Deer Hunting at the Gaston Site

By

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Table of Contents

INTRODUCTION

Archaeology has come leaps and bounds in filling in the gaps and answering questions about past inhabitants of the world. However, there are still many unknowns, especially concerning times where no written record exists. The period of the Late Woodland (500 CE- 1000CE, possibly all the way up to European contact) and early European contact (late 1500s) in the North Carolina piedmont is one such unknown (UNC RLA, 2010). Vast research has been conducted into the lithics and pottery of these early American peoples. However less is known about the interactions with the area's most important food animal, white tailed deer (*Odocoileus virginianus*).

Faunal analysis can often fill this gap in information and shed light on human interaction with the local animal populations. The research described in this thesis is focused on the Gaston site, a Late Woodland period settlement in the piedmont region of North Carolina, and the interaction with white tailed deer. This research will hopefully answer some of the unknowns about this important part of their economy, providing a baseline in which comparisons can be made with other sites as well as changes that occurred after European contact. The main question I address is how was deer hunting organized and carried out? This is further developed through an examination of whether late Woodland period hunters at the Gaston site focused on targeting larger, older male deer or juveniles and females. In addition, I attempt to determine whether hunting was done by stalking or intensive hunting through cooperative drives.

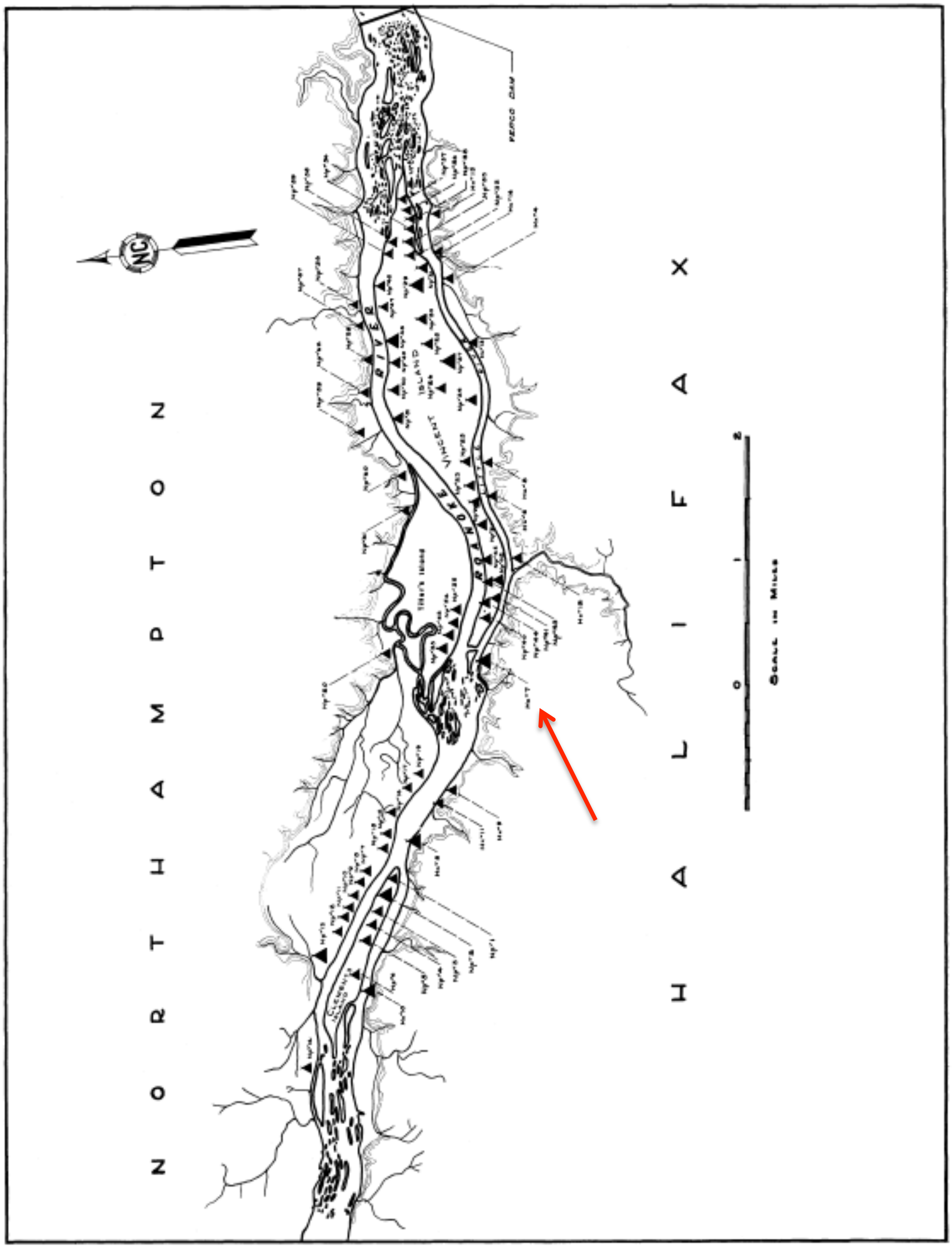


Figure 1 – Native American Sites on the Roanoke River, Halifax, NC (Coe, 1964, 85)

Background (Site)

This project focuses on an analysis of the deer remains from the Gaston site. The Gaston site (Hx 7) is located on the Roanoke River approximately 6 miles upstream from the town of Roanoke Rapids in Halifax County, North Carolina at an elevation of approximately 100 feet above sea level (Coe, 1964). "From this point the river flows on hundred and forty miles to the southeast and enters Albemarle Sound near the town of Plymouth" (Coe, 1964, 84). The site currently lies beneath the Roanoke Rapids Lake.

The project to build the Roanoke Rapids Dam was approved in 1953. In 1955, a "salvage program" including archaeological excavation was conducted (Coe, 1964, 90). Virginia Power and Electric Company financed the fieldwork for Coe and the University of North Carolina, allowing them access until the dam project was complete (Coe, 1964). The fieldwork lasted from April 19 through June 29, 1955 when the area was finally flooded. During that time "seventy-four sites were located, five were given exploratory excavations, and one, the Gaston Site, was excavated in depth" seen in Figure 1 (Coe, 1964, 90).

The excavation of the Gaston site included the excavation of 25 random control squares, measuring 5' x 5' x 3' deep to examine the upper midden deposits (Coe, 1964). In addition, heavy equipment was used to remove designated strips from 8 areas down to the bottom of this upper layer. Finally, the last phase of included the concentrated excavation of exposed features by 10-foot squares on the control grid; this continued until a total of 200 features were excavated and recorded (Coe, 1964).

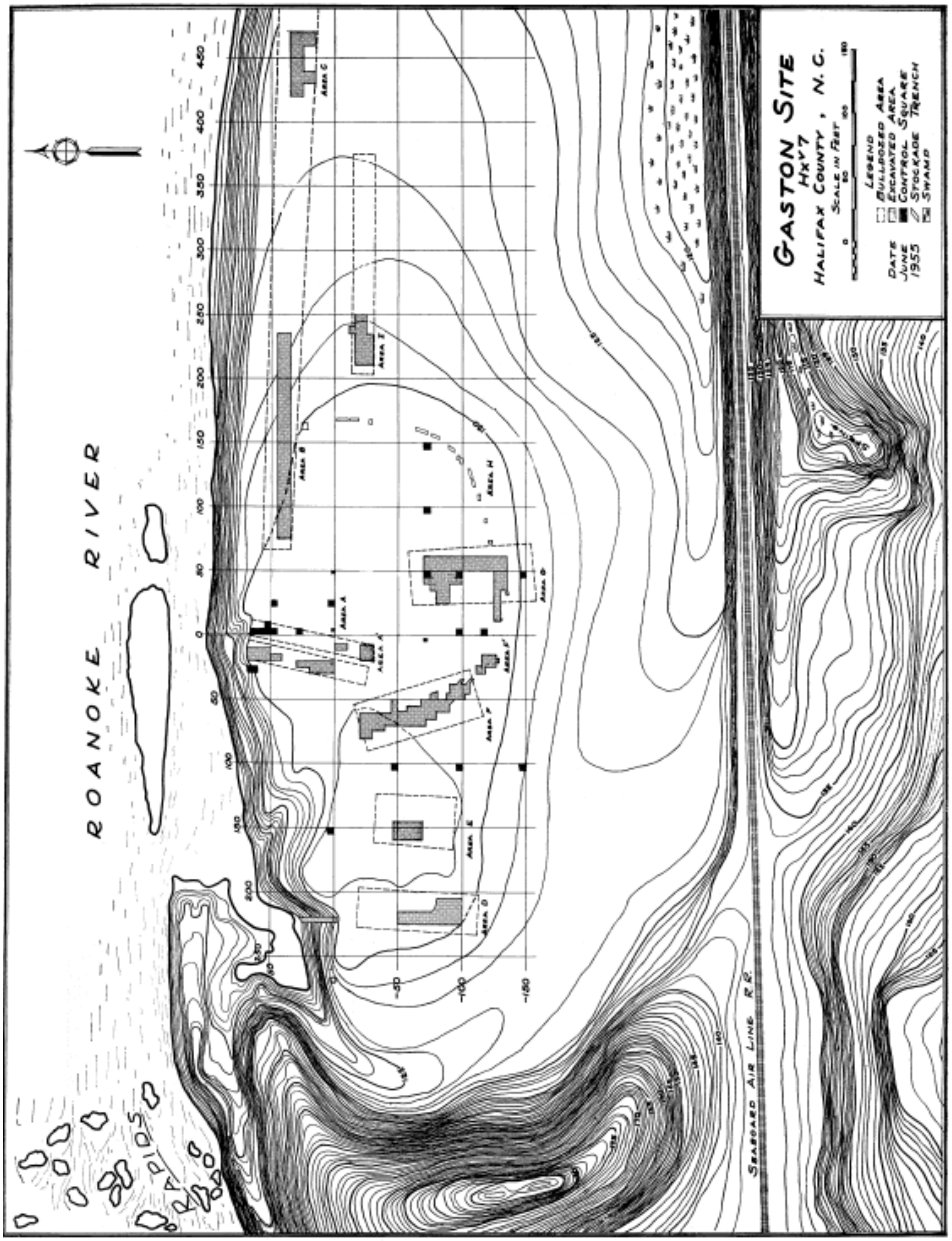


Figure 2 – Gaston Site Excavation Map (Coe, 1964, 88)

The occupation of Gaston site includes six occupational periods. The oldest of these is the Guilford occupation that is estimated to be at least 6000 years old based on C14 dating. This occupation is represented by a few rock-lined hearths. Associated finds include projectile points, chipped axes, chips, and hammer stones. The site was abandoned for an unknown length of time and then reoccupied during the Halifax occupation, which is dated around 3500 BCE (Coe, 1964). Shallow rock-lined pits were associated with this occupation, similar to the Guilford occupation. Finds include side-notched projectile points, stone chips, and hammer stones. “One major difference in their craft was the selection of quartz and quartzite as a raw material instead of the Carolina Slate which was used so consistently by the earlier group” (Coe, 1964, 118-119).

The site was abandoned again before it was re-occupied during the Savannah River occupation. Like the previous occupations stone-lined hearths where found. “Every indication suggested a larger group occupying the site over a longer continuous period than had been true of the earlier periods” (Coe, 1964, 119). Finds include steatite vessels and full-grooved axes. C14 dating for this occupation is approximately 2000 BCE (Coe, 1964).

On top of this level lies a significant flood deposit upon which a new occupation was built. This occupation is identified as the Vincent occupation and is dated to approximately 500-1000 CE. “These people lived in houses arranged in a small, compact village. They cooked in a deep rock-lined pits and made extensive use of pottery” (Coe, 1964, 119). During this period the occupants may have had the technology of the bow and arrow, however, the atlatl and polished stone celts were still the tools of choice and stone pipes were used for smoking (Coe, 1964).

There seems to be no break in occupation, but a change in archaeological material marks the next occupation known as the Clements phase (Coe, 1964). The Clements occupation is dated from 1200 to 1600 CE and is characterized by a gradual change in pottery tradition as well as the complete abandonment of the atlatl for the bow and arrow. There is no "great break" between the Clements and Vincent occupation (Coe, 1964, 119).

The Gaston phase represents the last occupation of the site and is dated to the end of the late Woodland period most likely prior to European settlement (Coe 1964). This occupation was marked by differences in pottery style, more emphasis on bone tools and smoking pipes, and the addition of fortifications to the settlement by means of a series of stockades (Coe, 1964). The stockade wall found ran from the southeast side of the site and ran in a semi-circular pattern to the northeast side of the site. The upstream side of the stockade was never located, even though several lines of post holes were found, none seemed to be the continuation of this stockade (South, 2005). It is believed that these differences mark the displacement of the Clements phase occupants by those of the Gaston phase rather than the evolution of the Clements group as seen in the earlier phase (South, 2005).

There were only two stone mortars found at the Gaston site. Both of these were in the form of "large flat slabs of stone that had a shallow depression ground on one side" both related to the Halifax occupation (Coe, 1964, 115). Other than this there is very little evidence found in the groundstones or plant remains to determine the level of agricultural use or impact. However, it is almost certain that these occupants practiced agriculture and there are just no remains preserved.

For this thesis, the focus is on the last three occupations including the Vincent, Clement and Gaston phases. Due to the lack of a distinctive termination of the Vincent phase, but rather a gradual change in archaeological material, the Vincent and Clement occupations are grouped together. This combined group will be referred to as the Vincent-Clement occupation for the duration of this thesis.

Background

***White-tailed deer* (Odocoileus virginianus)**

The white-tailed deer population in North Carolina has undergone extensive changes during the occupation of the Gaston site from prehistory through to the present. Little is known about the population of deer in the area during prehistoric periods. However, it is known that deer were the primary game animal in the Late Woodland period (VanDerwarker, 2005). Upon European contact, this species was extensively hunted for meat and hides. Within 100 years of European contact, the population of white-tailed deer in North Carolina was threatened to the point of extinction (Hartigan, 2017). It wasn't until 1738 that the first game laws protecting white-tailed deer in North Carolina were enacted.

It is estimated that by 1900 they were only about 10,000 white-tailed deer left in the state(Learning, 2010). A restoration program was implemented in the 1890s through 1980s. During this time over 174 deer were brought in from Florida, New York, and Wisconsin while another 3319 deer were moved from the coast of North Carolina (Blackard, 1971). As a result, the white-tailed deer population today is no longer purely local *Odocoileus virginianus*, but also contains genetic stock of the subspecies *Odocoileus virginianus borealis, Odocoileus virginianus seminolus* and *Odocoileus virginianus osceola* (Learning, 2018). Today there are over one million white-tailed deer in North Carolina

(Learning, 2018). Although this restocking effort was not as focused on bringing in large numbers of deer from outside of North Carolina, the modern deer population as well as the comparative models used to address body size may not represent the average deer observed through this research. This could be a source of bias when analyzing the biometric data.

White-tailed deer in North Carolina are among the largest wild herbivores in the state (Osborne, 1993). Their average size is approximately 3 feet in length, and they stand about 3 feet at the shoulders (Osborne, 1993). Males can reach weights from 100 to in excess of 200 pounds, while females have an average weight between 80 and 160 pounds. They have a home range of 200 to over 1,000 acres and tend to stay in the same ranges year after year (Osborne, 1993). Males, bucks, will mate with several female deer, does, each year. Prime mating season is from October to December, from the coast to the mountains respectively. The gestation period for white-tailed deer is approximately 200 days and a doe can give birth 1-3 fawn each year. These fawns are generally born between May and June and are weaned after four months. These fawns will generally stay with the doe for the first year. Does can begin breeding when they are fawns but most won't begin breeding until they are at least 18 months old. The average life expectancy is 2 to 5 years for males, and 3 to 6 years for females in the wild (Hartigan, 2017).

Native deer hunting in the Piedmont

Previous work has addressed deer hunting in late Prehistoric and early Colonial Virginia and North Carolina (Lapham, 2005; Holm, 1994; Waselkov, 1978). For this region there are two main hunting models that had been used historically that will be examined in this thesis. The first is a targeting model distinguished by the selective hunting of the largest animals, predominantly old males. This method is often referred to as *stalking*. This method could be done with a single hunter. In this method the hunter might drape a deerskin over his body as a decoy in order to get closer to his prey (Lapham, 2005). Using this method the hunter could pick out the deer he wanted to kill from the herd. Based on the idea of maximizing effort versus reward the hunter will tend to choose the largest or easiest animal to kill. The second model is *cooperative hunting*. This method entails targeting entire populations including males, females, old, and young. This model has two sub models, communal drives and surrounds. Communal drives require the cooperation of many people and would often include men women and children (Lapham, 2005). With this technique the majority of the individuals would use noise or smoky fires to frighten the deer toward a chosen location where hunters lay in wait. In the surrounding method, hunters would form a circle around the herd and drive them inward toward the center of the circle in order to completely trap their prey and efficiently slaughter them (Lapham, 2005). For this thesis both sub-model will be combined under the premise of cooperative hunting and no difference between the two techniques will be examined.

Based on Heather Lapham's research in southwestern Virginia there was a significant change in deer hunting techniques between the Late Woodland period and post-contact with Europeans. There are very few written records describing how the European markets affected the harvesting strategies of the Native Americans. A quote from Thomas Harriot in his "Brief and True Report of the New Found Land of Virginia" describes Native deer hunting as "no more waste or spoile of Deere than is and hath bene ordinarily in the time before" (1588). However "between 1698 and 1710 the two colonies [Virginia and Carolina] exported an average of 72,000 deerskins per year, a total of more than 800,000 hides in little more than a decade" (Lapham, 2005, 173). This exploitation would have been impossible without Native Americans altering their deer harvesting strategies.

During the Late Woodland period, deer hunting occurred primarily during late summer, fall, and early winter generally targeting younger individuals, including juveniles. Post-Contact "kill-off pattern dominated by prime-age animals, more male than female deer, and deer killed fairly regularly throughout the year" (Lapham, 2005, 189). There was a clear shift revealed from opportunistic practices in the Late Woodland period to targeting prime-age deer, especially males, post-contact in order to obtain hides that would fetch the best price with the European traders. As western expansion continued and good hunting grounds and herds became more competitive, Native American hunting strategies gradually changed from selecting the deer that would bring the most commercial return to that of killing the first available deer regardless of commercial value (Lapham, 2004).

Gregory Waselkov's (1978) work "Evolution of Deer Hunting in the Eastern Woodlands" expands on possible hunting techniques employed by native populations. These techniques all come from ethnohistorical accounts of Europeans from 1584 to 1728 (Waselkov, 1978). He states that deer hunting in the Virginia and North Carolina regions could "be grouped into four major types: 1) stalking, 2) using a decoy while stalking, 3) surrounds or drives to water, and 4) surrounds or drives using fire" (Waselkov, 1978, 18). In this publication he describes the general view that drives would produce a full arrangement of ages in the population while selective hunting techniques would produce an abundance of the very young and very old. However, it is almost impossible to determine what the natural makeup of a population is and to assume that 2-3 year olds make up the majority could be wrong. However, Waselkov also cites two studies done on natural predation of the population conducted in Ontario "where there are undisturbed wolf packs which prey on deer" (1978, 19). The results of these studies were that the wolves preyed on the old and young almost exclusively. This closely related selective hunting conducted by the native populations. In addition, Waselkov argued that the technology of the age, spears and bows and arrow, were less of a threat to the prime two to three year old population (Waselkov, 1978). It is important to understand that in this publication Waselkov's idea of selective hunting falls along the premise of a "nonrandom sample" whether that be targeting the most vulnerable population (the young and old), or selecting prime age individuals (Waselkov, 1978, 19). If a population contained a random sample of individuals then it could be concluded that the occupants used drives to hunt.

Mary Holm (1994), in her doctoral thesis "Continuity and Change: The Zooarchaeology of Aboriginal Sites in the North Carolina Piedmont" observes deer hunting in a different way. In her work she looked at deer hunting from an economic and cultural view. This work does not particularly focus of hunting methods used but more so the impact of the fur trade and European contact. She used the Wall, Fredericks, and Saratown sites for her comparisons. She concluded that there was very little change in hunting pattern and cultural practices from pre- to post-contact. She also states that the rapidity of European occupation could have something to do to this effect (Holm, 1994).

Although Lapham, Waselkov, and Holm have all addressed the nature of pre-and post-Contact deer hunting in the area of Virginia and North Carolina, these works mainly focus on the external effects such as the fur trade and culture. There is still little known about the details of the deer hunting practices in the late Woodland period in the North Carolina Piedmont. Work on the Gaston site, therefore, provides an important opportunity to not only set the baseline for pre-contact sites in the region but also provide valuable comparison between other pre-contact sites along the east coast, like the ones addressed by the above authors.

METHODS

The faunal remains examined for this thesis were excavated by Joffre Coe, Stanley South and Lewis Binford in 1955 (Coe, 1964). During this excavation, 13,845 individual bone fragments were recovered which are currently curated by the Research Labs in Archaeology at the University of North Carolina at Chapel Hill (VanDerwarker, 2001:13).

My analysis of the faunal assemblage was conducted from February 2017 through December 2017 in the University of North Carolina at Chapel Hill zooarchaeology laboratory (Smith Hall). In order to identify specimens, modern comparative skeletons as well as books and atlases were used. These included *Atlas of Animal Bones* by Elisabeth Schmid (1972), *Comparative Osteology* by Adams and Crabtree (2012), *Mammal Bones and Teeth* by (1992), and *Teeth* (1986) by Simon Hillson, and *Zooarchaeology* by Rietz and Wing (2008). The comparative skeletons came from the Research Laboratories of Archaeology (RLA) located in Smith and Alumni Halls at the University of North Carolina, Chapel Hill.

The initial identification and sorting of the Gaston faunal assemblage was conducted by Amber VanDerwarker in 2001. Of the total faunal assemblage, 1887 fragments were identified as white-tailed deer (VanDerwarker, 2001). This thesis focuses on an in-depth recording and analysis of the white-tailed deer, *Odocoileus virginianus,* specimens only. Unidentified and non-deer specimens were not examined or recorded. During the research, 913 deer fragments were recorded with 265 fragments phased to the Vincent/Clements occupation and 176 fragments phased to the Gaston occupation. This was done by examining bags of white-tailed deer (sorted previously by VanDerwarker), sorting by element and recording information including element, skeletal part, anatomical landmarks, symmetry, fragment size, fusion, sex, cut marks, carnivore gnawing, burning, pathology, count, weight, tooth wear and crown height, and standard measurements.

A number of quantification methods were utilized for this thesis. These methods include NISP, MNE, MAU, %MAU, fusion, tooth wear, bone density, food index, biometrics (including LSI), and C14 dating. NISP, the number of identified specimens, is the basic unit of quantification in zooarchaeology and provides a standardized means to quantify the frequency of taxa, but does not account for age, sex, fragmentation, size, or relative abundance of the specimen (Rietz 2008). It is used to give a general impression of the abundance of a species and a faunal assemblage. NISP data for the Gaston faunal assemblage are available from VanDerwarker (2001).

In order to address skeletal part abundance, I used MNE, MAU, and %MAU as well as bone density and FUI. MNE, minimum number of elements, and is defined as “minimum number of complete skeletal elements necessary to account for all observed specimens" (Rietz, 2008, 227). It is used to determine the number of elements by quantifying specific skeletal parts or feature, for example distal and proximal radius. MNE is calculated by observing the largest concentration of an anatomical feature for each element as a sub count of NISP. This quantification method takes into consideration overlapping features and fragmentation (Lyman 1994). MAU, minimum number of animal units, quantifies the skeletal parts that are present in a given skeleton for example two metacarpals (Rietz, 2008). MAU is calculated by dividing MNE by the number of times that element appears in the anatomical skeleton. It is used to calculate %MAU. %MAU is the MAU divided by the maximum MAU observed in a particular assemblage (Rietz 2008). This quantification provides an estimate of abundance for each skeletal element present in the faunal assemblage.

Bone density is the relative density of each bone and can be used along with %MAU to identify biases created by taphonomic processes. Bone density is displayed using a scatter plot to show the relationship between bone density and element frequency. Food Utility Index, FUI, is "defined as the gross weight of a part minus the dried bone weight of that part, where the gross weight is the way of the bone, meat, marrow, and bone grease of each body part" (Reitz, 2008, 230). The FUI is also graphed on a scatter plot and is used to show the relationship between element frequency and food utility of each element.

Age at death was estimated based on the state of fusion of long bone epiphyses as well as tooth eruption and wear. Bone fusion is the examination of the proximal and distal epiphyseal plates. These plates fuse with the bone shaft at different periods in the animal's life and can be use to help determine a specimen's age. Skeletal elements are divided into fusion stages and for each stage the number of fused elements his divided by the total number of elements for that phase (Purdue, 1983). These phases can then be used to graph a survivorship curve representing the ages at which deer were killed. Tooth wear examines the teeth, focusing on the presence or absence of deciduous and permanent teeth, and how worn these teeth are. Tooth eruption and subsequent wear happens throughout the life of the individual and can be used to help determine age (Severinghaus, 1949). For this thesis only mandibular teeth were examined. Patterns of tooth eruption and wear on the enamel cusps were noted and crown heights were measured for mandibular teeth. Like epiphyseal fusion tooth eruption and wear can be used to estimate individuals age.

Biometric data were collected following Von Den Driesch (1976), and all recorded measurable elements in the assemblage were examined. These measurements were used to create histograms for each element and are used to show frequency by size and to identify the ratio of male to female animals in the assemblage. These measurements can be used to create an LSI, log size index, value for each recorded element. Because sample sizes were relatively small, LSI, log size index, method was used in order to address the general body size characteristics of the entire biometric dataset. The LSI value is calculated by the equation [Log10(element measurement) - Log10(standard measurement)]. The standard animal used to calculate LSI value was a female skeleton (5028) from Dorchester, MD. As previously mentioned the modern deer that make up the comparative skeletons used are not exact representation of the deer present during the late Woodland period. The standard female used has a bias of being somewhat larger than the population represented in this assemblage.

Carbon 14 dating was used to get a more concrete date for a specimen from the phased material. Bone sample, unique bone number 305, a petrous bone, linked to the Clements occupation, was sent to Beta Analytics Inc. in Miami, Florida for radiocarbon dating in July 2017. In full report was received from Beta Analytics including the probability of accuracy and a calibrated calendar year scale. This dating will be used to give a more concrete date for the phased material (see results below).

RESULTS

NISP

In order to put the Gaston site hunting economy into regional context, I compared the frequencies of identified taxa with those from other late prehistoric sites in the North Carolina Piedmont region. The NISP data used are a compilation of the entire assemblage including all phased material. The individual specimen count was examined from several different perspectives to determine where the site lies in comparison to neighboring sites. On all charts below the total NISP and NISP for identified individuals, identified down to the species level, are displayed. The %NISP has been calculated by dividing the NISP of the comparative category (e.g., mammals, deer, turtles, birds, and fish) by the NISP of identified specimens. An average percent, representing the regional norm, for each category is listed at the bottom of every chart. The Gaston site had one major bias with NISP that was identified. This bias was the existence of several canine burial sites that heavily biased the data (for more information see dog NISP below). To mitigate this bias both the original data and the data with removed canine specimens are shown on the charts, labeled Gaston (non-dog).

Mammals (with comparative sites)

Through use of the RLA database the Gaston site was compared against two dozen other regional late prehistoric Native American sites on the holistic level concerning faunal assemblages. From the perspective of examining mammal distribution and the removal of the canine bias, the Gaston faunal assemblage contains over 51% mammals. This is somewhat higher than the regional average of 41% mammals (Figure 3).

Site name	Site code	Date	Location (state, county, river valley, etc)	Total NISP (includes unidentified)	NISPtotal (identified)	NISPmammals	%mammals (all fauna)
Edgar Rogers	Am162	AD 1500-1620	NC, Haw River, NC	1928	602	173	28.74
Holt	Am163		NC, Haw River, NC	3701	1637	251	15.33
George Rogers	Am236	AD 1500-1620	NC, Haw River, NC	9988	6734	359	5.33
Webster	Ch463	AD 1000-1500	NC, Haw River, NC	1194	619	48	7.75
Mitchum	Ch452	AD 1620-1670	NC, Haw River, NC	2264	937	242	25.83
Gaston	**Hx7**	**AD 500 +**	**Roanoke River**	**14359**	**5422**	**3377**	**62.28**
Gaston (Non Dog)	**Hx7**	**AD 500 +**	**Roanoke River**	**14359**	**4193**	**2148**	**51.23**
Wall	Or11	AD 1400-1500	NC, Eno River, NC	29794	9716	5224	53.77
Fredricks	Or231	AD 1680-1710	NC, Eno River, NC	70774	16402	6804	41.48
Jenrette	Or231a	AD 1600-1680	NC, Eno River, NC	22483	5806	3027	52.14
Lower Saratown	Rk1	AD 1620-1670	NC, Dan River, NC	34070	6439	2538	39.42
Powerplant	Rk5	AD 1000-1550	NC, Dan River, NC	2175	330	136	41.21
Early Upper Saratown	Sk1	AD 1450-1620	NC, Dan River, NC	43096	12041	2975	24.71
Upper Saratown	Sk1a	AD 1670-1710	NC, Dan River, NC	18159	5255	1556	29.61
William Kluttz	Sk6	AD 1690-1710	NC, Dan River, NC	5707	310	233	75.16
Vir150	Vir150	AD 1000-1400	Virginia, Mecklenburg Co., Roanoke River	48339	14043	7844	55.9
Koehler	Vir 201	AD 1300-1450	Virginia	6014	3502	620	17.7
Dallas Hylton	Vir 216		Virginia, Henry County	6901	4232	1965	46.4
Gravely	Vir225	AD 1300-1450	Virginia, Henry County	4306	390	315	80.8
Stockton	Vir 231	AD 1000-1450	Virginia, Leatherwood Creek	4031	2231	879	39.4
Jordan's Landing	31Br7	AD 800-1650	Roanoke River	16326	8190	599	7.3
Crab Orchard		AD 1500s	Virginia	15,729	5148	2521	49.0
Hoge		AD 1500s	Virginia	5564	3693	2474	67.0
Trigg		AD 1600	Virginia	11,525	8717	4302	49.4
Sandy site	44RN220	AD900-1600	Roanoke, VA	5578	1250	1244	99.52
Graham-White	44RN21	1400s AD	Roanoke River, Salem (SW Virginia)	7994	4330	1099	25.38106236
Graham-White	44RN21	1600 AD	Roanoke River, Salem (SW Virginia)	65634	11861	3017	25.43630385
						Average	**41.37**

Figure 3 – NISP Mammal Comparison

Deer (with comparative sites)

Of the specimens identified as mammals, the deer distribution, the focus of this research, for the Gaston site is over 87%. The comparative average is just below 83%. Gaston therefore exhibits a higher than average focus on white-tailed deer compared to other sites in the region (Figure 4).

Site name	Site code	Date	Location (state, county, river valley, etc)	Total NISP (includes unidentified)	white tailed deer (*Odocoileus virginianus*)	NISPtotal (identified)	%deer (out of all)	%deer (out of mammals)
Edgar Rogers	Am162	AD 1500-1620	NC, Haw River, NC	1928	157	602	26.08	90.75
Holt	Am163		NC, Haw River, NC	3701	184	1637	11.24	73.31
George Rogers	Am236	AD 1500-1620	NC, Haw River, NC	9988	277	6734	4.11	77.16
Webster	Ch463	AD 1000-1500	NC, Haw River, NC	1194	25	619	4.04	52.08
Mitchum	Ch452	AD 1620-1670	NC, Haw River, NC	2264	217	937	23.16	89.67
Gaston	**Hx7**	**AD 500 +**	**Roanoke River**	**14359**	**1887**	**5422**	**34.80**	**55.88**
Gaston (Non Dog)	**Hx7**	**AD 500 +**	**Roanoke River**	**14359**	**1887**	**4193**	**45.00**	**87.85**
Wall	Or11	AD 1400-1500	NC, Eno River, NC	29794	4654	9716	47.90	89.09
Fredricks	Or231	AD 1680-1710	NC, Eno River, NC	70774	5483	16402	33.43	80.58
Jenrette	Or231a	AD 1600-1680	NC, Eno River, NC	22483	2935	5806	50.55	96.96
Lower Saratown	Rk1	AD 1620-1670	NC, Dan River, NC	34070	2091	6439	32.47	82.39
Powerplant	Rk5	AD 1000-1550	NC, Dan River, NC	2175	114	330	34.55	83.82
Early Upper Saratown	Sk1	AD 1450-1620	NC, Dan River, NC	43096	2650	12041	22.01	89.08
Upper Saratown	Sk1a	AD 1670-1710	NC, Dan River, NC	18159	1401	5255	26.66	90.04
William Kluttz	Sk6	AD 1690-1710	NC, Dan River, NC	5707	218	310	70.32	93.56
Vir150	Vir150	AD 1000-1400	Virginia, Mecklenburg Co., Roanoke River	48339	6991	14043	49.8	89.1
Koehler	Vir 201	AD 1300-1450	Virginia	6014	492	3502	14.0	79.4
Dallas Hylton	Vir 216		Virginia, Henry County	6901	1618	4232	38.2	82.3
Gravely	Vir225	AD 1300-1450	Virginia, Henry County	4306	286	390	73.3	90.8
Stockton	Vir 231	AD 1000-1450	Virginia, Leatherwood Creek	4031	764	2231	34.2	86.9
Jordan's Landing	31Br7	AD 800-1650	Roanoke River	16326	418	8190	5.1	69.8
Crab Orchard		AD 1500s	Virginia	15,729	2063	5148	40.1	81.8
Hoge		AD 1500s	Virginia	5564	2112	3693	57.2	85.4
Trigg		AD 1600	Virginia	11,525	3898	8717	44.7	90.6
Sandy site	44RN220	AD900-1600	Roanoke, VA	5578	1239	1250	99.12	99.59807074
Graham-White	44RN21	1400s AD	Roanoke River, Salem (SW Virginia)	7994	589	4330	13.60277136	53.59417652
Graham-White	44RN21	1600 AD	Roanoke River, Salem (SW Virginia)	65634	2727	11861	22.99131608	90.38780245
						Average	**35.51**	**82.66**

Figure 4 - NISP Deer Comparison

Turtles (with comparative sites)

The distribution of turtles among the Gaston assemblage was also higher the regional average. Turtles comprise about 38% of the Gaston assemblage while the average is about than 25% (Figure 5).

Site name	Site code	Date	Location (state, county, river valley, etc)	Total NISP (includes unidentified)	turtles(all parts)	NISPtotal (identified)	%turtle(all fauna)
Edgar Rogers	Am162	AD 1500-1620	NC, Haw River, NC	1928	171	602	28.41
Holt	Am163		NC, Haw River, NC	3701	472	1637	28.83
George Rogers	Am236	AD 1500-1620	NC, Haw River, NC	9988	377	6734	5.60
Webster	Ch463	AD 1000-1500	NC, Haw River, NC	1194	396	619	63.97
Mitchum	Ch452	AD 1620-1670	NC, Haw River, NC	2264	332	937	35.43
Gaston	**Hx7**	**AD 500 +**	**Roanoke River**	**14359**	**1597**	**5422**	**29.45**
Gaston (Non Dog)	**Hx7**	**AD 500 +**	**Roanoke River**	**14359**	**1597**	**4193**	**38.09**
Wall	Or11	AD 1400-1500	NC, Eno River, NC	29794	2901	9716	29.86
Fredricks	Or231	AD 1680-1710	NC, Eno River, NC	70774	4845	16402	29.54
Jenrette	Or231a	AD 1600-1680	NC, Eno River, NC	22483	2517	5806	43.35
Lower Saratown	Rk1	AD 1620-1670	NC, Dan River, NC	34070	1594	6439	24.76
Powerplant	Rk5	AD 1000-1550	NC, Dan River, NC	2175	68	330	20.61
Early Upper Saratown	Sk1	AD 1450-1620	NC, Dan River, NC	43096	3915	12041	32.51
Upper Saratown	Sk1a	AD 1670-1710	NC, Dan River, NC	18159	1377	5255	26.20
William Kluttz	Sk6	AD 1690-1710	NC, Dan River, NC	5707	36	310	11.61
Vir150	Vir150	AD 1000-1400	Virginia, Mecklenburg Co., Roanoke River	48339	3983	14043	28.4
Koehler	Vir 201	AD 1300-1450	Virginia	6014	859	3502	24.5
Dallas Hylton	Vir 216		Virginia, Henry County	6901	740	4232	17.5
Gravely	Vir225	AD 1300-1450	Virginia, Henry County	4306	33	390	8.5
Stockton	Vir 231	AD 1000-1450	Virginia, Leatherwood Creek	4031	590	2231	26.4
Jordan's Landing	31Br7	AD 800-1650	Roanoke River	16326	1432	8190	17.5
Crab Orchard		AD 1500s	Virginia	15,729	1372	5148	26.7
Hoge		AD 1500s	Virginia	5564	206	3693	5.6
Trigg		AD 1600	Virginia	11,525	2930	8717	33.6
Sandy site	44RN220	AD900-1600	Roanoke, VA	5578	4	1250	0.32
Graham-White	44RN21	1400s AD	Roanoke River, Salem (SW Virginia)	7994	335	4330	7.736720554
Graham-White	44RN21	1600 AD	Roanoke River, Salem (SW Virginia)	65634	3029	11861	25.53747576
						Average	**24.83**

Figure 5 - NISP Turtle Comparison

Birds (with comparative sites)

Looking at the frequency of birds, Gaston showed another clear distinction from other sites in the region. The average frequency of bird remains in faunal assemblages for the regional sites was over 11%. The distribution and Gaston on the other hand was below this average at c.4% (Figure 6).

Site name	Site code	Date	Location (state, county, river valley, etc)	Total NISP (includes unidentified)	turkey	other bird	NISPtotal (identified)	%birds (all fauna)
Edgar Rogers	Am162	AD 1500-1620	NC, Haw River, NC	1928	3	21	602	3.99
Holt	Am163		NC, Haw River, NC	3701	24	273	1637	18.14
George Rogers	Am236	AD 1500-1620	NC, Haw River, NC	9988	3	11	6734	0.21
Webster	Ch463	AD 1000-1500	NC, Haw River, NC	1194	0	6	619	0.97
Mitchum	Ch452	AD 1620-1670	NC, Haw River, NC	2264	8	2	937	1.07
Gaston	**Hx7**	**AD 500 +**	**Roanoke River**	**14359**	**151**	**2**	**5422**	**2.82**
Gaston (Non Dog)	**Hx7**	**AD 500 +**	**Roanoke River**	**14359**	**151**	**2**	**4193**	**3.65**
Wall	Or11	AD 1400-1500	NC, Eno River, NC	29794	103	524	9716	6.45
Fredricks	Or231	AD 1680-1710	NC, Eno River, NC	70774	1102	2279	16402	20.61
Jenrette	Or231a	AD 1600-1680	NC, Eno River, NC	22483	39	148	5806	3.22
Lower Saratown	Rk1	AD 1620-1670	NC, Dan River, NC	34070	194	468	6439	10.28
Powerplant	Rk5	AD 1000-1550	NC, Dan River, NC	2175	18	66	330	25.45
Early Upper Saratown	Sk1	AD 1450-1620	NC, Dan River, NC	43096	89	2011	12041	17.44
Upper Saratown	Sk1a	AD 1670-1710	NC, Dan River, NC	18159	55	339	5255	7.50
William Kluttz	Sk6	AD 1690-1710	NC, Dan River, NC	5707	4	10	310	4.52
Vir150	Vir150	AD 1000-1400	Virginia, Mecklenburg Co., Roanoke River	48339	512	946	14043	10.4
Koehler	Vir 201	AD 1300-1450	Virginia	6014	90	223	3502	8.9
Dallas Hylton	Vir 216		Virginia, Henry County	6901	513	906	4232	33.5
Gravely	Vir225	AD 1300-1450	Virginia, Henry County	4306	31	10	390	10.5
Stockton	Vir 231	AD 1000-1450	Virginia, Leatherwood Creek	4031	111	477	2231	26.4
Jordan's Landing	31Br7	AD 800-1650	Roanoke River	16326	24	59	8190	1.0
Crab Orchard		AD 1500s	Virginia	15,729	106	585	5148	13.4
Hoge		AD 1500s	Virginia	5564	433	570	3693	27.2
Trigg		AD 1600	Virginia	11,525	263	297	8717	6.4
Sandy site	44RN220	AD900-1600	Roanoke, VA	5578	0	2	1250	0.16
Graham-White	44RN21	1400s AD	Roanoke River, Salem (SW Virginia)	7994	38	1784	4330	42.07852194
Graham-White	44RN21	1600 AD	Roanoke River, Salem (SW Virginia)	65634	46	1043	11861	9.181350645
							Average	**11.68**

Figure 6 - NISP Bird Comparison

Fish (with comparative sites)

The distribution of fish at the Gaston site is approximately 1/4 the average in comparison. The average for the region is over 20% while the frequency of fish in the Gaston assemblage is less than 6%. This is surprising due to location of the site being along the Roanoke River (Figure 7).

Site name	Site code	Date	Location (state, county, river valley, etc)	Total NISP (includes unidentified)	fishes	NISPtotal (identified)	%fish (all fauna)
Edgar Rogers	Am162	AD 1500-1620	NC, Haw River, NC	1928	223	602	37.04
Holt	Am163		NC, Haw River, NC	3701	400	1637	24.43
George Rogers	Am236	AD 1500-1620	NC, Haw River, NC	9988	5969	6734	88.64
Webster	Ch463	AD 1000-1500	NC, Haw River, NC	1194	164	619	26.49
Mitchum	Ch452	AD 1620-1670	NC, Haw River, NC	2264	353	937	37.67
Gaston	**Hx7**	**AD 500 +**	**Roanoke River**	**14359**	**294**	**5422**	**5.42**
Gaston (Non Dog)	**Hx7**	**AD 500 +**	**Roanoke River**	**14359**	**294**	**4193**	**7.01**
Wall	Or11	AD 1400-1500	NC, Eno River, NC	29794	858	9716	8.83
Fredricks	Or231	AD 1680-1710	NC, Eno River, NC	70774	1194	16402	7.28
Jenrette	Or231a	AD 1600-1680	NC, Eno River, NC	22483	63	5806	1.09
Lower Saratown	Rk1	AD 1620-1670	NC, Dan River, NC	34070	1515	6439	23.53
Powerplant	Rk5	AD 1000-1550	NC, Dan River, NC	2175	40	330	12.12
Early Upper Saratown	Sk1	AD 1450-1620	NC, Dan River, NC	43096	2925	12041	24.29
Upper Saratown	Sk1a	AD 1670-1710	NC, Dan River, NC	18159	1922	5255	36.57
William Kluttz	Sk6	AD 1690-1710	NC, Dan River, NC	5707	27	310	8.71
Vir150	Vir150	AD 1000-1400	Virginia, Mecklenburg Co., Roanoke River	48339	752	14043	5.4
Koehler	Vir 201	AD 1300-1450	Virginia	6014	1514	3502	43.2
Dallas Hylton	Vir 216		Virginia, Henry County	6901	87	4232	2.1
Gravely	Vir225	AD 1300-1450	Virginia, Henry County	4306	1	390	0.3
Stockton	Vir 231	AD 1000-1450	Virginia, Leatherwood Creek	4031	93	2231	4.2
Jordan's Landing	31Br7	AD 800-1650	Roanoke River	16326	6058	8190	74.0
Crab Orchard		AD 1500s	Virginia	15,729	540	5148	10.5
Hoge		AD 1500s	Virginia	5564	6	3693	0.2
Trigg		AD 1600	Virginia	11,525	797	8717	9.1
Sandy site	44RN220	AD900-1600	Roanoke, VA	5578	0	1250	0
Graham-White	44RN21	1400s AD	Roanoke River, Salem (SW Virginia)	7994	900	4330	20.7852194
Graham-White	44RN21	1600 AD	Roanoke River, Salem (SW Virginia)	65634	4569	11861	38.52120395
						Average	**20.64**

Figure 7 - NISP Fish Comparison

Dog (with comparative sites)

As mentioned above the Gaston site has an unusual bias in comparison to the comparative sites. It has several describe dog burials, most of which are fully articulated or are buried alongside human burials (Coe, 1964). All other examined sites have less than one percent canis remains, while Gaston has almost 24%. Since many of these remains seem to derive from burials, I have removed them from calculations of species frequencies (Figure 8).

Site name	Site code	Date	Location (state, county, river valley, etc)	Total NISP (includes unidentified)	dog/wolf	NISPtotal (identified)	%dog/wolf
Edgar Rogers	Am162	AD 1500-1620	NC, Haw River, NC	1928	0	602	0.00
Holt	Am163		NC, Haw River, NC	3701	0	1637	0.00
George Rogers	Am236	AD 1500-1620	NC, Haw River, NC	9988	0	6734	0.00
Webster	Ch463	AD 1000-1500	NC, Haw River, NC	1194	0	619	0.00
Mitchum	Ch452	AD 1620-1670	NC, Haw River, NC	2264	0	937	0.00
Gaston	**Hx7**	**AD 500 +**	**Roanoke River**	**14359**	**1229**	**5422**	**23.97**
Gaston (Non Dog)	**Hx7**	**AD 500 +**	**Roanoke River**	**14359**	**0**	**4193**	**0.00**
Wall	Or11	AD 1400-1500	NC, Eno River, NC	29794	5	9716	0.06
Fredricks	Or231	AD 1680-1710	NC, Eno River, NC	70774	11	16402	0.07
Jenrette	Or231a	AD 1600-1680	NC, Eno River, NC	22483	1	5806	0.02
Lower Saratown	Rk1	AD 1620-1670	NC, Dan River, NC	34070	2	6439	0.04
Powerplant	Rk5	AD 1000-1550	NC, Dan River, NC	2175	0	330	0.00
Early Upper Saratown	Sk1	AD 1450-1620	NC, Dan River, NC	43096	6	12041	0.07
Upper Saratown	Sk1a	AD 1670-1710	NC, Dan River, NC	18159	3	5255	0.09
William Kluttz	Sk6	AD 1690-1710	NC, Dan River, NC	5707	0	310	0.00
Vir150	Vir150	AD 1000-1400	Virginia, Mecklenburg Co., Roanoke River	48339	132	14043	0.99
Koehler	Vir 201	AD 1300-1450	Virginia	6014	2	3502	0.10
Dallas Hylton	Vir 216		Virginia, Henry County	6901	9	4232	0.22
Gravely	Vir225	AD 1300-1450	Virginia, Henry County	4306	0	390	0.00
Stockton	Vir 231	AD 1000-1450	Virginia, Leatherwood Creek	4031	7	2231	0.33
Jordan's Landing	31Br7	AD 800-1650	Roanoke River	16326	1	8190	0.05
Crab Orchard		AD 1500s	Virginia	15,729		5148	0.00
Hoge		AD 1500s	Virginia	5564		3693	0.00
Trigg		AD 1600	Virginia	11,525	12	8717	0.15
Sandy site	44RN220	AD900-1600	Roanoke, VA	5578	0	1250	0
Graham-White	44RN21	1400s AD	Roanoke River, Salem (SW Virginia)	7994	3	4330	0.087463557
Graham-White	44RN21	1600 AD	Roanoke River, Salem (SW Virginia)	65634	2	11861	0.027427318
						Average	**0.97**

Figure 8 - NISP Dog Comparison

Taphonomy

The Gaston faunal assemblage was extensively fragmented. Only 12.8% of all recorded specimens were complete, all of which were phalanges or tarsal bones. A majority of specimens, 63.6%, were less than 25% complete. The average fragment size was 41.56mm. All fragments recovered from the Gaston site were hand sifted through a 3/8 inch screen. Any fragment smaller than this would have passed through the screen and been lost, thus there is potential bias towards larger specimens in the assemblage.

The level of preservation of the deer remains ranged from complete, undamaged specimens to highly damaged highly fragmented specimens that received additional damage just from being handled in the lab. The undamaged bones were almost indistinguishable from those in the comparative collection. The more common characteristic of the highly damage specimens was a chalky, flaky, easily crumbled exterior with many if not all distinguishable and measurable features eroded. This damage was so severe in some cases that only element identification could be obtained with unknowns being left about size, sex, anatomical side, cut marks, burning, and pathologies.

A number of taphonomic processes were evident in this faunal assemblage including cut marks, burning, and carnivore gnawing. A total of 79/913, 8.6%, specimens had evidence of cut marks. Of those, 31, 3.3%, had unusual divots in them. These markings run all variety of bone and followed no distinction will pattern. Stanley South recorded similar markings on a few steatite potsherds (Archaeology of Roanoke, 87). In his analysis South calls these markings 'rodent gnawing'. 76 fragments, 8.3%, showed signs of burning. This ranged from partially to fully carbonized specimens. Carnivore gnawing was present 49 fragments, 5.3%. This likely indicates that dogs had access to the faunal remains prior to burial.

<u>Age Data</u>

Age data are used to determine the age of the individual at time of death. This can be done through both examining epiphyseal fusion and dental wear patterns on teeth. Epiphyseal plates fuse to long bones at different times in relation to the individual's maturity. This fusion information is listed in (Figures 9) and represents a sample of 303 specimens shown below (Purdue, 1983). In this chart the number of fused specimens is divided by the total to provide the percent fused. The second chart groups these individual elements and is broken down into six fusion stages (Figure 10). This table is used to create a survivorship curve (Figure 11) derived from the percent fused column. The survivorship curve shows the percent of the original population has survived to different points of maturity up to the age at which all skeletal parts are fully fused (c. 3.5 years). This can be used to decipher hunting patterns and preferences since it reflects the age demographics of the culled deer population. Since there is evidence for carnivore gnawing it is possible that the unfused specimens are under-represented.

Survivorship data in (Figure 9) represent long bone fusion for the entire assemblage including Vincent, Clement, Gaston and unphased material. These data show that approximately 97% of the population survived to the age of five months and 88% to 11 months. This indicates that very few infantile deer are represented in the total assemblage. This could be due to selective hunting or taphonomic processes in which have removed the infantile remains from the archaeological record. The largest decline in survivorship occurs between 11 and 20 when survivorship declines to 65.2%. At 23 months survivorship drops to 54.8% while 38.2% survive past 29 months indicating continued intensive kill-off of young adults. Finally, the last fusion state 6, is represented by 66.7% survivorship at 38 months. Age stage 6 is represented by only one skeletal part, proximal humerus, and a small sample size (N=3) gives a false impression the greater survivability to this point.

Fusion Stage	Element	Age of fusion	Fused	Unfused	Total	%Fused
1	pxRadius	5	18	0	18	100.0
1	dsHumerus	5	14	1	15	93.3
2	Acetabulum	8	0	0	0	0.0
2	Second phalanx	8	30	4	34	88.2
2	First phalanx	11	42	5	47	89.4
2	Atlas	11	0	0	0	0.0
3	dsTibia	17	10	5	15	66.7
3	Calcaneum	20	32	12	44	72.7
3	pxUlna	20	1	1	2	50.0
3	pxFemur	20	2	6	8	25.0
4	dsMC	23	9	14	23	39.1
4	dsMT	23	16	8	24	66.7
4	dsMP	23	4	2	6	66.7
4	lumbar vert centrum	23	4	3	7	57.1
4	thoracic vert centrum	23	1	1	2	50.0
5	dsRadius	29	13	12	25	52.0
5	dsFemur	29	3	13	16	18.8
5	pxTibia	29	4	9	13	30.8
5	cervical vert centrum	29	1	0	1	100.0
6	pxHumerus	38	2	1	3	66.7

Figure 9 - Fusion by Element (Holistic)

Fusion Stage	Fused	Unfused	Total	%Fused
1	32	1	33	97.0
2	72	9	81	88.9
3	45	24	69	65.2
4	34	28	62	54.8
5	21	34	55	38.2
6	2	1	3	66.7

Figure 10 - Fusion by Stage (Holistic)

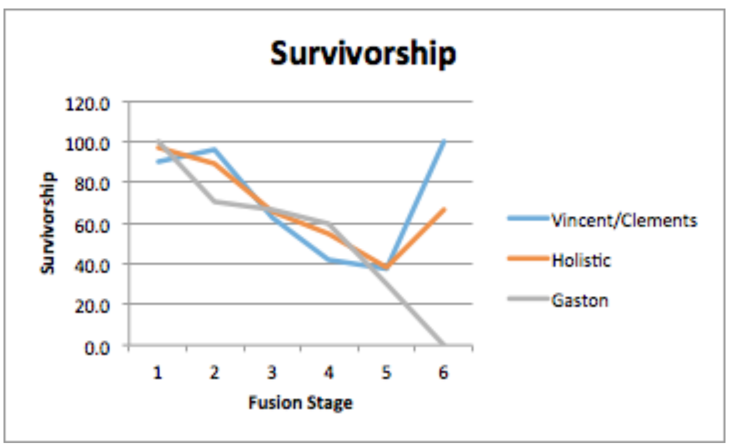


Figure 11 - Survivorship Curve

Vincent/Clements Phase

Epiphyseal fusion for the Vincent/Clements occupation period is represented by (Figures 12 & 13). These charts show the same information as displayed above in (Figures 9 & 10) for a sample of 93 specimens. Overall, survivorship for the Vincent/Clements phase (Figure 11) is similar to that from the total assemblage. At least 90% of the population has survived the age of 11 months, representing fusion stages 1 and 2. This shows that very few juveniles were hunted. From here survivorship follows a general downward curve similar to what is represented by the overall assemblage. By 20 months (fusion stage 3) only 62.5% of the population survived indicating significant harvesting of deer between the ages of one and one and a half years. This may correspond to an intensive fall hunt targeting juvenile animals. Fusion stage 4 indicates that 41.7% of individuals survived past 23 months. This steep decline in survivorship represents intensive hunting of young adults. The population declines slightly in fusion stage 5 with 37.5% surviving past 29 months, the age of fusion of epiphyses in fusion stage 5. For fusion stage 6, 38 months, the sample size is too small being represented by only two specimens.

Fusion Stage	Element	Age of fusion	Fused	Unfused	Total	%Fused
1	pxRadius	5	6	0	6	100.0
1	dsHumerus	5	3	1	4	75.0
2	Acetabulum	8	0	0	0	0.0
2	Second phalanx	8	12	0	12	100.0
2	First phalanx	11	12	1	13	92.3
2	Atlas	11	0	0	0	0.0
3	dsTibia	17	1	0	1	100.0
3	Calcaneum	20	8	4	12	66.7
3	pxUlna	20	1	1	2	50.0
3	pxFemur	20	0	1	1	0.0
4	dsMC	23	4	5	9	44.4
4	dsMT	23	3	7	10	30.0
4	dsMP	23	1	1	2	50.0
4	lumbar vert centrum	23	1	0	1	100.0
4	thoracic vert centrum	23	1	1	2	50.0
5	dsRadius	29	4	5	9	44.4
5	dsFemur	29	1	3	4	25.0
5	pxTibia	29	1	2	3	33.3
5	cervical vert centrum	29	0	0	0	0.0
6	pxHumerus	38	2	0	2	100.0

Figure 12 - Fusion by Element (Vincent/Clements)

Fusion Stage	Fused	Unfused	Total	%Fused
1	9	1	10	90.0
2	24	1	25	96.0
3	10	6	16	62.5
4	10	14	24	41.7
5	6	10	16	37.5
6	2	0	2	100.0

Figure 13 - Fusion by Stage (Vincent/Clements)

Gaston phase

Survivorship data for the Gaston occupation are presented in (Figures 14 & 15) and survivorship curve (Figure 11). These data depict a somewhat different pattern of survivorship. The sample size recorded for this Period was 72 specimens. Fusion data show that there is 100% survival rate to five months. This declines dramatically to 70% survivorship by 11 months indicating the targeting of yearlings. From 20 and 23 months (fusion stages 3 and 4) survivorship declines only slightly from 66.7% to 60%, indicating that young adults were not heavily targeted for culling. Fusion stage 5 is represented by only 10 specimens, but these data show that at only 30% of individuals survived past 29 months. This represents an intensive hunting of young adult deer between 2 and 3 years of age.

Fusion Stage	Element	Age of fusion	Fused	Unfused	Total	%Fused
1	pxRadius	5	4	0	4	100.0
1	dsHumerus	5	3	0	3	100.0
2	Acetabulum	8	0	0	0	0.0
2	Second phalanx	8	7	3	10	70.0
2	First phalanx	11	7	3	10	70.0
2	Atlas	11	0	0	0	0.0
3	dsTibia	17	2	1	3	66.7
3	Calcaneum	20	8	2	10	80.0
3	pxUlna	20	0	0	0	0.0
3	pxFemur	20	0	2	2	0.0
4	dsMC	23	2	2	4	50.0
4	dsMT	23	9	2	11	81.8
4	dsMP	23	1	0	1	100.0
4	lumbar vert centrum	23	0	1	1	0.0
4	thoracic vert centrum	23	0	3	3	0.0
5	dsRadius	29	3	3	6	50.0
5	dsFemur	29	0	2	2	0.0
5	pxTibia	29	0	2	2	0.0
5	cervical vert centrum	29	0	0	0	0.0
6	pxHumerus	38	0	0	0	0.0

Figure 14 - Fusion by Element (Gaston)

Fusion Stage	Fused	Unfused	Total	%Fused
1	7	0	7	100.0
2	14	6	20	70.0
3	10	5	15	66.7
4	12	8	20	60.0
5	3	7	10	30.0
6	0	0	0	0.0

Figure 15 - Fusion by Stage (Gaston)

Teeth holistic

Age data were also recorded for teeth based on eruption and wear. To derive accurate age from teeth, a mandible with two or more intact teeth, premolar four through molar three, is required. Teeth that do not fit this criteria, can still be used to determine the percent of juvenile represented in the assemblage. This is calculated by taking the number of DP4, deciduous premolar four, and dividing it by the number of either P4, permanent premolar four, or M3, molar three, whichever is the greater (Figure 16). For this thesis the P4 was used. This transition from DP4 to P4 occurs roughly between 17 and 20 months according the Severinghaus (1949). This provides a general estimate of the frequency of juvenile individuals in the assemblage based on dental remains and can be compared with the results of survivorship based on epiphyseal fusion (Figure 9). For the overall site the frequency of juveniles was calculated as 23.8% of the population. Comparing this to the above (Fusion Stage 3) these data represents fairly similar results. The fusion data puts the percent juvenile at roughly 35% indicating that young individuals are somewhat better represented in the fusion data. For the small sample from the Vincent/Clements occupation the percent juvenile was 33%, and for the Gaston sample 66%.

Tooth Wear				
	DP4	P4	M3	% Juv
Gaston	2	1	1	0.66
Vincent/Clements	2	4	4	0.33
Total	5	16	15	0.238

Figure 16 - Tooth Wear

Skeletal Part Analysis

Analysis of the frequencies of portions of the skeleton is important for understanding the impact of taphonomic factors on the deer assemblage as well as interpreting carcass transport and processing behaviors. This can allow further interpretation on whether all portions of the skeleton were brought back to the Gaston site or whether carcasses were processed in the field and only certain meaty portions brought back. Skeletal part analysis addresses skeletal part abundance through use MNE, MAU, and %MAU as well as bone density and FUI.

For the entire assemblage I calculated MNE values. I then calculated MAU and %MAU for each skeletal part (e.g., distal humerus, proximal humerus) after Binford. I compared %MAU with both bone density as well as food utility index. Comparison with bone density is intended to determine if the density of a bone has any correlation with it's frequency in the assemblage. This can be used to determine the effects of taphonomic processes on the faunal assemblage. Comparison with food utility index is meant to determine if a relationship exists between element frequency in the assemblage and the amount of meat on specific parts of the body. This can be used to examine carcass transport techniques.

As seen in (Figure 17) the NISP is listed for all recorded bone types. The top concentrations of elements were metatarsal 8.4%, calcaneus 7.9%, astragalus 6.9%, first phalanx 5.9%, radius 5.5% and metacarpal 5.4%. As seen from this recorded data all of the high concentrated elements come from the extremities. Techniques use for recording might have played a part and potentially created a bias that formed these results. These include for the skull only the petrous, occipital condyle, and frontal with or without antler were recorded. For the body only rib heads, and vertebra with centrum were recorded. Lastly for extremities all of their tarsal in carpal bones with the exception of the astragalus and calcaneus were not recorded.

Analysis of the frequency distribution of skeletal elements is important for understanding the impact of taphonomic factors on the assemblage as well as interpreting carcass transport and processing behaviors. For this the MNE was calculated based on the highest frequency of a specific anatomical feature (e.g., distal humerus) for each element. The MNE was then used to calculate MAU by dividing the MNE by the number of times each specific element appears in the body. This was then used to calculate %MAU by dividing each MAU value by the value of the element with the highest MAU frequency. This %MAU value represents the frequency of skeletal elements compared to the expected values based on the most abundant skeletal portion in the assemblage. For assessing the frequency by %MAU the elements the following one of three categories, highly represented: greater than 75%, moderate representation: 45-55%, poorly represented less than 25%, will be examined.

For the entire assemblage, the most abundant skeletal elements are the astragalus, 100 %MAU, and a calcaneus, 93.9 %MAU indicating that the anklebones are very well represented. The elements that fall in the moderately well represented category are the radius 57.1%, metatarsal 55.1%, ulna 53.1%, humerus 53.1%, femur, 44.9%, and scapula 44.9%. There primarily represent elements of the upper limbs. In the underrepresented category falls all metapodials 24.5%, first phalanx 18.9%, pelvis 16.3%, second and third phalanges 14.8%, skull 12.2%, vertebrae 8.2 through .8%, and ribs 3.6%, representing the axial skeleton, and distal extremities.

Skeletal Portion	NISP	MNE	# in a deer skeleton	MAU	%MAU	FUI	Density
antler	35	8	2	4	0.126984127	1	
skull	14	6	2	3	0.095238095	469	
mandible	28	21	2	10.5	0.333333333	1600	0.57
atlas	9	9	1	9	0.285714286	524	0.14
axis	7	7	1	7	0.222222222	524	0.16
cervical vert 3-7	1	1	5	0.2	0.006349206	1905	0.19
thoracic vert	7	7	13	0.53846154	0.017094017	2433	0.24
lumbar vert	12	12	6	2	0.063492063	1706	0.3
general vert	21	21	24	0.875	0.027777778		0.243333333
ribs	23	23	26	0.88461538	0.028083028	2650	0.25
PELVIS	19	8	2	4	0.126984127	2531	0.27
ilium	8	8	2	4	0.126984127		0.49
ischium	8	8	2	4	0.126984127		0.16
pubis	3	3	2	1.5	0.047619048		0.46
scapula	40	22	2	11	0.349206349	2295	0.36
HUMERUS	32	26	2	13	0.412698413		0.53
pxhumerus	3	3	2	1.5	0.047619048	2295	0.25
dshumerus	26	26	2	13	0.412698413	1891	0.63
RADIUS	51	28	2	14	0.444444444		0.68
pxradius	20	20	2	10	0.317460317	1323	0.62
dsradius	28	28	2	14	0.444444444	1039	0.43
Ulna	26	26	2	13	0.412698413		0.45
METCARPUS	50	32	2	16	0.507936508		0.72
pxmc	18	18	2	9	0.285714286	461	0.69
dsmc	32	32	2	16	0.507936508	364	0.51
FEMUR	39	22	2	11	0.349206349		0.57
pxfemur	10	10	2	5	0.158730159	5139	0.41
dsfemur	22	22	2	11	0.349206349	5139	0.37
TIBIA	38	16	2	8	0.253968254		0.74
pxtibia	16	16	2	8	0.253968254	3225	0.3
dstibia	16	16	2	8	0.253968254	2267	0.5
Astragalus	63	63	2	31.5	1	1424	0.61
Calcaneus	73	46	2	23	0.73015873	1424	0.64
METATARSAL	77	27	2	13.5	0.428571429		0.74
pxmt	27	27	2	13.5	0.428571429	1003	0.65
dsmt	27	27	2	13.5	0.428571429	792	0.5
METAPODIAL	33	24	4	6	0.19047619		0.73
pxmp	9	9	4	2.25	0.071428571		0.67
dsmp	24	24	4	6	0.19047619		0.505
FIRST PHALANX	54	37	8	4.625	0.146825397	443	0.42
px	37	37	8	4.625	0.146825397		0.36
ds	26	26	8	3.25	0.103174603		0.57
SECOND PHALANX	38	29	8	3.625	0.115079365	443	0.25
px	23	23	8	2.875	0.091269841		0.28
ds	29	29	8	3.625	0.115079365		0.35
THIRD PHALANX	29	29	8	3.625	0.115079365	443	0.25

Figure 17 - Skeletal Part Analysis (Holistic)

Bone Density

In order to better understand the factors responsible for the frequencies of different skeletal parts I compare the %MAU against both bone density and the Food Utility Index (FUI). The more dense the bone, the more durable it is in the archaeological deposits and resistant to taphonomic processes (Rietz, 2008). First, I examine the relationship between %MAU and bone density. The scatterplot (Figure 18) clearly shows the increase in element frequency is directly related to an increase in bone density. This means the more dense and element or anatomical feature the higher the likelihood of it being preserved in the archaeological record indicating the importance of density mediated destruction is the faunal assemblage.

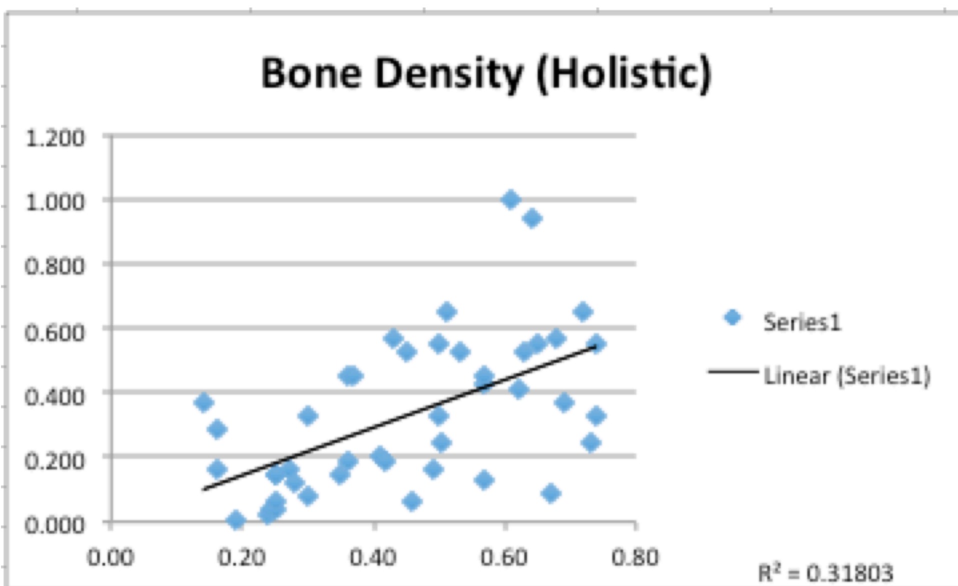


Figure 18 - Bone Density (Holistic)

Food Index

The FUI, or food utility index, is used to establish the relationship between skeletal part frequency in the food utility of the skeletal part. Through the scatterplot (Figure 19) it can be observed that a majority of the most frequent elements falls very low, less than

2000, on the FUI. The highest utility skeletal portions are poorly represented. However, since the highest utility skeletal elements are also the least dense, this pattern is likely the result of density mediated destruction, noted above, rather than human behaviors such as carcass transport.

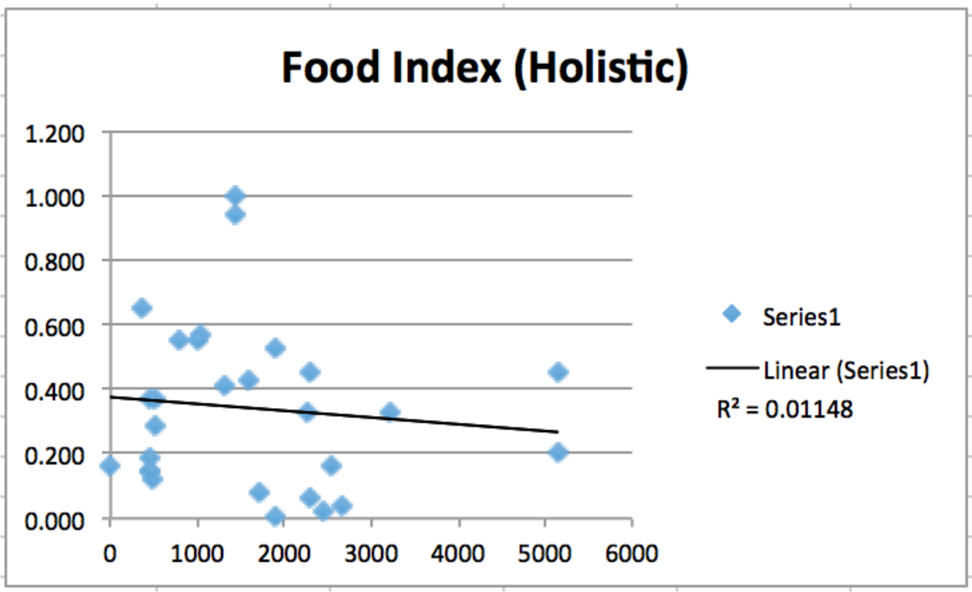


Figure 19 - Food Index (Holistic)

Vincent/Clements Phase

Skeletal part frequencies for the Vincent/Clements phase are presented in (Figure 20). The Vincent/Clements occupation %MAU shows that astragalus 100%, and calcaneus 92.9% are the most abundant elements. Mandible 50%, is represented at moderate levels and vertebra 7.1%-0%, ribs 1.6%, axis 14.3%, skull 14.3%, third phalanx 17.9%, second phalanx and first phalanx and antler 21.4% are poorly represented.

Skeletal Portion	NISP	MNE	# in a deer skeleton	MAU	%MAU	FUI	Density
antler	7	3	2	1.5	0.214285714	1	
skull	4	2	2	1	0.142857143	469	
mandible	11	7	2	3.5	0.5	1600	0.57
atlas	4	4	1	4	0.571428571	524	0.14
axis	1	1	1	1	0.142857143	524	0.16
cervical vert 3-7	0	0	5	0	0	1905	0.19
thoracic vert	2	2	13	0.153846154	0.021978022	2433	0.24
lumbar vert	3	3	6	0.5	0.071428571	1706	0.3
general vert	8	8	24	0.333333333	0.047619048		0.243333333
ribs	3	3	26	0.115384615	0.016483516	2650	0.25
PELVIS	7	4	2	2	0.285714286	2531	0.27
ilium	4	4	2	2	0.285714286		0.49
ischium	2	2	2	1	0.142857143		0.16
pubis	1	1	2	0.5	0.071428571		0.46
scapula	10	4	2	2	0.285714286	2295	0.36
HUMERUS	11	9	2	4.5	0.642857143		0.53
pxhumerus	2	2	2	1	0.142857143	2295	0.25
dshumerus	9	9	2	4.5	0.642857143	1891	0.63
RADIUS	16	10	2	5	0.714285714		0.68
pxradius	6	6	2	3	0.428571429	1323	0.62
dsradius	10	10	2	5	0.714285714	1039	0.43
Ulna	8	8	2	4	0.571428571		0.45
METCARPUS	13	9	2	4.5	0.642857143		0.72
pxmc	4	4	2	2	0.285714286	461	0.69
dsmc	9	9	2	4.5	0.642857143	364	0.51
FEMUR	6	5	2	2.5	0.357142857		0.57
pxfemur	1	1	2	0.5	0.071428571	5139	0.41
dsfemur	5	5	2	2.5	0.357142857	5139	0.37
TIBIA	7	4	2	2	0.285714286		0.74
pxtibia	4	4	2	2	0.285714286	3225	0.3
dstibia	1	1	2	0.5	0.071428571	2267	0.5
Astragalus	14	14	2	7	1	1424	0.61
Calcaneus	23	13	2	6.5	0.928571429	1424	0.64
METATARSAL	27	10	2	5	0.714285714		0.74
pxmt	10	10	2	5	0.714285714	1003	0.65
dsmt	8	8	2	4	0.571428571	792	0.5
METAPODIAL	13	12	4	3	0.428571429		0.73
pxmp	0	0	4	0	0		0.67
dsmp	12	12	4	3	0.428571429		0.505
FIRST PHALANX	15	12	8	1.5	0.214285714	443	0.42
px	12	12	8	1.5	0.214285714		0.36
ds	6	6	8	0.75	0.107142857		0.57
SECOND PHALANX	15	12	8	1.5	0.214285714	443	0.25
px	12	12	8	1.5	0.214285714		0.28
ds	9	9	8	1.125	0.160714286		0.35
THIRD PHALANX	10	10	8	1.25	0.178571429	443	0.25

Figure 20 - Skeletal Part Analysis (Vincent/Clements)

The Vincent/Clement phase data are almost identical to that of the entire assemblage in both bone density and food index. There remains a very strong direct relationship between bone frequency and bone density (Figure 21). This reinforces the idea that the key factor to preservation at this site is bone density and the elements ability to resist taphonomic factors. The FUI and %MAU comparison again shows a slightly negative relationship with low utility skeletal elements being the most abundant (Figure 22). However, given the impact of bone density on bone survivorship, it is difficult to interpret the FUI data.

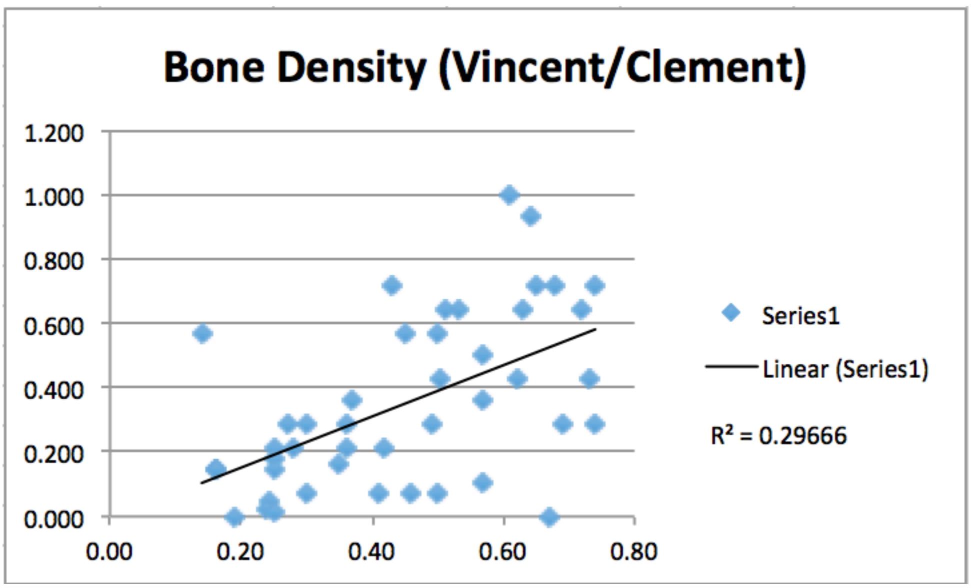


Figure 21 - Bone Density (Vincent/Clements)

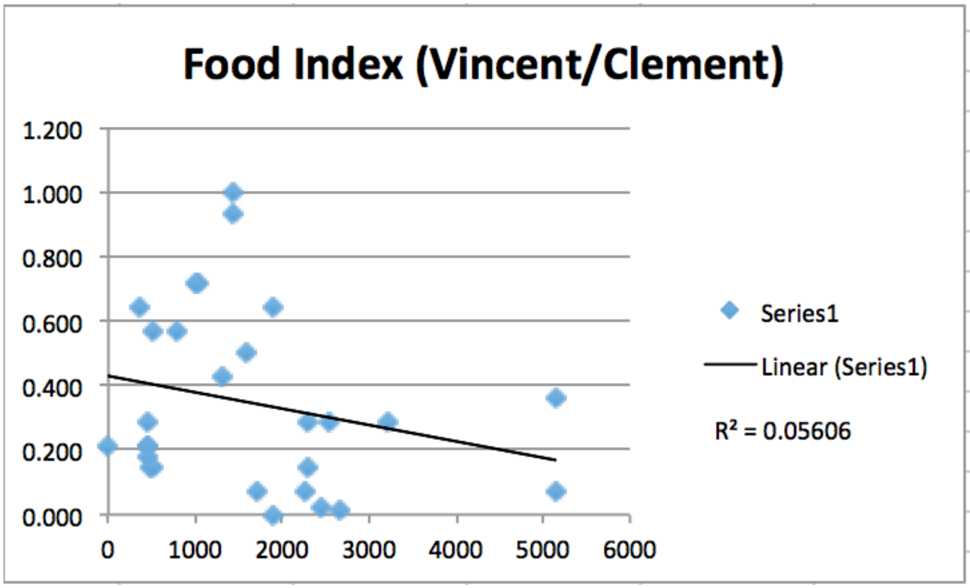


Figure 22 - Food Index (Vincent/Clements)

Gaston Phase

Skeletal part abundance data are presented for the Gaston phase in (Figure 23). Similarly to the previous occupation, in the Gaston phase astragalus 100%, and calcaneus 92.3% are the best represented elements. The ulna 84.6% is highly represented, while there is moderate representation of the radius 46.2%. Poorly represented elements include tibia 23.1%, second phalanx 21.2%, femur, pelvis, and mandible 15.4%, first phalanx 13.5%, metapodial 11.5%, skull and antler 7.7%, ribs 1.8%, and vertebra 5.1%-0%.

Skeletal Portion	NISP	MNE	# in a deer skeleton	MAU	%MAU	FUI	Density
antler	2	1	2	0.5	0.076923077	1	
skull	1	1	2	0.5	0.076923077	469	
mandible	4	2	2	1	0.153846154	1600	0.57
atlas	0	0	1	0	0	524	0.14
axis	2	2	1	2	0.307692308	524	0.16
cervical vert 3-7	0	0	5	0	0	1905	0.19
thoracic vert	3	3	13	0.230769231	0.035502959	2433	0.24
lumbar vert	2	2	6	0.333333333	0.051282051	1706	0.3
general vert	1	1	24	0.041666667	0.006410256		0.243333333
ribs	3	3	26	0.115384615	0.017751479	2650	0.25
PELVIS	3	2	2	1	0.153846154	2531	0.27
ilium	1	1	2	0.5	0.076923077		0.49
ischium	0	0	2	0	0		0.16
pubis	2	2	2	1	0.153846154		0.46
scapula	8	5	2	2.5	0.384615385	2295	0.36
HUMERUS	7	5	2	2.5	0.384615385		0.53
pxhumerus	0	0	2	0	0	2295	0.25
dshumerus	5	5	2	2.5	0.384615385	1891	0.63
RADIUS	11	6	2	3	0.461538462		0.68
pxradius	3	3	2	1.5	0.230769231	1323	0.62
dsradius	6	6	2	3	0.461538462	1039	0.43
Ulna	11	11	2	5.5	0.846153846		0.45
METCARPUS	9	5	2	2.5	0.384615385		0.72
pxmc	4	4	2	2	0.307692308	461	0.69
dsmc	5	5	2	2.5	0.384615385	364	0.51
FEMUR	6	2	2	1	0.153846154		0.57
pxfemur	2	2	2	1	0.153846154	5139	0.41
dsfemur	2	2	2	1	0.153846154	5139	0.37
TIBIA	6	3	2	1.5	0.230769231		0.74
pxtibia	2	2	2	1	0.153846154	3225	0.3
dstibia	3	3	2	1.5	0.230769231	2267	0.5
Astragalus	13	13	2	6.5	1	1424	0.61
Calcaneus	15	12	2	6	0.923076923	1424	0.64
METATARSAL	19	9	2	4.5	0.692307692		0.74
pxmt	5	5	2	2.5	0.384615385	1003	0.65
dsmt	9	9	2	4.5	0.692307692	792	0.5
METAPODIAL	5	3	4	0.75	0.115384615		0.73
pxmp	3	3	4	0.75	0.115384615		0.67
dsmp	2	2	4	0.5	0.076923077		0.505
FIRST PHALANX	10	7	8	0.875	0.134615385	443	0.42
px	7	7	8	0.875	0.134615385		0.36
ds	6	6	8	0.75	0.115384615		0.57
SECOND PHALANX	12	11	8	1.375	0.211538462	443	0.25
px	7	7	8	0.875	0.134615385		0.28
ds	11	11	8	1.375	0.211538462		0.35
THIRD PHALANX	5	5	8	0.625	0.096153846	443	0.25

Figure 23 - Skeletal Part Analysis (Gaston)

The Gaston material also was almost identical in bone density (Figure 24)and FUI (Figure 25) in the percent MAU comparison. Bone density again reflected the higher the density the higher the frequency in the assemblage. FUI also showed a slightly negative correlation with representation in the material for this occupation.

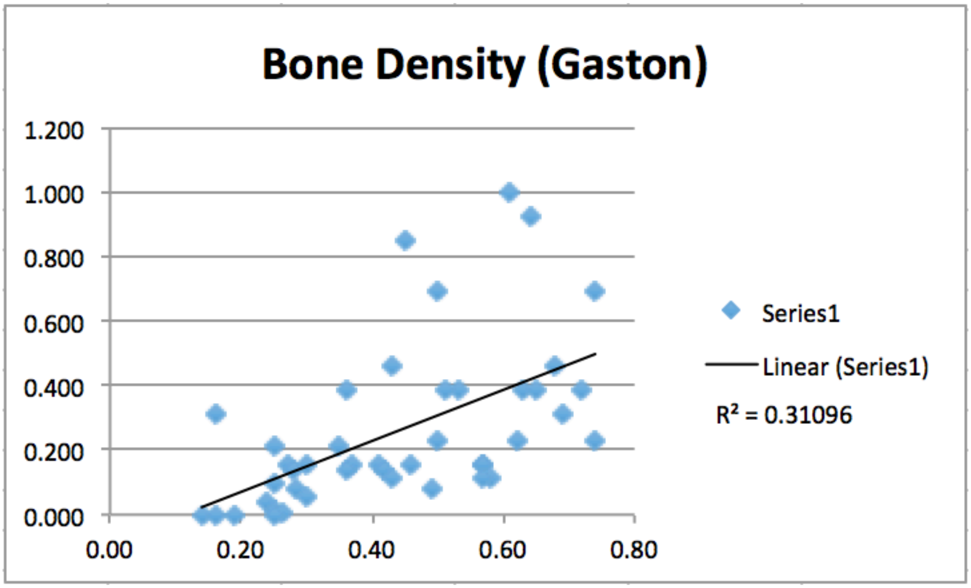


Figure 24 - Bone Density (Gaston)

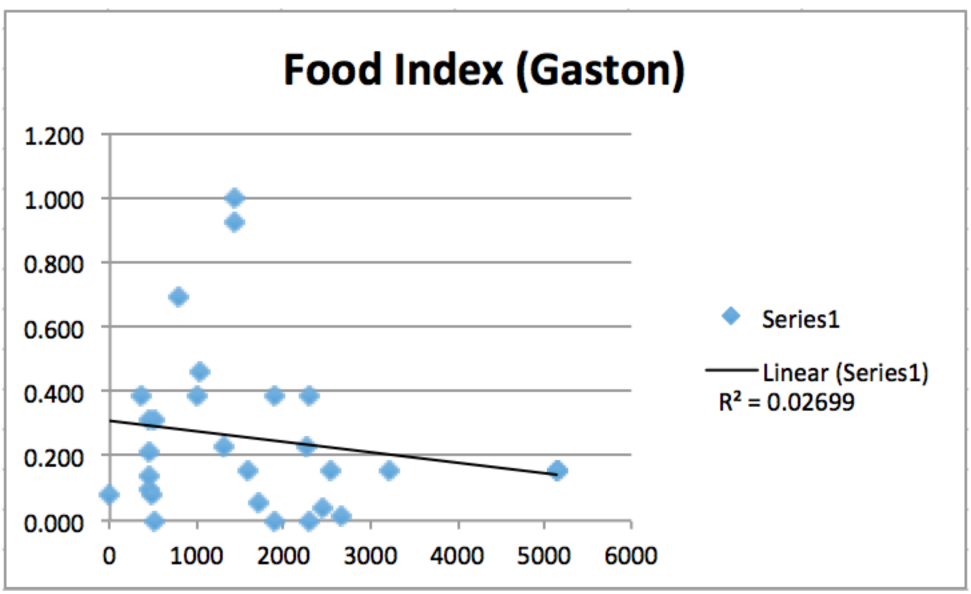


Figure 25 - Food Index (Gaston)

Biometrics

The purpose of analyzing biometric data is to observe trends that might enable the distinction between males and females in the assemblage. This is established through comparing measurement frequencies and LSI values. The LSI value was calculated using female skeleton (5028) from Dorchester, MD as the baseline. Measurement frequencies were done through graphing specific measurements from one anatomical location (e.g., distal breadth of the humerus) in the form of a histogram. This histogram can be compared against measurements from comparative deer specimens of known sex in order to estimate the biometric range for bucks and does. For this thesis two comparative female skeletons (5028) from Dorchester, MD, and (7000) from Orange County, NC as well as two male skeletons from Texas and (6005) from Carbondale, IL were used. In addition, in some cases mixture analysis was used in an attempt to classify measurements into male and female groups. Finally, due to small sample sizes, Log Size Index (LSI) values were calculated in order to address the biometric characteristics of the biometric dataset for the entire site as well as the two phased occupations. Looking at the site as a whole each individual skeletal element will be examined to determine if a pattern is present.

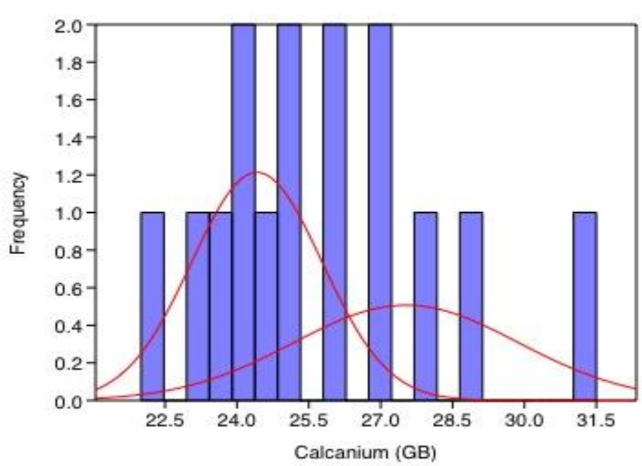


Figure 26 – Greatest Breadth of Calcanium

Comparative Specimens

(5028 female)-26.92

(7000 female)- n/a

(6005 male)-29.49

(Tx male)-30.7

The histogram (Figure 26) showing greatest breadth of the calcaneus measurements. Lines represent estimates of male and female populations using mixture analysis. Looking at the greatest breadth (GB) of the calcaneus, through the used mixture analysis two groups were identified which likely represent males and females. This can be interpreted in several ways the most common being the peak on the left represents the female population while the smaller sample on the right represents the male specimens. Examining this against the four comparative skeletons it can be seen that these peaks fall shy of known male and female examples. This could be due to differences in the size of ancient and modern deer covered in the introduction, which cause modern deer to be larger than their predecessors. Another explanation for this pattern would be the hunting of individuals of different age groups since younger animals exhibit smaller body size. In this explanation the peak on the left might represent younger individuals while the peak on the right represents older individuals.

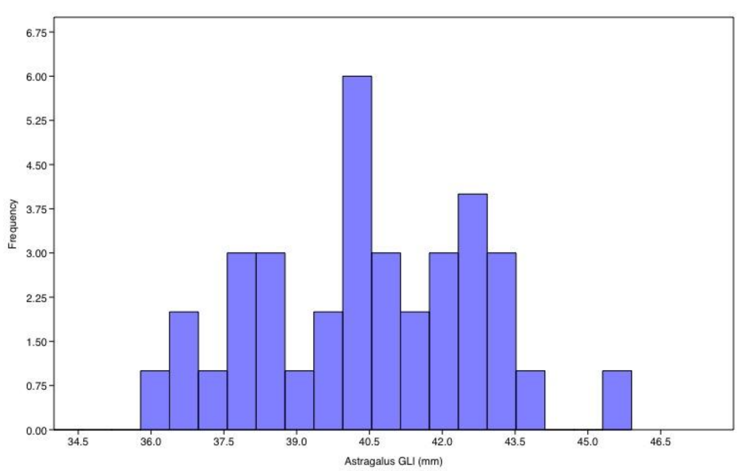


Figure 27 – Greatest Length of Astragalus

Comparative Specimens

(5028 female) - 39.72

(7000 female) - 35.95

(6005 male) - 42.12

(Tx male) - 41.2

A histogram for the length of the astragalus is presented in (Figure 27); in this case, mixture analysis produced no discernible trends. However, when the data are compared against the specimens of known sex, it can be seen in that several individuals fall within the range of both known males and females. It can also be observed that the peak at c. 40mm is located in between the sizes of the males and females; there are also a few much larger individuals (>42mm) which likely represent males. This shows that a broad range of individuals were being hunted including very large older males, probably smaller younger males, as well as adult females and smaller juveniles of both sexes.

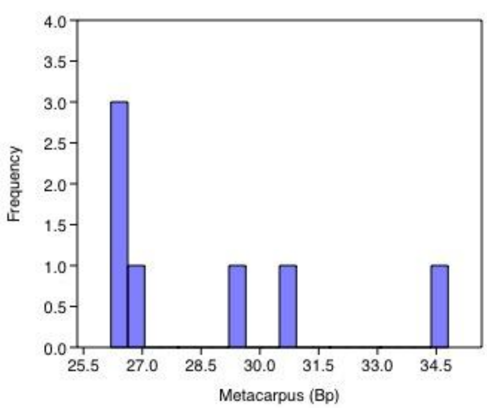


Figure 28 - Proximal Breadth of Metacarpus

Comparative Specimens

(5028) - 26.1

(7000) - 24.78

(6005) - 32.46

(Tx) - 30.6

The metacarpus proximal breadth (Bp) had very few specimens present in the assemblage and no trends by mixture analysis could be determined (Figure 28). However compared against the known skeletons it can be seen that there are three specimens that fall within the range of males, one of which is very large. Four smaller specimens fall within the size range of females. This suggests a balanced representation of male and female animals although the smaller individuals could represent juvenile males or females.

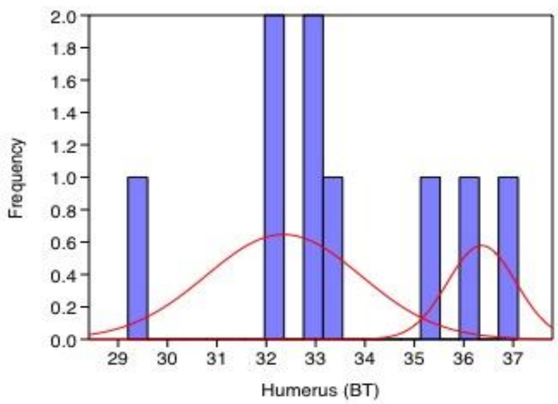


Figure 29 - Breadth of Trochlea

Comparative Specimens

(5028) - 32.18,

(7000) - 30.7

(6005) - 36.2

(Tx) - 35.7

Mixture analysis was able to determine two peaks in the humerus for the breadth of the trochlea (BT). On this histogram (Figure 29) the two peaks fall at or above the size of the known male and female specimens. This can be interpreted as either the males and females from this assemblage are larger than the examined specimens on average or both younger males and prime age to older males were being targeted. Six specimens are smaller than the known males; three specimens are in the size range of bucks. This graph also shows one outlier that falls below that of the known females and can be determined to either be a female and/or a juvenile specimen.

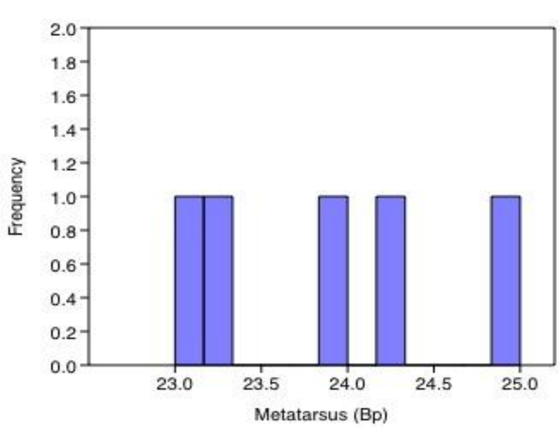


Figure 30 - Proximal Breadth of Metatarsus

Comparative Specimens

(5028) - 25.2

(7000) - 22.85

(6005) - 30.82

(Tx) - 28.2

The proximal breadth (Bp) of the metatarsus was also examined (Figure 30), however mixture analysis produced no trends. Compared against the skeletons all specimens fall within the range of known females. This could be due to the fact that it is such a small sample size. Interpretation of this histogram would show that all individuals present were either adult females or young males.

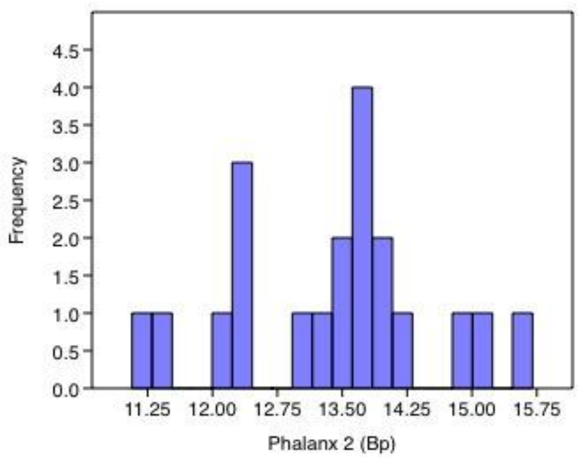


Figure 31 - Proximal Breadth of Phalanx 2

Comparative Specimens

(5028) - 12.5

(7000) - N/A

(5006) - 12.69

(Tx) - 14.8

For phalanx 2 (Figure 31), the proximal breadth (Bp) was examined and mixture analysis produced no trends. Due to similarities in size of the comparative skeletons these data is difficult to analyze. The peak in the measurements seems to suggest the presence of a majority of male-sized specimens although the sex distribution cannot be determined with confidence. Since all measurements were taken on fused specimens, this histogram shows the size distribution of animals older than 9 months; a few specimens fall in the size range of large adult males.

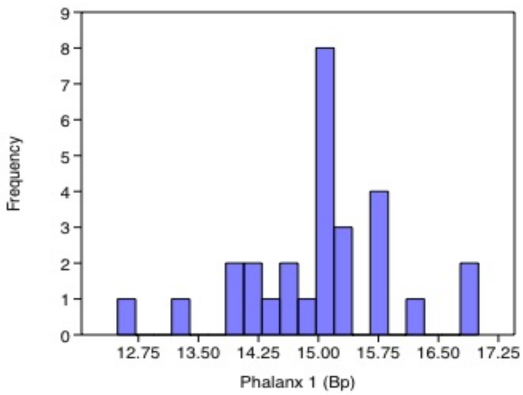


Figure 32 - Proximal Breadth of Phalanx 1

Comparative Specimens

(5028) - 14.33

(7000) - N/A

(6005) - 13.67

(Tx)- 16.2

The proximal breadth (Bp) was examined for phalanx 1 (Figure 32) and mixture analysis produced no trends. Due to overlapping sizes in the comparative models distinguishing between sex is not possible. A broader examination of these data shows a majority of the individuals fall within the range of average adult male, or slightly large adult female.

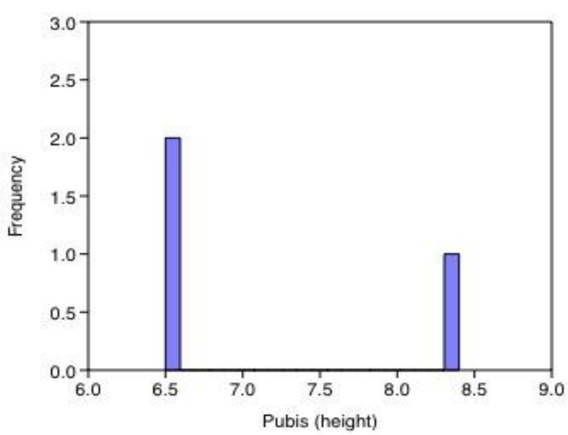


Figure 33 - Height of Pubis

Comparative Specimens

(5028) - 4.77

(7000) - 5.17

(6005) - 11.75

(Tx) - 9.8

Extremely small sample size was recorded for pubis height (Figure 33), due to this note trends could be produced through mixture analysis. However, the two small specimens are very likely females while the larger specimen is likely a male.

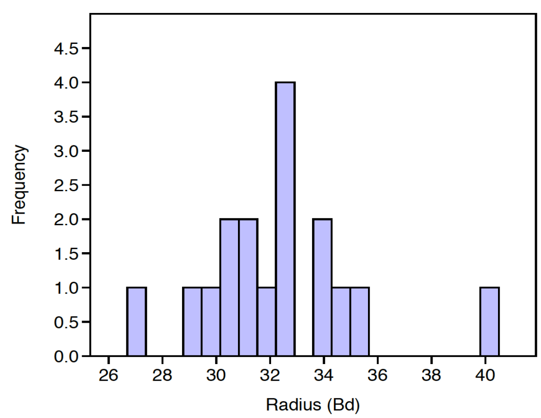


Figure 34 - Distal Breadth of Radius

Comparative Specimens

(5028) - 31.57

(7000) - 29.47

(6005) - 37.59

(Tx) - 35

The distal breadth (Bd) of the radius (Figure 34) produced no trends through mixture analysis. Compared against the known skeletons the peak in the data (32.5mm) lies in between the known male and female individuals. Since all measurements were taken on fused specimens they represent animals older than 28 months. These measurements therefore could represent a predominance of large adult females or younger adult males, or any combination of these. The two outliers, represent a large male and a small female.

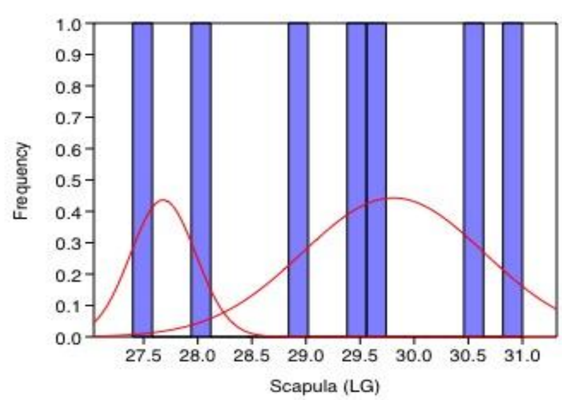


Figure 35 - Length of Glenoid

Comparative Specimens

(5028) - 28.59

(7000) - 26.02

(6005) - 34.3

(Tx) - 34.2

For the scapula (Figure 35) the length of the glenoid (LG) was examined. Mixture analysis produced two trends for this histogram. The first trend falls in the realm of the known females while the second falls well shy of the known males. This could represent a mixed population of adult females and young males or could be a wide variety of all young males from yearling to young adult. The small sample size makes interpreting these data difficult.

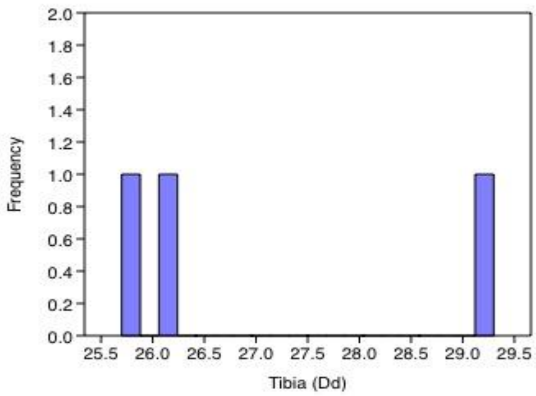


Figure 36 - Distal Depth of Tibia

Comparative Specimens

(5028) - 26.11

(7000) - 23.9

(6005) - 28.34

(Tx) - 27.5

The distal depth (Dd) for the tibia (Figure 36) was examined but due to small sample size mixture analysis used no trends. Compared against the known males and females, one specimen is clearly a large adult male. While the other two are either adult females or younger adult males (all measurements are from fused specimens representing individuals older than 18 months).

<u>LSI Analysis</u>

Since sample sizes from specific skeletal elements were somewhat small, the next biometric data analyzed was LSI values for both the assemblage as a whole and for each individual phase. In addition, individual skeletal elements were also examined. The purpose of comparing LSI values is to determine if the majority of specimens fall above, below, or at the same size of a known comparative specimen. Even though a known female from the local region is part of the comparative skeletons it was not used as the standard when computing LSI due to its incompleteness of skeletal elements that comprise of majority of the Gaston site assemblage. Instead the complete known female specimen (5028) from Dorchester Maryland was used as the standard when computing LSI, and is represented on all histograms as 0.00. On the histograms if a specimen falls in the negative range it is smaller than the comparative female specimen. Likewise if the specimen falls in the positive range is larger than the comparative female specimen.

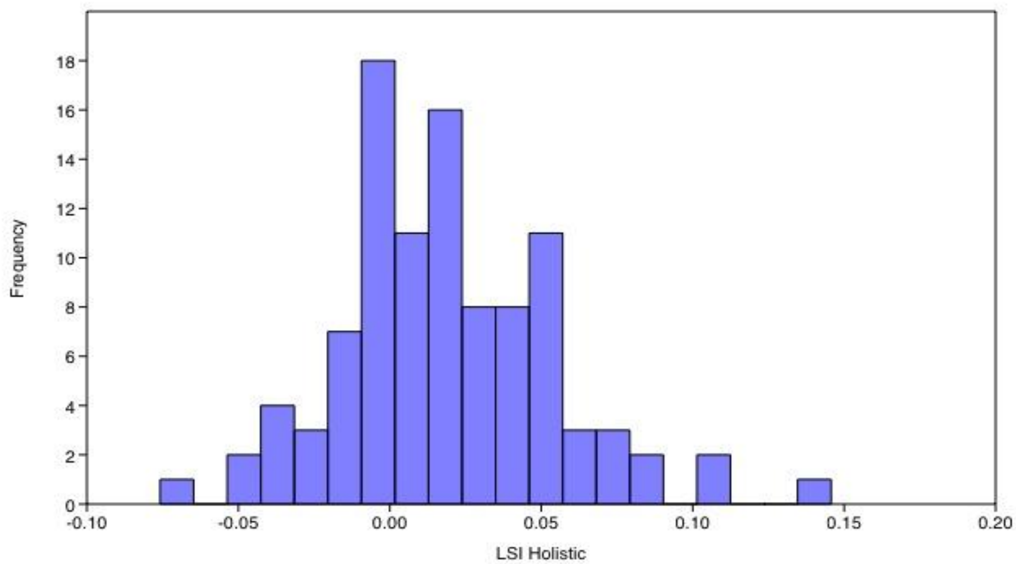


Figure 37 - LSI Values (Holistic)

From a holistic perspective, including all examined measurable specimens from the Gaston site in one LSI graph (Figure 37) shows that a majority of individuals in the assemblage were either larger or equal in size to the standard. The peak in the data falls just below the size of the standard animal suggesting females or smaller sized juveniles were abundant. A small percentage of specimens are much smaller than the standard. Many specimens exhibit LSI values that are larger than the standard including some very large individuals. The secondary peak at 0.05 on the LSI scale likely represents large male animals. Overall, the biometric population of this assemblage likely represents a combination of some small females and large males, combined with large numbers of larger adult females and/or smaller young males. The latter is supported by the survivorship data for the site, which indicates consistent culling of juvenile and young adult deer.

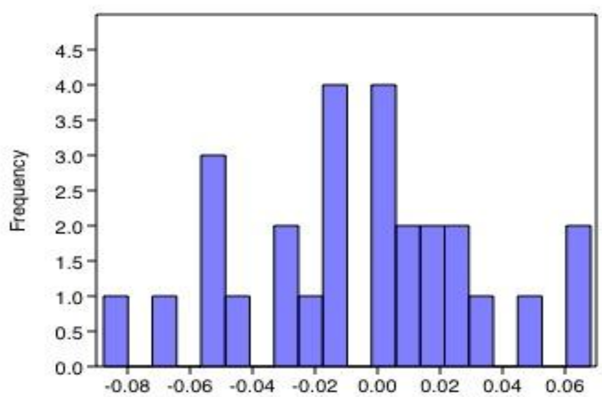
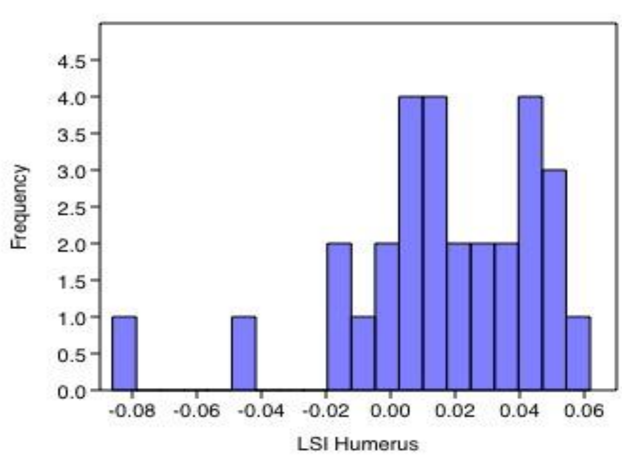


Figure 38 - LSI Values Calcanium

LSI comparison for the calcaneus (Figure 38) shows that just over half of the specimens fall at or above the standard. Just below half fall below the standard. This shows that larger individuals were not the sole targets of hunters but rather smaller individuals were also hunted.

Figure 39 - LSI Values Humerus



The humerus LSI data (Figure 39) shows that almost all individuals fall at or above the standard. Only a handful of specimens fall below the standard. The peak just above 0 on the LSI scale probably represents female individuals while the peak at 0.04 probably represents males. This distribution suggests a somewhat balanced sex ratio.

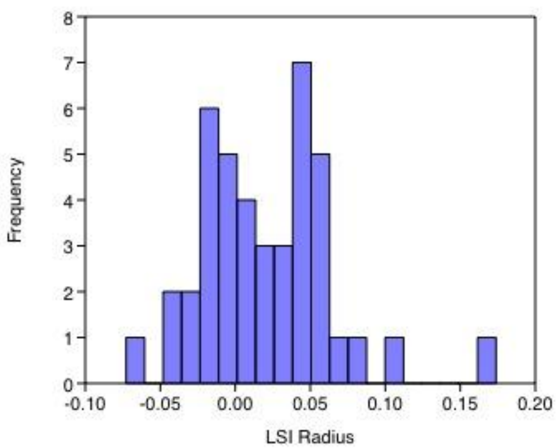


Figure 40 - LSI Values Radius

The LSI values for the radius (Figure 40) form two peaks falling to just below or slightly above the standard. The smaller peak (-0.03) probably represents females while the larger peak (0.05) represents male animals. A few outliers on either side represent very large and small individuals. These data are similar to those from the humerus and show that among adults both male and female deer were culled in similar quantities.

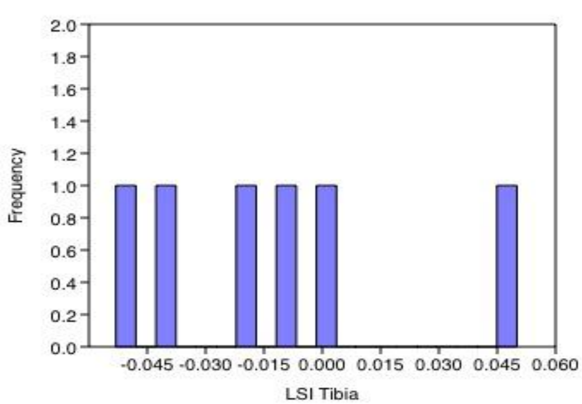


Figure 41 - LSI Values Tibia

The tibia (Figure 41) sample size was small however that which is represented shows that nearly all specimens were either at or smaller than the standard. With the exception of the one outlier this data shows the majority of individuals hunted were small.

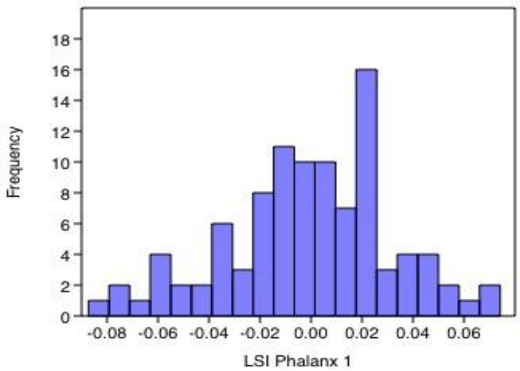


Figure 42 - LSI Values Phalanx 1

They are LSI values for the first phalanx (Figure 42) shows a fairly normal distribution with a peak at 0.02. This measurement, which reflects animals older than 12 months, does not seem to discriminate between males and females very clearly but shows a slight emphasis on larger individuals.

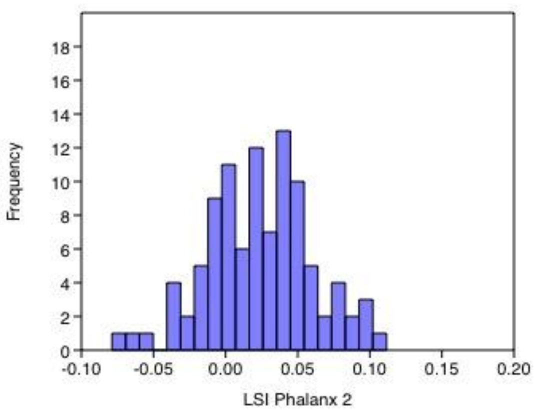


Figure 43 - LSI Values Phalanx 2

The LSI data for the second phalanx (Figure 43) illustrates a group of specimens located around 0.0 as well as a group of larger specimens around 0.04. The peak at 0.025 reflects the area of overlap between the sizes of males and females.

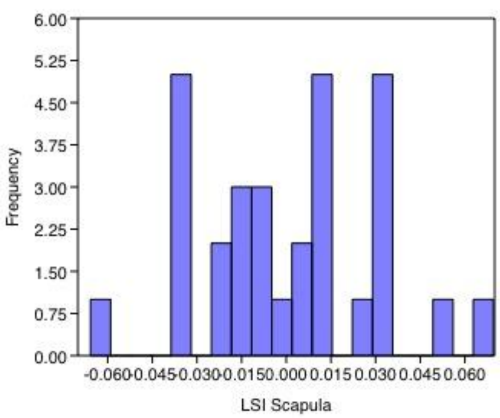


Figure 44 - LSI Values Scapula

The scapula LSI data (Figure 44) reflect a fairly balanced distribution of individuals larger and smaller than the standard. The data show a slight bit of favoritism toward the smaller individuals.

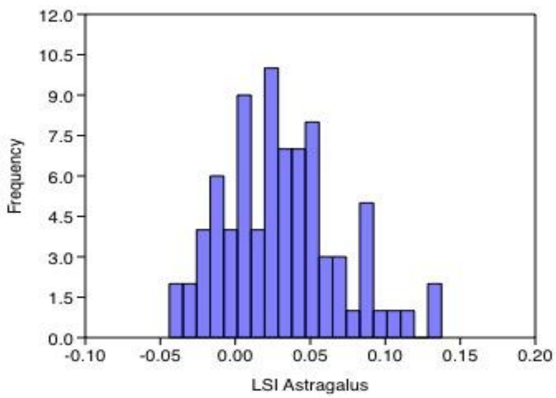


Figure 45 - LSI Values Astragalus

The astragalus LSI data (Figure 45) show a large skew towards individuals of a larger size indicating the presence of large males in the range of 0.05 and larger on the LSI scale. A peak located at the size of the standard (0.0) probably represent a combination of females and juvenile males while smaller males and larger females are likely indicated by LSI values around 0.03.

LSI Vincent/Clements Phase

By examining the LSI values for the individual phases it might be possible to address changes in hunting strategies between these two occupations by testing evidence for changes in the distribution of body size between the Vincent/Clement phase and the Gaston phase. This will be attempted through in-depth examination of the phases is as a whole. The standard skeleton and histogram representation remains the same as above.

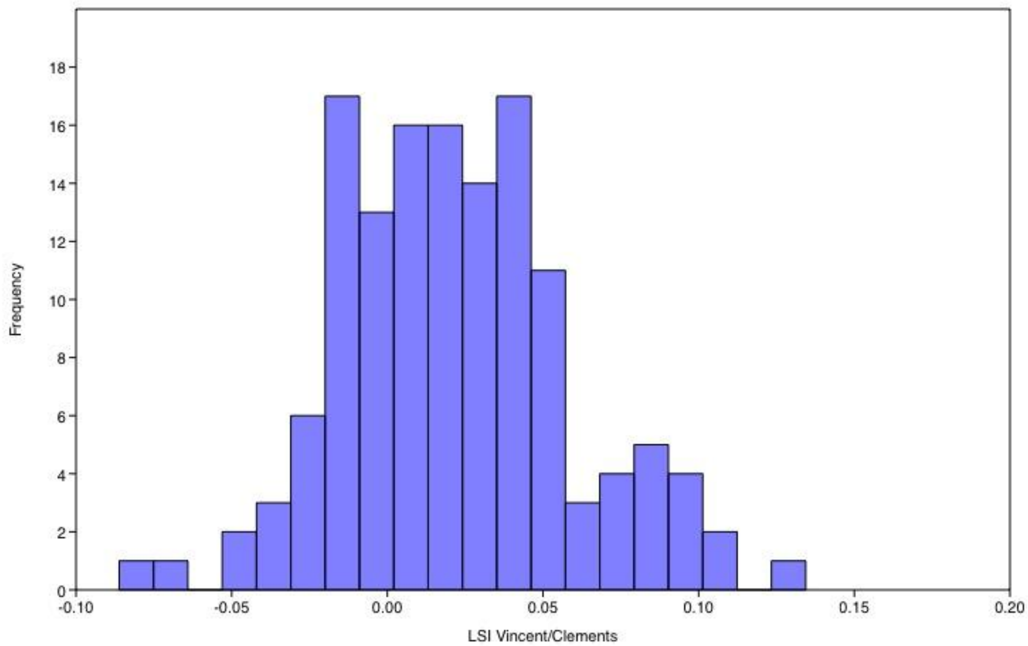


Figure 46 - LSI Values (Vincent/Clements)

The LSI values for the Vincent/Clements (Figure 46) occupation phase show two peaks, one located just below the standard female -0.02) and the other located at 0.04 which likely represents male animals. A smaller group of specimens between 0.05 and 0.10 probably represent large adult males. The large number of specimens between 0.0 and 0.05 on the LSI scale likely represent a combination of larger adult females and young male individuals. As a whole the Vincent/Clements occupants favored standard to larger than standard sized deer for harvesting.

LSI Gaston Phase

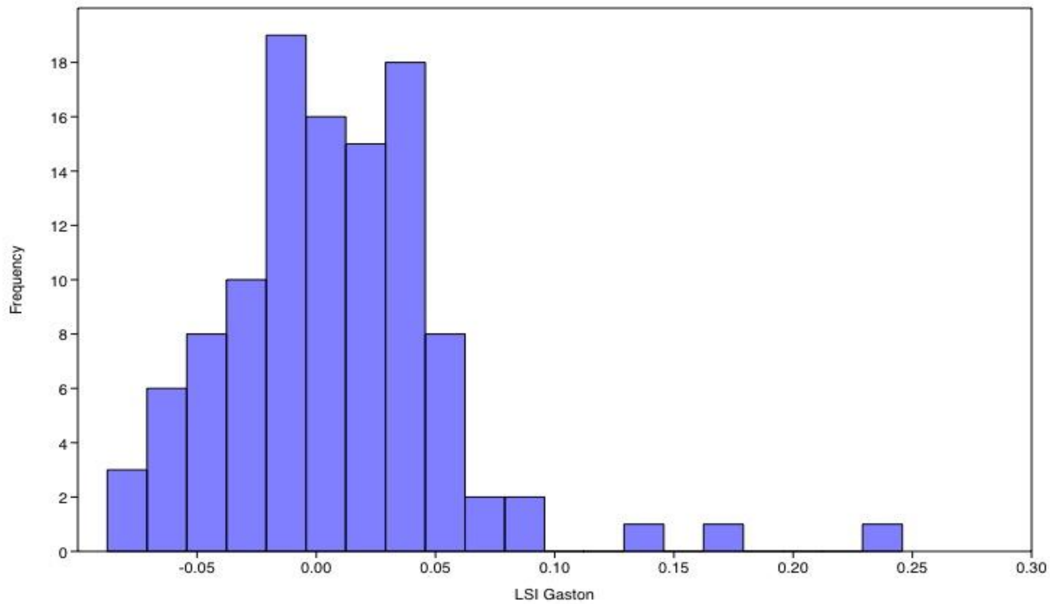


Figure 47 - LSI Values (Gaston)

For the Gaston occupation phase the LSI values (Figure 47) show a similar overall pattern compared to the Clement/Vincent phase. One peak is located just below the standard female (-0.01) while a second peak is located at 0.04, likely represent males. However, there are also differences in the two assemblage. In the Gaston phase, there are more smaller individuals than in the earlier phase, and there are fewer specimens in the large size range. These differences are confirmed by both a T-test and a Mann-Whitney U test.

The T-test shows that the mean LSI value for the Vincent/Clements phase (0.021) is significantly larger than that for the Gaston phase (0.007) (p=0.009). This result is confirmed by a nonparametric Mann-Whitney U test, the results of which indicate that the LSI means of the two assemblages are significantly different (p=0.002)

[T-TEST]

Tests for equal means

A Vincent/Clements B Gaston
N: 136 N: 110
Mean: 0.021499 Mean: 0.0071349
95% conf.: (0.015077 0.027921) 95% conf.: (-0.0018355 0.016105)
Variance: 0.0014341 Variance: 0.0022533

Difference between means: 0.014364
95% conf. interval (parametric): (0.0036474 0.025081)
95% conf. interval (bootstrap): (0.0034565 0.025327)

t : 2.6401 p (same mean): 0.0088215
Uneq. var. t : 2.5786 p (same mean): 0.010617
Monte Carlo permutation: p (same mean): 0.0079

[MANN-WHITNEY TEST]

Tests for equal medians

A Vincent/Clements B Gaston
N: 136 N: 110
Mean rank: 75.15 Mean rank: 48.35

Mann-Whitney U : 5789
z : -3.0464 p (same med.): 0.0023157
Monte Carlo permutation: p (same med.): 0.002

LSI Fusion Data

Vincent/Clements Phase

LSI data was calculated for the fusion stages to try and discern if the individuals of a certain sex or age were being targeted and how it compared to the fusion data. The same comparative individual was used as the standard as the rest of the LSI data.

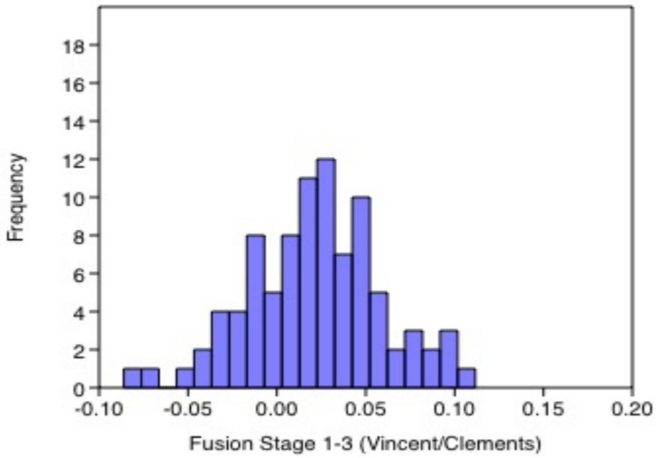


Figure 48 - LSI Values Fusion Stages 1-3 (Vincent/Clements)

This chart (Figure 48) is hard to interpret, but represents fused specimens from early fusing skeletal parts. This means that the individuals represented could potentially represent quite a wide range of ages. In general terms for Fusion Stages 1-3 a majority of the individuals in the Vincent/Clements occupation were larger than the standard. The individuals above .05 are almost certainly all males.

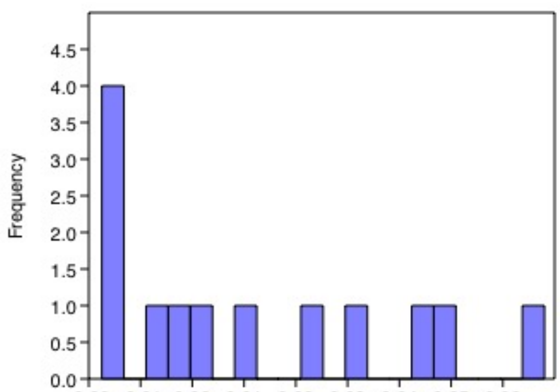


Figure 49 - LSI Values Fusion Stages 4-5 (Vincent/Clements)

For fused specimens representing Fusion Stages 4-5 (Figure 49) the LSI data shows something different. All of the individuals represented here are at least 23 months old and therefore represent adult deer. There is a peak in body size slightly smaller than the standard. This could easily represent adult females or possibly young adult males. The individuals to the far right of the standard are certainly large males. There is almost even distribution of individuals above (N=7) and below (N=6) the standard. Those below are all closely related in size, while those larger than the standard are spread out.

Gaston Phase

Unlike the Vincent/Clements occupation the individuals from the Gaston occupation are closer in size to the standard for Fusion Stages 1-3 (Figure 50). There are still outliers to both ends of the spectrum representing larger males and very small individuals. A majority of individuals fall either just above or below the standard animal in a somewhat bimodal pattern.

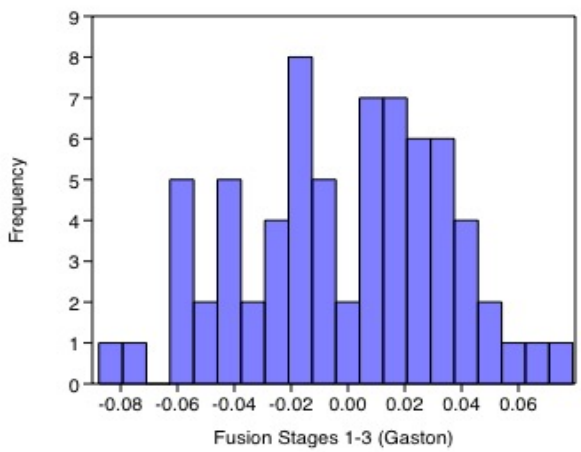


Figure 50 - LSI Values Fusion Stages 1-3 (Gaston)

For the later fusion stages (4-5) Gaston individuals are well above the standard (Figure 51). All of these represent large older males. There are a few smaller than standard individuals that could be either the adult females or younger adult males. Again small sample size makes interpreting these results difficult.

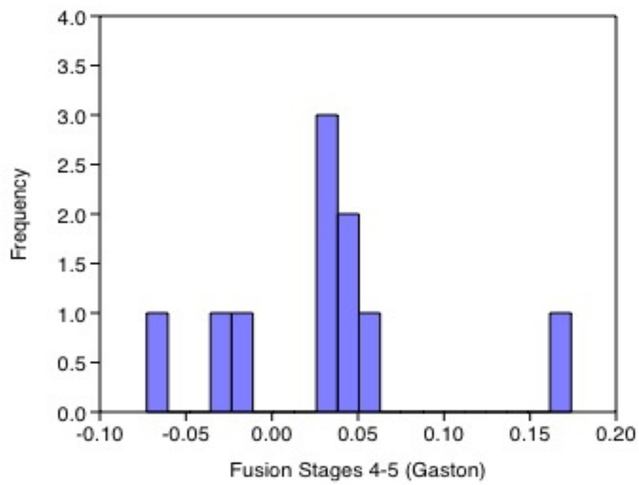


Figure 51 - LSI Values Fusion Stages 4-5 (Gaston)

Fusion Stages 1-3 T-test

In order to compare how similar the LSI fusion data are, I ran a T-test and Mann-Whitney U test to compare the fusion stages 1-3 between the Vincent/Clement and Gaston phases. These tests work by comparing the mean values from each and generating comparisons in similarities. The Vincent/Clements individuals on average are larger than the standard (.021), while the Gaston individuals are slightly smaller than standard (-0.001). For the T-test the p value is .0001 indicating a significant difference is mean size between the two phases. The Mann-Whitney test is another way to compare the mean value similarities and the p value represents the same significant result (p=. 0002). This gives a very clear distinction in the way the two groups of people were interacting with the white tailed deer population in the Late Woodland period. The smaller mean size of the Gaston phase early fusing skeletal parts may be related to the high representation of small –sized juvenile deer evident in fusion stage 2.

Tests for equal means

A Vincent/Clements B Gaston
N: 90 N: 70
Mean: 0.02157 Mean: -0.0018224
95% conf.: (0.013629 0.029511) 95% conf.: (-0.010483 0.0068385)
Variance: 0.0014375 Variance: 0.0013194

Difference between means: 0.023393
95% conf. interval (parametric): (0.011675 0.03511)
95% conf. interval (bootstrap): (0.01198 0.035034)

t : 3.9429 p (same mean): 0.00012067
Uneq. var. t : 3.9643 p (same mean): 0.00011321
Monte Carlo permutation: p (same mean): 0.0004

Mann-Whitney

Tests for equal medians

A Vincent/Clements B Gaston
N: 90 N: 70
Mean rank: 51.944 Mean rank: 28.556

Mann-Whitn U : 2084
z : -3.6649 p (same med.): 0.00024741
Monte Carlo permutation: p (same med.): 0.0004

<u>Fusion Stages 4-5 T-Test</u>

For Fusion Stages 4-5 the same tests were generated to compare Vincent/Clements and Gaston occupations. In this test the individuals from Vincent/Clements are larger than the standard (.011) and the individuals from Gaston are significantly larger than the standard (.028) on average. The T-test p value is (.40) showing that these differences are not statistically significant. The Mann-Whitney p value of .55 shows the same result between the two data sets.

Tests for equal means

D Vincent/Clements E Gaston
N: 13 N: 10
Mean: 0.011652 Mean: 0.028753
95% conf.: (-0.0057526 0.029056) 95% conf.: (-0.018043 0.075549)
Variance: 0.00082952 Variance: 0.0042793

Difference between means: 0.017101
95% conf. interval (parametric): (-0.024923 0.059124)
95% conf. interval (bootstrap): (-0.025649 0.056985)

t : -0.84626 p (same mean): 0.40695
Uneq. var. t : -0.77116 p (same mean): 0.45592
Monte Carlo permutation: p (same mean): 0.4278
Exact permutation: p (same mean): 0.43308

Mann-Whitney

Tests for equal medians

D Vincent/Clements E Gaston
N: 13 N: 10
Mean rank: 6.3478 Mean rank: 5.6522

Mann-Whitn U : 55
z : -0.58931 p (same med.): 0.55565
Monte Carlo permutation: p (same med.): 0.552
Exact permutation: p (same med.): 0.5521

<u>C14 Dating</u>

Carbon-14 dating was conducted by Beta Analytics Inc., Miami, Florida. The bone sample sent was unique bone number 305, a petrous bone, which was grouped to the Vincent/Clements occupation by Steve Davis. Although this specimen was destroyed in the process, it provided a date of 1010 CE with a range of plus or minus 30 years. The 68.2% confidence interval falls right in the middle of the established dates for the Vincent/Clements occupation of 500-1600 CE. The full report provided by Beta Analytics Inc. has been attached as (Addendum A) at the end of this report.

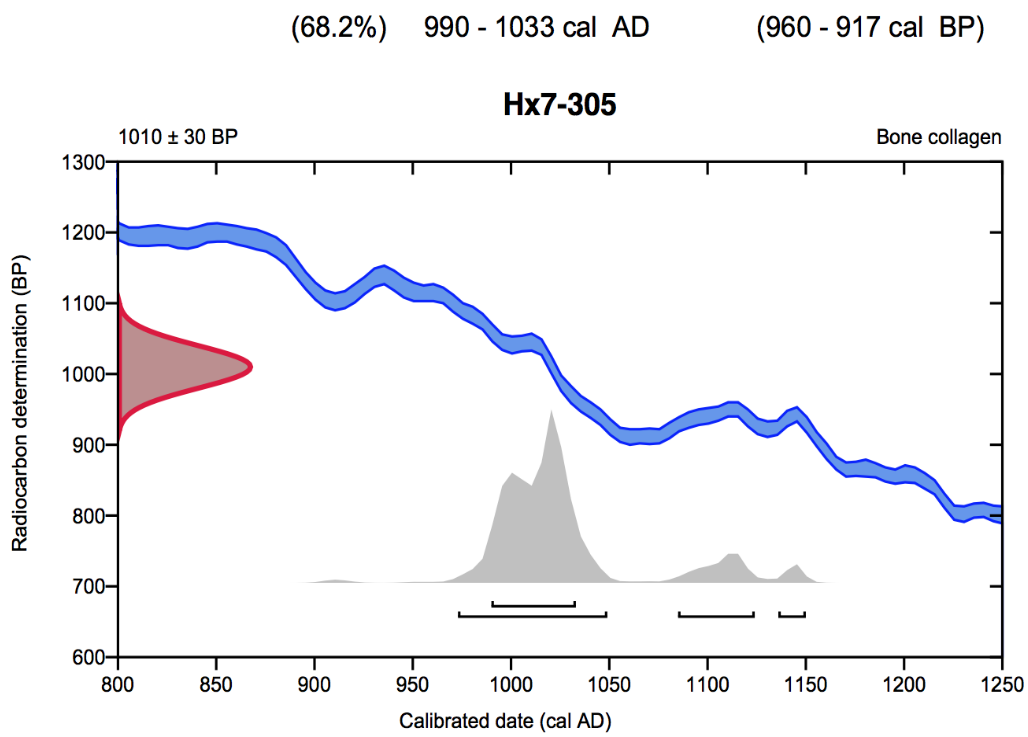


Figure 52 - Carbon 14 Dating for Sample 305

DISCUSSION

The analysis of the deer assemblage from the Gaston site give special insight into Native American hunting practices in North Carolina during the pre-contact periods. Due to the long-duration of occupation of this site, long-term trends and changes in hunting an economy can be established. Through this data collection, the effects of taphonomic processes as well as age and sex of the hunted deer can be established. This can then be used to compare and contrast the occupants of the different phases.

NISP

Species frequency through NISP gives easily comparable data across sites. Excluding the large numbers of dog remains from the Gaston site for purposes of cross comparison the Gaston site still contained above average amount of mammals compared to regional assemblages. White tailed deer makeup by far a majority of this sites food economy and falls above the comparative average. These occupants were more reliant on this species in those other sites. The distribution of turtles was also well above the average. This is not surprising given the location of the site being right on the edge of the Roanoke Rapids. What was surprising however, was the fact the displays location the frequency the fish in the assemblage was about one fourth of the comparative sites. This either means that the occupants had almost no reliance on the fish for sustenance or the collection method of sifting through a 3/8 screen did not retain the small fish bones and created this unusually small bias. The other main difference in species frequency between the sites is Gaston only had a fraction of birds represented in the assemblage by comparison. This again could be do two less of a reliance on the species, collection methods, or possibly lack of availability of the species.

Taphonomy

Taphonomy played a significant role in the Gaston site assemblage. The use of a ⅜" screen for sifting most likely created a bias for larger fragments only. Soil conditions also had a role to play in a survivorship of specimens. Many of the examined bones were highly deteriorated and displayed a chalky, flaky, and easily crumble exterior it was further damaged upon recording. This damage also made several fragments unmeasurable or recordable in further detail beyond element part. This very well could have created a bias in the biometric, sex, age, human and carnivore interaction data due to the fact that only the best-preserved elements could be recorded in detail. Other processes such as cut marks, burning, and carnivore gnawing also affected the overall representation of specimens in the assemblage. Less than 10% of recorded specimens had cut marks and of those 3% were unusual divots. This is a bit unusual for the fact that deer played such a vital role sustenance the presence of more cut marks are expected. This might be explained by the skill of the butcher, however more likely it is due to the lack of preservation. The unusual divots were more generally 1 cm wide by 2 cm long and did not seem to follow any discernible pattern. They were present on all manner intensity of bone. Stanley South describes similar markings on steatite sherds as rodent gnawing in his publication of the Roanoke sites (South, 2005). I am not convinced that this is the case as for the markings found on the bones in this assemblage. The reason for this uncertainty is the fact that the scraping in these markings follow no directional pattern and there are clear signs of crosshatching. This is further reinforced to me by the lack of parallel markings that are expected from a rodent scraping its incisors on an object. I also do not believe these markings to be carnivore gnawing because a similar marking was never found on the direct opposite location on any specimen. I do not have an explanation as to the formation of these markings the only thing I can say for certain is they all formed by the same process due to similarity, locations found, and frequency. Carnivore gnawing was present approximate 5% of the assemblage, which is a clear indication that dogs had access to the following means prior to burial. This percentage would most certainly be much higher, however the simple act itself destroyed the rest of the marked specimens. Due to the fact it is assemblage was all deposited within the confines of the occupation if further reinforces the importance of canines to the occupants, who probably lived among its people and were most likely fed these remains.

Age Data

Epiphyseal Fusion

Fusion data enables determination of an individual's age at the time of death. This is used for the purpose of formulating what age of individual were being hunted. For the Gaston site there is very little representation of infantile deer meaning these individuals were not purposely targeted. The biggest declines in survivorship (Figure 11) takes place between 11 and 20 months, 23.7%, and between 23 and 29 months, 16.6%. These large declines indicate intensive hunting of the specific age groups. Due to reproduction and survival rates the younger age groups are going to be more abundant, because of this regardless of hunting technique utilized the most abundant group has the highest chance of being killed.

In the Vincent/Clements phase there is very little representation of infantile deer, showing that they were not specifically targeted by hunters. The drastic decrease from 11 to 20 months, at least 27.5% shows an extensive hunting and targeting of this age group. A decrease of 20.8% by 23 months shows that this age group is also extensively hunted. Due to this slaughter of specific groups I think it is unlikely the occupants of this phase used cooperative hunting techniques or large-scale game drives which would be expected to result in targeting a wider range of ages. Instead these individuals conducted selective targeting, probably through stalking, focusing primarily on targets of opportunity. Based on of kill off age it appears that the occupants had two distinct hunting seasons. The large drop in survivorship at Fusion Stage 3 (17-20 months) would line up with a late fall early winter hunting season. Then a second large decline at Fusion Stage 4, (23 months) line up with a late spring early summer hunting season. A possible reason for this intensive culling could be because these younger age groups are the most abundant and therefore the most opportune.

In the Gaston phase survivorship data indicates a drastic change in hunting techniques. This is evident through the 30% decline in population by 11 months, showing a much more intensive targeting of juvenile deer than in the Vincent/Clement occupation. Due to limited sample sizes, decline survivorship from stages 3 to 5 is a little hard to interpret. However, by 29 months only 33% of the population remains. This means that most deer were targeted between the ages of 1 and 2 years and very old adults were rarely killed and brought back to the settlement. Although it is inconclusive by survivorship alone, because of the lack of older individuals in the assemblage, I think that juveniles were intensively selected through probable stalking. If theses individuals were killed in mass by communal drives then there should be a stronger presence of older individuals. Due to seasonality of the hunts, which from survivorship (Fusion Stages 2, 11 months, and Fusion Stage 3, 23 months) appears to have taken place each year in the late spring, shortly before birthing season. This could explain the complete absence of infantile deer in the assemblage that you would expect if communal hunts were utilized. The technique utilized is inconclusive; however there is strong evidence of repeated annual hunts on a unknown scale.

<u>Tooth Wear</u>

Tooth wear and the presence or absence of juvenile teeth can be used to help identify age of individuals at time of death. The presence or absence deciduous teeth is used to determine whether individual is juvenile. Calculating the percent juvenile is done by dividing the number of deciduous premolar 4 (DP4) by the number of permanent premolar 4 (P4) or molar 3 (M3) whichever is greater in frequency. Four this assemblage the P4 was used as the base. According to Severinghaus, the DP4 is replaced by the P4 by 18 months of age (1949). The Gaston site had a 24% juvenile population in the assemblage according to tooth eruption. This means that 24% of individuals were less than 18 months old when they were killed. This roughly matches up with the large dip in survivorship scene from stages 2, 11 months, and stage 3, 23 months. The overall decline in population from birth to 23 months is roughly 34%. This close relationship clearly shows that these young individuals were being killed in mass whether through direct targeting or part of a larger communal hunting endeavor. Tooth eruption was not compared on the phased level due to small sample size.

Skeletal Part Analysis

Skeletal part frequency can be examined to see the presence or absence a specific anatomical elements. This can be used to help reconstruct how the animal may have been processed and secondary uses for bones (e.g., for tools). Is interesting to note that there is extreme underrepresentation of the upper limb bones, femur and humerus. Even though these bones are almost twice as dense as the phalanges their overall distribution in the assemblage is low. At the same time the lower limb bones radius down and tibia a down made up a good portion of the assemblage. It is possible that these large bones or being repurposed after harvest and that is why that are lacking in the archaeological record. Is also worth noting that the femur and humerus are the largest marrow stores in the body. This could provide extra food utility two either the occupants or carnivores such as the dogs found on the site.

Through use of calculating MNE and MAU in order to get % MAU, further analysis into the skeletal part frequency and distribution was done. The % MAU was used to make scatter plots for both bone density and food utility in order to establish a pattern in the assemblage. It is clear from (Figures 18, 21 & 24) on the whole site as well as in both Vincent/Clements and Gaston occupation phases that there is a direct correlation between density and frequency in the assemblage. These scatterplots show that the bones with the highest distribution in the assemblage are also the densest. This means that regardless of use or utility of a particular skeletal element density is the driving factor in whether or not is present the archaeological record.

Food utility measures how much sustenance can be derived from an anatomical element of the body. On both site and phase level the FUI follows the same pattern. Elements with the lowest utility have the highest representation in the assemblage. These elements also have the highest bone density this further reinforces the idea that density is a driving factor in representation in the assemblage. The elements that have the highest utility also have some of the lowest density. Following patterns of density mediated destruction human behaviors such as carcass transport can be ruled out as the main reason for lack of representation in the archaeological assemblage.

Biometrics

Biometrics observes differences in size in order to identify trends that can lead to the distinction between males and females as well as possible juveniles. Overall, the biometric data for the entire assemblage suggest that there is extensive hunting of individuals right around the size of the standard animal (an adult doe). There is also a strong preference for individuals who are larger than the standard. Comparing this with the survivorship data this could very well be representing the repeated seasonal kill-offs demonstrated by both occupation periods. However, the relative size difference between the LSI values and the standard animal does not make sense because of the expected peak well below the standard animal representing the yearlings that were exploited. This could be explained only if it disproves a previously conception that the deer population is relatively larger after reinstitution than their ancestors that lived before the time of the mass hide exportation of colonial times, extensively researched by Heather Lapham (2005). If the deer hunted during this time period were larger than the two peaks just below and above the standard could be explained as the 1 and 2 year olds that were mass exploited. This gradual decrease in overall body size could be due to an evolutionary response. If the individual was smaller it was less likely to be harvested for its pelt during the colonial era. As described in the introduction North Carolina did instituted a massive repopulation effort at the turn of the 20th century, however, because only a small number of individuals were brought in from other states, the smaller remaining local deer passed on more of their genetic code, resulting in smaller deer today. This idea can be reinforced by the comparative specimen (7000) that was harvested from Orange County, NC; which is within 100 miles of the site. This individual is dwarfed in comparison to the individuals of the assemblage.

For the Vincent/Clements occupation the LSI values are either just below almost entirely about the standard. This shows intentional selection toward larger individuals. The large mass right around the standard could easily account for the biannual hunting seasons discussed above. With a majority of the individuals being right around the standard this could reflect the data shown in survivorship and account for the majority of individuals who where killed at Fusion Stages 3-4. The second smaller cluster just shy of (.10) also show another selected population represented by large adult males. However, this small accumulation of individuals shows that these males where only hunted if the opportunity was present, but by no means were they the focal population.

In Gaston occupation there was a similar trend of focusing on the standard sized individuals. Those that are shown as smaller than standard are most likely the yearling that were culled, while those around standard size were probably the 2 year olds. Gaston had a much smaller focus on large males. Those that are present are very few and far between but are of a much larger body size than seen in the Vincent/Clements occupation. These individuals were also most likely only hunted if the opportunity was available.

C14 Dating

From the previous work conducted on the site by Coe and South, solid dates were established for the periods of occupation based off of finds; especially pottery, and C14 dating that was conducted. However even with these C14 dates, they were established off of charcoal found within the stratigraphy, not directly related to the faunal remains. By getting a solid C14 date off of the faunal assemblage we can clearly and undeniably relate the assemblage to the site as a whole. The sample tested for this thesis clearly falls in Vincent/Clements occupation pre-established timeline and definitely proves the site to be pre-European contact. Therefore hunting patterns observed at this site can be compared to post-contact sites in order to examine the extent European contact influenced the hunting patterns of Native Americans in the Piedmont area.

Summary

Unfortunately the main question of how hunting was organized and carried out at the Gaston site in the late Woodland period remains inconclusive concerning the techniques utilized. Most likely both occupations hunted selectively by stalking. The lack of infant deer or very old individuals does not support the use of communal group drives; however, strong density related survivorship could have removed very young specimens from archaeological record. Regardless of the hunting technique, it most likely remained similar in both phases, only the targeted individual changed slightly with more young individuals targeted in the Gaston phase. The reason for this change is unknown and could be due to the displacement of the Vincent/Clements occupants by those of Gaston like thought by Coe or possible a reaction to a changing environmental stressor. This will need to be the topic of further research for any further clarification.

This research did prove conclusively that there was a very strong premeditated disposition for the culling of young adult individuals who were approximately the size of the standard animal. This probably represents young males. While older individuals were hunted, with records of some very large old males, they were not the main target of hunters. The reason for the focus on 1-2 year old individuals is most likely due to sheer availability; the most abundant population stands the greatest risk of being approached by hunters. Since these individuals also lack the experience of avoiding hunters this also probably made it easier for them to be killed.

The occupants of the Vincent/Clements occupation focused on larger than standard young adults who were probably males based off of size data. These hunt would have taken place in winter and the spring. At Gaston there is strong evidence for seasonal hunting focusing on yearlings, 2 year olds, very large males. There appears to only be one large hunting season that takes place in the spring.

Both of theses occupations raise one very prominent question. Why were large annual hunts being conducted in the early spring, not late fall early winter as described in previous work by Heather Lapham and others? For this I have no answer. To me it would seem counterproductive because the deer are not at their largest annual body size due to shortages of food during the winter and killing off pregnant females could have a negative effect on the future herd. This will have to be addressed in future research.

CONCLUSION

The Native American site at Gaston was a long-term multi-occupation site utilized over several thousand years. This thesis covered just the last three occupation periods with the focus on native interactions with the white-tailed deer population. This was done through the examination of the faunal record. The aim of this thesis was to address the questions of how the occupants of the Gaston site hunted the deer as well as what was there targeted population and did this change over time.

There was strong evidence that several taphonomic processes took place that altered the archaeological record. The strongest of these of density related survivorship, the denser the bone the better chance it had of surviving in the record. The distinct presence of dogs on the site made carnivore gnawing a prevalent and destructive impact on the faunal assemblage. Other biases could have also played a role in overwhelming percentage of deer represented in the assemblage compared to other prey. The use of ⅜ inch screen to recover the remains could have easily filtered out smaller prey such as fish, which would have expected to be present by the given location of the site.

Reconstruction of the Late Woodland period hunting patterns is important to better understand the impact of Europeans, not only on the native peoples but also the land as a whole. This research can be used to compare trends from the precontact and postcontact periods, emphasizing the impact on the most important food source in the Piedmont.

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