From Turkeys To Tamales: Paleoindian To Preclassic Period Faunal Use At Maya Hak Cab Pek Rockshelter In Southern Belize

Stephanie Raye Orsini
University of Mississippi

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FROM TURKEYS TO TAMALE
PALEOINDIAN TO PRECLASSIC PERIOD FAUNAL USE AT MAYA HAK CAB PEK
ROCKSHELTER IN SOUTHERN BELIZE

A Thesis
presented in partial fulfillment of requirements
for the degree of Master of Arts
in the Department of Sociology and Anthropology
The University of Mississippi

by
STEPHANIE R. ORSINI

May 2016
ABSTRACT

Very little is known about Paleoindian and Archaic subsistence strategies of the people of Mesoamerica prior to the development of ceramics. Rockshelters with good preservation and stratigraphic deposits can provide excellent contexts for a comparative faunal analysis though time. In February of 2014, the Bladen Paleoindian and Archaic Project (BPAP), directed by Dr. Keith Prufer, began excavations at the rockshelter Maya Hak Cab Pek (MHCP). The site has evidence for human activities from the Paleoindian period (11,500 BC to 8,000 BC) through the Preclassic Maya period (2,000 BC to AD 250). This research uses zooarchaeological analysis to investigate animal use in the rockshelter and how it changed from preceramic and to ceramic periods. Statistical analysis including, the chi-squared statistic and the Shannon diversity index, of 1,651 bones and more than twenty vertebrate species, show that there is a significant difference in species diversity between preceramic and ceramic times at MHCP. The preceramic has a more focused animal use with an emphasis on large mammals, while the ceramic assemblage is more diverse with an emphasis on medium mammals.
DEDICATION

This thesis is dedicated to my cat Charles, who moved across the country with me in order to complete this research. He has sat beside me through endless hours of writing, and always offered comfort and companionship.
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I am also grateful to Dr. Keith Prufer of the University of New Mexico for allowing me to participate in the Bladen Paleoindian and Archaic Archaeological Project (BPAAP). This research was conducted under permits granted by the Institute of Archaeology (IOA) of Belize and Forestry Department by Dr. Jaime Awe and Dr. Jon Morris. I am extremely thankful to Dr. Jaime Awe, Dr. Julie Hoggarth, and all additional staff members of the Belize Valley Archaeological Reconnaissance Project (BVAR) for starting my archaeological career and their continued support and endless advice. Without BVAR, I would not have had the opportunities that have led me to writing this thesis. Dr. Jon Lohse also graciously dedicated his time and
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CHAPTER 1: INTRODUCTION

The goals of my research are to examine preceramic and ceramic faunal use, with a focus on understanding Archaic and Paleoindian period foodways and how they compare to subsistence patterns of the Maya at Maya Hak Cab Pek (MHCP).

Figure 1  Map of Belize
MHCP is a large rockshelter occupied from 10,030 BC to approximately AD 250 with fauna representing over 10,000 years of occupation and use by Maya and pre-Maya groups living in the region. MHCP is located in the Ek Xux Valley of the Maya Mountains, in the Bladen Preserve, in Toledo District of Southern Belize (Figures 1 and 2).

By looking at the fauna from MHCP, which was used from the Paleoindian (11,500 BC to 8,000 BC) through the Preclassic Maya periods (2,000 BC to AD 250), we can determine if there is change in the diversity of species utilized for consumption. While some species are used before and after the introduction of ceramics at MHCP, such as jute snails (*Pachychilus* spp.), blue land crab (*Cardisoma guanhumi*), and brocket deer (*Mazama* sp.), animal use during preceramic period is focused on fewer species than during the ceramic period. There is a statistical difference in the species diversity of the assemblage, which may relate to the
introduction of ceramics and associated changes, such as increased sedentism that affected the activities occurring in and around the rockshelter.

Preclassic Maya period (2,000 BC to AD 250) animal use is well documented, but publications that focus on Paleoindian and Archaic zooarchaeology are limited. The Archaic period was a time of transition and included the first settled villages, the beginning of agricultural practices, and the introduction of ceramics. These major developments had all occurred by the time we begin characterizing people as Maya (Inomata et al. 2013:467; Lohse 2010:312-317). The Paleoindian period differs in timeframe from region to region (Cannon and Meltzer 2004:1956; Emery 2004b:1; Götz 2008:154-155). This necessitates more faunal analyses in order to establish subsistence patterns regionally as opposed to applying few studies to broad regions (Cannon and Meltzer 2004:1955; Bousman and Vierra 2012:7-10).

While I am comparing preceramic to ceramic period animal use, my intentions are to examine the changes in subsistence and how the diversity of species differs after ceramics are introduced. Ceramics are often used as a proxy for sedentary communities and imply that people relied on agriculture for most of their subsistence needs (Marshall 2006:154).

Background

As pointed out by Lohse and colleagues (2006:221), rockshelters are ideal places to look for early cultural remains as they contain some of the most well preserved contexts for organic material. Some of the earliest sites known to have human occupation in Mesoamerica are found in rockshelters and caves in the Oaxaca and Tehuacan Valleys in Mexico dating as far back as 10,500 BC (Zeitlin and Zeitlin 2000). Tropical regions such as Mesoamerica often have preservation issues that limit the recovery, representation, and interpretation of faunal remains, and this is one of only a small number of sites in Mesoamerica that has preserved faunal remains. The Paleoindian period spans from 11,500 BC to 8,000 BC. In the 1950s, Paleoindians were
depicted as big game hunters, based on excavations done in the late 1930s and early 1940s by E.H. Sellards and colleagues. More recent research suggests more diversity in subsistence strategies that might include the use of small and medium game species (Cannon and Meltzer 2004:1981; Hill 2007:417).

The Archaic period spans from 8,000 BC to 900 BC. In 1958, Willey and Phillips (1958:107-11) defined the Archaic period and its characteristics, including a shift from big game to a larger variety of smaller fauna (Bayham 1979; Flannery 1969, 1989; Bousman and Vierra 2012:2). The beginning of the Archaic marks a major transition characterized by environmental changes that caused a change in both fauna and flora (Lohse et al. 2006:216, 219). This included the extinction of at least 35 mammalian genera (Grayson 1991). Furthermore, according to Flannery (1969, 1989), the wetter conditions, warming climate, and sedentism that occurred in the Late Archaic period led to a shift from a focus on large mammals to an increase in the utilization of smaller fauna and also in aquatic fauna.

The preservation of remains at MHCP is unusual and allows for a detailed analysis of early human diet. The remains at MHCP also demonstrate some of the earliest evidence of human occupation known in the Maya lowlands (Prüfer et al. 2014:2, 11). This time period is not well studied in the Maya area, and not many sites prior to 3,400 BC are documented in Belize with the preservation of Archaic and Paleoindian faunal remains (Lohse et al. 2006:210). Most Paleoindian sites in Mesoamerica have been dated to the period by the presence of megafauna and not by C14 dates (Ochoa 2012:133). MHCP does not contain megafauna, but relative and absolute dating methods present a timeline for the site that span from 10,030 to 9,461 BC, placing it securely within Archaic and Paleoindian periods (Prüfer et al. 2014:2).
The site presents a unique opportunity to examine animal use among the earliest inhabitants of Belize and the change in diversity of animals utilized by the people at MHCP during the later Preclassic period (2,000 BC to AD 250) rockshelter use.

**Methods**

The methods used to collect the data used in my thesis include species identification, Number of Identified Specimens (NISP), Minimum Number of Individuals (MNI), and statistics such as chi-squared and the Shannon diversity index (1949). MNI and NISP will help understand the reliance upon specific animals for subsistence. NISP is a simple calculation, which allows us to see how much of the collection is identifiable. MNI tells us the smallest number of animals that could have been present to make up the collection at hand. This does not mean there were not more animals than what the MNI shows, but simply the fewest possible animals (Beisaw 2013:129-130; Morin 2012:68). I apply MNI and NISP to both the preceramic and ceramic period faunal assemblages separately to examine the change in diversity between the two assemblages.

Analysis for this research was completed by comparing the NISP from the preceramic and ceramic levels, as MNI results were too small for meaningful comparisons. I analyzed the data using the Shannon diversity index (1949), a simple statistical test based on the number of categories that measures diversity based on proportional species (Johnson 1984:232-233; Shannon 1949).

I sampled 1,651 specimens (with a total weight of 1,018.85 grams) of the nearly 5,000 faunal remains collected from MHCP. This sample includes all faunal remains collected from Unit 1E, a two by two meter excavation unit at MHCP consisting of 14 arbitrary levels. The preceramic levels (9-14) contain 1,051 faunal remains (weighing 612.28 grams) and the ceramic levels (1-8) include 600 faunal remains (weighing 406.57 grams). This unit contains faunal
remains in all levels and has the most complete representation of both preceramic and ceramic use of the rockshelter. Unit 1E also contains the most radiocarbon dates, allowing me to securely date faunal remains to their context and time period.

Preceramic occupation is found in levels 9 through 14, and levels 1 through 8 contain ceramics. Level nine has been dated to 3,499 to 3,348 BC and level fourteen was dated to 8,762 to 9,120 BC. Due to the nature of MHCP, the best way to separate the faunal remains is by the presence or absence of ceramics. Ceramics appear in the Late Archaic levels of the rockshelter and span through Preclassic levels. By grouping the faunal collection into preceramic and ceramic levels, the Archaic period will be divided in two and it will be included in both groups.

Results

My research demonstrates that there are over 20 species in the faunal assemblage including both large and small mammals, birds, reptiles, and large amounts of jute. Jute is a freshwater snail that is common in southern Belize, and has been a large part of subsistence for people in this area from Paleoindian through modern times. The matrix contains up to 50 percent jute in some areas of the excavations, and many burials at MHCP were covered with jute shells. However, due to the large numbers of jute shells, the snail shells were not collected or exported with the faunal remains (Prufer 2014:8; Prufer 2002:227).

However, there are some notable differences. Preceramic levels have fewer species and more large mammal bone fragments. In contrast, ceramic levels have six more species, a more diverse array of fauna, and an increased use of reptiles and aquatic resources.
Conclusions

By conducting this research, I hope to show that the change over time in animal use is present and that the nomadic lifestyle of the preceramic people of MHCP drastically changes the not only faunal utilization but the use of the rockshelter itself from preceramic to ceramic periods. I also hope to provide additional research on regional subsistence patterns in Paleoindian and Archaic periods.
CHAPTER II: BACKGROUND

This chapter provides an overview of the studies that characterize the earliest faunal use in Mesoamerica, especially in what became the Maya region. There is little information available about the animal use of the Paleoindian and Archaic periods, but during the Maya period there is significant variability among regions and in different contexts (Bousman and Vierra 2012:7-10; Cannon and Meltzer 2004:1956; Emery 2004b:1; Götz 2008:154-155). MHCP tells us about the changes over time in the lowlands of southern Belize, especially before and after the introduction of ceramics, which changes the storage, cooking, and culture associated with subsistence. Faunal analysis can tell us a considerable amount about subsistence patterns in the archaeological record and helps us understand the economic and cultural reasons for food choices.

There is little early faunal data published in the archaeological record. Few faunal remains endure the decomposition that occurs at sites occupied during the Paleoindian and Archaic periods. Those that do consist mostly of larger mammals or megafauna, as they preserve far better than smaller fragile remains of birds, reptiles, and small mammals (Bousman and Vierra 2012:7-10; Cannon and Meltzer 2004:1956). Maya sites have better preservation than those from Paleoindian and Archaic periods. The most prevalent animal in the archaeological record of Mesoamerica is the white-tailed deer (Emery 2007:189). The turkey later becomes an important dietary element in some parts of the Maya world, and replaces the dependence upon large mammals we see in earlier occupations in Mesoamerica (Emery 2004c:47-48).
Both freshwater and marine sources are heavily used throughout time in Mesoamerica. Snails, mollusks, crabs, and fish are a vital part of the Mesoamerican diet throughout time, especially at sites located near aquatic resources (Götz 2008:164-165, 167; Masson 1999:106, 111, 113; Pohl 1985:109).

In this chapter, I overview the faunal record during the Paleoindian, Archaic, and Preclassic Maya periods. I also address environmental changes and lithic technologies, which have important implications for the types of animals relied upon for subsistence. By studying a site such as MHCP that contains remains from all three time periods, we can see the changing subsistence patterns and better understand animal use in this region of Mesoamerica.

The Paleoindian Period in Mesoamerica

The Paleoindian period begins at the end of the Pleistocene epoch and dates from 11,500 BC to 8,000 BC. The term “Paleoindian period” was first used as a stage of human history by Roberts in 1940. Paleoindians were first characterized as specialized big game hunters based on excavations by E.H. Sellards and his colleagues beginning in the 1930’s and continuing through the late 1940’s (Bousman and Vierra 2012:2). People of this time were nomadic, and hunting strategies focused on large mammals. Sites of this period are usually dated by the presence of fluted points, as there is a lack of preserved datable material (Awe 2005:1; Bousman and Vierra 2012:2-4; Lohse et al. 2006:209). The Paleoindian period has two distinct points: fishtail points, which are found in the south, and Clovis points in the north. Belize is an important intersection of these two technologies and is one of few places in Mesoamerica where we find both types of points, which has important implications for the peopling of the Americas.
Subsistence

The Basin of Mexico is an important geographic area for evidence of the first humans in the New World. It is a high plateau characterized by extensive shallow lakes during the late Pleistocene that may have provided extensive resources for early peoples in the Americas. While Paleoindians focused their hunting strategies on big game, they also relied on smaller animals that are still present in these areas today.

After the introduction of humans into the Americas, there was a massive extinction of megafauna in North America near the end of the Pleistocene and Paleoindian period. This is believed to be due to a combination overhunting and rapid climate change, but there is still little evidence to prove any single cause (González et al. 2008:7). Over 35 mammalian genera became extinct at this transition; including, the giant horse (Equus sp.), mammoth (Mammuthus), mastodon (Mammut), camel (Camelops), llama (Tanupolama, Hemiauchenia, and Palaeolama), muskox (Bootherium), shrub-ox (Euceratherium), tapir (Tapirus sp.), giant peccary (Mylohyus and Platycopus), serval wild cat (Cervales), giant beaver (Castoroides), short-face bear (Tremarctos and Arctodus), deer (Navahocerus and Sangamona), pronghorn (Tetrameryx, Stockoceros, and Capromeryx), saber-toothed cat (Homotherium and Smilodon), American cheetah (Miracinonyx), capybara (Hydrochoerus), giant armadillo (Glypotherium and Holmesina), giant ground sloth (Eremotherium, Northrotheriops, Megalonyx, and Paramylodon), short faced skunk (Brachyprotoma), and Aztlan rabbit (Aztlanolagus) (Grayson 2007: Table 1). This dramatic shift in animal species, mostly mammals, along with the extinction of 19 genera of birds, drastically changed subsistence patterns (Grayson 2007:2). While megafauna are present in Mesoamerica, there are no documented sites where megafauna are associated with cultural
materials. For this reason, it does not seem that big game hunting of megafauna was key to subsistence strategies for Paleoindians in Mesoamerica.

While no megafauna are have been discovered in Mesoamerica in association with human hunting activities, skeletal remains demonstrate the presence of humans in Mesoamerica by 11,500 BP. Human skeletal remains at El Peñon III date to 10,755 ± 75 BP, those in Texcal cave date to 7,480 ± 55 BP, and skeletal material at San Vincente Chicolopan date to 4410 ± 50 BP. At Tlapacoya, animal bones associated with a hearth were dated as early as 24,000 ± 4,000 BP, while skeletal remains from the same site were dated to 9,920 ± 250 BP. A second hearth was dated to 21,700 ± 500. No provenience for this site was recorded as the original excavations were done in the 1960’s after road construction (Gonzalez et al. 2003:383-385; Ochoa 2010:131).

There is evidence that groups with “flake industry” tool traditions were highly dependent on freshwater snail and shellfish, while coastal sites relied heavily on marine resources (Ochoa 2012:134). Carbon and nitrogen stable isotope analysis on both human and animal remains at four sites, including Peñon III, Tlapacoya I, Texcal Cave, and San Vincent Chicolopan, has determined that the people relied on a significant proportion of plant resources rather than marine sources based on C4 levels. The plant sources may reflect the diets of herbivores eaten by these humans rather than their own diets (Gonzalez et al. 2003:379, 385).

The Basin of Mexico offers the best evidence for association of aquatic fauna with lithic artifacts (Ochoa 2012:132-133). At Santa Marta, a rockshelter located in Chiapas, Mexico, large amounts of jute snail shells indicate its importance in subsistence. No megafauna was recovered at Santa Maria. There is botanical evidence found on lithic technology for the early horticultural practices. This occurrence dates late in the Paleoindian period and possibly into the beginnings
of the Archaic period, while the site itself dates as early as 10,460 ± 50 RCYBP. Pollen analysis presented evidence of starch grains, along with cacao, green tomato seeds, figs, and other tropical vegetables. Faunal remains were also recovered at this site and include deer (*O. virginianus* and *Mazama* sp.), peccary (*Dicotyles*), rabbit (*Sylvilagus* sp.), snakes (*Crotalus* sp.), iguanas (*Iguana* sp.), tortoises, and large amounts of freshwater jute snails (*Pachychilus* sp.) (Ochoa 2010:2-3; Ochoa 2012:135).

Underwater archaeologists have recently explored cenotes, sinkholes created by the collapse of limestone bedrock exposing groundwater, and underwater river systems in the Yucatan peninsula. While an Archaic presence was known here, it was believed that the Yucatan’s lack of accessible fresh water sources prevented Paleoindian peoples from inhabiting the area. However, recent excavations done in these systems have confirmed Paleoindian occupation. These sites include cenotes such as Aktun Ha, La Chimena, and cave systems such as the Naanjal cave system and El Templo. Faunal remains, such as the camelid (*Hemiauchenia macrocephala*), proboscidean (*Gomphotherium* sp.), tapir (*Tapirus bairdii*), giant armadillo (*Glyptotherium* cf., *G. floridanum*), American horse (*Equus conversidens*), fox (*Urocyon cinereoargenteus*), and rabbit (*Sylvilagus* sp.), along with human remains and hearths have been found in most of these systems and date to 13,300-12,900 CALYBP. The faunal remains include fossilized bones, some of which are partially burned and have cut marks, which indicate human consumption of the animals (González et al. 2008:8-17, 19).

Excavations at Actun Halal, a rockshelter in Caves Branch in Belize, revealed faunal remains dating to the Paleoindian period and included a maxillary fragment of a peccary (*Tayassuidae*) along with a maxillary fragment from a spectacled bear (*Ursidae*) and two partial teeth fragments of a horse (*Equidae*) (Lohse et al. 2006:216, 221; Awe 2005:2). Although not
much analysis was possible on these three animal fragments, it did supply archaeologists with reassurance that some faunal remains have survived in the Mesoamerican region, as well as show that these animals were present. Paleoindian peoples would have been residing in areas similar to Actun Halal, and rockshelters would have been used in a wide range of activities, such as butchering and consumption. Rockshelters were dwellings for nomadic peoples, as opposed to later periods when rockshelters served as processing or ritual sites. Faunal remains recovered at Actun Halal show the importance of rockshelters for preservation of early archaeological contexts in Mesoamerica (Lohse et al. 2006:216, 221).

Other sites containing megafauna include El Gigante rockshelter in Honduras and Actun Lak, in Cayo District, Belize. Two teeth from a Pleistocene bovid (Euceratherium sp.), more commonly known as the shrub-ox, were located at El Gigante; however, they are believed to have been deposited before human occupation of the rockshelter (Scheffler et al. 2012:602-604). El Gigante does contain fauna utilized by humans, but only during the Archaic period. Actun Lak, a cave in western Belize, is the most southern site to contain the remains of an extinct sloth (Northrotheriops shastensis). Like the remains discovered at El Gigante, the sloth remains are not associated with human activity (Iuliis et al. 2015:153-154).

Faunal remains associated with Clovis points contain mostly medium-sized grazing animals, including white-tailed deer (Odocoileus virginianus), peccary (Dicotyles), and Pleistocene horse (Equus sp.). In excavations at the site of Los Grifos in Chiapas in southeastern Mexico, two fluted points have been discovered, including a Clovis point and a fishtail point (lithic technology described in detail below). This is the first co-occurrence of both these styles having been recorded in Mesoamerica (Ochoa 2010:2).
Lithic Assemblage

Lithics are one of the few materials that survive in tropical environments and are heavily relied upon for interpretations of the subsistence of Paleoindians. Fluted points have been discovered across Mexico, in the Guatemalan highlands, Belize, Honduras, and Panama. Fishtail points have been recovered in Chiapas, Belize and at the site of Los Grifos (mentioned previously). These lithic toolkits have important implications for the types of game hunted by Paleoindian peoples (Ochoa 2012:132). Belize is an intersection of these two lithic technologies, representing mobility of people, and possibly groups with different geographic origins. However, while fluted points are important indicators of Paleoindian time periods, most Paleoindian lithic assemblages in Mesoamerica, including at MHCP, consist almost exclusively of expedient tools (Prufer, personal communication).

Implications and Future Research

Overall, much more work needs to be done as many sites were excavated in the mid 1900’s and recovery and dating techniques have changed significantly since then. Current research suggests that the shift from Paleoindian period into the Archaic period happened at different times in different regions. Megafauna and other animals disappeared at different times in different parts of the Americas. The end of the Pleistocene marked shifts in fauna, the environment, and in human adaptations which can be better understand by studying transitions between periods, opposed to applying select studies to the entire time period (Bousman and Vierra 2012:6-8).
The Archaic Period in Mesoamerica

The Archaic period is characterized as a time of change in the composition of animal communities. Megafauna gradually became extinct, and people became more sedentary, inventing and adopting ceramics and relying more heavily on cultivated, and eventually domesticated plants patterns (Lohse et al. 2006; Bousman and Vierra 2012; Rosenswig 2015:115). The Archaic period dates from 8,000 BC to 900 BC at the start of the Holocene epoch and marks a major transition period. Although William Richie was the first to characterize the Archaic as a cultural period with stable societies and limited cultural change, he also believed this was the transition between mobile big game hunting societies and settled agricultural societies. It was then further characterized by Willey and Phillips as a transition period from large to smaller fauna along with other transitions (Bousman and Vierra 2012:2; Willey and Philips 1958).

Little is known about human activity during the Archaic period prior to 3,400 BC in Belize due to lack of dateable material. This could be due to the changing environment at the beginning of the Archaic, which included warming climates and changing waterways and an increase in lagoons and swamps. These changes caused large accumulations of sediment that may have buried Archaic and Paleoindian remains meters beneath the surface (Lohse et al. 2006:221; Rosenswig 2015:115).

Subsistence

Sedentism, agriculture, and ceramics are all fundamental changes that greatly affected subsistence patterns. Little research has been published on faunal reports in the Archaic period. In order to better understand patterns observed in animal use, data are drawn from sites across North America, not just Mesoamerica. According to Bayham (1979), Archaic peoples in North
America increasingly relied on smaller fauna as the preferred larger fauna began to be less available (Bayham 1979:233). Kent Flannery explains this increased use of smaller fauna as the Broad Spectrum Revolution (BSR) (1969). This theory was first to explain the increased breadth in diet in the Near East, but Flannery later applied the theory to his work in Oaxaca in 1989. The change from a focus on large game to a broad diversity of species at the end of the Archaic period seems to be a widespread phenomenon (Flannery 1969, 1989; Zeder 2012:242). With the environmental changes discussed earlier, such as rising sea levels, and an increase in river systems, swamps, and wetter conditions in general, there was an increase in use of small aquatic game such as snails, turtles, crabs, and others (Lohse et al. 2006:210, 216; Rosenswig 2015:120-124; Zeder 2012:242-245).

These conditions also reduced mobility, setting the stage for sedentism. As mobile groups were looking for areas to settle, sites near these aquatically rich areas become more favorable and later become important areas of growth (Flannery 1989; Zeder 2012:243-245). The BSR has long been relied upon to explain the phenomenon of increased diversity in small game and a shift away from the large game focus of the Paleoindian period (Flannery 1969, 1989). This shift was a reaction to the changing environment, and while there was an increase in reliance on a broad variety of small game, large game was still preferred. The BSR was “the result of reduced availability of higher ranked prey that lowered foraging efficiency”, which resulted in a broad diversity of animal use (Zeder 2012:245). Flannery (1969) also states that all these changes and reactions set the stage for the beginnings of agriculture.
In 1989, Flannery applied the BSR to his work at Guilá Naquitz, a cave site located in the Valley of Oaxaca, Mexico. The site was occupied multiple times and is dated to between 8,000 and 6,500 BC. The fauna at this site include white-tailed deer (*O. virginianus*) and rabbit (*Sylvilagus* sp.) (Flannery 1986:65-95; Rosenswig 2015:125-126).

In the Basin of Mexico, the site of Zohapilco near Lake Chalco dates to 5,500 to 3,500 BC. The site was likely occupied by a sedentary group and contained a variety of plant and animal remains. Fauna recovered at the site include white-tailed deer (*O. virginianus*) rabbit (*Sylvilagus* sp.), dog (*Canis lupus familiaris*) and many birds, including migratory geese, ducks, mallards, along with unidentified turtle and unidentified freshwater fish (Niederberger 1979: 135; Rosenswig 2015:127).

El Gigante rockshelter is located in the southwestern highlands of Honduras and contains remains from Paleoindian and Archaic periods. The rockshelter maintained dry conditions, which have helped preserve these remains. The fauna from the Archaic layers have yet to be formally analyzed, but preliminary identifications include mammals such as the agouti (*Dasyprocta punctata*), paca (*Agouti paca*), armadillo (*Dasypus novemcinctus*), porcupine (*Coendou* sp.), opossum (*Deidelphis marsupialis*), bats (*Chiroptera*) and rabbit (*Sylvilagus* sp.). Other mammals recovered in the rockshelter include possible dog (*Canis lupus familiaris*), and howler monkey (*Alouatta* sp.). Large mammals may include jaguar (*Felis onca*), tapir (*Tapiris bairdii*), and the most prevalent species, white-tailed deer (*O. virginianus*). Reptiles consist of iguana and turtle, and birds may include turkey (*Meleagris* sp.) and not yet identified waterfowl species. Jute snails (*Pachychilus* ssp.) were also identified but amounts are not noted in the preliminary results (Scheffler 2008:138-139). Projectile points found at the site indicate the preference for large fauna; however, there is a much higher presence of small fauna within the
rockshelter (Scheffler et al. 2012:603-604). There is a decline in the utilization of larger game through the Archaic period at El Gigante based on preliminary counts of large, medium, and small mammals (Scheffler 2008:139). Few sites contain remains spanning both the Paleoindian and Archaic periods, but sites such as El Gigante rockshelter demonstrate an increase of diversity of species in the Late Archaic period.

Due to the minimal number of Archaic period faunal reports in Mesoamerica, we must look elsewhere in North America in order to understand patterns in Archaic period animal use. As previously mentioned, Bayham (1979:227) attempts to characterize patterns of animal exploitation by comparing faunal assemblages from four sites in North America. These sites include Russell Cave, Alabama (Griffin 1974), Rodgers Shelter, Missouri (Wood and McMillan 1976), and Hogup Cave, Utah (Aikens 1970). Russell Cave is a stratified rockshelter dating from 10,000 BC to AD 1650. The Archaic period is well represented at Russell Cave. The gray squirrel (*Sciurus carolinensis*) was the most frequently occurring species at Russell Cave. The cave also contained remains of coyote (*Canis* sp.), porcupine (*Erethizon dorsatum*), and collared peccary (*Tayassu* sp.) (Griffin 1974).

Similarly, at Rodgers Shelter, there is a high frequency of gray squirrel (*S. carolinensis*) and fox squirrel (*S. niger*), but the eastern cottontail (*Sylvilagus floridanus*) made up the highest percentage of the faunal assemblage. Hogup Cave was dominated by the black-tailed jackrabbit (*Lepus californicus*), and there were also a large number of rodents, including kangaroo rats (*Dipodomys* sp.), wood rats (*Neotoma* sp.), and pocket gophers (*Thomomys bottae*) (Bayham 1979:228). Bayham concludes that faunal patterns at these Archaic sites demonstrate an increase in small fauna representation due to a decrease in preferred large fauna (Bayham 1979:233).
Lithic Assemblage

Large projectile points are important to subsistence in areas with poor preservation of organic materials as they indicate the importance of large fauna within the diet (Scheffler et al. 2012:603). Stone tools were increasingly made from higher quality materials, most of which are associated with cultivation practices (Lohse et al. 2006:216). Again, there is a lack of datable material from Archaic sites, so lithics recovered in excavations are vital to dating many sites. Lithics also tell us a great deal about hunting practices and other agricultural practices. Lowe points and Sawmill points are both common lithics associated with the Archaic period in Belize (Kelly 1993:215-216; Lohse et al. 2006:218). These are the only bifacial tools present in preceramic periods; however, many uniface lithics are part of a long-lived Mesoamerican lithic technology beginning in Late Archaic (Lohse et al. 2006:219; Rosenswig 2004:267).

Stone tool technology is one of many cultural continuities during in the Late Archaic (Lohse et al. 2006:219; Rosenswig 2004:267). Macroblades continue well into the Maya civilization, as do many other lithic technologies that begin during the Archaic period. Distinctive unifaces found across Belize beginning in 1,500 BC have evidence of use in soils and are believed to have been used for clearing farmable land (Lohse et al. 2006:219).

Concluding the Archaic Period

The time scale of the domestication of different plants varies, but the domestication of maize, which was the most influential crop in Mesoamerica, dates to 2,500 BC. These major changes, although over a large span of time, would have greatly impacted what people were eating and how they processed and prepared their foods. We also see evidence for the clearing of forests based on pollen analysis by 2,500 BC. Cultivation was accelerating rapidly when the
introduction of ceramics appeared in the archaeological record. This implies that people were becoming more sedentary (Lohse et al. 2006).

The introduction of agricultural practices and use of ceramics would have changed the diet of Archaic peoples. The environmental changes in the Late Archaic period (3,400 to 900 BC), combined with the effects of the extinction of megafauna, encroaching shorelines, and an increased reliance on plants and the introduction of ceramics all contribute to changes in animal use patterns (Lohse et al. 2006:210, 216; Rosenswig 2015:120-124). This would have resulted in a heavier reliance on plants, cultural transitions, and an increase in sedentary life. The increased reliance on plants began early in the Archaic period and would have led to the domestication of many plants that early Archaic peoples used frequently (Kennett 2012:147; Lohse et al. 2006:212; Rosenswig 2015:118). Agriculture first appears in Belize around 2,500 BC, followed by the introduction of ceramics. The earliest irrefutable date of the appearance of ceramics is 1,000 BC and suggests that people were increasingly sedentary (Inomata et al. 2015:4; Inomata et al. 2014; Lohse et al. 2006:212).

As people became more sedentary and increasingly reliant on agriculture, a large demographic shift occurred as populations grew larger. Tropical rainforests are sensitive to growth, so an increase in human populations also affects animal populations. Once full-blown agriculture occurred, there would have been changes in the habitat construction for many of these animals. Some animals adapt well to humans and include fields as part of their habitats. For example, insectivores may do well near humans, while peccary herds may relocate. It is possible that as larger mammals populations dwindled, people started exploiting smaller fauna as their numbers grew.
This would have impacted the use of the rockshelter. As the population increased in the Late Archaic period, peoples’ behaviors changed. Instead of using the rockshelter for processing, cooking, consumption as they did in the preceramic periods, rockshelter use shifted to a first-stage processing location, with later stages such as cooking and eating at their home base, away from the rockshelter.

The Maya Hak Cab Pek Rock shelter offers a rare window into subsistence changes as it includes human occupation from Paleoindian through the Preclassic Maya periods. Many of the changes during the Late Archaic could have resulted as a response to the changing environments that began in the Early Archaic (Lohse et al. 2006:223).

The Preclassic Maya Period

Foodways of the Maya have received more attention than those of Paleoindian and Archaic periods. The Maya world includes the present day Yucatán peninsula, southern Mexico, Guatemala, Belize, and parts of Honduras. This large area has a wide range of environments that vary in climate, biodiversity, and available resources. I will focus my research on the Lowland Maya area, specifically in southern Belize, which is a deciduous tropical rainforest. As MHCP only contains remains from the Preclassic Maya period, dating from 2,000 BC to AD 250, my focus is on faunal analyses from this time period. The Preclassic period is split into three timeframes, including the early Preclassic (2,000 to 1,000 BC), the middle Preclassic (1,000 to 400 BC), and the late Preclassic (400 BC to AD 250).

The Early Maya

The origins of the Maya begin at the end of the Archaic period and are often characterized by the rise of similarities in architecture, technology, and ideology. The Preclassic period is characterized by the beginnings of sedentary villages, increasing social stratification,
the introduction of ceramics, and formal Maya architecture (Inomata et al. 2013:467; Lohse et al. 2006:212; Rosenswig 2006:335). We see some of the earliest evidence for formal Maya architecture at Ceibal, Guatemala. The first architectural structure built at Ceibal has a radiocarbon date of 1,000 BC, which is the first dated example of Maya architecture in the lowlands at approximately the same time that sedentism and ceramics are found across Mesoamerica (Inomata et al. 2013:467). We also see beginnings of architecture and other characteristics of Maya sites beginning in the Preclassic in the Belize River Valley, including at the sites Cahal Pech, Baking Pot, and Barton Ramie (Awe and Helmke 2005:47). Other early examples of early Maya architecture appear at Tikal and Cival in the Petén area of Guatemala in the Maya lowlands. Fundamental social changes such as standardized architecture implies that these groups are interacting and are sharing other concepts such as beliefs and ideology, which all influence food choices (Inomata et al. 2013:470).

Looking at the subsistence of the Maya through faunal analysis first began in the 1930s. Early studies were done by zoologists, and the archaeological side of their work was largely ignored. In the 1960’s, there was a surge in environmental and economic interests in Mesoamerica with the rise of New Archaeology, and particularly in the Belize River Valley area with Gordon Willey’s archaeological projects. Zooarchaeological studies continued to rise in popularity until the 1990’s when there was a return to culture-based research with the rise of post processualism (Emery 2004c:38-39).

Implications of Ceramics

Agriculture, sedentism, ceramics, and social complexity often appear together (Marshall 2006:154). According to Rosemary Joyce, early villages are distinguished by ceramics, reliance on agriculture, economic exchange, and housing structures (Joyce 2001:5). Agriculture within
Mesoamerica is often depicted by an increased consumption of maize and an increase in tools used to process it (Rosenswig 2006:355). Some of these tools include grinding surfaces such as manos and matates and ceramics that were used for storage and processing grains such as maize.

Sophie D. Coe’s work with historical records of the first European contacts with the Maya show how the use of ceramics affected subsistence strategies. Cooking food in ceramics made more resources usable. Coe separates Maya cooking methods into four basic groups, including cooking, grinding, soaking, and fermentation (Coe 1994:7-8).

Maize, more than any other food, was the most critical part of the Maya diet. Maize has important ideological importance to the Maya and is important in daily diet as well as in ritual offerings. It was first domesticated from teosinte in the Tehuacan Valley of Mexico and spread across Mesoamerica (Coe 1994:10). Almost every meal would have had some form of maize incorporated into the dish. Solid maize food includes maize dough that was sometimes filled with beans or meats, wrapped in leaves or cornhusks and steamed, similar to tamales (Coe 1994:121-124). There also was a rise in the symbolic importance of maize, which can be seen in the iconography of the Maya.

As Coe (1994) states, meat was often included in maize based dough. Many types of meat could be included, such as deer (O. virginianus and Mazama sp.), dog (C. familiaris), turkey (M. ocellata), and other meats. Animal resources were an important part of the Maya diet, especially in feasting and ritual activities. Animals were included as parts of offerings to deities and to hosts of festivals. Animal resources greatly varied according to the ecology of the area, but one of the most common animal resources was the white-tailed deer (O. virginianus) (Pohl 1985:109).
Small game is also a common zooarchaeological find at Preclassic sites. At the site of Cuello in Belize, small game included rabbit (*Sylvilagus* sp.), agouti (*Dasyprocta punctata*), paca (*Cuniculus paca*), and armadillos (*D. novemcinctus*). Armadillos were a common food source throughout Mesoamerica. They were associated with corn and the underworld, as they were referenced in the Popol Vuh. The hero twins performed the ‘armadillo dance’ while passing though the underworld. They were an important part of Maya ideology and were often depicted on vessels (Benson 1997:58-59; Coe 1973:Figure 16; Prufer 2002:229; Reents-Budet 1994:Figure 5.32). Animals such as rabbit, armadillo, agouti, and iguana are present in Preclassic contexts at sites such as Blackman Eddy (Freiwald in Brown 2008:178). The coastal site of Cerros included small game such as armadillo, rabbit, agouti, paca, raccoon, and unidentified bird remains. While Cuello does not show any major patterns in small game, there are species that are present throughout the Preclassic period, such as opossums, agoutis, and armadillo, although they are not found in large numbers (Wing and Scudder 1991:87).

Cerros inhabitants also utilized white-tailed deer (*O. virginianus*) and dog (*Canis familiaris*) for a significant portion of their meat consumption. Dogs were domesticated, and therefore this was a constant source of meat available to the people of Cerros (Carr 1985:126). The faunal assemblage also included brocket deer (*Mazama* sp.), peccary (*Tayassu* sp.), and other unidentified carnivores and large mammals (Carr 1985:Table 8.1). The amount of white-tailed deer (*O. virginianus*) and dog (*Canis familiaris*) at Cerros and Cuello is similar. Excavations at Cuello in the late 1970’s recovered 7,974 bone and tooth fragments including 57 taxa. Mammals make up 77% of the fauna collected, most of which are dogs (*C. familiaris*) and deer (*O. virginianus* and *Mazama* sp.). Deer became more important throughout the Preclassic period at Cuello, as remains became more abundant through time and also occurred more
frequently in ritual spaces (Wing and Scudder 1991:84-86). At Pacbitun, Preclassic fauna includes white-tailed deer (*O. virginianus*), brocket deer (*Mazama* sp.), dogs (*C. familiaris*), and peccary (*Tayassu* sp.). White-tailed deer (*O. virginianus*), brocket deer (*Mazama* sp.) made up 19.6% of the preceramic faunal assemblage at Pacbitun (Stanchly 1999:44).

**Aquatic Resources**

Aquatic resources made up significant portions of the diets of people living at sites located near swamps, lakes, river systems, and the coast. Snakes were often roasted or added to stews. Frogs, turtles, salamanders, and lake shrimp were other lake resources that were cooked as well. These were often included in stews, roasted, or stuffed into tamales (Coe 1994:68). Fish were present in most some regional diets in Mesoamerica, especially near coasts or lakes (Masson 1999:106, 111). The preceramic faunal assemblage at San Felipe, in Guatemala, consists of 59% fish remains. Cerros, a coastal site in northern Belize, also relied heavily on aquatic resources. It is located near the shore, and marine fish make up a significant portion of the faunal assemblage with a wide variety of species (Carr 1985:126). Cerros contained blue crab (*Callinectes* sp.) sharks (*Carcharhinidae*), and various species of fish and turtles (Carr 1985:Table 8.1). At sites such as Colha, there is faunal evidence that crocodiles were eaten, although this is not common. They were sometimes found in ritual contexts and almost always found in high status residential areas (Masson 1999:106,111). Colha fauna also includes 42% marine organisms (Wing and Scudder 1991:87). Cuello has important implications for the Mayas use of fishing, as freshwater fish occur twice as much as marine species of fish.

Cuello’s second most common class of vertebrates is reptiles during the Preclassic period. Turtles were used extensively. The most abundant species is the mud turtle (*Kinosternon* sp.), followed by *Rhinoclemmys areolata* and then *Trachemys* sp. The large river turtle
(Dermatemys mawii) is also present at Cuello during the Preclassic period (Wing and Scudder 1991:84-86). Lubaantun (Wing 1975) and Colha (Scott 1982) also have large amounts of freshwater turtles. Turtle was an important food source for the Maya and has symbolic importance as well. The turtle is depicted in iconography and often depicts the earth and the birthplace of the corn god (Benson 1997:97; Prufer 2002:228; Pugh 2001:219).

Mollusks were another popular food during the Preclassic Maya period. Species such as Pomacea sp., Pachychilus spp., and Nephronaias spp. are prevalent at the site of Cuello, Lamanai (Pendergast 1981), Barton Ramie (Willey et al. 1965:525-528), Copan (Longyear 1952:16-17), and Tikal (Moholy-Nagy 1978) (Pohl 1995:109). At Pacbitun, Belize, the preceramic faunal assemblage consists of high amounts of marine and freshwater shellfish. Freshwater species such as Pachychilus indiorum, Pachychilus glaphyrus, Pomacea flagellate, and Nephronaias ortmanni are all present at Pacbitun (Stanchly 1999:42-43). The jute snail (Pachychilus sp.) is often downplayed in regard to subsistence of the Maya (Halperin et al. 2003:214; Healy et al. 2013:70). It is found in fast moving streams across the Maya area including southern Mexico, the Yucatan Peninsula, Guatemala, and Belize. Subsistence studies tend to focus on the importance of corn and the large game, but the Maya were proficient hunter-gatherers. The shells would often be used in ritualized feasting and then returned to caves and rockshelters as jute comes from the earth and was returned as offering (Halperin et al. 2003; Prufer 2002:227).

Modern Maya groups located in Toledo District, Belize use jute shells to temper pottery and burn the shells to use the powdered lime to add nutritional value to corn gruels. These shells would have offered high calcium content as well as other minerals (Healy et al. 2013:170-171). In prehistoric times these snails were also used in ceramic making, construction fill, ritual
practices, and as an important staple of the Maya diet especially in times when other animals were not available. At Maya Hak Cab Pek, jute consisted of at least fifty percent of the matrix within burials. The incorporation of jute with the burial of their dead displays the important role jute played in their lives (Halperin et al. 2003:211). Jute snails are high in fats, calories, and carbohydrates, and offer easily obtained dietary supplements that can be gathered from rivers and streams (Healy et al. 2013:174-177). In modern Maya groups in San Ignacio, Belize, men collect jute snails to be consumed. After the jute snails are gathered, they are kept in a bucket and fed corn tortillas or spices to replace the sandy riverbed contents within their digestive tracks. The snails are then cut to make meat removal easier and boiled in a stew before eaten. In archaeological contexts the snail shells are broken in a similar spot near the top of the spire and were most likely used in soups as well (Healy et al. 2013:178-179). The jute snail is used as part of subsistence by peoples during the Middle Preclassic period (900 BC) through some modern Maya cultures (Healy et al. 2013:179; Moholy-Nagy 1978:156).

Concluding Thoughts

Subsistence would have varied greatly in different Maya regions with different access to local resources and availability through trade routes across Mesoamerica (Emery 2004c:38). There are common large mammals that are favored pan-Maya such as the white-tailed deer, peccaries, and brocket deer. Many of these animals have been an important part of Mesoamerican subsistence from Paleoindian through Maya periods. Regional differences have a major impact on subsistence, as resources vary; however, the high level of interaction between Maya cultures did bring some regularity in Maya foodstuffs (Pohl 1985:109).

Access to resources is also an important factor, not only because of location but limitation to access because of status. This would have been a vital trading tool in early Maya
times as Mesoamerican trade routes were established. An increase in trade and the development of complex societies would also create status limits to access of certain resources (Pohl 1985:110). These status differences also would have been implemented through ritual practices and displayed by the elite and distinctions in foodstuffs among classes are present by the Late Preclassic period, which can be seen at sites such as Nohmul and Cerros (Pohl 1985:111; Webster 1977). All these factors will have important implications when observing faunal remains and it is important to keep these in mind when interpreting faunal data.
CHAPTER III: METHODS

In this chapter I present the methods used to collect the data used in this thesis along with quantification methods used in zooarchaeology. To understand the change in animal use over time, I observed the diversity of species present between preceramic and ceramic levels, which was determined by the association of the faunal remains with ceramic sherds. This chapter describes the recovery process of the faunal remains by the Bladen Paleoindian and Archaic Project (BPAP) at MHCP, the faunal assemblage, the quantification and recording process, taphonomic agents observed, statistics used, and the sources of error common within zooarchaeology.

Excavation Process

In February of 2014 BPAP made a two-day hike to the site of MHCP and stayed for 11 nights. The project included five professional archaeologists, local archaeological assistants, two rangers, and a staff member from the Institute of Archaeology (IOA) of Belize. The rockshelter is 32 meters wide by 8 meters deep. Three excavation units, two 2 by 2 meter units and one 1 by 3 meter unit, were established at MHCP along a north-south grid and excavated in arbitrary levels of twenty centimeters for the first 130 centimeters. Excavators then switched to arbitrary levels of ten centimeters, as the levels were less clear in the preceramic levels. Unit 1E, the sample chosen for this study, is located one meter east of the limestone wall face of the rockshelter. There were a total of fourteen levels within Unit 1E.
Levels one through eight represent the Preclassic Maya period (2,000 BC to AD 250) and the Late Archaic period (3,400 to 900 BC), and levels nine through fourteen represent the Early Archaic through Paleoindian periods (11,500 to 3,400 BC) (Prufer et al. 2014:5-6).

All matrix was screened through 1/8 inch mesh screens. Units were subdivided into quadrants, and all faunal remains were collected with the exception of jute snails (*Pachychilus ssp.*), which were weighed and left at the site due to copious amounts, an approximated 50% of the matrix, and insufficient means of transporting the jute back to the lab (Prufer et al. 2014:5, 8, 9).

Prufer’s dissertation (2002) research, based on excavations done in 1998 and 1999, at MHCP describes a heavy concentration of jute snails (*Pachychilus sp.*), which were found both within and outside of burial contexts and made up to an approximated 50% of the matrix (Prufer 2002:380-382). A sample of 2,233 jute shells were analyzed and a total of 1,898 (84.5%) were spire lopped, indicating human consumption of the jute snails (Prufer 2002:227).

Unit 1E contains fauna from all levels and is the focus of this study for two reasons. Unit 1W was excavated by Peter Dunham and Keith Prufer in 1998 and 1999 and is described in Prufer’s dissertation (2002), and therefore the fauna from the upper levels within ceramic times were not available for this study (Prufer et al. 2014:2; Prufer 2002). Furthermore, radiocarbon dates were collected from every preceramic level of Unit 1E, and 1W had only three radiocarbon samples dated. Sampling Unit 1E allows for study of a broader scope of time and has more reliable dates associated with the fauna.
Preceramic and Ceramic Comparison

In order to compare the fauna from MHCP, I separated the collection into preceramic and ceramic assemblages. Levels one through eight contain ceramic sherds and represents a clear separation from lower levels. Levels nine through fourteen represent the preceramic assemblage: Level nine has been dated to 3,499 to 3,348 BC, and level fourteen dates to 9,120 to 8,762 BC. The ceramic levels have not yet been dated, but the ceramics present represent the Preclassic period of the Maya, which spans from 2,000 BC to AD 250 (Prufer n.d.).
While there are not enough dates to tease out the chronologies within specific time periods, it is clear that ceramics appear after level 9 (3,499 to 3,348 BC) (Prufer n.d.).

Identification Process

I began my research by processing and completing a basic inventory of the MHCP faunal remains, including some preliminary species identifications and an assessment of the extent to which remains were burned in different contexts. I used this data to develop my thesis, and used comparative collections from the University of Wisconsin-Madison Zoological Museum, and the University of Mississippi as well as animal osteological reference manuals, including those by Olsen (1982, 1986), Gilbert (1993), Hillson (1992), and France (2009).

All specimens were washed and counted by undergraduate and graduate students at the University of Mississippi. Some preliminary identifications were completed under the supervision of Carolyn Freiwald, who supervised the independent study course. Bones were sorted into burned and unburned categories, including many unidentified small fragments. The count of fragments smaller than 0.25 centimeters was approximated. Recent breaks were counted separately; however, it was noted that they belong to the same element. I also recorded any cut marks, root etching, or gnaw marks visible to the naked eye within the excel sheet created for these data, but did not use this in my research.

After analysis, some bones that had been identified to taxa and weighed over 1.00 gram were photographed and sent to University of New Mexico for chemical analysis by Dr. Keith Prufer and Clayton Meredith. It was noted in the data sheet that these specimens were removed, but they are included in this analysis.
Faunal remains were identified to the lowest taxonomic level possible. If species could not be determined, I separated them by class, and mammals were further separated into size classes including small, medium, and large. Small mammals include rodents such as mice, squirrel, gopher, rat and other similarly sized animals. Medium mammals include rabbit, paca, agouti, armadillo, opossum, raccoon, dogs, and small cats such as the jaguarundi, ocelot, and margay. The large mammal category includes white-tailed deer, brocket deer, tapir, jaguar, puma, and peccary (Emery 2007; Savage 1971).

Quantification and Recording Process

Quantifications in zooarchaeology are largely uniform and allow for comparative research across similar environments. Common calculations include the Number of Identified Specimens (NISP), Minimum Number of Individual (MNI). The Number of Identified Specimens is commonly referred to as NISP and represents all the elements and fragments of elements identified within the assemblage. NISP is the simplest of these calculations. It is a record of each specimen within the sample (Beisaw 2013:136-133; Lyman 1994:101-111; Reitz and Wing 2008:167-168, 202-205). For the purpose of my thesis, I include all fragments, regardless of their level of identification. Teeth are counted as one element unless still articulated with the mandible or cranium. NISP counts were taken for each identified taxa, small mammals, medium mammals, large mammals, reptiles, birds, and for fragments identified only as vertebrate.

The Minimum Number of Individuals, or MNI, refers to the smallest number of animals it would require to produce the assemblage. This method is determined by manual counting. MNI takes more time to calculate than NISP but is more representative of the quantity of animals in the assemblage. It is important to remember that MNI does
not represent the actual number of each species identified, but the smallest number of animals. Sex and age are not accounted for in MNI as it could inflate the results (Beisaw 2013:129-130; Lyman 1994:101-111; Morin 2012:68; Reitz and Wing 2008:205-210).

For the purposes of this research, I calculated MNI of both preceramic and ceramic faunal remains.

NISP is a simple calculation and easily replicable, and makes one faunal assemblage comparable with another. However, NISP does not account for the variation of number of bones in different animal species. Some specimens are also more fragmented than others due to the fragility of bones. These variations cause under and over representation. For example, an NISP for an assemblage might be 30, but those 30 bones could all be representative of a single animal. The MNI addresses interdependency problems and misrepresentation of NISP mentioned above. However, MNI is not as easily replicable as NISP as many researchers calculate MNI differently (Boileau 2013:77-81; Bunn and Kroll 1986:434-435; Grayson 1984; Lyman 1994:102; Reitz and Wing 2008:205-210; Savage 1971).

Taphonomy

Taphonomy can be defined as any process that affects the bones postmortem. These include fractures, fragmentation, butchering, cut marks, gnaw marks, weathering and any other process affecting the bone after death (Gilbert 1993:5-7). For this research, I recorded the level of burning, weathering, cut marks, and gnaw marks on the bones; however, only the level of burning was used in my results.
**Burning**

Burning is considered evidence of human activity that implies that the bones were cooked, disposed of in a fire, used as fuel, cremated, or had accidental contact with fire. The color of the bone evidences the temperature the bone was exposed to. Brown to black, or slightly burned, is charred or carbonized. This infers the bones were exposed to low heat or high heat for a very short period of time. As the bone continues to burn, it will become calcined and be gray to white in color. Calcination of the bone is indicative of high heat or long periods of heat exposure. As the bones are burned they become more fragile and risk increased fracturing. Bones that are calcined are often considered to be bones that were thrown into a fire for disposal or cremation. Because burned bones are more fragile, they are often less identifiable as a result of a high degree of fragmentation. The fragmentation caused by a high degree of heat is distinguishable by the angular fragments with the same coloration of the internal surfaces. Bone that is partially charred is often caused by the roasting of meat, though it could be purposeful in order to make a portion of the bone more easily broken for tool production (Beisaw 2013:109-110; Lyman 1994:216-217, 384; Reitz and Wing 2008:132-135; Stiner et al. 1995).

I recorded whether the bones were charred or calcined. I also compare the percentage of both the ceramic and preceramic faunal assemblages to see if there is a pattern. I also separated the percentages of burning by each level of excavation to further identify if there was a pattern in burning among the faunal assemblages.

**Additional taphonomy**

There are many taphonomic agents that can modify bones besides human and animal activity. Plants, minerals, sunlight, and water can cause root etching, staining,
and/or cracking. For example, varying environmental conditions such as changes in temperature and change in moisture can cause cracking and discoloration. The more weathering a bone has, the longer it stayed on the surface, which can also tell us whether or not the bone was buried. The bioturbation of an archaeological site can also cause root etching, staining, and/or cracking. Soil variations change the coloration of bones as well (Lyman 1994:334-375; Reitz and Wing 2008:168-172). These taphonomic agents will not be used extensively in my research as most bones were well preserved and do not present significant taphonomic variability.

**Statistics**

I used the number of identified specimens (NISP) as the main basis for comparison of the preceramic and ceramic assemblages. I used the Shannon diversity index (1949) to assess the extent to which there were significant changes in the diversity of species. This simple statistic measures diversity based on proportional species representation in the preceramic and ceramic levels (Johnson, 1984:232-233; Bobrowsky 1989:7-9). If the Paleoindian and Archaic occupants of the rock shelter were focusing their subsistence efforts on fewer species, the resulting faunal assemblage would be less diverse.

I also used the chi-squared statistic to see if there is a significant relationship between the preceramic and ceramic assemblages and the species present within those assemblages. For this statistic, I grouped the animals by size and class into five categories, including small mammals, medium mammals, large mammals, reptiles, and birds.
Some faunal remains had to be excluded from the analysis in order to create broad categories. Shark, fish, unidentified vertebrates and mammals unidentified to size were excluded from the chi-squared analysis. There was only a single shark tooth and three fish bones within both assemblages; therefore, excluding these does not significantly change the results. The unidentified vertebrates tell us nothing about the diversity of the species present within the assemblages, so I also excluded these so as not to skew results. Lastly, there were 30 mammal bone fragments that were too small for size distinction that I did not include in the chi-squared test.

**Sources of Error**

Zooarchaeological research needs to account for variation in multiple areas of research. The first to consider is the recovery techniques. Some excavations are troweled only while others are screened. If the project is screening the matrix, we then need to take note of what size the screen is. Obviously the 1/16th inch screen will collect much smaller faunal remains than ¼ inch, but soil type, availability of supplies, and other factors may prevent projects from using finer screens. Flotation is another useful technique to recover the most representative faunal assemblage but may not always be an option. Standardized methods would help minimize variation in the zooarchaeological record (Emery 2004c:44-45; Reitz and Wing 2008:147-50).

Preservation is extremely variable in archaeological sites. It is affected by many factors including temperature, humidity, soil type and forms of bioturbation such as plant and animal disturbance. Tropical areas, such as most of Mesoamerica, are not ideal for preservation, but there are areas that preserve better than others. Caves and rockshelters, for example, have some of the best preservation in tropical climates since they are
protected from erosion, plant activity and rainfall. Levels of preservation should be noted in faunal reports so that comparability is better understood among assemblages. If these factors are not taken into account, the results of any comparative analysis will be flawed (Emery 2004c:43; Lyman 1994:354-37; Reitz and Wing 2008:140-143, 146-147). I include the numbers of unidentified bone fragments for both ceramic and preceramic assemblages from MHCP in the following chapter.

Sample size is a concern when trying to make meaningful interpretations of collected data. Sample sizes must be large enough to be representative (Emery 2004a, 2004c:38; Grayson 1978), and Emery has determined that it should consist of between 3,000 and 5,000 total identified specimens (NISP). She argues that when looking at previous faunal analyses and their sample sizes, this would be the number where the taxonomic richness stops growing with the NISP, and would therefore be the most representative of animal use (Emery 2004c:41; Grayson 1978).

Misrepresentation of certain species will occur, especially in areas of poor preservation, and will be altered by recovery techniques as well. Fish and bird remains are often either absent due to preservation issues, or are not collected due to recovery techniques. These fragile categories are often misinterpreted and must be addressed with caution when doing faunal analysis (Emery 2004c:47; Olsen 2006:3).

Conclusions

The methods described in this chapter were used to determine if there is a significant change in species diversity between preceramic and ceramic times at MHCP. I sampled faunal remains from Unit 1E, which has faunal remains in 13 of the 14 excavated levels.
The quantification methods used, including MNI and NISP, will help to understand the reliance upon animals for subsistence and if animal use patterns changed over time. The Shannon diversity index and the chi-squared statistic demonstrate that there is a significant difference in species diversity between the preceramic and ceramic assemblages.
CHAPTER IV: RESULTS AND DISCUSSION

This chapter examines the utilization of animals from the Paleoindian period through the Preclassic Maya period at MHCP. There is a significant difference in the diversity of animal use between the preceramic and ceramic period faunal assemblages. I begin the chapter with a description of the faunal assemblage using MNI and NISP. Percentages of taxa found in both the preceramic and ceramic period faunal assemblages will be listed along with the percentage of burned fauna within both assemblages. Using the Shannon diversity index (1949) discussed in chapter three, I will investigate the diversity of species used throughout time at MHCP and explore aspects of animal use that changed over time, along with what remained the same. A comparison with other cave and rockshelter contexts will offer explanations as to what behaviors changed the rockshelter assemblage, from different choices in aquatic animals to the types of activities the Maya and earlier occupants of southern Belize utilized the rockshelter for. I also discuss the results of the chi-squared test on broader categories of the faunal remains from the preceramic and ceramic periods.

Dates

The BPAAP ran radiocarbon dates on human remains from each preceramic level from unit 1E. However, many of the dates in preceramic levels are from intrusive burials and therefore are not included in Table 2, as the dates do not correlate with the levels they were sampled from. Level 14 dates securely fit within the Paleoindian period, but there is no clear separation between other Paleoindian and Archaic levels. For this reason, I
could not compare Paleoindian, Archaic, and Preclassic Maya period faunal assemblages, and instead focus on fauna from ceramic and preceramic levels. Additional samples were collected from MHCP, and these dates are in the process of being analyzed by Dr. Keith Prufer at University of New Mexico.

Table 1  Radiocarbon Dates from Unit 1E

<table>
<thead>
<tr>
<th>Level</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-7</td>
<td>Preclassic Maya</td>
</tr>
<tr>
<td>8</td>
<td>3499-3348 BC</td>
</tr>
<tr>
<td>9</td>
<td>5198-4836 BC</td>
</tr>
<tr>
<td>10</td>
<td>6660-6502 BC</td>
</tr>
<tr>
<td>13</td>
<td>7030-6992 BC</td>
</tr>
<tr>
<td>14</td>
<td>9120-8726 BC</td>
</tr>
</tbody>
</table>

**Faunal Assemblage**

The MHCP faunal assemblage is an interesting collection because it contains approximately 5,000 bone fragments from the Paleoindian period through the Preclassic Maya period. I analyzed 1,651 bone fragments that were recovered from unit 1E, representing 33.32% of the total collection. There are over 20 species identified in the faunal assemblage, including mammals, birds, and reptiles. In addition, many bones are charred and calcined. Gnaw marks were also fairly common but are not included in this analysis. There is a high frequency of armadillo (*Dasypus novemcinctus*), jute snail (*Pachychilus* spp.), and blue land crab (*Cardisoma guanhumi*). Jute snails represented an approximated 50% of the matrix of Unit 1E, but were not collected or counted. For this reason they are not included in the percentages of fauna in this chapter.
Table 2  Specimen Counts and Weights

<table>
<thead>
<tr>
<th>Category</th>
<th>Counts</th>
<th>Weights</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entire Assemblage</td>
<td>1,651</td>
<td>1,018.85</td>
</tr>
<tr>
<td>Preceramic</td>
<td>1,051</td>
<td>612.28</td>
</tr>
<tr>
<td>Ceramic</td>
<td>600</td>
<td>406.57</td>
</tr>
<tr>
<td>Level 1</td>
<td>12</td>
<td>22.87</td>
</tr>
<tr>
<td>Level 3</td>
<td>1</td>
<td>28.40</td>
</tr>
<tr>
<td>Level 4</td>
<td>99</td>
<td>90.60</td>
</tr>
<tr>
<td>Level 5</td>
<td>149</td>
<td>88.65</td>
</tr>
<tr>
<td>Level 6</td>
<td>196</td>
<td>101.76</td>
</tr>
<tr>
<td>Level 7</td>
<td>73</td>
<td>17.57</td>
</tr>
<tr>
<td>Level 8</td>
<td>70</td>
<td>56.72</td>
</tr>
<tr>
<td>Level 9</td>
<td>204</td>
<td>111.02</td>
</tr>
<tr>
<td>Level 10</td>
<td>134</td>
<td>94.45</td>
</tr>
<tr>
<td>Level 11</td>
<td>80</td>
<td>80.25</td>
</tr>
<tr>
<td>Level 12</td>
<td>210</td>
<td>62.31</td>
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<tr>
<td>Level 13</td>
<td>221</td>
<td>150.82</td>
</tr>
<tr>
<td>Level 14</td>
<td>202</td>
<td>113.43</td>
</tr>
</tbody>
</table>

*Preceramic Levels*

The preceramic faunal assemblage consists of 1,051 bone fragments weighing 612.28 grams. The assemblage is represented by 15 identified taxa. Charred or calcined bones made up 11.04% of the preceramic assemblage. Of the 1,051 analyzed specimens from the preceramic levels, 667 (63.46%) were identified to class or lower, while 337 (32.07%) were identified to species. The preceramic assemblage is 63.66% of the total analyzed sample. While this assemblage contains more specimens than the ceramic period levels, the preceramic assemblage also represents a much larger time period (~6,600 years) than the ceramic period (~3,650 years). Large mammals made up 15.03% of the assemblage (n=158), not including the large mammals that were identified to species. The preceramic levels had the highest amount of blue land crab (*C. guanhumi*),
making up 12.08% of the preceramic levels, followed by armadillos (*D. novemcinctus*) (8.09%) and brocket deer (*Mazama sp.*) (2.85%). Table 3 shows the NISP of the preceramic fauna. The table lists specimens identified to species organized in alphabetical order, followed by specimens identified to lower levels of identification.

Table 3  Preceramic Period Faunal Assemblage NISP

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>Count</th>
<th>Weight</th>
<th>Proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td>C. paca</td>
<td>Paca</td>
<td>5</td>
<td>5.95</td>
<td>0.008</td>
</tr>
<tr>
<td>C. guanhumi</td>
<td>Blue Land Crab</td>
<td>127</td>
<td>74.94</td>
<td>0.212</td>
</tr>
<tr>
<td>Actinopterygii</td>
<td>Fish</td>
<td>1</td>
<td>0.22</td>
<td>0.002</td>
</tr>
<tr>
<td>D. punctata</td>
<td>Agouti</td>
<td>5</td>
<td>6.63</td>
<td>0.008</td>
</tr>
<tr>
<td>D. novemcinctus</td>
<td>Armadillo</td>
<td>85</td>
<td>29.7</td>
<td>0.142</td>
</tr>
<tr>
<td>D. virginiana</td>
<td>Virginia Opossum</td>
<td>5</td>
<td>5.53</td>
<td>0.008</td>
</tr>
<tr>
<td>Felidae</td>
<td>Felid sp.</td>
<td>1</td>
<td>1.54</td>
<td>0.002</td>
</tr>
<tr>
<td>Mazama sp.</td>
<td>Brocket Deer</td>
<td>22</td>
<td>53.02</td>
<td>0.037</td>
</tr>
<tr>
<td>O. hispidus</td>
<td>Pocket Gopher</td>
<td>3</td>
<td>0.48</td>
<td>0.005</td>
</tr>
<tr>
<td>Procyonidae</td>
<td>Raccoon or Coati</td>
<td>1</td>
<td>1.58</td>
<td>0.002</td>
</tr>
<tr>
<td>Tayassuidae</td>
<td>Peccary</td>
<td>8</td>
<td>38.02</td>
<td>0.013</td>
</tr>
<tr>
<td>Testudinata</td>
<td>Turtle</td>
<td>28</td>
<td>25.19</td>
<td>0.047</td>
</tr>
<tr>
<td>Mammal</td>
<td>Small Mammal</td>
<td>32</td>
<td>15.77</td>
<td>0.053</td>
</tr>
<tr>
<td>Mammal</td>
<td>Medium Mammal</td>
<td>110</td>
<td>63.2</td>
<td>0.183</td>
</tr>
<tr>
<td>Mammal</td>
<td>Large Mammal</td>
<td>158</td>
<td>190.42</td>
<td>0.263</td>
</tr>
<tr>
<td>Mammal</td>
<td>Unidentified</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mammal</td>
<td>Mammal</td>
<td>30</td>
<td>8.35</td>
<td>0.050</td>
</tr>
<tr>
<td>Aves</td>
<td>Bird</td>
<td>29</td>
<td>13.59</td>
<td>0.048</td>
</tr>
<tr>
<td>Reptilia</td>
<td>Reptile</td>
<td>10</td>
<td>6.48</td>
<td>0.017</td>
</tr>
<tr>
<td>Rodentia</td>
<td>Rodent</td>
<td>7</td>
<td>1.87</td>
<td>0.012</td>
</tr>
<tr>
<td>Vertebrate</td>
<td>Vertebrate</td>
<td>384</td>
<td>69.8</td>
<td>0.640</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td></td>
<td>1051</td>
<td>612.28</td>
<td></td>
</tr>
</tbody>
</table>

There are a minimum number of 35 individuals within the preceramic levels, and 15 taxa. This number is most likely much higher due to the time span of these levels; a specimen from the lowest/oldest level is not from the same animal as one found in more recent or higher levels. As previously stated, due to lack the lack of radiocarbon dates outside of burial contexts, there is not a clear separation between Paleoindian and Archaic
periods and I did not estimate MNI separately between the time periods. There is an MNI of 13 blue land crabs (*C. guanhumi*), five brocket deer (*Mazama* sp.), two armadillos (*D. novemcinctus*), two opossums (*Didelphis virginiana*), two pocket gophers (*Orthogeomys hispidus*), and two rodents. There is one of each of the following animals: Paca (*Cuniculus paca*), agouti (*Dasyprocta punctata*), unidentified Felines (Felidae), raccoon or coati (Procyonidae), peccary (Tayassuidae), bird, fish, and reptile (Reptilia).

Table 4  Prehistoric Period Faunal Assemblage MNI

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>MNI</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>C. paca</em></td>
<td>Paca</td>
<td>1</td>
</tr>
<tr>
<td><em>C. guanhumi</em></td>
<td>Blue Land Crab</td>
<td>13</td>
</tr>
<tr>
<td>Actinopterygii</td>
<td>Fish</td>
<td>1</td>
</tr>
<tr>
<td><em>D. punctata</em></td>
<td>Agouti</td>
<td>1</td>
</tr>
<tr>
<td><em>D. novemcinctus</em></td>
<td>Armadillo</td>
<td>2</td>
</tr>
<tr>
<td><em>D. virginiana</em></td>
<td>Virginia Opossum</td>
<td>2</td>
</tr>
<tr>
<td>Felida</td>
<td>Feline sp.</td>
<td>1</td>
</tr>
<tr>
<td><em>Mazama</em></td>
<td>Brocket Deer</td>
<td>5</td>
</tr>
<tr>
<td><em>O. hispidus</em></td>
<td>Pocket Gopher</td>
<td>2</td>
</tr>
<tr>
<td>Procyonidae</td>
<td>Raccoon or Coati</td>
<td>1</td>
</tr>
<tr>
<td>Tayassuidae</td>
<td>Peccary</td>
<td>1</td>
</tr>
<tr>
<td>Testudinata</td>
<td>Turtle</td>
<td>1</td>
</tr>
<tr>
<td>Aves</td>
<td>Bird</td>
<td>1</td>
</tr>
<tr>
<td>Reptilia</td>
<td>Reptile</td>
<td>1</td>
</tr>
<tr>
<td>Rodentia</td>
<td>Rodent</td>
<td>2</td>
</tr>
</tbody>
</table>

**Total MNI:** 35

**Ceramic Levels**

The ceramic period faunal assemblage contains 600 analyzed bone fragments weighing 406.57 grams. A total of 8.33% of the ceramic assemblage analyzed was charred or calcined. Of the 600 bone fragments from the ceramic levels, 357 (59.50%) were identified to class.
The ceramic assemblage represents 36.34% of the total analyzed sample. Medium mammals represent 8.17% of the ceramic assemblage.

Of the fauna identified to species, the ceramic assemblage had the highest amount of blue land crab (*C. guanhumi*) making up 27.67%, followed by dog or coyote (*Canis* sp.) (1.83%).

The number of blue land crab (*C. guanhumi*) is high in both preceramic and ceramic periods, but makes up 27.67% of the ceramic assemblage. It is possible that people are collecting them from the river nearby, and eating them in the rockshelter, as they currently are abundant in the rainy season. It is possible that as population peaked in the area during ceramic periods, people became more reliant upon species such as the blue land crab for the protein. Further research needs to be done to understand why they are frequent in ceramic periods and not as abundant in the preceramic levels of MHCP.
Table 5  Ceramic Period Faunal Assemblage NISP

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>Count</th>
<th>Weight</th>
<th>Proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertebrate</td>
<td>Unidentified</td>
<td>243</td>
<td>23.53</td>
<td>0.405</td>
</tr>
<tr>
<td>Aves</td>
<td>Aves</td>
<td>7</td>
<td>2.54</td>
<td>0.012</td>
</tr>
<tr>
<td>Reptilia</td>
<td>Reptile</td>
<td>16</td>
<td>13.52</td>
<td>0.027</td>
</tr>
<tr>
<td>Mammal</td>
<td>Small Mammal</td>
<td>8</td>
<td>12.46</td>
<td>0.013</td>
</tr>
<tr>
<td>Mammal</td>
<td>Medium Mammal</td>
<td>49</td>
<td>40.04</td>
<td>0.082</td>
</tr>
<tr>
<td>Mammal</td>
<td>Large Mammal</td>
<td>31</td>
<td>55.6</td>
<td>0.052</td>
</tr>
<tr>
<td>Testudinata</td>
<td>Turtle</td>
<td>23</td>
<td>23.78</td>
<td>0.038</td>
</tr>
<tr>
<td>Selachimorpha</td>
<td>Shark</td>
<td>1</td>
<td>0.27</td>
<td>0.002</td>
</tr>
<tr>
<td>Tayassuidae</td>
<td>Peccary</td>
<td>7</td>
<td>6.45</td>
<td>0.012</td>
</tr>
<tr>
<td>Canis sp.</td>
<td>Dog</td>
<td>11</td>
<td>58.52</td>
<td>0.018</td>
</tr>
<tr>
<td>C. guanhumi</td>
<td>Blue Land Crab</td>
<td>166</td>
<td>82.45</td>
<td>0.277</td>
</tr>
<tr>
<td>C. paca</td>
<td>Paca</td>
<td>8</td>
<td>8.73</td>
<td>0.013</td>
</tr>
<tr>
<td>D. punctata</td>
<td>Agouti</td>
<td>6</td>
<td>8.54</td>
<td>0.010</td>
</tr>
<tr>
<td>D. novemcinctus</td>
<td>Armadillo</td>
<td>8</td>
<td>4.39</td>
<td>0.013</td>
</tr>
<tr>
<td>D. mawii</td>
<td>Central American River Turtle</td>
<td>2</td>
<td>45.02</td>
<td>0.003</td>
</tr>
<tr>
<td>D. virginiana</td>
<td>Virginia Opossum</td>
<td>3</td>
<td>5.04</td>
<td>0.005</td>
</tr>
<tr>
<td>Actinopterygii</td>
<td>Fish</td>
<td>2</td>
<td>0.43</td>
<td>0.003</td>
</tr>
<tr>
<td>I. iguana</td>
<td>Iguana</td>
<td>1</td>
<td>0.15</td>
<td>0.002</td>
</tr>
<tr>
<td>Mazama sp.</td>
<td>Brocket Deer</td>
<td>1</td>
<td>1.37</td>
<td>0.002</td>
</tr>
<tr>
<td>Meleagris sp.</td>
<td>Turkey</td>
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<td>7.55</td>
<td>0.003</td>
</tr>
<tr>
<td>O. virginianus</td>
<td>White-tailed Deer</td>
<td>1</td>
<td>3.65</td>
<td>0.002</td>
</tr>
<tr>
<td>O. hispidus</td>
<td>Pocket Gopher</td>
<td>4</td>
<td>2.54</td>
<td>0.007</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td></td>
<td>600</td>
<td>406.57</td>
<td></td>
</tr>
</tbody>
</table>

The minimum number of individuals of the ceramic levels is 36 individuals, represented by 19 taxa. There was an MNI of 17 blue land crabs (*C. guanhumi*), 2 unidentified turtles (Testudinata), and 2 pacas (*C. paca*). There is one of all of the following animals: Brocket deer (*Mazama* sp.), white-tailed deer (*Odocoileus virginianus*), canid (*Canis* sp.), unidentified fish, unidentified shark (*Selachimorpha*), agouti (*D. punctata*), pocket gopher (*O. hispidus*), unidentified cat (*Felidae*), raccoon or coati (*Procyonidae*), peccary (*Tayassuidae*), armadillo (*D. novemcinctus*), opossum...
(D. virginiana), turkey (Meleagris sp.), iguana (I. iguana), Central American river turtle (Dermatemys mawii), and reptile. Due to low MNI in both assemblages, I use NISP results for comparison.

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>MNI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aves</td>
<td>Aves</td>
<td>1</td>
</tr>
<tr>
<td>Reptilia</td>
<td>Reptile</td>
<td>1</td>
</tr>
<tr>
<td>Testudinata</td>
<td>Turtle</td>
<td>2</td>
</tr>
<tr>
<td>Selachimorpha</td>
<td>Shark</td>
<td>1</td>
</tr>
<tr>
<td>Tayassuidae</td>
<td>Peccary</td>
<td>1</td>
</tr>
<tr>
<td>Canis sp.</td>
<td>Dog</td>
<td>1</td>
</tr>
<tr>
<td>C. guanhumi</td>
<td>Blue Land Crab</td>
<td>17</td>
</tr>
<tr>
<td>C. paca</td>
<td>Paca</td>
<td>2</td>
</tr>
<tr>
<td>D. punctata</td>
<td>Agouti</td>
<td>1</td>
</tr>
<tr>
<td>D. novemcinctus</td>
<td>Armadillo</td>
<td>1</td>
</tr>
<tr>
<td>D. mawii</td>
<td>Central American River Turtle</td>
<td>1</td>
</tr>
<tr>
<td>D. virginiana</td>
<td>Virginia Opossum</td>
<td>1</td>
</tr>
<tr>
<td>Actinopterygii</td>
<td>Fish</td>
<td>1</td>
</tr>
<tr>
<td>L. iguana</td>
<td>Iguana</td>
<td>1</td>
</tr>
<tr>
<td>Mazama sp.</td>
<td>Brocket Deer</td>
<td>1</td>
</tr>
<tr>
<td>Meleagris sp.</td>
<td>Turkey</td>
<td>1</td>
</tr>
<tr>
<td>O. virginianus</td>
<td>White-tailed Deer</td>
<td>1</td>
</tr>
<tr>
<td>O. hispidus</td>
<td>Pocket Gopher</td>
<td>1</td>
</tr>
</tbody>
</table>

|               | Total MNI: 36                |

A Comparison of Species Diversity

A comparison of the number of identified species (NISP) in each assemblage, with out unidentified remains, shows some obvious differences (Figures 4 and 5), including the number of blue land crab (C. guanhumi) and large mammals. In the preceramic faunal assemblage armadillo bones, represent 12.74% of the faunal remains, but only make up 2.24% of the ceramic period faunal assemblage. Large mammals account for 23.69% of the preceramic assemblage and only 8.68% of the ceramic
assemblage. Unlike large mammals and armadillos, the blue land crab is better represented in the ceramic assemblage. Blue land crab represents only 19.04% of the preceramic assemblage, while it represents 46.50% of the ceramic assemblage. Other than these three species, the two graphs are relatively similar in the diversity of other animals.

Figure 4  Ceramic Period Faunal Assemblage: Excluding Unidentified Remains

Figure 5  Preceramic Period Faunal Assemblage: Excluding Unidentified Remains
The Shannon diversity index is a descriptive statistic that is dependent upon the number of categories. When applying the Shannon diversity index (1949) to a 26-class assemblage, the minimum diversity is zero and the maximum diversity is 3.26. The diversity index for the preceramic period faunal assemblage is 2.21, and the ceramic period faunal assemblage is 1.99, meaning the preceramic fauna are more diverse than the ceramic levels. The ceramic assemblage contains a larger variety of species and appears to be more diverse; however, the high percentage of blue land crab (46.50%), skews the results of the Shannon diversity index and suggest that the preceramic assemblage is more diverse. However, when the blue land crab is omitted, the diversity is more appropriately illustrated.

Figures 6 and 7 provide a clearer picture of differences in animal use by excluding the unidentified faunal remains and the blue land crab. The ceramic period faunal assemblage is more diverse, with six more species that are not found in the preceramic levels. Large mammals account for 29.26% of the preceramic levels and only 16.23% ceramic levels. In this breakdown of the faunal diversity, armadillos (D. novemcinctus) make up 4.19% of the ceramic levels and 15.74% of the preceramic levels, excluding the crab and unidentified remains. Reptiles (8.38%) and turtles (12.04%) are well represented in the ceramic period faunal assemblage while in the preceramic period reptiles (1.85%) and turtles (5.19%) are less represented.

The preceramic period faunal assemblage has more focused animal use patterns with an emphasis on large mammals (29.25%). Medium (20.37%) and large mammals (29.25%) are the most represented within the preceramic, along with some bird (5.37%) and turtle (5.19%) remains. Fewer species are represented in the preceramic assemblage
and there are a select few that dominate the assemblage. Figures 4 and 5 show a shift from large mammals in the preceramic period faunal assemblage to medium-small fauna in the ceramic period faunal assemblage.

Not only is the preceramic less diverse because fewer species are present but also because the diversity index of the preceramic is 2.12 while that of the ceramic assemblage is 2.42. The Shannon diversity index (1949) bears out that the preceramic fauna are less diverse. Excluding the blue land crab from the diversity index calculation immediately makes the ceramic period faunal assemblage more diverse than the preceramic levels. As stated earlier, with 26 categories, the minimum diversity is zero and the maximum diversity is 3.26, making the ceramic levels more diverse with the exclusion the blue land crab. The ceramic period has a less focused animal use pattern with an emphasis on medium mammals (25.65%), when excluding unidentified vertebrates and blue land crabs (*C. guanhumi*).

Figure 6 Ceramic Period Faunal Assemblage: Excluding Unidentified Remains and Crab
The Chi-square test was used to determine if there is a statistically significant difference in the observed and expected utilization of fauna at MHCP. When using the chi-squared statistic, the categories being compared must be few in numbers. I have chosen to group the faunal remains into five groups including small mammal, medium mammal, large mammal, birds and reptiles. I further explore differences in the size of mammals exploited in each time period, as there is a statistically significant change in fauna that shifts during the Archaic period, mainly in large mammals.
My null hypothesis states there is not a relationship between time periods (preceramic and ceramic) and animal classes within the faunal remains recovered in Unit 1E at MHCP. The null hypothesis is non-directional and nominal-by-nominal, which dictates chi-squared as the appropriate statistic. I used an alpha of 0.05 and my region of rejection was 9.48773.
The chi-squared test demonstrates that there is a significant relationship between time period and animal classes. That is, the difference in large animal use is statistically significant. In fact, by looking at the observed and expected results, the major contributor is the large mammal category. The preceramic assemblage has the largest positive loading in large mammals, while the ceramic has the largest negative loading in small mammals. Not only is the preceramic period faunal assemblage less diverse, but this also suggests that preceramic use of the rockshelter was focused on large mammals.

The difference in expected and observed amounts of large mammal is 21.49 in both preceramic and ceramic levels. Figures 8 and 9 also show the observed and expected numbers of reptiles. It is apparent that the difference between the preceramic and ceramic period faunal assemblages is about 20.42. The preceramic assemblage consists of 7.47% reptile, and it increases to 22.34% in the ceramic levels. Turtles make up 54.76% of the reptile assemblage from ceramic period levels.

The observed and expected numbers of the other categories (small and medium mammals, along with birds) are all within 2-5 of each other, so these categories are not creating the statistical difference in the diversity of preceramic and ceramic period faunal assemblages. Instead these changes are mainly based on the change from a focus on large mammals to a less focused utilization of species. The increase in species diversity also includes a significant change in the utilization of reptiles. This fits with the characterization of the Late Archaic shift to an increase in species diversity, and an increase in the use of small fauna, (Bayham 1979; Flannery 1969, 1989).
Table 7 Chi-Squared Observed and Expected

<table>
<thead>
<tr>
<th>Chi-Squared</th>
<th>Preceramic</th>
<th>Ceramic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small Mammal</td>
<td>O= 42</td>
<td>O= 12</td>
</tr>
<tr>
<td></td>
<td>E= 39.4347202</td>
<td>E= 14.5652798</td>
</tr>
<tr>
<td>Medium Mammal</td>
<td>O= 212</td>
<td>O= 85</td>
</tr>
<tr>
<td></td>
<td>E= 216.890961</td>
<td>E= 80.1090387</td>
</tr>
<tr>
<td>Large Mammal</td>
<td>O= 188</td>
<td>O= 40</td>
</tr>
<tr>
<td></td>
<td>E= 166.502152</td>
<td>E= 61.4978479</td>
</tr>
<tr>
<td>Aves</td>
<td>O= 29</td>
<td>O= 9</td>
</tr>
<tr>
<td></td>
<td>E= 27.7503587</td>
<td>E= 10.2496413</td>
</tr>
<tr>
<td>Reptile</td>
<td>O= 38</td>
<td>O= 42</td>
</tr>
<tr>
<td></td>
<td>E= 58.4218077</td>
<td>E= 21.5781923</td>
</tr>
</tbody>
</table>

**Burning**

The preceramic period faunal assemblage contained 11.04% charred or calcined bones. The ceramic period faunal assemblage has a total of 8.33% charred or calcined bone. To further explore burning patterns, I calculated the percent of burning in each level of Unit 1E (Table 8) to observe possible changes in rockshelter use. The highest level of burning is in level seven, which is dated to the Preclassic Maya period based on ceramic types, followed by level 14, dated to 9120 to 8726 BC. Level one had the third highest level of burning, but may have been disturbed by modern activities. Excluding level 1, the ceramic period faunal assemble contains 8.16% charred or calcined bones, and the preceramic period faunal assemblage remains at 11.04% burned bones. The frequency of burning in the ceramic period assemblage goes down, which may indicate a change in the use of the rockshelter over time. In preceramic periods, the rockshelter was likely used as a home base, and more animals would have been processed and cooked there. In ceramic periods, the rockshelter was more likely an activity area for early stages of animal processing.
People may have done the later stages of food processing in nearby settlements, resulting in smaller proportions of burned bones in the ceramic period faunal assemblage.

Table 8  Percent Burned Per Level

<table>
<thead>
<tr>
<th>Level</th>
<th>Percent burned</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td>16.67%</td>
</tr>
<tr>
<td>Level 3</td>
<td>0.00%</td>
</tr>
<tr>
<td>Level 4</td>
<td>5.05%</td>
</tr>
<tr>
<td>Level 5</td>
<td>6.04%</td>
</tr>
<tr>
<td>Level 6</td>
<td>5.10%</td>
</tr>
<tr>
<td>Level 7</td>
<td>23.29%</td>
</tr>
<tr>
<td>Level 8</td>
<td>10.00%</td>
</tr>
<tr>
<td>Level 9</td>
<td>5.39%</td>
</tr>
<tr>
<td>Level 10</td>
<td>0.75%</td>
</tr>
<tr>
<td>Level 11</td>
<td>1.25%</td>
</tr>
<tr>
<td>Level 12</td>
<td>10.95%</td>
</tr>
<tr>
<td>Level 13</td>
<td>18.10%</td>
</tr>
<tr>
<td>Level 14</td>
<td>19.80%</td>
</tr>
</tbody>
</table>

**Regional Comparison of MHCP**

MHCP, similar to other archaeological sites in Mesoamerica, contains no megafauna remains. The lowest level excavated, level 14, dates securely to the Paleoindian period (see Table 1). MHCP also shows heavy uses of aquatic resources later in later preceramic levels such as the blue land crab (*C. guanhumi*), jute snails, (*Pachychilus* spp.), and turtles (*Testudinata*). Like Santa Marta, a rockshelter in Chiapas, Mexico, that dates to late in the Paleoindian period through the Early Archaic period, jute snails, (*Pachychilus* spp.) were well represented. Approximately 50% of the matrix of Unit 1E at MHCP consisted of jute snails (Ochoa 2012:132-133; Prufer et al. 2014). Santa Marta also contained deer (*O. virginianus* and *Mazama* sp.), peccary (Tayassuidae), and iguanas (*Iguana* sp.) (Ochoa 2010:2-3; Ochoa 2012:135), which are also present within the preceramic levels at MHCP.
El Gigante, a rockshelter in Honduras, species such as agouti (*D. punctata*), paca (*A. paca*), armadillo (*D. novemcinctus*), opossum (*D. marsupialis*), iguana (Iguanidae), jute snails (*Pachychilus* ssp.), and turtles have been identified in the Archaic period levels (Scheffler 2008:138-139). These species are also present in the preceramic faunal assemblage at MHCP. El Gigante demonstrates an increase of faunal diversity in the Late Archaic period (Scheffler et al. 2012:603-604). As the ceramic period faunal assemblage at MHCP is dated to ~3,400 BC, it includes the Late Archaic period. Patterns observed at MHCP follow the same pattern of an increased diversity in fauna seen at El Gigante.

Cuello and Cerros, both Preclassic sites in Belize, contain agouti (*D. punctata*) paca (*C. paca*) and armadillos (*D. novemcinctus*) (Wing and Scudder 1991:87). All of these species were also identified in the faunal assemblage from the ceramic levels at MHCP. Freiwald also identified a diverse array of small and medium mammals in a Preclassic deposit at Blackman Eddy (Freiwald in Brown 2008). The trend towards a diverse utilization of small game is present across the Maya lowlands in the Preclassic period, as well as at MHCP.

Aquatic resources are also heavily utilized in the Preclassic period, mainly the jute snail (*Pachychilus* spp.). Other species including *Pomacea* sp. and *Nephronaias* spp. are prevalent at the site of Cuello, Lamanai (Pendergast 1981), Barton Ramie (Willey et al. 1965:525-528), Copan (Longyear 1952:16-17), and Tikal (Moholy-Nagy 1978; Pohl 1995:109). Colha’s Preclassic faunal assemblage is made up of 42% marine resources (Wing and Scudder 1991:87), and San Felipe’s faunal assemblage consists of 59% fish (Carr 1985:126). At MHCP the blue land crab represents 46.5% of the identified
preceramic period faunal assemblage. As noted previously, jute snails made up nearly 50% of the matrix, most of which were spire lopped (Prüfer 2002, Prüfer et al. 2014). MHCP occupants were heavily exploiting aquatic resources including the blue land crab (*C. guanhumi*), jute snails (*Pachychilus* spp.), and turtles (Testudinata).

The faunal remains recovered from MHCP show the results of the cultural and environmental changes that occurred during the Archaic period. The wetter conditions, warming climate, as well as sedentism and the introduction of ceramics, all affected the utilization of fauna by the inhabitants of MHCP. The change from a focus on large mammals to smaller fauna is explained using Kent Flannery’s Broad Spectrum Revolution model. The environmental changes may be reflected in an increased use of aquatic game, but also may be linked to reduced mobility that affected the use of large game (Flannery 1969, 1989).
CHAPTER IV: CONCLUSIONS

The purpose of this research is to compare the preceramic and ceramic faunal assemblages from Maya Hak Cab Pek, a rockshelter in southern Belize. The human presence at MHCP spans from 10,030 to 9,461 BC to the Preclassic Maya period (2,000 BC to AD 250). While there is a significant amount of research on the Preclassic Maya period within Belize, very little is known about Paleoindian and Archaic period people within the Maya lowlands.

MHCP offers a rare opportunity to observe animal use patterns at a specific location over ten thousand years. In 1998 and 1999, Keith Prufer and Peter Dunham worked at MHCP found Archaic dates in nearby areas of study, which led Dr. Prufer to return to MHCP with the interest of studying the lives of preceramic peoples of Belize (Prufer 2002; Prufer et al. 2014). Faunal analysis from MHCP may help us better understand the affects the introduction of ceramics, which changes the storage, cooking, and culture associated with subsistence, may have had in the Maya lowlands of southern Belize.

People of the Paleoindian period were highly mobile. Early in the Archaic period there was a warming climate, which changed the environment significantly. By the Late Archaic, megafauna were extinct and early villages were established. With sedentism, we see the introduction of ceramics at different times across Belize, but the earliest irrefutable presence of ceramics dates to approximately 1,000 BC (Lohse et al. 2006).
With all these major changes, the diversity of species between the preceramic and ceramic assemblages is significantly different. Fauna found in MHCP show that people’s reliance on certain species changed in this region of southern Belize.

**Results**

This thesis sampled all the faunal remains recovered in Unit 1E. The unit contained a total of 1,651, approximately 33% of the entire assemblage from MHCP. As previously stated, I had to use the NISP results for comparison, as MNI results were too small. In Figures 1 and 2, the largest difference between the preceramic and ceramic assemblages is in the blue land crab. Due to the large number of crabs, other species are minimized and not represented as well, which led me to exclude the blue land crab.

Figures 3 and 4 reveal much more about the species diversity of Maya Hak Cab Pek. The ceramic period’s largest category, medium mammals, makes up 25.65% of the ceramic assemblage. The animal use in the preceramic assemblage is much more focused, with an emphasis on large mammals, making up 29.25% of the assemblage.

The major contributor in both the preceramic and ceramic assemblages is the large mammal (Table 7). This means that not only is preceramic animal use less diverse, but that they were also targeting large mammals.

**Discussion**

Through zooarchaeological analysis of the fauna recovered from MHCP, we see that there is a significant difference in species diversity between the preceramic and ceramic levels of Unit 1E. Preceramic animal use was more focused with an emphasis on large mammals, while ceramic period animal use was more diverse and contained more taxa than the preceramic. It is important to note that medium to small mammals were
present in both the ceramic and preceramic assemblages. Also, large mammals, most commonly deer, were a mainstay in Mesoamerican subsistence well into the historic period. This research will significantly add to the studies of Paleoindian and Archaic periods, and with radiocarbon dates, may be able to identify changing patterns of animal use in Paleoindian, early, and mid-Archaic periods.

At MHCP, Preceramic animal use was more focused with an emphasis on large mammals, while ceramic period animal use was more diverse and contained more taxa than the preceramic. MHCP, similarly to all other archaeological sites in Mesoamerica, contains no megafauna in association with cultural remains.

Because of this we see a much broader use of other species such as birds and reptiles and small mammals within ceramic times at MHCP. The more focused economy of the preceramic levels corresponds with the earlier characterizations of the preceramic subsistence strategies. El Gigante, a rockshelter in Honduras, also displays a decline in the use of large fauna and an increase in species diversity in the Late Archaic (Scheffler 2008:139). Bayham (1979) also discusses the shift from larger to smaller fauna used across the Americas within the Archaic period. With the changing climate, preferred fauna were declining and this may have caused dietary changes. Sedentism also may have restricted prey choice, and tethered hunters to one location. Based on Bayham’s analysis of four Archaic sites in North America, including Russell Cave in Alabama, Rodgers Shelter in Missouri, Hogup Cave in Utah, and Apple Creek in Illinois, he concludes that there was an increased reliance on smaller fauna due to the low availability of larger fauna (Bayham 1979:233). There was a decrease in use of large game, but it is important to note that large game such as deer remained an important food source into ceramic
periods. Analysis of the rockshelters use needs to be separated more discrete time periods to see if the shifts Bayham (1979) identified are present in southern Belize.

The change from a focus on large mammals to smaller fauna is explained using Kent Flannery’s (1969) Broad Spectrum Revolution model. The environmental changes increased the availability of aquatic game (Flannery 1969, 1989). At Santa Marta, a rockshelter in Mexico, jute snails are well represented; Santa Marta also contained deer, peccary, and iguanas, which are also present within the preceramic levels at MHCP (Ochoa 2010:2-3; Ochoa 2012:135). El Gigante may be one of the best sites to compare MHCP to. It is a rockshelter in Honduras, which also has Archaic period occupations and contains species such as agouti, paca, armadillo, opossum, iguana, jute snails, and turtles. Like MHCP, El Gigante demonstrates and increased diversity of species present in the Late Archaic period (Scheffler 2008:138-139). It is important to note the use of this rockshelter may have changed as well, serving as a home base in the preceramic periods, to a hunting camp in the ceramic periods.

MHCP also shows heavy use of aquatic resources later in the ceramic levels, such as the blue land crab, jute snails, and turtles. We see this at many Preclassic Maya sites including Cuello, Lamanai, Tikal, Colha, and San Filipe (Carr 1985:126; Pendergast 1981; Moholy-Nagy 1978; Pohl 1985:109; Wing and Scudder 1991:87).
Concluding Remarks

Through zooarchaeological analysis of the remains recovered from MHCP, we see there is a significant difference in species diversity between the preceramic and ceramic levels of Unit 1E. The wetter conditions, warming climate, sedentism, and the introduction of ceramics, all likely affected the utilization of fauna by the inhabitants of MHCP.

While faunal analysis has not always been at the forefront of archaeological inquiry, it is hoped that research such as this can display how valuable zooarchaeology is to examining subsistence at archaeological sites, especially those from Paleoindian and Archaic periods. By analyzing these remains there will be comparable data for future work on faunal assemblages from Archaic and Paleoindian time periods. This is important, as there has been little work conducted on sites of this time period because of the poor preservation of the tropics. Sites including Archaic and Paleoindian period remains are rare in the Maya area. As the techniques and methodology have increased and become more uniform, the opportunities for quality research in zooarchaeology are becoming more attainable. Therefore, zooarchaeology enables us to see reflections of broad societal changes and cultural patterns that can tell us not only about what the people are eating, but also hunting practices, domestication of animals, ritual activity, and ideological importance of animals. Research in the Maya region tends to focus on the use of caves and rockshelters for burials, opposed to other activities people were partaking in at these locations, while this research shows how they utilized the rockshelter through subsistence, to learn about the Maya and pre-Maya peoples residing in the lowlands.
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Bousman, C. Britt and Bradley J. Vierra

Brown, Kathryn M.
Bunn, H. T. and E. M. Kroll

Cannon, Michael D. and David J. Meltzer

Carr, Helen Sorayya

Coe, Michael

Coe, Sophie D.

Emery, Kitty F.

Flannery, Kent V.

France, Diane
Gilbert, B. Miles

González González, Arturo H., Carmen Rojas Sandoval, Alejandro Terrazas Mata, Martha Benavente Sanvivente, Wolfgang Stinnesbeck, Jeronimo Aviles O., Magdalena de los Ríos, and Eugenio Acevez

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Grayson, Donald K.

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Inomata, Takeshi, Daniela Triadan, Kazuo Aoyama, Victor Castillo, Histoshi Yonenobu

Inomata, Takeshi, Jessica MacLellan, Daniela Triadan, Jessica Munson, Melisa Burham, Kazuo Aoyama, Hiroo Nasu, Flory Pinzón, and Hitoshi Yonenbu

Inomata, Takeshi, Raúl Ortiz, Bábara Arroyo, and Eugenia J. Robinson

Iuliis, Gerardo De, Gregory H. McDonald, Norbert Stanchly, Jon Spenard and Terry G. Powis

Johnson, Jay K.

Joyce, Rosemary

Kelly, Thomas C.

Kennett, Douglas J.
Lohse, Jon C.

Lohse, Jon C. and Jaime Awe, Cameron Griffith, Robert M. Rosenswig, and Fred Valdez Jr.

Longyear John M.

Lyman, R. Lee

Marshall, Yvonne

Masson, Marilyn A.

Moholy-Nagy, H.

Morin, Eugène

Niederberger, Christine

Ochoa, Guillermo Acosta
Olsen, Stanley J.

Pendergast, David M.

Pohl, Mary

Prüfer, Keith

Prüfer, Keith, Christopher Merriman, Clayton Meredith, Willa Trask, Mark Robinson, and Josue Ramos

Pugh, Timothy,

Reents-Budet,

Reitz, Elizabeth and Elizabeth Wing

Rosenswig, Robert
Savage, Howard G.

Scheffler, Timothy E.

Scheffler, Timothy E., Kenneth G. Hirth, and George Hasemann

Scott, R.F., IV

Sellards, E.H., G.L. Evans, G.E. Meade, A.D. Krieger

Shannon, Claude E. and Weaver, Warren

Stanchly, Norbert

Stiner, M. C., S. L. Kuhn, S. Weiner and O. Bar-Yosef

Webster, D.L.
Willey Gordon R., W.R. Bullard, Jr., J. B. Glass, and James C. Gifford  

Willey, Gordon R., and Phillip Phillips  

Wing, Elizabeth S.  

Wing, Elizabeth S., and Sylvia J. Scudder  


Zeder, Melinda A.  

Zeitlin, Robert N. and Judith F. Zeitlin  
VITA

STEPHANIE ORSINI

Sorsini2@gmail.com

EDUCATION

University of Mississippi August 2014 – May 2016
Master of Arts in Anthropology with a focus in zooarchaeology

Relevant Coursework: Zooarchaeology, Biological Anthropology, Anthropological Theory, Archaeological Theory, Introduction to Geographic Information Systems

University of Illinois at Chicago, August 2010 – May 2012
Bachelor of Arts in Anthropology with a focus in Archaeology

Relevant Coursework: Introduction to Archaeology; Human Evolution; Ancient Civilizations of Mexico and Central America; Ethnography of Mesoamerica; Archaeology of North America; Fossil Humans; Writing Culture; Modern Human Variation and Adaptation; Anthropology of Food; Cuisines of Mesoamerica

College of Lake County, January 2008 – May 2010
Associate Degree in Arts

Relevant Coursework: World Cultures; Biological Anthropology

FIELDWORK

2016  El Preceramico del Valle de Nochixtlán Santo Domingo Yahuittlán, Oaxaca, Mexico
Excavations of Yuz 50, graduate assistant
Project directed by Dr. Jon Lohse, Dr. Arthur Joyce, and Dr. Alex Borejsza

2015  LCIDA Steel Dynamics Paint Line Survey West Point, Mississippi
Survey
Project directed by Dr. Jay K. Johnson
2015 **Carson Mound Group** Clarksdale, Mississippi  
Magnetic Gradiometer, burial excavations  
Project directed by Dr. John Connaway

2015 **Uxbenká Archaeological Project** Santa Cruz, Toledo District, Belize  
Excavations of T’zib te Yux  
Project directed by Dr. Keith Prufer

2015 **Center for Archaeological Research** Oxford, Mississippi  
Graduate Assistant in Hurricane Landing Excavations  
Project directed by Dr. Jay Johnson and Corp. of Engineers

2013 **Belize Valley Archaeological Reconnaissance Project** San Ignacio, Cayo District, Belize  
Research student  
Supervised student excavations, collected macro and microbotanical samples, faunal analysis, mapping  
Project directed by Dr. Jaime Awe

2012 **Belize Valley Archaeological Reconnaissance Project**, San Ignacio, Belize  
Field school student  
Mapping, Total Station, Artifact Identification, Excavation, Unit Set-up  
Project directed by Dr. Jaime Awe

**RESEARCH**

2016 **Tayasal Archaeological Project**  
Faunal Analysis of Postclassic faunal assemblages from Ixlu, Zacpeten, Nixtun Ch’ich’ and Tayasal  
Project directed by Dr. Timothy Pugh and Evelyn Chan Nieto

2015 **Hugh Craft House Archaeology Project** Holly Springs, Mississippi  
Faunal analysis and graduate assistant  
Supervised undergraduate and graduate student excavations  
Project directed by Dr. Jodi Skipper and Dr. Carolyn Freiwald

2015 **Center for Archaeological Research** Oxford, Mississippi  
Faunal Analysis of Hurricane Landing Excavations  
Project directed by Dr. Jay Johnson and Corp. of Engineers

2014 **Actuncan Archaeological Project** Clarissa Falls, Cayo District, Belize  
Analyzed human remains and burial data, inventoried special finds, and worked with multiple classes of faunal remains, including gastropods  
Project directed by Dr. Lisa LeCount
2013  **Belize Valley Archaeological Reconnaissance Project**  San Ignacio, Cayo District, Belize
Research student, report writing
Project directed by Dr. Jaime Awe

2013  **Mensabak Archaeological Project**  
Lab Assistant, University of Illinois at Chicago
Faunal Analysis under the direction of Caleb Kestle
Project directed by Dr. Joel Palka

**RESEARCH GRANTS AND AWARDS**

2016  *The Graduate Student Travel Award, University of Mississippi Graduate School*  
$350

2015  *Summer Research Assistantship. University of Mississippi Graduate School*  
$2,500

2014-2016  *Graduate Teaching Assistantship, University of Mississippi*  
$10,000

**PUBLICATIONS AND PRESENTATIONS**

2016  **Orsini, Stephanie,** Carolyn Freiwald, and Keith Prufer  

2014  **Orsini, Stephanie,** Angelina Perrotti, and Julie A. Hoggarth  


**SKILLS AND TRAINING**

- Archaeological Excavation
- Field Survey and Mapping Techniques including GPS Technology
- Macrobotanical Sampling
- Microbotanical Sampling
- Faunal Analysis
ORGANIZATIONS

• Society for American Archaeology, 2013 – Present