrae	Black Rat	*Rattus rattus*	3	93N 490E	50-75 cmbs
09W-2614	UID bone fragment	UID Fish	UID Osteichthyes	1	93N 490E	50-75 cmbs
09W-2615	exoskeleton fragment	American Cockroach	*Periplaneta americana*	3	93N 491E	78 cmbs
09W-2616	UID bone fragment	UID Bone	UID Vertebrata	1	93N 490E	50-75 cmbs
09W-2619	right femur	Black Rat	*Rattus rattus*	1	93N 490E	67-83 cmbs
09W-2620	UID bone fragment	UID Fish	UID Osteichthyes	2	93N 490E	67-83 cmbs
09W-2621	UID bone fragment	UID Fish	UID Osteichthyes	1	93N 490E	67-83 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
09W-2623	UID bone fragment	UID Fish	UID Osteichthyes	7	93N 491E	103-122 cmbs
09W-2624	1 right femur; 1 tarsal	rodent	Family Muridae	2	93N 491E	103-122 cmbs
09W-2625	UID bone fragment	UID Fish	UID Osteichthyes	1	93N 491E	103-122 cmbs
09W-2626	UID bone fragment	UID Sea Turtle	Superfamily Chelonioidea	1	93N 498E	90-120 cmbs
09W-2635	1 left innominate; 1 thoracic vertebra; 1 rib	Black Rat	*Rattus rattus*	3	93N 490E	50-75 cmbs
09W-2641	scale	UID Fish	UID Osteichthyes	3	93N 498E	90-120 cmbs
09W-2643-001	1 atlus; 3 sacral vertebrae; 1 lumbar vertebra; 1 left humerus; 5 ribs; 2 innominate fragments, 1 right ulna; 1 left ulna; 1 left radius	Black Rat	*Rattus rattus*	16	93N 490E	90-120 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
09W-2643-002	UID bone fragment	UID Fish	UID Osteichthyes	6	93N 490E	90-120 cmbs
09W-2643-003	coracoid	Chicken	*Gallus gallus*	1	93N 490E	90-120 cmbs
09W-2644	UID bone fragment	UID Fish	UID Osteichthyes	13	93N 490E	90-120 cmbs
09W-2645	UID bone fragment	UID Mammal	UID Mammalia	2	93N 490E	90-120 cmbs
09W-2646	UID bone fragment	UID Fish	UID Osteichthyes	17	93N 490E	90-120 cmbs
09W-2647	exoskeleton fragment	American Cockroach	*Periplaneta americana*	1	93N 498E	90-120 cmbs
09W-2652	UID bone fragment	UID Fish	UID Osteichthyes	1	84N 499E	25-52 cmbs
09W-2653	vertebra	UID Fish	UID Osteichthyes	3	84N 499E	25-44 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
09W-2654	2 ribs; 1 tarsal	Black Rat	*Rattus rattus*	3	84N 499E	25-44 cmbs
09W-2658	UID bone fragment	UID Fish	UID Osteichthyes	1	93N 491E	78-107 cmbs
09W-2659	exoskeleton fragment	American Cockroach	*Periplaneta americana*	3	93N 491E	78-107 cmbs
09W-2660	scale	UID Fish	UID Osteichthyes	3	93N 491E	78-107 cmbs
09W-2661	UID bone fragment	UID Fish	UID Osteichthyes	4	93N 491E	78-107 cmbs
09W-2671-001	1 rodent incisor; 2 individual long bones; 3 UID bone fragments	Black Rat	*Rattus rattus*	6	90N 487E	0-20 cmbs
09W-2671-002	UID bone fragment	UID Fish	UID Osteichthyes	1	90N 487E	0-20 cmbs
09W-2671-003	UID bone fragment	UID Mammal	UID Mammalia	2	90N 487E	0-20 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
09W-2673	right tibia	Chicken	*Gallus gallus*	1	90N 487E	0-20 cmbs
09W-2677	wing	Beetle	Order Coleoptera	1	93N 491E	78-107 cmbs
09W-2681	scale	UID Fish	UID Osteichthyes	2	93N 491E	103-122 cmbs
09W-2686	phalanx	Pig	*Sus scrofa*	1	85N 499E	82-162 cmbs
09W-2688	vertebra	Shark	Superorder Selachimorpha	1	85N 499E	82-162 cmbs
09W-2689	UID bone fragment	UID Bone	UID Vertebrata	1	85N 499E	82-162 cmbs
09W-2690	ligament	UID Mollusk	Class Bivalvia	2	85N 499E	82-162 cmbs
09W-2691	UID bone fragment	UID Mammal	UID Mammalia	11	85N 499E	82-162 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
09W-2692	1 left mandible; 1 right mandible; 5 lower incisor teeth; 1 left maxilla; 1 right maxilla; 2 upper incisor teeth; 1 basioccipital; 1 left innominate; 1 left femur; 1 right tibia; 1 left ulna; 1 right ulna; 2 right humerii; 1 left humerus; 1 rib; 1 caudal vertebra	Black Rat	*Rattus rattus*	23	85N 499E	82-162 cmbs
09W-2693	1 lower incisor; 1 lower incisor fragment; 2 left humerii; 1 left radius; 1 right ulna; 1 left pelvis; 3 left tibiae; 1 right tibia	Black Rat	Family Muridae	9	85N 499E	82-162 cmbs
09W-2694	UID bone fragment	UID Bone	UID Vertebrata	2	85N 499E	82-162 cmbs
09W-2695	UID bone fragment	UID Mammal	UID Mammalia	1	85N 499E	82-162 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
09W-2696	UID bone fragment	UID Fish	UID Osteichthyes	19	85N 499E	82-162 cmbs
09W-2697	UID bone fragment	UID Bone	UID Vertebrata	1	85N 499E	82-162 cmbs
09W-2698	right pelvis	Chicken	*Gallus gallus*	1	85N 499E	82-162 cmbs
09W-2699	UID bone fragment	UID Fish	UID Osteichthyes	7	85N 499E	82-162 cmbs
09W-2700	1 coracoid; 1 femur; 1 humerus, 6 UID bone fragments	Chicken	*Gallus gallus*	9	85N 499E	82-162 cmbs
09W-2701	UID bone fragment	UID Bone	UID Vertebrata	8	85N 499E	82-162 cmbs
09W-2702	UID bone fragment	UID Fish	UID Osteichthyes	2	93N 491E	87-106 cmbs
09W-2703-001	UID bone fragment	UID Fish	UID Osteichthyes	1	93N 491E	87-106 cmbs

Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Recovered	Provenience	Depth (In CM below surface)
09W-2803-002	rib	UID Bird	UID Aves	1	93N 491E	87-106 cmbs
09W-2706	caudal vertebra	Black Rat	*Rattus rattus*	1	93N 491E	62-92 cmbs

Appendix B

Zooarchaeological Remains Recovered From Emanuel Point I Sediment Samples
(Sorted by Sediment Sample)

Sediment Sample #01,500				Collected October 1997			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
01,500-001	UID bone fragment	UID Fish	UID Osteichthyes	1	0	116N 104E NE Quad	50-60 cmbs
01,500-002	feces	Rodent Fecal Matter	Family Muridae	1	0	116N 104E NE Quad	50-60 cmbs
01,500-003	feces, small	Rodent Fecal Matter	Family Muridae	1	0	116N 104E NE Quad	50-60 cmbs
01,500-006	UID bone fragment	UID Bone	UID Vertebrata	1	0	116N 104E NE Quad	50-60 cmbs

Sediment Sample #02,205				Collected November 1997			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
02,205-001	exoskeleton fragment	UID Insect	UID Insecta	1	0	114N 108E SE Quad	N/A
02,205-002	exoskeleton fragment	UID Insect	UID Insecta	1	0	114N 108E SE Quad	N/A
02,205-003	feces	Rodent Fecal Matter	Family Muridae	6	0	114N 108E SE Quad	N/A
02,205-004	wing	UID Beetle	Order Coleoptera	19	0	114N 108E SE Quad	N/A
02,205-005	prothorax	Weevil	Genus Sitophilus	5	0	114N 108E SE Quad	N/A
02,205-006	exoskeleton fragment	UID Insect	UID Insecta	1	0	114N 108E SE Quad	N/A

Sediment Sample #02,205				Collected November 1997			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
02,205-007	leg fragment	UID Insect	UID Insecta	1	0	114N 108E SE Quad	N/A
02,205-008	head	Weevil	Genus *Sitophilus*	1	0	114N 108E SE Quad	N/A
02,205-009	exoskeleton fragment	UID Insect	UID Insecta	1	0	114N 108E SE Quad	N/A
02,205-010	larva fragment	Skin beetle	Family Dermestidae	1	0	114N 108E SE Quad	N/A
02,205-011	articulated leg	UID Insect	UID Insecta	2	0	114N 108E SE Quad	N/A
02,205-012	head	UID beetle	Order Coleoptera	1	0	114N 108E SE Quad	N/A

Sediment Sample #02,205				Collected November 1997			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
02,205-014	claw	UID Rodent	Muridae Family	1	0	114N 108E SE Quad	N/A
02,205-015	UID bone fragment	UID Fish	UID Osteichthyes	11	0	114N 108E SE Quad	N/A
02,205-016	vertebra fragment	UID Bone	UID Vertebrata	1	0	114N 108E SE Quad	N/A

Sediment Sample #02,206				Collected November 1997			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
02,206-003	intact body	Weevil	Genus *Sitophilus*	1	0	114N 108E Keel/Stem Scarf	N/A
02,206-004	exoskeleton fragment	UID Insect	UID Insecta	3	0	114N 108E Keel/Stem Scarf	N/A
02,206-005	exoskeleton fragment	UID Insect	UID Insecta	1	0	114N 108E Keel/Stem Scarf	N/A
02,206-006	feces	Rodet Fecal Matter	Family Muridae	2	0	114N 108E Keel/Stem Scarf	N/A
02,206-007	intact body	Weevil	Genus *Sitophilus*	1	0	114N 108E Keel/Stem Scarf	N/A

Sediment Sample #02,206				Collected November 1997			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
02,206-008	mouthpart	American cockroach	*Periplaneta americana*	2	0	114N 108E Keel/Stem Scarf	N/A
02,206-009	wing	UID Beetle	Order Coleoptera	1	0	114N 108E Keel/Stem Scarf	N/A
02,206-010	prothorax	Darkling Beetle	Family Tenebrionidae	1	0	114N 108E Keel/Stem Scarf	N/A
02,206-011	articulated leg	UID Insect	UID Insecta	1	0	114N 108E Keel/Stem Scarf	N/A
02,206-012	leg fragment	UID Insect	UID Insecta	12	0	114N 108E Keel/Stem Scarf	N/A

Sediment Sample #02,206				Collected November 1997			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
02,206-013	head	Weevil	Genus *Sitophilus*	7	0	114N 108E Keel/Stem Scarf	N/A
02,206-014	prothorax	Weevil	Genus *Sitophilus*	5	0	114N 108E Keel/Stem Scarf	N/A

Sediment Sample #02,208				Collected November 1997			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
02,208-001	feces	Rodent Fecal Matter	Family Muridae	1	0	114N 108E SW Quad	N/A
02,208-002	wings	UID Beetle	Order Coleoptera	4	0	114N 108E SW Quad	N/A
02,208-003	prothorax	Skin beetle	Family Dermestidae	1	0	114N 108E SW Quad	N/A

Sediment Sample #02,209				Collected November 1997			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
02,209-001	Feces	Rodent Fecal Matter	Family Muridae	5	0	114N 108E SE Quad	N/A
02,209-002	exoskeleton fragment	UID Insect	UID Insecta	1	0	114N 108E SE Quad	N/A
02,209-003	exoskeleton fragment	UID Insect	UID Insecta	3	0	114N 108E SE Quad	N/A
02,209-004	head with prothorax attached	Skin beetle	Family Dermestidae	1	0	114N 108E SE Quad	N/A
02,209-005	prothorax	skin beetle	Family Dermestidae	3	0	114N 108E SE Quad	N/A

Sediment Sample #02,209				Collected November 1997			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
02,209-006	exoskeleton fragment	UID Insect	UID Insecta	3	0	114N 108E SE Quad	N/A
02,209-007	articulated leg	UID Insect	UID Insecta	8	0	114N 108E SE Quad	N/A
02,209-008	larva fragment	Skin beetle	Family Dermestidae	2	0	114N 108E SE Quad	N/A
02,209-009	prothorax	Weevil	Genus *Sitophilus*	15	0	114N 108E SE Quad	N/A
02,209-010	head	Weevil	Genus *Sitophilus*	6	0	114N 108E SE Quad	N/A

Sediment Sample #02,209				Collected November 1997			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
02,209-011	exoskeleton fragment	UID Insect	UID Insecta	3	0	114N 108E SE Quad	N/A
02,209-012	head	Skin beetle	Family Dermestidae	6	0	114N 108E SE Quad	N/A
02,209-013	wing	UID Beetle	UID Coleoptera	12	0	114N 108E SE Quad	N/A
02,209-014	mouthpart	American cockroach	Periplaneta americana	4	0	114N 108E SE Quad	N/A
02,209-015	exoskeleton fragment	UID Insect	UID Insecta	2	0	114N 108E SE Quad	N/A

Sediment Sample #02,210				Collected November 1997			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
02,210-001	leg fragment	UID Insect	UID Insecta	1	0	114N 108E SE Quad	N/A
02,210-002	mouthpart	American cockroach	*Periplaneta americana*	1	0	114N 108E SE Quad	N/A
02,210-003	exoskeleton fragment	UID Insect	UID Insecta	1	0	114N 108E SE Quad	N/A
02,210-004	exoskeleton fragment	UID Insect	UID Insecta	2	0	114N 108E SE Quad	N/A
02,210-005	wing	UID Beetle	UID Coleoptera	2	0	114N 108E SE Quad	N/A

Sediment Sample #02,210					Collected November 1997		
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
02,210-006	head	Weevil	Genus *Sitophilus*	6	0	114N 108E SE Quad	N/A
02,210-007	prothorax	Weevil	Genus *Sitophilus*	4	0	114N 108E SE Quad	N/A
02,210-008	feces	Rodent Fecal Matter	Family Muridae	3	0	114N 108E SE Quad	N/A
02,210-009	UID bone fragment	UID Fish	UID Osteichthyes	1	0	114N 108E SE Quad	N/A

Sediment Sample #02,226				Collected November 1997			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
02,226-001	bone	UID Fish	UID Osteichthyes	1	0	116N 104E NW Quad (Near Rope)	N/A
02,226-002	feces	Rodent Fecal Matter	Family Muridae	1	0	116N 104E NW Quad (Near Rope)	N/A

Appendix C

Zooarchaeological Remains Recovered From Emanuel Point II Sediment Samples
(Sorted by Sediment Sample)

Sediment Sample #0332				Collected July 2007			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
0332-002	UID bone fragment	UID Fish	UID Osteichthyes	1	0	90N 490E	50-60 cmbs
0332-003	UID bone fragment	UID Fish	UID Osteichthyes	1	0	90N 490E	50-60 cmbs
0332-004	UID bone fragment	UID Fish	UID Osteichthyes	1	0	90N 490E	50-60 cmbs
0332-005	UID bone fragment	UID Fish	UID Osteichthyes	1	0	90N 490E	50-60 cmbs
0332-006	exoskeleton fragment	UID Insect	UID Insecta	2	0	90N 490E	50-60 cmbs
0332-007	tooth	UID Fish	UID Osteichthyes	1	0	90N 490E	50-60 cmbs

Sediment Sample #1568				Collected June 2007			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1568-001	vertebra	UID Fish	UID Osteichthyes	1	0	96N 490E	50-70 cmbs
1568-002	prothorax	Darkling beetles	Family Tenebrionidae	1	0	96N 490E	50-70 cmbs
1568-003	exoskeleton fragment	UID Insect	UID Insecta	2	0	96N 490E	50-70 cmbs
1568-005	UID bone fragment	UID Fish	UID Osteichthyes	1	0	96N 490E	50-70 cmbs
1568-006	larva casing	Fruit Fly	Genus *Drosophila*	1	0	96N 490E	50-70 cmbs
1568-007	vertebra	UID Fish	UID Osteichthyes	1	0	96N 490E	50-70 cmbs
1568-008	wing	UID Beetle	Order Coleoptera	1	0	96N 490E	50-70 cmbs

Sediment Sample #1568				Collected June 2007			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1568-010	tooth	UID Fish	UID Osteichthyes	1	0	96N 490E	50-70 cmbs
1568-011	mouthpart	American cockroach	*Periplaneta americana*	1	0	96N 490E	50-70 cmbs
1568-012	exoskeleton fragment	UID Insect	UID Insecta	1	0	96N 490E	50-70 cmbs
1568-013	feces	Rodent Fecal Matter	Family Muridae	2	0	96N 490E	50-70 cmbs
1568-014	prothorax	Skin beetle	Family Dermestidae	1	0	96N 490E	50-70 cmbs
1568-015	tooth, shovel-shaped	Sheepshead	*Archosargus probatocephalus*	1	0	96N 490E	50-70 cmbs

Sediment Sample #1568					Collected June 2007		
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1568-016	larval fragment	Skin beetle	Family Dermestidae	1	0	96N 490E	50-70 cmbs
1568-017	exoskeleton fragment	UID Insect	UID Insecta	1	0	96N 490E	50-70 cmbs

Sediment Sample #1569				Collected July 2007			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1569-001	wing	UID Beetle	Order Coleoptera	2	0	96N 491E	30-50 cmbs
1569-002	larva casing	Fruit Fly	Genus *Drosophila*	1	0	96N 491E	30-50 cmbs
1569-003	articulated leg	UID Beetle	Order Coleoptera	1	0	96N 491E	30-50 cmbs
1569-004	head	UID Beetle	Order Coleoptera	1	0	96N 491E	30-50 cmbs
1569-005	feces	Rodent Fecal Matter	Family Muridae	2	0	96N 491E	30-50 cmbs
1569-006	mouthpart	American cockroach	*Periplaneta americana*	2	0	96N 491E	30-50 cmbs
1569-007	vertebra	UID Fish	UID Osteichthyes	1	0	96N 491E	30-50 cmbs

Sediment Sample #1569				Collected July 2007			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1569-008	exoskeleton fragment	UID Insect	UID Insecta	1	0	96N 491E	30-50 cmbs
1569-009	mouthpart	American cockroach	*Periplaneta americana*	2	0	96N 491E	30-50 cmbs
1569-010	exoskeleton fragment	UID Insect	UID Insecta	1	0	96N 491E	30-50 cmbs
1569-011	tooth	Drum Fish	Family Sciaenidae	1	0	96N 491E	30-50 cmbs
1569-013	vertebra	UID Fish	UID Osteichthyes	1	0	96N 491E	30-50 cmbs
1569-014	vertebra	UID Fish	UID Osteichthyes	1	0	96N 491E	30-50 cmbs

Sediment Sample #1569				Collected July 2007			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1569-015	larval fragment	Skin beetle	Family Dermestidae	1	0	96N 491E	30-50 cmbs
1569-016	vertebra	UID Fish	UID Osteichthyes	1	0	96N 491E	30-50 cmbs
1569-017	prothorax	UID Beetle	Order Coleoptera	1	0	96N 491E	30-50 cmbs
1569-018	prothorax	Weevil	Genus *Sitophilus*	2	0	96N 491E	30-50 cmbs
1569-019	prothorax	Darkling beetle	Family Tenebrionidae	1	0	96N 491E	30-50 cmbs
1569-020	prothorax	Skin Beetle	Family Dermestidae	1	0	96N 491E	30-50 cmbs

Sediment Sample #1569				Collected July 2007			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1569-021	exoskeleton fragment	UID Insect	UID Insecta	1	0	96N 491E	30-50 cmbs

Sediment Sample #1572				Collected July 2007			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1572-001	vertebra	UID Fish	UID Osteichthyes	1	0	90N 490E	50-60 cmbs
1572-002	vertebra	UID Fish	UID Osteichthyes	1	0	90N 490E	50-60 cmbs
1572-003	vertebra	UID Fish	UID Osteichthyes	1	0	90N 490E	50-60 cmbs
1572-004	vertebra	UID Fish	UID Osteichthyes	1	0	90N 490E	50-60 cmbs
1572-005	vertebra	UID Fish	UID Osteichthyes	1	0	90N 490E	50-60 cmbs
1572-006	vertebra	UID Fish	UID Osteichthyes	1	0	90N 490E	50-60 cmbs
1572-007	vertebra	UID Fish	UID Osteichthyes	1	0	90N 490E	50-60 cmbs

Sediment Sample #1572					Collected July 2007		
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1572-008	vertebra	UID Fish	UID Osteichthyes	1	0	90N 490E	50-60 cmbs
1572-009	tooth	Drum Fish	Family Sciaenidae	1	0	90N 490E	50-60 cmbs
1572-010	tooth	UID Fish	UID Osteichthyes	1	0	90N 490E	50-60 cmbs
1572-011	tooth	Drum Fish	Family Sciaenidae	1	0	90N 490E	50-60 cmbs

Sediment Sample #1582				Collected July 2007			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1582-001	exoskeleton fragment	UID Insect	UID Insecta	1	0	96N 489E	70-80 cmbs
1582-002	heads	UID Beetle	Order Coleoptera	5	0	96N 489E	70-80 cmbs
1582-003	tooth	UID Fish	UID Osteichthyes	1	0	96N 489E	70-80 cmbs
1582-004	prothorax	Weevil	Genus *Sitophilus*	3	0	96N 489E	70-80 cmbs
1582-005	tooth	Drum Fish	Family Sciaenidae	1	0	96N 489E	70-80 cmbs
1582-006	intact body	Weevil	Genus *Sitophilus*	1	0	96N 489E	70-80 cmbs
1582-007	tooth	UID Fish	UID Osteichthyes	1	0	96N 489E	70-80 cmbs

Sediment Sample #1582				Collected July 2007			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1582-008	mouthpart	American cockroach	*Periplaneta americana*	1	0	96N 489E	70-80 cmbs
1582-009	wing	UID Insect	UID Insecta	1	0	96N 489E	70-80 cmbs
1582-010	leg	American cockroach	*Periplaneta americana*	2	0	96N 489E	70-80 cmbs
1582-011	head	Weevil	Genus *Sitophilus*	2	0	96N 489E	70-80 cmbs
1582-012	exoskeleton fragment	UID Insect	UID Insecta	1	0	96N 489E	70-80 cmbs
1582-013	prothorax	Sawtooth or Merchant Grain Beetle	Genus *Oryzaephilus*	1	0	96N 489E	70-80 cmbs

Sediment Sample #1582				Collected July 2007			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1582-014	larva fragment	Weevil	Genus *Sitophilus*	4	0	96N 489E	70-80 cmbs
1582-015	larva fragment	Skin beetle	Family Dermestidae	13	0	96N 489E	70-80 cmbs
1582-016	wing	UID Beetle	Order Coleoptera	50	~200	96N 489E	70-80 cmbs
1582-017	exoskeleton fragment	UID Insect	UID Insecta	2	0	96N 489E	70-80 cmbs
1582-018	prothorax	Skin beetle	Family Dermestidae	9	0	96N 489E	70-80 cmbs

Sediment Sample #1583				Collected July 2007			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1583-001	larva casing	Fruit Fly	Genus *Drosophila*	1	0	91N 490E	40-50 cmbs
1583-002	UID bone fragment	UID Fish	UID Osteichthyes	1	0	91N 490E	40-50 cmbs
1583-003	tooth	UID Fish	UID Osteichthyes	1	0	91N 490E	40-50 cmbs

Sediment Sample #1607					Collected June 2008		
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1607-001	head	UID Beetle	Order Coleoptera	1	0	87N 497E	60-80 cmbs
1607-002	dorsal spine	UID Fish	UID Osteichthyes	1	0	87N 497E	60-80 cmbs
1607-003	UID bone fragment	UID Bone	UID Vertebrata	1	0	87N 497E	60-80 cmbs
1607-004	vertebra	UID Fish	UID Osteichthyes	1	0	87N 497E	60-80 cmbs
1607-005	UID bone fragment	UID Bone	UID Vertebrata	1	0	87N 497E	60-80 cmbs
1607-006	vertebra	UID Fish	UID Osteichthyes	1	0	87N 497E	60-80 cmbs
1607-007	vertebra	UID Fish	UID Osteichthyes	1	0	87N 497E	60-80 cmbs

Sediment Sample #1607				Collected June 2008			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1607-008	vertebra	UID Fish	UID Osteichthyes	1	0	87N 497E	60-80 cmbs
1607-009	UID bone fragment	UID Bone	UID Vertebrata	1	0	87N 497E	60-80 cmbs
1607-010	wing	UID Beetle	Order Coleoptera	3	0	87N 497E	60-80 cmbs
1607-011	exoskeleton fragment	UID Insect	UID Insecta	1	0	87N 497E	60-80 cmbs
1607-012	leg	UID Insect	UID Insecta	1	0	87N 497E	60-80 cmbs
1607-013	exoskeleton fragment	UID Insect	UID Insecta	1	0	87N 497E	60-80 cmbs

Sediment Sample #1607				Collected June 2008			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1607-014	prothorax	Skin beetle	Family Dermestidae	6	0	87N 497E	60-80 cmbs
1607-015	intact body	Weevil	Genus *Sitophilus*	1	0	87N 497E	60-80 cmbs

Sediment Sample #1608				Collected June 2008			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1608-002	UID bone fragment	UID Fish	UID Osteichthyes	1	0	100N 486E	60-80 cmbs
1608-003	mouthpart	American cockroach	*Periplaneta americana*	1	0	100N 486E	60-80 cmbs
1608-004	UID bone fragment	UID Fish	UID Osteichthyes	1	0	100N 486E	60-80 cmbs

Sediment Sample #1615				Collected July 2008			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1615-001	scale	UID Fish	UID Osteichthyes	1	0	87N 498E	20-40 cmbs
1615-002	tooth	Drum Fish	Family Sciaenidae	1	0	87N 498E	20-40 cmbs
1615-003	tooth	UID Fish	UID Osteichthyes	1	0	87N 498E	20-40 cmbs
1615-004	tooth	Drum Fish	Family Sciaenidae	1	0	87N 498E	20-40 cmbs
1615-005	feces	Rodent Fecal Matter	Family Muridae	1	0	87N 498E	20-40 cmbs
1615-006	wing	UID Beetle	Order Coleoptera	1	0	87N 498E	20-40 cmbs

Sediment Sample #1615				Collected July 2008			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1615-007	UID bone fragment	UID Fish	UID Osteichthyes	1	0	87N 498E	20-40 cmbs
1615-008	tooth	UID Fish	UID Osteichthyes	3	0	87N 498E	20-40 cmbs
1615-009	UID bone fragment	UID Fish	UID Osteichthyes	1	0	87N 498E	20-40 cmbs
1615-010	vertebra	UID Fish	UID Osteichthyes	1	0	87N 498E	20-40 cmbs
1615-011	exoskeleton fragment	UID Insect	UID Insecta	1	0	87N 498E	20-40 cmbs
1615-012	prothorax	Skin beetle	Family Dermestidae	1	0	87N 498E	20-40 cmbs

Sediment Sample #1615				Collected July 2008			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1615-013	articulated bones	UID Fish	UID Osteichthyes	3	0	87N 498E	20-40 cmbs
1615-014	UID bone fragment	UID Bone	UID Vertebrata	1	0	87N 498E	20-40 cmbs

Sediment Sample #1617				Collected July 2008			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1617-002	mouthpart	UID Fish	UID Osteichthyes	1	0	93N 491E	40-60 cmbs
1617-003	UID bone fragment	UID Fish	UID Osteichthyes	1	0	93N 491E	40-60 cmbs
1617-004	spine	UID Fish	UID Osteichthyes	1	0	93N 491E	40-60 cmbs
1617-005	mouthpart	UID Fish	UID Osteichthyes	1	0	93N 491E	40-60 cmbs
1617-007	vertebra	UID Fish	UID Osteichthyes	1	0	93N 491E	40-60 cmbs
1617-008	UID bone fragment	UID Bone	UID Vertebrata	1	0	93N 491E	40-60 cmbs

Sediment Sample #1617				Collected July 2008			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1617-009	UID bone fragment	UID Fish	UID Osteichthyes	1	0	93N 491E	40-60 cmbs
1617-010	exoskeleton fragment	UID Insect	UID Insecta	1	0	93N 491E	40-60 cmbs
1617-011	exoskeleton fragment	UID Insect	UID Insecta	2	0	93N 491E	40-60 cmbs
1617-012	exoskeleton fragment	UID Insect	UID Insecta	1	0	93N 491E	40-60 cmbs
1617-013	tooth	Drum Fish	Family Sciaenidae	1	0	93N 491E	40-60 cmbs
1617-014	vertebra	UID Fish	UID Osteichthyes	12	0	93N 491E	40-60 cmbs

Sediment Sample #1617				Collected July 2008			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1617-015	UID bone fragment	UID Fish	UID Osteichthyes	4	0	93N 491E	40-60 cmbs
1617-017	intact ant	Big Headed Ant	Genus *Pheidole*	1	0	93N 491E	40-60 cmbs
1617-025	prothorax	Skin beetle	Family Dermestidae	1	0	93N 491E	40-60 cmbs
1617-026	mouthpart	American cockroach	*Periplaneta americana*	1	0	93N 491E	40-60 cmbs
1617-027	leg fragment	UID Beetle	Order Coleoptera	1	0	93N 491E	40-60 cmbs

Sediment Sample #1618				Collected July 2008			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1618-001	feces	Rodent Fecal Matter	Family Muridae	1	0	87N 498E	60-80 cmbs
1618-003	exoskeleton fragment	UID Insect	UID Insecta	10	0	87N 498E	60-80 cmbs
1618-004	UID bone fragment	UID Fish	UID Osteichthyes	1	0	87N 498E	60-80 cmbs
1618-005	UID bone fragment	UID Fish	UID Osteichthyes	1	0	87N 498E	60-80 cmbs
1618-006	UID bone fragment	UID Fish	UID Osteichthyes	1	0	87N 498E	60-80 cmbs
1618-007	UID bone fragment	UID Bone	UID Vertebrata	1	0	87N 498E	60-80 cmbs

Sediment Sample #1618				Collected July 2008			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1618-008	exoskeleton fragment	UID Insect	UID Insecta	2	0	87N 498E	60-80 cmbs
1618-009	prothorax	Skin beetle	Family Dermestidae	1	0	87N 498E	60-80 cmbs
1618-010	mouthpart	American cockroach	*Periplaneta americana*	1	0	87N 498E	60-80 cmbs
1618-011	intact body	Weevil	Genus *Sitophilus*	2	0	87N 498E	60-80 cmbs
1618-012	wing	American cockroach	*Periplaneta americana*	15	0	87N 498E	60-80 cmbs
1618-013	exoskeleton fragment	UID Insect	UID Insecta	3	0	87N 498E	60-80 cmbs

Sediment Sample #1620				Collected August 2008			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1620-004	wing fragment	American cockroach	*Periplaneta americana*	3	0	87N 497E	100-120 cmbs
1620-005	UID bone fragment	UID Mammal	UID Mammalia	1	0	87N 497E	100-120 cmbs
1620-006	intact body	Weevil	Genus *Sitophilus*	1	0	87N 497E	100-120 cmbs
1620-007	leg piece	UID Beetle	Order Coleoptera	1	0	87N 497E	100-120 cmbs
1620-008	larva fragment	Skin Beetle	Family Dermestidae	2	0	87N 497E	100-120 cmbs
1620-009	UID bone fragment	UID Fish	UID Osteichthyes	1	0	87N 497E	100-120 cmbs

Sediment Sample #1620				Collected August 2008			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1620-010	head	UID Beetle	Order Coleoptera	1	0	87N 497E	100-120 cmbs
1620-011	exoskeleton fragment	UID Insect	UID Insecta	1	0	87N 497E	100-120 cmbs
1620-012	prothorax	Weevil	Genus *Sitophilus*	5	0	87N 497E	100-120 cmbs
1620-013	UID bone fragment	UID Fish	UID Osteichthyes	1	0	87N 497E	100-120 cmbs
1620-014	feces	Rodent Fecal Matter	Family Muridae	1	0	87N 497E	100-120 cmbs
1620-015	exoskeleton fragment	UID Insect	UID Insecta	0	0	87N 497E	100-120 cmbs

Sediment Sample #1620				Collected August 2008			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1620-021	exoskeleton fragment	UID Insect	UID Insecta	8	0	87N 497E	100-120 cmbs
1620-022	exoskeleton fragment	UID Insect	UID Insecta	3	0	87N 497E	100-120 cmbs
1620-023	larva casing	Fruit Fly	Genus *Drosophila*	1	0	87N 497E	100-120 cmbs
1620-024	mouthparts	American cockroach	*Periplaneta americana*	2	0	87N 497E	100-120 cmbs
1620-025	head	UID Beetle	Order Coleoptera	2	0	87N 497E	100-120 cmbs
1620-026	larva fragment	Weevil	Genus *Sitophilus*	1	0	87N 497E	100-120 cmbs

Sediment Sample #1620				Collected August 2008			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1620-027	wing	UID Beetle	Order Coleoptera	30	~200	87N 497E	100-120 cmbs
1620-028	exoskeleton fragment	UID Insect	UID Insecta	1	0	87N 497E	100-120 cmbs
1620-029	prothorax	Skin beetle	Family Dermestidae	3	0	87N 497E	100-120 cmbs
1620-030	exoskeleton fragment	UID Insect	UID Insecta	1	0	87N 497E	100-120 cmbs
1620-031	head	Weevil	Genus *Sitophilus*	4	0	87N 497E	100-120 cmbs

Sediment Sample #1626				Collected June 2009			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1626-001	UID bone fragment	UID Fish	UID Osteichthyes	1	0	106N 494 E	0-20cm
1626-002	vertebra	UID Fish	UID Osteichthyes	1	0	106N 494 E	0-20cm
1626-003	tooth	UID Fish	UID Osteichthyes	1	0	106N 494 E	0-20cm

Sediment Sample #1627					Collected June 2009		
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1627-004	tooth	Drum Fish	Family Sciaenidae	1	0	85N 498E	25-30 cmbs
1627-005	tooth	stingray	Family Dasyatidae	1	0	85N 498E	25-30 cmbs
1627-006	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 498E	25-30 cmbs
1627-007	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 498E	25-30 cmbs
1627-008	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 498E	25-30 cmbs
1627-009	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 498E	25-30 cmbs

Sediment Sample #1627					Collected June 2009		
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1627-010	phalanx	UID Rodent	Family Muridae	1	0	85N 498E	25-30 cmbs
1627-011	tooth	Drum Fish	Family Sciaenidae	1	0	85N 498E	25-30 cmbs
1627-012	tooth; molar	House mouse	*Mus musculus*	1	0	85N 498E	25-30 cmbs
1627-013	vertebra	UID Fish	UID Osteichthyes	1	0	85N 498E	25-30 cmbs
1627-014	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 498E	25-30 cmbs
1627-015	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 498E	25-30 cmbs

Sediment Sample #1627				Collected June 2009			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1627-016	tooth	UID Fish	UID Osteichthyes	1	0	85N 498E	25-30 cmbs
1627-017	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 498E	25-30 cmbs
1627-018	phalanx	UID Rodent	Family Muridae	1	0	85N 498E	25-30 cmbs
1627-019	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 498E	25-30 cmbs
1627-020	tooth	UID Fish	UID Osteichthyes	1	0	85N 498E	25-30 cmbs
1627-021	tooth	Stingray	Family Dasyatidae	1	0	85N 498E	25-30 cmbs

Sediment Sample #1627					Collected June 2009		
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1627-022	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 498E	25-30 cmbs
1627-023	UID bone fragment	UID FIsh	UID Osteichthyes	2	0	85N 498E	25-30 cmbs
1627-024	long bone, unfused; prenatal or neonatal	UID Rodent	Family Muridae	1	0	85N 498E	25-30 cmbs
1627-025	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 498E	25-30 cmbs
1627-026	tooth; incisor	House mouse	*Mus musculus*	1	0	85N 498E	25-30 cmbs
1627-027	right mandible including 2 molars	House mouse	*Mus musculus*	1	0	85N 498E	25-30 cmbs

Sediment Sample #1627				Collected June 2009			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1627-028	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 498E	25-30 cmbs
1627-029	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 498E	25-30 cmbs
1627-030	rib	UID Rodent	Family Muridae	1	0	85N 498E	25-30 cmbs
1627-031	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 498E	25-30 cmbs
1627-032	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 498E	25-30 cmbs
1627-033	feces	Rodent Fecal Matter	Family Muridae	9	0	85N 498E	25-30 cmbs

Sediment Sample #1627				Collected June 2009			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1627-034	larval fragment	Weevil	Genus *Sitophulus*	1	0	85N 498E	25-30 cmbs
1627-035	exoskeleton fragment	UID Insect	UID Insecta	3	0	85N 498E	25-30 cmbs
1627-036	intact head	Weevil	Genus *Sitophulus*	8	0	85N 498E	25-30 cmbs
1627-037	larva fragment	Skin beetle	Family Dermestidae	3	0	85N 498E	25-30 cmbs
1627-038	head with prothorax attached	Weevil	Genus *Sitophulus*	1	0	85N 498E	25-30 cmbs
1627-039	head	UID Beetle	Order Coleoptera	5	0	85N 498E	25-30 cmbs

Sediment Sample #1627				Collected June 2009			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1627-040	prothorax	Weevil	Genus *Sitophulus*	16	0	85N 498E	25-30 cmbs
1627-041	mouthpart	American cockroach	*Periplaneta americana*	4	0	85N 498E	25-30 cmbs
1627-042	leg	UID Beetle	Order Coleoptera	3	0	85N 498E	25-30 cmbs
1627-043	exoskeleton fragment	UID Insect	UID Insecta	2	0	85N 498E	25-30 cmbs
1627-044	larva fragment	Fruit Fly	Genus *Drosophila*	10	0	85N 498E	25-30 cmbs
1627-045	wing	UID Beetle	Order Coleoptera	25	~100	85N 498E	25-30 cmbs

Sediment Sample #1627					Collected June 2009		
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1627-046	exoskeleton fragment	UID Insect	UID Insecta	5	0	85N 498E	25-30 cmbs
1627-047	prothorax	Sawtooth or Merchant Grain Beetle	Genus *Oryzaephilus*	1	0	85N 498E	25-30 cmbs
1627-048	prothorax	Skin beetle	Family Dermestidae	17	0	85N 498E	25-30 cmbs
1627-049	exoskeleton fragment	UID Insect	UID Insecta	3	0	85N 498E	25-30 cmbs

Sediment Sample #1654					Collected June 2009		
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1654-001	vertebra	UID Fish	UID Osteichthyes	1	0	93N 490E	40-60 cmbs
1654-002	vertebra	UID Fish	UID Osteichthyes	1	0	93N 490E	40-60 cmbs
1654-003	UID bone fragment	UID Fish	UID Osteichthyes	1	0	93N 490E	40-60 cmbs
1654-004	vertebra	UID Fish	UID Osteichthyes	1	0	93N 490E	40-60 cmbs
1654-005	UID bone fragment	UID Bone	UID Vertebrata	1	0	93N 490E	40-60 cmbs
1654-006	feces; very small	Rodent Fecal Matter	Family Muridae	2	0	93N 490E	40-60 cmbs

Sediment Sample #1654					Collected June 2009		
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1654-007	vertebra	UID Fish	UID Osteichthyes	1	0	93N 490E	40-60 cmbs
1654-008	vertebra	UID Fish	UID Osteichthyes	1	0	93N 490E	40-60 cmbs
1654-009	leg	UID Beetle	Order Coleoptera	1	0	93N 490E	40-60 cmbs
1654-010	prothorax	Skin beetle	Family Dermesitdae	2	0	93N 490E	40-60 cmbs
1654-011	vertebra	UID Fish	UID Osteichthyes	1	0	93N 490E	40-60 cmbs
1654-012	feces	Rodent Fecal Matter	Family Muridae	2	0	93N 490E	40-60 cmbs

Sediment Sample #1654				Collected June 2009			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1654-013	UID bone fragment	UID Bone	UID Vertebrata	1	0	93N 490E	40-60 cmbs
1654-014	vertebra	UID Fish	UID Osteichthyes	1	0	93N 490E	40-60 cmbs
1654-015	vertebra	UID Fish	UID Osteichthyes	1	0	93N 490E	40-60 cmbs
1654-016	larva fragment	Skin beetle	Family Dermesitdae	2	0	93N 490E	40-60 cmbs
1654-018	larva casing	Fruit Fly	Genus *Drosophila*	3	0	93N 490E	40-60 cmbs

Sediment Sample #1661						Collected June 2009	
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1661-001	vertebra	UID Fish	UID Osteichthyes	3	0	85N 499E	40-60 cmbs
1661-002	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 499E	40-60 cmbs
1661-003	intact body	Weevil	Genus *Sitophilus*	1	0	85N 499E	40-60 cmbs
1661-004	mouthpart	American cockroach	*Periplanta americana*	1	0	85N 499E	40-60 cmbs
1661-005	exoskeleton fragment	UID Insect	UID Insecta	2	0	85N 499E	40-60 cmbs
1661-006	exoskeleton fragment	UID Insect	UID Insecta	1	0	85N 499E	40-60 cmbs

Sediment Sample #1661				Collected June 2009			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1661-007	head	Weevil	Genus *Sitophilus*	1	0	85N 499E	40-60 cmbs
1661-008	wings	UID Beetle	Order Coleoptera	30	~150	85N 499E	40-60 cmbs
1661-009	exoskeleton fragment	UID Insect	UID Insecta	1	0	85N 499E	40-60 cmbs
1661-010	prothorax	Sawtooth or Merchant Grain Beetle	Genus *Oryzaephilus*	1	0	85N 499E	40-60 cmbs
1661-011	larva fragments	Skin beetle	Family Dermestidae	1	0	85N 499E	40-60 cmbs
1661-012	left chelicerae (jaw with fang)	UID Spider	Order Araneae	1	0	85N 499E	40-60 cmbs

Sediment Sample #1661				Collected June 2009			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1661-014	larva fragment	Fruit Fly	Genus *Drosophila*	1	0	85N 499E	40-60 cmbs
1661-015	feces	Rodent Fecal Matter	Family Muridae	16	0	85N 499E	40-60 cmbs
1661-016	prothorax	Darkling beetle	Family Tenebrionidae	2	0	85N 499E	40-60 cmbs
1661-017	prothorax	Skin beetle	Family Dermestidae	2	0	85N 499E	40-60 cmbs
1661-018	prothorax	Weevil	Genus *Sitophilus*	1	0	85N 499E	40-60 cmbs
1661-019	prothorax	UID Beetle	UID Coleoptera	5	0	85N 499E	40-60 cmbs

Sediment Sample #1683				Collected June 2009			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1683-001	feces	Rodent Fecal Matter	Family Muridae	65	~200	85N 499E	84-87cm
1683-002	exoskeleton fragment	UID Insect	UID Insecta	2	0	85N 499E	84-87cm
1683-003	articulated leg	UID Beetle	Order Coleoptera	60	~250	85N 499E	84-87cm
1683-004	exoskeleton fragment	UID Insect	UID Insecta	1	0	85N 499E	84-87cm
1683-005	head with prothorax attached	Weevil	Genus *Sitophilus*	1	0	85N 499E	84-87cm
1683-006	exoskeleton fragment	UID Insect	UID Insecta	70	~250	85N 499E	84-87cm

Sediment Sample #1683				Collected June 2009			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1683-007	prothorax	Skin beetle	Family Dermestidae	45	~100	85N 499E	84-87cm
1683-008	wings	UID Beetle	Order Coleoptera	100	~500	85N 499E	84-87cm
1683-009	leg fragment	UID Beetle	Order Coleoptera	8	0	85N 499E	84-87cm
1683-010	intact body	Weevil	Genus *Sitophilus*	1	0	85N 499E	84-87cm
1683-011	larva casing	Family Calliphoridae or Sarcophagidae	Order Diptera	1	0	85N 499E	84-87cm
1683-012	intact wing	Skin beetle	Family Dermestidae	1	0	85N 499E	84-87cm

Sediment Sample #1683				Collected June 2009			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1683-013	exoskeleton fragment	UID Insect	UID Insecta	40	0	85N 499E	84-87cm
1683-014	mouthpart	American cockroach	*Periplaneta americana*	50	~100	85N 499E	84-87cm
1683-015	prothorax	Sawtooth or Merchant Grain Beetle	Genus *Oryzaephilus*	6	0	85N 499E	84-87cm
1683-016	intact head	Weevil	Genus *Sitophilus*	40	0	85N 499E	84-87cm
1683-017	exoskeleton fragment	UID Insect	UID Insecta	5	0	85N 499E	84-87cm
1683-018	larva fragment	Skin beetle	Family Dermestidae	20	0	85N 499E	84-87cm

Sediment Sample #1683				Collected June 2009			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1683-019	intact body	Weevil	Genus *Sitophilus*	21	0	85N 499E	84-87cm
1683-020	head	UID Beetle	Order Coleoptera	62	0	85N 499E	84-87cm
1683-021	wing fragment	American cockroach	*Periplaneta americana*	40	~500 fragments	85N 499E	84-87cm
1683-022	leg fragment	UID Beetle	UID Coleoptera	3	0	85N 499E	84-87cm
1683-023	prothorax	Darkling beetle	Family Tenebrionidae	27	0	85N 499E	84-87cm
1683-024	prothorax	Weevil	Genus *Sitophilus*	28	0	85N 499E	84-87cm

Sediment Sample #1683				Collected June 2009			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1683-025	prothorax	UID Beetle	UID Coleoptera	9	0	85N 499E	84-87cm
1683-026	head with prothorax attached	Skin beetle	Family Dermestidae	4	0	85N 499E	84-87cm
1683-027	prothorax	UID Beetle	UID Coleoptera	6	0	85N 499E	84-87cm
1683-028	leg fragment	Skin beetle	Family Dermestidae	1	0	85N 499E	84-87cm
1683-029	leg fragment	Weevil	Genus *Sitophilus*	1	0	85N 499E	84-87cm
1683-030	tooth	Stingray	Family Dasyatidae	2	0	85N 499E	84-87cm

Sediment Sample #1683					Collected June 2009		
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1683-032	feces, very tiny	Rodent Fecal Matter	Family Muridae	1	0	85N 499E	84-87cm
1683-033	UID bone fragment	UID bone	UID Vertebrata	1	0	85N 499E	84-87cm
1683-034	vertebra	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm
1683-035	phalanx	House mouse	*Mus musculus*	2	0	85N 499E	84-87cm
1683-036	vertebra	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm
1683-037	UID bone fragment	UID Bone	UID Vertebrata	1	0	85N 499E	84-87cm

Sediment Sample #1683				Collected June 2009			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1683-038	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm
1683-039	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm
1683-040	femur fragment	House mouse	*Mus musculus*	1	0	85N 499E	84-87cm
1683-041	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm
1683-042	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm
1683-043	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm

Sediment Sample #1683					Collected June 2009		
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1683-044	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm
1683-045	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm
1683-046	tooth; molar	House mouse	*Mus musculus*	1	0	85N 499E	84-87cm
1683-047	rib	UID Rodent	Family Muridae	1	0	85N 499E	84-87cm
1683-048	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm
1683-049	UID bone fragment	UID Bone	UID Vertebrata	1	0	85N 499E	84-87cm

Sediment Sample #1683				Collected June 2009			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1683-050	caudal vertebra	House mouse	*Mus musculus*	1	0	85N 499E	84-87cm
1683-051	vertebra	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm
1683-052	tooth	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm
1683-053	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm
1683-054	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm
1683-055	tarsal	House mouse	*Mus musculus*	1	0	85N 499E	84-87cm

Sediment Sample #1683				Collected June 2009			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1683-056	caudal vertebra	UID Rodent	Family Muridae	1	0	85N 499E	84-87cm
1683-057	femur; distal epiphysis, unfused	Black rat	*Rattus rattus*	1	0	85N 499E	84-87cm
1683-058	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm
1683-059	right mandible with 2 teeth	House mouse	*Mus musculus*	1	0	85N 499E	84-87cm
1683-060	tarsal, prenatal or neonatal	UID Rodent	Family Muridae	1	0	85N 499E	84-87cm
1683-061	tarsal	House mouse	*Mus musculus*	1	0	85N 499E	84-87cm

Sediment Sample #1683				Collected June 2009			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1683-062	UID bone fragment	UID Bone	UID Bone	1	0	85N 499E	84-87cm
1683-063	tarsal	House mouse	*Mus musculus*	1	0	85N 499E	84-87cm
1683-064	spine fragment	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm
1683-065	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm
1683-066	spine	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm
1683-067	vertebra	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm

Sediment Sample #1683				Collected June 2009			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1683-068	UID bone fragment	UID Bone	UID Vertebrata	1	0	85N 499E	84-87cm
1683-069	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm
1683-070	tooth; molar	House mouse	*Mus musculus*	1	0	85N 499E	84-87cm
1683-071	rib	UID Rodent	Family Muridae	1	0	85N 499E	84-87cm
1683-072	vertebra	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm
1683-073	radius	Black rat	*Rattus rattus*	1	0	85N 499E	84-87cm

Sediment Sample #1683					Collected June 2009		
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1683-074	UID bone fragment	UID Bone	UID Vertebrata	1	0	85N 499E	84-87cm
1683-075	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm
1683-076	caudal vertebra	House mouse	*Mus musculus*	1	0	85N 499E	84-87cm
1683-077	tooth; molar	House mouse	*Mus musculus*	1	0	85N 499E	84-87cm
1683-078	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm
1683-079	femur fragment	Black rat	*Rattus rattus*	1	0	85N 499E	84-87cm

Sediment Sample #1683				Collected June 2009			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1683-080	humerus	UID Rodent	Family Muridae	1	0	85N 499E	84-87cm
1683-081	dorsal spine	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm
1683-082	tarsal	House mouse	*Mus musculus*	1	0	85N 499E	84-87cm
1683-083	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm
1683-084	vertebra	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm
1683-085	vertebra	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm

Sediment Sample #1683				Collected June 2009			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1683-086	spine	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm
1683-087	radius	House mouse	*Mus musculus*	1	0	85N 499E	84-87cm
1683-088	vertebra	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm
1683-089	spine	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm
1683-090	tooth; incisor	Black rat	*Rattus rattus*	1	0	85N 499E	84-87cm
1683-091	UID bone fragment	UID Bone	UID Vertebrata	1	0	85N 499E	84-87cm

Sediment Sample #1683				Collected June 2009			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1683-092	rib	UID Rodent	Family Muridae	1	0	85N 499E	84-87cm
1683-093	UID bone fragment	UID Bone	UID Vertebrata	1	0	85N 499E	84-87cm
1683-094	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm
1683-095	UID bone fragment	UID Bone	UID Vertebrata	1	0	85N 499E	84-87cm
1683-096	UID bone fragment	UID Bone	UID Vertebrata	1	0	85N 499E	84-87cm
1683-097	vertebra	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm

Sediment Sample #1683				Collected June 2009			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1683-098	UID bone fragment	UID Bone	UID Vertebrata	1	0	85N 499E	84-87cm
1683-099	UID bone fragment	UID Bone	UID Vertebrata	1	0	85N 499E	84-87cm
1683-100	atlas vertebra	House mouse	*Mus musculus*	1	0	85N 499E	84-87cm
1683-101	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm
1683-102	UID bone fragment	UID Bone	UID Vertebrata	1	0	85N 499E	84-87cm
1683-103	vertebra	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm

Sediment Sample #1683				Collected June 2009			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1683-104	vertebra	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm
1683-105	caudal vertebra	UID Rodent	Family Muridae	1	0	85N 499E	84-87cm
1683-106	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm
1683-107	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm
1683-108	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm
1683-109	rib	UID Rodent	Family Muridae	1	0	85N 499E	84-87cm

Sediment Sample #1683					Collected June 2009		
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1683-110	UID bone fragment	UID Bone	UID Vertebrata	1	0	85N 499E	84-87cm
1683-111	spine	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm
1683-112	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm
1683-113	UID bone fragment	House mouse	*Mus musculus*	1	0	85N 499E	84-87cm
1683-114	UID bone fragment	UID Bone	UID Vertebrata	1	0	85N 499E	84-87cm
1683-115	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm

Sediment Sample #1683				Collected June 2009			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1683-116	tooth	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm
1683-117	tooth; incisor	House mouse	*Mus musculus*	2	0	85N 499E	84-87cm
1683-118	UID bone fragment	UID Bone	UID Vertebrata	1	0	85N 499E	84-87cm
1683-119	spine	UID Fish	UID Osteichthyes	8	0	85N 499E	84-87cm
1683-120	spine	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm
1683-121	vertebra	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm

Sediment Sample #1683				Collected June 2009			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1683-122	vertebra	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm
1683-123	right femur	Black rat	*Rattus rattus*	1	0	85N 499E	84-87cm
1683-124	vertebra	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm
1683-125	vertebra fragment	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87cm
1683-126	right femur	Black rat	*Rattus rattus*	1	0	85N 499E	84-87cm
1683-127	UID bone fragment	UID Bone	UID Vertebrata	1	0	85N 499E	84-87cm

Sediment Sample #1683				Collected June 2009			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1683-128	wing	Hide beetle	*Dermestes maculatus*	12	0	85N 499E	84-87cm
1683-129	wing	Larder beetle	*Dermestes lardarius*	11	0	85N 499E	84-87cm
1683-130	wing	Drugstore beetle	*Stegobium paniceum*	15	0	85N 499E	84-87cm

Sediment Sample #1718				Collected July 2009			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1718-001	vertebra	UID Fish	UID Osteichthyes	1	0	84N 499E	59-80 cmbs
1718-002	UID bone fragment	UID Fish	UID Osteichthyes	1	0	84N 499E	59-80 cmbs
1718-003	vertebra	UID Fish	UID Osteichthyes	1	0	84N 499E	59-80 cmbs
1718-004	vertebra	UID Fish	UID Osteichthyes	1	0	84N 499E	59-80 cmbs
1718-005	vertebra	UID Fish	UID Osteichthyes	1	0	84N 499E	59-80 cmbs
1718-006	prothorax	Skin beetle	Family Dermestidae	1	0	84N 499E	59-80 cmbs

Sediment Sample #1718				Collected July 2009			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1718-007	UID bone fragment	UID Fish	UID Osteichthyes	1	0	84N 499E	59-80 cmbs

Sediment Sample #1755					Collected June 2009		
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1755-001	caudal vertebra	UID Rodent	Family Muridae	1	0	85N 498E NW Quad	40-60 cmbs
1755-002	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 498E NW Quad	40-60 cmbs
1755-003	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 498E NW Quad	40-60 cmbs
1755-014	feces	Rodent Fecal Matter	Family Muridae	12	0	85N 498E NW Quad	40-60 cmbs
1755-015	humerus	House mouse	*Mus musculus*	2	0	85N 498E NW Quad	40-60 cmbs
1755-016	UID bone fragment	UID Bone	UID Vertebrata	1	0	85N 498E NW Quad	40-60 cmbs

Sediment Sample #1755				Collected June 2009			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1755-017	UID bone fragment	UID Bone	UID Vertebrata	1	0	85N 498E NW Quad	40-60 cmbs
1755-018	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 498E NW Quad	40-60 cmbs
1755-019	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 498E NW Quad	40-60 cmbs
1755-020	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 498E NW Quad	40-60 cmbs
1755-021	tooth; incisor	House mouse	Family Muridae	1	0	85N 498E NW Quad	40-60 cmbs
1755-022	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 498E NW Quad	40-60 cmbs

Sediment Sample #1755					Collected June 2009		
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1755-023	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 498E NW Quad	40-60 cmbs

Sediment Sample #1756					Collected June 2009		
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1756-001	UID bone fragment	UID Fish	UID Osteichthyes	2	0	93N 490E NW Quad	40-60 cmbs
1756-002	UID bone fragment	UID Bone	UID Vertebrata	1	0	93N 490E NW Quad	40-60 cmbs
1756-003	tooth	UID Fish	UID Osteichthyes	1	0	93N 490E NW Quad	40-60 cmbs
1756-016	wing fragment	American cockroach	*Periplaneta americana*	2	0	93N 490E NW Quad	40-60 cmbs
1756-019	wing	UID Beetle	Order Coleoptera	5	0	93N 490E NW Quad	40-60 cmbs
1756-025	exoskeleton fragment	UID Insect	UID Insecta	1	0	93N 490E NW Quad	40-60 cmbs

Sediment Sample #1756				Collected June 2009			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1756-026	head	UID Beetle	Order Coleoptera	1	0	93N 490E NW Quad	40-60 cmbs
1756-027	UID bone fragment	UID Fish	UID Osteichthyes	1	0	93N 490E NW Quad	40-60 cmbs
1756-029	prothorax	Skin beetle	Family Dermestidae	2	0	93N 490E NW Quad	40-60 cmbs
1756-030	larva casing	Fruit Fly	Genus *Drosophila*	6	0	93N 490E NW Quad	40-60 cmbs
1756-031	prothorax	Weevil	Genus *Sitophilus*	1	0	93N 490E NW Quad	40-60 cmbs
1756-032	articulated leg	UID Beetle	Order Coleoptera	1	0	93N 490E NW Quad	40-60 cmbs

Sediment Sample #1756				Collected June 2009			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1756-034	exoskeleton fragment	UID Insect	UID Insecta	1	0	93N 490E NW Quad	40-60 cmbs
1756-035	vertebra fragment	UID Fish	UID Osteichthyes	7	0	93N 490E NW Quad	40-60 cmbs
1756-037	wing fragment	Ladybird beetle (Ladybug)	Family Coccinellida	2	0	93N 490E NW Quad	40-60 cmbs
1756-038	leg fragment	Skin beetle	Family Dermestidae	1	0	93N 490E NW Quad	40-60 cmbs
1756-041	leg fragment	Skin beetle	Family Dermestidae	1	0	93N 490E NW Quad	40-60 cmbs

Sediment Sample #1757				Collected June 2009			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1757-001	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 499E	40-60 cmbs
1757-002	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 499E	40-60 cmbs
1757-003	tooth; molar	House mouse	*Mus musculus*	1	0	85N 499E	40-60 cmbs
1757-004	wing	UID Beetle	Order Coleoptera	1	0	85N 499E	40-60 cmbs
1757-005	UID bone fragment	UID Bone	UID Vertebrata	1	0	85N 499E	40-60 cmbs
1757-006	tooth	UID Fish	UID Osteichthyes	1	0	85N 499E	40-60 cmbs

Sediment Sample #1757					Collected June 2009		
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1757-007	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 499E	40-60 cmbs
1757-022	feces	Rodent Fecal Matter	Family Muridae	20	0	85N 499E	40-60 cmbs
1757-023	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 499E	40-60 cmbs
1757-024	exoskeleton fragment	UID Insect	UID Insecta	1	0	85N 499E	40-60 cmbs
1757-025	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 499E	40-60 cmbs
1757-026	prothorax	Weevil	Genus *Sitophilus*	1	0	85N 499E	40-60 cmbs

Sediment Sample #1757				Collected June 2009			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1757-027	intact body	Weevil	Genus *Sitophilus*	3	0	85N 499E	40-60 cmbs
1757-028	exoskeleton fragment	UID Insect	UID Insecta	1	0	85N 499E	40-60 cmbs
1757-029	prothorax	Skin beetle	Family Dermestidae	1	0	85N 499E	40-60 cmbs

Sediment Sample #1758				Collected June 2009			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1758-001	exoskeleton fragment	UID Insect	UID Insecta	1	0	85N 499E	84-87 cmbs
1758-005	exoskeleton fragment	UID Insect	UID Insecta	1	0	85N 499E	84-87 cmbs
1758-007	feces	Rodent Fecal Matter	Family Muridae	150	~200	85N 499E	84-87 cmbs
1758-009	1 right humerus; 1 right femur; 1 tarsus; 1 atlas vertebra; 1 lumbar vertebra	House mouse	*Mus musculus*	5	0	85N 499E	84-87 cmbs
1758-010	UID bone fragment	UID Fish	UID Osteichthyes	2	0	85N 499E	84-87 cmbs
1758-014	larva casing	Fruit Fly and Scuttlefly	*Drosophila* and Phoridae	Dr-30, Ph-50	~100	85N 499E	84-87 cmbs

Sediment Sample #1758				Collected June 2009			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1758-024	prothorax	Weevil	Genus *Sitophilus*	1	0	85N 499E	84-87 cmbs
1758-027	tooth; molar	black rat, juvenile	*Rattus rattus*	1	0	85N 499E	84-87 cmbs
1758-028	dorsal spine	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87 cmbs
1758-029	tooth; molar, very worn	House mouse	*Mus musculus*	1	0	85N 499E	84-87 cmbs
1758-030	caudal vertebra	House mouse	*Mus musculus*	1	0	85N 499E	84-87 cmbs
1758-031	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87 cmbs

Sediment Sample #1758					Collected June 2009		
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1758-032	vertebra	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87 cmbs
1758-033	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87 cmbs
1758-034	vertebra fragment	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87 cmbs
1758-035	UID bone fragment	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87 cmbs
1758-041	exoskeleton fragment	UID Insect	UID Insecta	1	0	85N 499E	84-87 cmbs
1758-042	prothorax	UID Beetle	Order Coleoptera	20	0	85N 499E	84-87 cmbs

Sediment Sample #1758				Collected June 2009			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1758-043	head	Weevil	Genus *Sitophilus*	30	0	85N 499E	84-87 cmbs
1758-044	exoskeleton fragment	UID Insect	UID Insecta	1	0	85N 499E	84-87 cmbs
1758-045	exoskeleton fragment	UID Insect	UID Insecta	10	0	85N 499E	84-87 cmbs
1758-046	wing	UID Beetle	Order Coleoptera	100	~200	85N 499E	84-87 cmbs
1758-047	prothorax	Weevil	Genus *Sitophilus*	2	30	85N 499E	84-87 cmbs
1758-048	leg fragment	UID Beetle	Order Coleoptera	2	0	85N 499E	84-87 cmbs

Sediment Sample #1758				Collected June 2009			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1758-049	leg fragment	Skin beetle	Family Dermestidae	15	0	85N 499E	84-87 cmbs
1758-050	larva casing	Fruit Fly	Genus *Drosophila*	20	~100	85N 499E	84-87 cmbs
1758-051	exoskeleton fragment	UID Insect	UID Insecta	1	0	85N 499E	84-87 cmbs
1758-052	articulated leg	UID Beetle	Order Coleoptera	70	~100	85N 499E	84-87 cmbs
1758-053	intact body	Weevil	Genus *Sitophilus*	30	~100	85N 499E	84-87 cmbs
1758-054	intact body	Rove beetle	Genus *Staphylinidae*	1	0	85N 499E	84-87 cmbs

Sediment Sample #1758				Collected June 2009			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1758-055	exoskeleton fragment	UID Insect	UID Insecta	1	0	85N 499E	84-87 cmbs
1758-056	exoskeleton fragment	UID Insect	UID Insecta	1	0	85N 499E	84-87 cmbs
1758-057	prothorax with leg attached	UID Beetle	Order Coleoptera	5	0	85N 499E	84-87 cmbs
1758-058	exoskeleton fragment	UID Insect	UID Insecta	5	0	85N 499E	84-87 cmbs
1758-059	mouthpart	American cockroach	*Periplaneta americana*	75	~150	85N 499E	84-87 cmbs
1758-060	wing fragment	American cockroach	*Periplaneta americana*	200	~300	85N 499E	84-87 cmbs

Sediment Sample #1758				Collected June 2009			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1758-061	larva fragment	Weevil	Genus *Sitophilus*	1	~20	85N 499E	84-87 cmbs
1758-063	head with prothorax attached	Weevil	Genus *Sitophilus*	1	0	85N 499E	84-87 cmbs
1758-064	feces	Rodent Fecal Matter	Family Muridae	20	~25	85N 499E	84-87 cmbs
1758-065	exoskeleton fragment	UID Insect	UID Insecta	1	1	85N 499E	84-87 cmbs
1758-066	larva fragment	Skin beetle	Family Dermestidae	40	~150	85N 499E	84-87 cmbs
1758-067	leg	UID Insect	UID Insecta	50	~20	85N 499E	84-87 cmbs

Sediment Sample #1758				Collected June 2009			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1758-068	prothorax	Darkling beetle	Family Tenebrionidae	12	~20	85N 499E	84-87 cmbs
1758-069	exoskeleton fragment	UID Insect	UID Insecta	25	0	85N 499E	84-87 cmbs
1758-071	exoskeleton fragment	UID Insect	UID Insecta	75	~150	85N 499E	84-87 cmbs
1758-072	exoskeleton fragment	UID Insect	UID Insecta	1	0	85N 499E	84-87 cmbs
1758-073	larva fragment	Skin beetle	Family Dermestidae	20	~30	85N 499E	84-87 cmbs
1758-074	head	Skin beetle	Family Dermestidae	40	~15	85N 499E	84-87 cmbs

Sediment Sample #1758				Collected June 2009			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1758-075	leg fragment	UID Insect	UID Insecta	4	0	85N 499E	84-87 cmbs
1758-076	intact wings	Weevil	Genus *Sitophilus*	3	0	85N 499E	84-87 cmbs
1758-077	dorsal spine	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87 cmbs
1758-078	rib	UID Fish	UID Osteichthyes	1	0	85N 499E	84-87 cmbs
1758-079	leg fragment	Skin beetle	Family Dermestidae	1	0	85N 499E	84-87 cmbs
1758-080	feces	Rodent Fecal Matter	Family Muridae	1	0	85N 499E	84-87 cmbs

Sediment Sample #1758					Collected June 2009		
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1758-081	prothorax	Skin beetle	Family Dermestidae	50	~150	85N 499E	84-87 cmbs
1758-082	tibia	House Mouse	*Mus musculus*	1	0	85N 499E	84-87 cmbs
1758-083	tarsal	Black Rat	*Rattus rattus*	2	0	85N 499E	84-87 cmbs
1758-084	UID bone fragment	UID Fish	UID Osteichthyes	7	0	85N 499E	84-87 cmbs
1758-085	UID bone fragment	UID Bone	UID Vertebrata	1	0	85N 499E	84-87 cmbs
1758-086	exoskeleton fragment	UID Insect	UID Insecta	1	0	85N 499E	84-87 cmbs

Sediment Sample #1758				Collected June 2009			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1758-087	larva casing	Scuttle Fly	Family Phoridae	50	~200	85N 499E	84-87 cmbs

Sediment Sample #1770				Collected August 2009			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1770-002	UID bone fragment	UID Fish	UID Osteichthyes	6	0	96N 477E	17-23 cmbs
1770-003	prothorax	Skin beetle	Family Dermestidae	1	0	96N 477E	17-23 cmbs
1770-004	exoskeleton fragment	UID Insect	UID Insecta	1	0	96N 477E	17-23 cmbs
1770-005	tooth	UID Fish	UID Osteichthyes	1	0	96N 477E	17-23 cmbs
1770-006	tooth	UID Fish	UID Osteichthyes	1	0	96N 477E	17-23 cmbs
1770-007	UID bone fragment	UID Fish	UID Osteichthyes	1	0	96N 477E	17-23 cmbs

Sediment Sample #1770				Collected August 2009			
Artifact Number	Element/Specimen Recovered	Common Name/ Description	Scientific Name	Count Collected	Count Observed But Not Collected	Provenience	Depth (In CM below surface)
1770-008	tooth	Stingray	Family Dasyatidae	1	0	96N 477E	17-23 cmbs