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Microfaunal remains from the Ryan-Harley site

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Background

The Southeastern United States is a heavily studied region, but there is a lack of data from the Middle and Late Paleoindian period (~12,700 – 11,500 cal BP) leading to it not being well understood (Dunbar et al. 2006; Sherwood et al. 2004; Smith 2020). This is due in part to there being a limited number of sites available to discover, as this period is typified by small, nomadic populations, who left little material culture behind. Additionally, over these many millennia, the environmental conditions of the southeastern region took their toll on the perishable record. Much of the soil in this area is highly acidic making preservation of organic materials rare and subject to being destroyed by constant wet and dry cycles (Dunbar et al. 2006; Smith 2020). This means that the few sites that have been found and studied in this area are an essential resource for understanding the early migratory patterns of peoples from this region. What lithics, animal remains, and plant materials are preserved allow archeologists to get a picture of the diet and social structure of the groups that inhabited the camps they left behind. Comparable data characterizing on the Paleoindian people in the Southeastern United States comes from research on rock shelter sites in and around the Middle Tennessee River Valley (Hollenbach 2009; Meltzer and Smith 1986). Research done on rock shelters from this region allowed for the study of well-preserved organic materials, therefore the data from excavations from the Middle Tennessee River Valley is used in this thesis as a baseline study for expectations of other sites in the southeast (Daniel and Wisenbaker 1987; Hollenbach 2009). Background research suggests that the uniformity of the toolkits found across sites in the southeast dating to the Late Paleoindian period was indicative of the high mobility of people groups who required adaptable and flexible tools (Anderson et al. 1996; Dunbar and Vojnovski 2007; Goodyear 1982; Kelly and Todd 1988). The use of non-local high-quality material and extensive toolkits suggest broad movement of these groups throughout the landscape and the existence of possible trade networks (Balsillie et al. 2005; Goodyear 1989). Furthermore, environmental reconstructions (Delcourt and Delcourt 1985) note that ecological communities changed rapidly across the Late Pleistocene and housed highly diverse species including extant and extinct fauna (Dunbar et al. 2006; Hollenbach 2009). This environmental shift is seen in pollen analysis that shows the dominant vegetative species transitioning from coniferous forests to deciduous hardwoods such as oaks (Widga et al. 2022). Pollen samples suggests a change in environment from warm humid conditions with many aquatic-adapted flora to cooler arid conditions during the deglaciation period (Grimm et al. 2006). However, to fully understand regional differences in foraging behaviors and how these groups were affected by ecological factors, more in-depth analysis needs to be conducted on sites. Therefore, the focus of this thesis is to compare and contrast the faunal assemblage of Ryan-Harley, an open-air Middle Paleoindian site now submerged in North Florida, with contemporaneous assemblages from rock-shelter contexts in North Alabama.

Based on regional data from northwest Alabama, it is likely that Paleoindian foraging groups were highly mobile and generally limited to small groups of extended families (Binford 1979). Foraging people were reliant on a wide range of plants and animals for their diet, many of which were seasonal and required some form of systematic movement to obtain reliably (Binford 1979). To understand early nomadic people's behaviors, the division of labor and Central Place Foraging Theory were used to interpret both subsistence activities and social roles (Hollenbach 2009). It was established that one of the most important variables in establishing a location to stay in was how close easily processed resources were, but not necessarily if they were animal or plant-based. These low-cost resources (Hollenbach 2009) were predictable based on season and landscape and thus served as a preferred resource for foragers who required a stable flow of nutrition. Such patterns reflect the contribution of gatherers (mainly women, their reliant children, and the elderly) in subsistence and provide insight into the many ways that subsistence plays a significant role in cultural practices (Hollenbach 2009).

Accordingly, in an effort to better understand the paleoenvironment and resource use of foragers in the Southeast, this research compares microfaunal remains from the Middle to Late Paleoindian Ryan-Harley site located in Florida to contemporaneous sites from the Middle Tennessee River Valley. By comparing the faunal specimens found at each site this research seeks to prove the importance of analyzing screened materials for the collection of data.

Foraging Theory in the Southeast

The impact of foragers in these Late Paleoindian societies can be better understood by looking at the division of labor and Central Place Foraging Theory (Hollenbach 2009). Many ethnographic accounts of foraging groups note the presence of the division of labor between women (gatherers) and men (hunters), with children of either sex acting as independent gatherers until deemed old enough to hunt or forage for the group (Bird 1999; Elston and Zeanah 2002; Hawkes 1996; Hollenbach 2009). Plant-based foods, small mammals, shellfish, and other process-heavy resources would generally be designated to gatherers due to their high processing cost and stable availability (Bird 1999; Hawkes 1996). Such data contrasts with the roles of hunters, who typically chose larger bodied animals and targeted resources yielding higher energy returns but whose attainment was much less reliable. The sexual dichotomy in the division of labor is not set in stone, as there is still plenty of evidence of women hunting, especially in cases where hunting is a more reliable resource in terms of energy return (Panter-Brick 2002; Walker et al. 2002). Likewise, in areas where hunting is particularly unfavorable, men will often take on more of a gathering role though they may focus on other protein sources like fishing or small game (Hawkes 1993). Central Place Foraging Theory places the goal of foragers being that the central place is located where they can spend as little energy as possible bringing back the largest quantity of resources (Hollenbach 2009).

Plant-based resources were likely a key component in the diets of foraging peoples that filled the gaps between the lulls of hunters returning with larger food sources and provided other key nutrients and minerals (Bird 1999; Hollenbach 2009). As such, site locations and mobility patterns were planned around the seasonal and spatial availability of gathered resources (Hollenbach 2009). Site locations were based around women, children, and the elderly being able to gather resources domestically while resources like animal meat and raw materials were obtained operationally (Kelly 1995; Panter-Brick 2002). Subsistence strategies in Northwest Alabama correlate with the most important aspect of gathering resources being the handling cost compared with the caloric return (Hollenbach 2009; Orians and Pearson 1979). Resources like animal meat and high-calorie nuts and seeds were more likely to travel long distances due to the high energy return rate. The value of animal resources may have been seasonally determined, with animals having higher yields based on fall fat stores, breeding periods, and migratory seasonality. Plant-based foods would have been seasonally restricted and required the travel of foragers to specific locals during different periods of the year.

The Central Place Foraging model effectively highlights the resources that are most likely to affect camp placement through the seasonal rounds that migratory hunter-gatherers made (Orians and Pearson 1979; Zeanah 2000). Another abiotic factor affecting seasonality is the extreme climate change that temporarily reversed the warming trend during the time known as the Younger Dryas. This Younger Dryas, a break in the warming period were temperatures dropped back to glacial conditions, shift in the paleoenvironment, in which trees like oaks slowly took over the landscape and outcompeted cooler climate species like spruce which were moving northward (Anderson et al. 1989; Boyd 1989). Changes in the flora would have greatly affected the animal and plant resource access, especially the megafaunal populations on which indigenous peoples relied on. By the Late Holocene, most Pleistocene indicator species left in the Tennessee River Valley research area are current southeastern species.

Overall, research focusing on migratory foraging groups in the American Southeast include excellent comparative studies for the more coastal localities under consideration here, even though there may be nuanced environmental differences. Looking at the Tennessee River Valley and Alabama provides a framework for considering how general foraging behaviors and environmental stresses may have proceeded through the region as a whole, especially in areas with less preservation potential for contemporary records.

Introduction

This research focuses on a case study from north Florida, the Ryan-Harley site. Ryan-Harley is a single-component submerged indigenous site located in north Florida along the Wacissa River that was an open-air campsite. This site contains an unfluted lanceolate Suwannee-type point within buried context in association with faunal and floral remains. The presence of these points supports the hypothesis of the site possibly being a Pleistocene-age foraging camp (Balsillie et al. 2005; Dunbar and Vojnovski 2007; Dunbar et al. 2006). However, the archeological component was intermittently buried and re-exposed by eolian activity and taphonomic agents that reworked some of the assemblages, until it was permanently inundated by 8,000 cal BP (Dunbar et al. 2006). It is uncertain whether this reworking affected the placement of floral and faunal remains within the Suwannee assemblage, but evidence suggests that the site is a discrete occupation of Suwannee point makers during the Younger Dryas (Dunbar and Vojnovski 2007; Dunbar et al. 2006).

The Wacissa River is at the base of an erosional feature called the Cody Escarpment which is 30 kilometers (km) southeast of Tallahassee, Florida (Smith 2020). The river is spring-fed and flows 21 km south, at which point it loses 9 meters (m) of elevation and converges with the Aucilla River to become an anastomosing channel 17 km further downstream (Dunbar et al. 2006; Smith 2020). Currently, the Ryan-Harley site is 9.8 km from the coast and 4 meters above sea level (masl). During the Younger Dryas the Ryan-Harley site would have been 120-170 km from the coast and 60-70 masl (Dunbar et al. 2006; Smith 2020). Due to the rise in sea levels since the end of the Pleistocene the site is now inundated and buried under sediment, this has helped preserve the artifacts and remains found. This site is essential in better understanding the chronology of people's movement and use of the Southeast during the Suwannee period.

Paleoenvironment

Comparative data on the paleoenvironment during the Younger Dryas in Florida comes from the Page-Landson site. The Page-Ladson site is 4 km south of Ryan-Harley and has undergone extensive environmental analysis (Hansen 2006; Hoppe and Kock 2006). Pollen samples from the site demonstrate that the environment in the early Younger Dryas was cooler and more arid than current conditions (Dunbar et al. 2006; Hansen 2006; Perrotti 2019). The climate underwent a transition from 12,500 – 11,500 cal BP to a warmer savannah-like landscape that supported high enough groundwater levels to produce intermittent freshwater ponds in geographic low spots (Dunbar and Vojnovski 2007; Dunbar 2006; Smith 2020). Around 11,500 cal BP the change in pollen profiles indicates that hydrophilic plant species collapsed, which indicates freshwater levels decreased greatly after this point (Hansen 2006). Page-Ladson being located close to Ryan-Harley means that these environmental analyses can be applied to what is being analyzed from this site.

Stratigraphy

Ryan-Harley has undergone several excavations since its discovery, and the analysis of the data gathered provides important information supporting the Suwanee people's occupation and use of the site (Dunbar et al. 2005). The two most recent excavations occurred in 2015 and 2017, where an 8 x 2 meter (m) grid was excavated in 1 x 1 m squares (Smith 2020). Units 4-6 were excavated in 10 centimeter (cm) levels, while Unit 3 which contains the Suwannee component was in 5 cm levels, all the way to Unit 2 which was the top of the Suwannee paleosol. Smith (2020) removed sediment by water induction dredge and directed excavated materials through several screens, including a 1/16th inch screen, where the retained material was bagged. In 2015, radiocarbon and OSL samples were collected and analyzed, and in 2017 a core sample was taken that yielded 31 samples used for sediment analysis (Smith 2020). The stratigraphy described comes from exposed profiles and yielded the analysis of the six units present in 2015 and 2017 from Smith's excavations at the site.

Unit 1 is around 30 cm thick and is composed of fine sands, it overlies Oligocene-aged Suwannee limestone bedrock. A fossilized bison vertebrae and part of a turtle carapace were found here, and it is likely groundwater levels were high enough to create freshwater pond environments (Dunbar 2006; Smith 2020). Unit 2 is separated from Unit 1 by an abrupt boundary and is 20-45 cm thick and composed of mainly fine and loamy sands, the upper portion of this unit underwent a soil formation period known as the Suwannee paleosol. It is here that a quarter of the Suwannee lithic and faunal assemblage is located, remains of extinct turtle and alligator bones were also found in this unit (Smith 2020). Unit 3 consists of 2-9 cm thick fine quartz sands which covered the Suwannee paleosol intermittently throughout the late quaternary and includes Suwannee lithic and faunal material through to Unit 4 (Smith 2020). Unit 4 is at the northeastern portion of the site and is 20 cm thick. At the juncture of Units 3 and 4, isolated wooden artifacts were found that dated from 6,150 to 5,100 cal BP (Smith 2020). This unit also contained faunal remains consisting of disarticulated fish and turtle remains. Unit 5 consists of two sections, 5a which is 2-40 cm thick that overlays Unit 4, and 5b which is 1-15 cm thick. This unit contained a single bone point and faunal remains of pieces of fish and turtle bones. Unit 6 is 50 cm thick and consists of sand and peat. It began forming some 4,130 cal BP, and is still forming to this day (Balsillie at al. 2005; Smith 2020). A Woodland period (3,000 – 1,000 cal BP) Deptford Check-Stamped ceramic body sherd was found near the top of this unit, while disarticulated turtle and fish remains were found throughout (Smith 2020).

Paleolandscape

Using the geophysical data into a reconstruction of the paleolandscape, Smith (2020) created a digital elevation model (DEM) was created to look at the surface of Unit 3, which revealed that the terrain was an eolian-like landscape. The terrain at Ryan-Harley during the Paleoindian period included irregular mounds and smaller deflation hollows between. The latter may have held seasonal surface water, as these features are oriented perpendicular to late Pleistocene northeasterly winds. The Ryan-Harley site is between two dune-like features and there are prominent low spots to the northeast and southwest of the site that intermittently held water. Smith's 2015 excavation block was bisected with four ground-penetrating-radar (GPR) transects that were used to corroborate the results of the DEM. This GPR data showed that Unit 3 – and the Suwannee paleosol – confirm the microtopography on the surface of Unit 3 seen in the DEM (Smith 2020). This data indicated that the anastomosing channel of the Wacissa River had cut down through Unit 6 and that the fluvial feature intruded after the deposition of Unit 3 (Balsillie et al. 2005; Smith 2020).

Fabric Analysis

Looking at the trend and plunge data from the 2015 and 2017 excavations allows the geologic integrity of the Suwannee component to be established. The artifacts found in Unit 3 are assumed to be anthropogenically deposited with little evidence for any reworking from outside sources. If materials are anthropogenically deposited they should have trend and plunge measurements that do not strictly match the surface contours of the unit (Balsillie et al. 2005; Smith 2020). Likewise, if the material is uniformly accumulated trend and plunge data patterns will reflect eolian activity with homogeneous data patterns. Other discrepancies in data can be caused by physical disturbances like walking or rodent burrowing; although no evidence of disturbance or repositioning is clearly apparent in the unit (Balsillie et al. 2005; Dunbar et al. 2006; Smith 2020).

Specimens gathered from Smith's latest excavations in the Suwannee component were hard to radiometrically date due to the lack of organic material present in the site. Radiocarbon dates were gathered from overlying strata, with the earliest age above the Suwannee component being dated to 7,900 cal BP or sometime in the middle Holocene (Smith 2020). This points to Unit 3 being intermittently covered and exposed before being sealed by Unit 4. The data from past excavations (Balsillie et al. 2005; Dunbar et al. 2007) showed Suwannee archeological assemblage association with faunal remains and the data from these excavations proved the integrity of associated cultural materials within intact subsurface deposits.

Faunal Data

Remains of *Ondatra zibethicus* (muskrat), *Tapirus veroensis* (tapir), *Paleollama mirifica* (camel), and *Geochelone sp.* (giant land tortoise) were previously recovered from Ryan-Harley and analyzed by rare-earth element (REE) analysis (Smith 2020). REE uptake is based on element availability in local groundwater, the time since the deposition of the fossil, and the diagenetic environment, but due to the similarity of the context the only variable that changes, in this case, would be the time of fossil deposition. Smith (2020) used this analysis to see if the extinct and extant faunal remains were deposited around the same time. Two controls from Units 1 and 2 were found to contain similar elements but in different concentrations from those in Unit 3, which confirmed that time since deposition was the main factor in REE uptake at Ryan-Harley (Smith 2020). The other eighteen samples from Unit 3 were determined to have minimal differences in REE concentrations, meaning they were likely deposited at the same time. However, the margin of error for Smith's (2020) analysis can be up to 5% of the sample age, so these remains could have shown up hundreds of years before the Suwannee assemblage and still yield this REE analysis result. Still, when paired with other data from the site these concentrations support that the faunal remains are likely associated with the Suwannee assemblage.

Summary

Examining all of these lines of evidence allows us to hypothesize a model for human occupation in the Wacissa river basin during the Late Pleistocene and early Holocene. An important component of this is the availability of freshwater during this period. For water to be present in the river basin, the hydrostatic head would have to be high enough to maintain a base flow capable of reaching the site or the potentiometric surface of the water table would have to be high enough to provide water in geographic low spots (Smith 2020). Both of these points could be true, but only one is necessary to provide water in this area during the time of occupation. During the Suwannee period sea level would have been some 70 – 60 mbsl (meters below sea level), which would reduce the hydrostatic head making it insufficient to maintain year-round flow. The Page-Ladson site is comparable to Ryan-Harley, analysis of this site's Unit 5 indicates that ground water was accessible during the Younger Dryas. The lack of a confining layer for this region's aquifer means groundwater could infiltrate rapidly and it is likely only during periods of high-water tables that surface water would be present at Ryan-Harley (Balsillie et al. 2005; Smith 2020). Water levels from the site are seen in the redoximorphic concentrations on the surface of Unit 2 that formed during a period of intermittent surface water present in the Wacissa River basin. These Unit analysis support the hypothesis that humans were constrained in their use of the river basin during the late Pleistocene, while the presence of upland, lowland, and aquatic species emphasizes the likelihood of seasonal water.

Analysis of the background of this site facilitates understanding of the possible conditions in which the Suwannee Paleoindian groups lived in the Wacissa River basin. To better understand these conditions, and draw conclusions about the environmental impacts of Paleoindian peoples' culture, this research analyzes the aforementioned 1/16-inch screened samples through a detailed analysis of microfaunal remains excavated from Unit 2. By finding the floral, faunal, lithic, and other material samples within the different strata from the site, more conclusions can be drawn on the changes that the Wacissa River Basin underwent during the Middle to Late Paleoindian occupation of the area. The impact of the loss of certain food sources like certain seeds, plants, and animals would likely govern the movement of human groups over time, as they had to adapt to find seasonally available hunting and foraging opportunities.

Materials and Methods

Summary of Field Excavation Methodology

Dunbar and colleagues (2006) initially conducted three underwater investigations in 1998 that led to a salvage effort in 1999 to try to recover and record eroding in situ materials. The Suwannee component, along with Archaic and Woodland period components, were found in an eroding feature. The Suwannee component included *in situ* lithic and faunal material that were excavated by hand and piece plotted, as well as additional materials recovered using floating artifact screens. The materials collected by Dunbar and colleagues (2006) came from seven test units, including 2.5 m^2 of an intact and buried Suwannee component. The controlled surface collections produced displaced artifacts and fossils that were likely correlated with the Suwannee component. A total of 368 bone specimens were retrieved out of six of the seven test units. Material from each 1x1 m unit was passed through a 1/8 inch screen and the fossil materials were collected for analysis. Dunbar and colleagues (2006) used the comparative collections of the BAR in Tallahassee and the Vertebrate Paleontology Range of the Florida Museum of Natural History in Gainesville, Florida to identify bone fragments.

In 2015, Smith directed geoarchaeological excavations from a 12 m^2 area that resulted in the discovery of 1763 faunal elements. Smith's last excavation took place in 2017 during which a 3 m^2 area was excavated that yielded another 241 faunal elements. In-situ materials were analyzed from the 8 x 2 m grid excavated in 10 cm levels (Smith 2020). Ground penetrating radar was used on some test units for analysis, and a total of six units were excavated during these years. Unit 1 had a juvenile bison vertebrae and turtle carapace fragments, Unit 2 had remains of extinct turtles and a partially articulated American alligator. Unit 3 included some Suwannee faunal material, Unit 4 mainly contained disarticulated fish and turtle remains, Unit 5 and Unit 6 contained disarticulated fish and turtle remains (Smith 2020). Subsamples collected in Smith's 2017 excavation underwent granulometric analysis to better understand the depositional environment of Units 2-4. Auger tests were performed on the surface of Unit 3 to better understand its geometry resulting in the creation of a digital elevation model (Smith 2020). Trend and plunge data were collected from these excavations on piece-plotted specimens, when possible, to assess the lithic and faunal material. Smith submitted samples of bone from the Suwannee component for XAD collagen purification, but no radiometric ages were successfully obtained. REE was performed on faunal specimens to test the association of the extant and extinct fauna from Units 1 and 2, as controls, and Unit 3 as the test samples (Smith 2020). Smith's analysis suggested roughly contemporaneous deposition of the fauna with the Suwannee component but the error of REE could be within a 400-600 year range, leaving deposition time uncertain (Smith 2020)

1/16th-inch Screening and Sorting

This research relies on materials collection during Smith's 2015 and 2017 excavations at Ryan-Harley, which merits a brief discussion, material collected from the site was originally passed through a ¼ in screen before going through the sixteenth-inch screenings in the field. This material was collected and put into bags for sorting at a later date. The bulk of the bags that were analyzed for my thesis came from Unit 1, Levels 26-28, AM#13007, which was excavated in 2015. In the archaeology lab at UTC, excavated 1/16 sample material was put on a tray and hand sorted to pick out any floral, faunal, lithic, quartz/rock, and shell remains for further analysis. Metal scupulas and handheld loupes (10x) were used during the sorting process to help get small materials out of the peat moss. The collected specimens were then put into labeled vials for archival storage. The remaining materials were then placed into discard bags to be weighed out before being discarded. The same process was repeated for the lower sediment layer, which only had one bag for analysis. A total of eight bags of 1/16 screened soil was analyzed between January 2022 and December 2023.

Faunal Analysis

After the collection of faunal remains were finished, the faunal remains were sorted and when possible identified using the comparative osteological and fossil collections at the University of Tennessee at Chattanooga Natural History Museum (UTCNHM) with Dr. Timothy Gaudin in the BGES. The vials were poured onto a small viewing tray and examined under a Leica microscope using 60x magnification. The elements that were identifiable were first sorted into basic animal categories (fish, snake, mammal, etc.,) and the ones that could be confidently identified to genus or species were assigned to genera and species categories based on comparative animal specimens. This was done using specimens from the collection in the Biology Department and looking at identification textbooks in the cases of mammal teeth with notable tooth patterns. A majority of the mammal teeth matched a comparative specimen outside of the woodrat which was determined using Gilbert 1993. Bones and bone fragments that were unidentifiable or could not be confidently placed in a group were labeled as unidentifiable and placed in a separate bag. All identified specimens were placed into separate labeled bags based on the bone element (rib, vertebrae, skull fragment, etc.,). Once all bones were analyzed they were sorted again to ensure they were all in the correct categories, counted out twice then weighed by these groupings.

Results

This analysis yielded 1,371 vertebrate faunal remains that weighed a total of 49.42 grams. Of the bones identified 567 were fish, 114 were reptiles or amphibian, 41 were mammals, 1 was avian, and the remaining 626 were unidentifiable (Table 2). Several fish specimens were found to bear evidence of being burnt and were cataloged separately (Table 3). Those that were identified down to the species level were *Sciurus niger* (fox squirrel), *Sciurus carolinensis* (eastern grey squirrel), *Odocoileus virginianus* (whitetail deer), *Ondatra zibethicus* (muskrat), *Neotoma floridana* (eastern woodrat), *Didelphis virginiana* (North American opossum), *Procyon lotor* (racoon), *Aplodinotus grunniens* (freshwater drum), and *Neovison vison* (american mink). Pictures of these are found below (Figures 1-13). Some specimens were identified to genus or family level and include Ictaluridae (bullhead and madtom catfish), Bufonidae (toad), Lepisosteus (gar), Salmonidae (Salmon), and *Sylvilagus* (rabbit). Below, these species are described with regard to the environmental niche they occupy and their potential cultural uses, which is summarized in Table 1.

Sciurus niger (fox squirrel)

The faunal remain of the fox squirrel can be seen in Figure 1. Fox squirrels are large arboreal squirrels weighing 0.7-1 kg, with grey to black to orange coloration with white or tawny tipped guard hairs, nose, napes, and feet, and have dark coloration in parts of the Southeast (Hunt and Best 2020; Koprowski 1994). They are larger than other arboreal squirrel species in the region, though they do have some overlap in dietary and environmental niches. Fox squirrels prefer diverse deciduous mixed forest habitats with an open understory, with a special preference for oak, hickory, walnut, and pine trees (Hunt and Best 2020; Koprowski 1994). Molts happen seasonally, in spring and autumn, and again for females after birthing young. Their diets and nests also change seasonally to accommodate for varying availability of food resources. A majority of their diet consists of tree nuts, flowers, and plant material like buds. Seasonal additions to diet in the summer include fruits and small seeds such as mulberry and hawthorn, and in the winter they are more limited and rely on stored nuts and fungi (Hunt and Best 2020; Koprowski 1994). Some animal-based foods are eaten in small amounts, including bird eggs and insects, but these are opportunistically sourced. These animals were a good source of hunting and trade-related revenue. Though they do not reproduce as quickly as other arboreal squirrels their larger size would make them more valuable and their populations could stil handle being harvested in relatively large numbers. Per kilogram of weight a fox squirrel can yield up to 0.4 kg of edible meat, and they are highly versatile in the ways they can be prepared for consumption. This along with their adaptability to outside strains like hunting pressure on their population would make them a good food resource for indigenous peoples with reliable seasonal ranges (Hunt and Best 2020). The abundance of their furs would have made them a valuable source of pelts for garment making. Their near year round availability meant they could be used as a renewable resource in cloth making.

Sciurus carolinensis (eastern gray squirrel)

The faunal remain of the eastern gray squirrel can be seen in Figure 2. Gray squirrels are small to medium sized arboreal squirrels weighing 0.3-0.7 kg, with light grey to washed in brown coloration and light-colored underbodies. These squirrels have a sympatric relationship with eastern fox squirrels, sharing much of the same habitat and food preference that they do, and can often outcompete them in active urban areas (Hunt and Best 2020; Koprowski et al. 2016). Preference for habitats with high concentrations of mast-producing trees such as oak, hickory, and walnut in their habitat coincides with fox squirrel preferences as well; however, they have a preference for mixed pine forests in the Southeastern United States (Hunt and Best 2020; Koprowski et al. 2016). Their diets vary seasonally, consuming more calories to prepare for winter and storing tree nuts for the time of decreased activity and food consumption, and expending more energy in the spring and summer when food sources are more plentiful (Hunt and Best 2020; Koprowski et al. 2016). Reproductive rates are high, higher per hectare than most other squirrel species in the United States, with the population peaking yearly in the autumn season and dropping in spring (Hunt and Best 2020; Koprowski et al. 2016). Like the fox squirrel, these would be good seasonally reliable sources of food for indigenous people, yielding up to 0.3 kg of meat per large squirrel. Though they are slightly smaller than the fox squirrel, they are capable of outcompeting other squirrel species, meaning they were likely more abundantly available once their population was more established. Their pelts would have been a readily available source to access for making garments and a reliable food source due to larger populations.

Odocoileus virginianus (white tail deer)

The faunal remain of the white tail deer can be seen in Figure 3. White tailed deer are native to North America, with three subspecies present on the continent. The larger subspecies are located further from the equator though they are generally between 91-136 kg (Hunt and Best 2020; Smith 1991). They are notable for their brown fur with white underbellies, with males having seasonal racks that are dropped with their winter molt. Their diet is seasonal as well, with declines in food resources occurring in winter then increasing into the summer and peaking during the autumn (Hunt and Best 2020; Smith 1991). Adults have a well-defined home range while adolescents are more likely to move greater distances but generally, any movement is related to food and water availability. A majority of their diet is grass and herbaceous flowering plants in the summer and autumn, nuts and fruits in autumn, and leaf fall, fungi, and sometimes woody foliage during the winter (Hunt and Best 2020; Smith 1991). Their relatively large population size and availability in the region would be ideal for hunting by early indigenous groups. Due to their size and local availability white tailed deer would be prime sources of larger quantities of usable meat, with a large animal yielding up to 30 kg. They also provide bone, antler, and hide for use and for trade. Basically all elements of the deer could be used, and they provided vital sources of material for trade, tool making, and clothing, along with providing a source of meat when others were out of season (Hunt and Best 2020; Miller 1987).

Ondatra zibethicus (muskrat)

Faunal remains of the muskrat can be seen in Figure 4 and Figure 5. Muskrats are mid-sized rodents that weigh 0.6-2 kg and are native to North America, where they reside in marsh environments alongside which there is access to still or slow running water where they will either dig a burrow or construct a den (Errington 1941; Hunt and Best 2020). Their diet consists mainly of plant material, including the shoots, roots, rhizomes, and stalk of water fairing plants, as well as cultivated plants, including corn (Errington 1941; Hunt and Best 2020; Messier et al. 1990). Though they do not hibernate, muskrats are much less active outside of their dens in cold weather conditions, making them sparse during the winter. They are most likely to be active during the spring and summer. They are mainly nocturnal animals and spend little time out of their dens during the daytime. Muskrats can have fur in various tones of brown, and their fur is double layered with the shorter hairs acting to trap air, giving their pelts a water-resistant property, which makes their hides very useful and durable (Hunt and Best 2020; Lantz 1910). Due to their high fecundity, muskrats would have been ideal prey for hunting and trapping strategies than other animals available during the Suwannee period (Errington 1941; Hunt and Best 2020). A large muskrat could yield up to 0.9 kg of usable meat, and their pelts' durability and water resistance would have made them ideal for garment making, especially for young children.

Neotoma floridana (eastern woodrat)

The faunal remain of the eastern woodrat can be seen in Figure 6. Eastern woodrats are native to a large portion of the continental United States, being found throughout the Eastern U.S and as far west as Texas, and occupy a multitude of habitats including hardwood forest understories and swamps (Haysmith 1995; Hunt and Best 2020). Woodrats are mainly nocturnal and construct stick nests for protection and nesting for their young, which they occupy during the day. They feed on a wide range of plant and animal materials, especially nursing females, that includes nuts, berries, seeds, other plant parts, and insects (Hunt and Best 2020; Kanine et al. 2015). Their diet and activity levels change seasonally, they exhibit food storing behavior and the use of a single den for the winter while they cycle through dens and actively look for food sources in the warmer seasons (Hunt and Best 2020; Kanine et al. 2015). There is evidence that people used rats and other small rodents as sources of food (Sonderman et al. 2019) and given their availability and high reproductive success, they would have supplied a consistent source of sustenance.

Didelphis virginiana (North American opossum)

The faunal remain of the North American opossum can be seen in Figure 7. The North American opossum can be found in the North America and the northern part of Central America and can inhabit most habitat types, but prefer woodlands with access to water, and agricultural land (Blumenthal et al. 1976; Hunt and Best 2020). Opossums tend to be gray in color, but can be pale gray to black in color, with a few color mutations occurring that include brown and white. They have small ears and eyes with a long thick scaled tail that is prehensile in the young (Gardner 1972; Hunt and Best 2020). They are less seasonally distinct activity wise, and actively look for food year-round as they do not store materials or hibernate for the winter, and may even become more active during the winter outside of their normal nocturnal pattern (Ryser 1995; Hunt and Best 2020). Their diet depends on the availability and is highly varied, including plant parts, fruits and seeds, insects, small crustaceans, birds and their eggs, and small reptiles/amphibians, but may also include dirt and pebbles in times of stress (Hunt and Best 2020). Opossums are large marsupials, with males weighing up to 6.5 kg and animals weighing the most in late autumn and early winter when they are preparing for harsher conditions (Gardner 1972; Hunt and Best 2020). A majority of opossum mating takes place in the winter in time for late winter to early spring rearing of young, with another later breeding period occurring to coincide with an autumn rearing time. The average size of a litter is between six and eight (Gardner 1972; Hunt and Best 2020). Opossums' size and reproductive rate would make them ideal hunting targets, especially in late autumn and early winter when they are consuming more calories, yielding up to 4 kg of usable meat. Their pelts are versatile and were likely used for making garments as well as for trade.

Procyon lotor (raccoon)

The faunal remain of the raccoon can be seen in Figure 8. Raccoons are small to mid-sized mammals that are native to North America, including Central America, and are habitat generalists, meaning they have adapted to most habitat types in their range and are capable of thriving in most conditions (Hunt and Best 2020; Lotze et al. 1979). They are well known for their dark face mask and ringed tail markings, with a grizzled gray to black coat on their back and light-colored underbelly (Hunt and Best 2020;Lotze et al. 1979). They range in size from 4.5-6.8 kg with weight and diet varying seasonally, and they are mainly nocturnal (Hunt and Best 2020). Their diet is basically unrestricted, and they eat opportunistically. When available they enjoy berries, nuts/seeds, arthropods, small vertebrates, and agricultural crops (Hunt and Best 2020;Lotze et al. 1979). Raccoons do not hibernate. Instead, they rely on stores of fat to supply them through short dormant periods that they take in their dens when winter weather gets exceptionally harsh (Hunt and Best 2020). The breeding season lasts from late winter to mid-summer, with a majority of young being born in the spring and early summer, with litters having 1 to 5 offspring on average (Hunt and Best 2020;Lotze et al. 1979). Raccoons' ability to adapt to most environments means they were likely available in most landscapes that migratory people encountered, and were a resource they could rely on seasonally for meat and hide. A large raccoon could yield up to 4.5 kg of usable meat and their pelts were likely used for clothes and trade.

Neovison vison (American mink)

The faunal remains of the American mink can be seen in Figure 10, Figure 11, Figure 12, and Figure 13. The American mink is native to North America, generally being found in forest habitats where there is access to water such as streams, rivers, swamps, and ponds (Enders 1952;

Hunt and Best 2020). Mink are mainly nocturnal and keep to their burrows, which they make in water banks and occupy during most of the day. Females are smaller than the males, with males weighing up to 1.6 kg and females up to 0.8 kg. During the winter when they store calories for the cold. They are carnivorous and rely on aquatic animals to provide food year round, including reptiles and amphibians, small mammals, waterfowl, and crustaceans (Enders 1952; Hunt and Best 2020). They reproduce during early spring, with females having up to 8 kits per litter, and offspring becoming independent within two months (Enders 1952; Hunt and Best 2020). Their population is able to remain relatively stable even with somewhat heavy seasonal harvesting, and they are prized for their pelts (Hunt and Best 2020). Mink pelt would have been an excellent resource for indigenous people given the durability of their hide despite their small size. A male mink could yield up to 0.5 kg of meat along with a pelt that was highly valuable for its durability, water resistance, and thickness. The mink's pelt is likely its most valuable asset to migratory people's during the Pleistocene era.

Aplodinotus grunniens (freshwater drum)

The faunal remain of the freshwater drum can be seen in Figure 9. The Freshwater drum is native to North America and is the only species of drum to spend its entire life cycle in freshwater, where it occurs abundantly in rivers and side channels. Freshwater drum are generally found towards the lower part of the body of water they live in, staying away from the surface water once they hatch and grow from the initial stages of life (McCauley 1983). A majority of the diet consists of various types of crustaceans, insects and their larvae, and mollusks, with other fish being opportunistically included depending on the size of the drum (Forbes 1888). Young fish are more likely to be found higher up in their body of water in which they live, and adults are more common around the surface waters in the spring and summer when they are spawning in the warmer water (McCauley 1983). Female freshwater drum are larger than their male counterparts and will continue to grow throughout their lifetime, weighing several pounds more at sexual maturity with an average weight of around 9 kg by their first decade of life. The habitat of these fish makes them attractive for indigenous people during the Younger Dryas, as they would have been accessible in many open waterways and seasonal water sources. Their size and spawn rate made them an ideal food source, particularly during the spring and summer when they came towards the surface to spawn. A large female could yield up to

4.5kg of usable meat, in general around half of their body weight would be consumable, this makes them a relatively high return resource.

Species	**Environmental niche**	**Possible use**
Scirus niger	Diverse deciduous forests with open understory. Feed on seasonal tree nuts, fruits, and plant material.	Meat and pelt for consumption and trade
Scirus carolinensis	Mixed pine forests with mast-producing species. Feed on seasonal tree nuts, fruits, and plant material.	Meat and pelt for consumption and trade
Odocoileus virginianus	Varied habitat use including forests and marshland. Feed on seasonal grass, flowering plants, fungi, and woody foliage	Large quantities of meat and pelt for consumption
Ondatra zibethicus	Marshlands or lowlands with access to water. Feed on plant materials including rhizomes and stalks of aquatic plants	Highly valued pelt for use and trade as well as meat for consumption
Neotoma floridana	Hardwood forest understories and swamps. Feed mainly on plant materials but opportunistically includes insects	Meat for consumption
Didelphis virginiana	Generalists that prefer woodlands with access to water. A highly diverse diet including plant and small animal materials	Meat for consumption and pelt for use and trade
Procyon lotor	Generalists with basically no diet restrictions	Meat for consumption and pelt for use and trade
Aplodinotus grunniens	Freshwater rivers and side channels	Meat for consumption
Neovison vison	Forests with access to sources of water	Highly valued pelts for use and trade as well as meat for consumption

Table 1. Species identified, ecological niche represented, and cultural use.

Specimen type	Column1	Count	Weight (g)	Percent of Total Count	Percent of Total Weight
Fish					
	Vertebrae	264	6.1055	19.26%	12.35%
	Skull fragment	119	5.0482	8.68%	10.21%
	Gar scale	83	1.7426	6.05%	3.53%
	Teleost scale	15	0.058	1.09%	0.12%
	Finspine	36	0.7005	2.63%	1.42%
	Teeth	23	0.1922	1.68%	0.39%
Snake					
	Vertebrae	50	2.2176	3.65%	4.49%
	Rib	7	0.1617	0.51%	0.33%
	Fang	1	0.002	0.07%	0.01%
Frog					
	Vertebrae	4	0.1644	0.29%	0.33%
	Pelvis	1	0.0207	0.07%	0.04%
Turtle					
	Shell	37	1.7803	2.70%	3.60%
Salamander					
	Vertebrae	14	0.1477	1.02%	0.30%
Identified					
	Madtom	8	0.368	0.58%	0.74%
	Salmonidae	2	0.0634	0.15%	0.13%
	Freshwater Drum	1	1.1382	0.07%	2.30%
	Rabbit	7	0.2776	0.51%	0.56%
	Squirrel	7	0.4416	0.51%	0.89%
	Mink	4	0.1873	0.29%	0.38%
	Muskrat	2	0.1236	0.15%	0.25%
	Deer	1	0.1312	0.07%	0.27%
	Possum	1	0.0214	0.07%	0.04%
	Woodrat	1	0.0203	0.07%	0.04%
	Racoon	1	0.1952	0.07%	0.39%
Unidentified					
	Mammalian	22	2.2237	1.60%	4.50%
	Unknown	626	21.0871	45.66%	42.67%

Table 2. Counts and weights of fauna observed, by class and element.

Type		Count	Weight (g)	Percent of Total Count	Percent of Total Weight
Fish					
	Skull fragment	5	0.1836	0.36%	0.37%
	Finspine	2	0.0822	0.15%	0.17%
	Vertebrae	1	0.0085	0.07%	0.02%

Table 3. Count and weight of burned bone specimens.

Figure 1. *Sciurus niger* (fox squirrel) upper incisor identified via comparative specimen UTCM1543.

Figure 2. *Sciurus carolinensis* (gray squirrel) chipped upper incisor identified via comparative specimen UTCM2476.

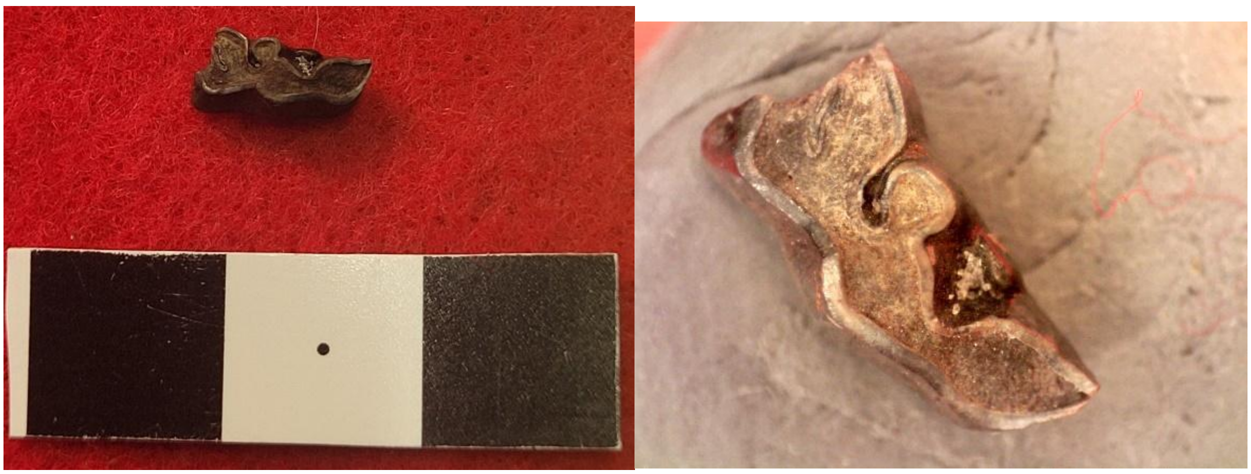

Figure 3. *Odocoileus virginianus* (Whitetailed deer) right lower third premolar identified via comparative specimen UTCM1237.

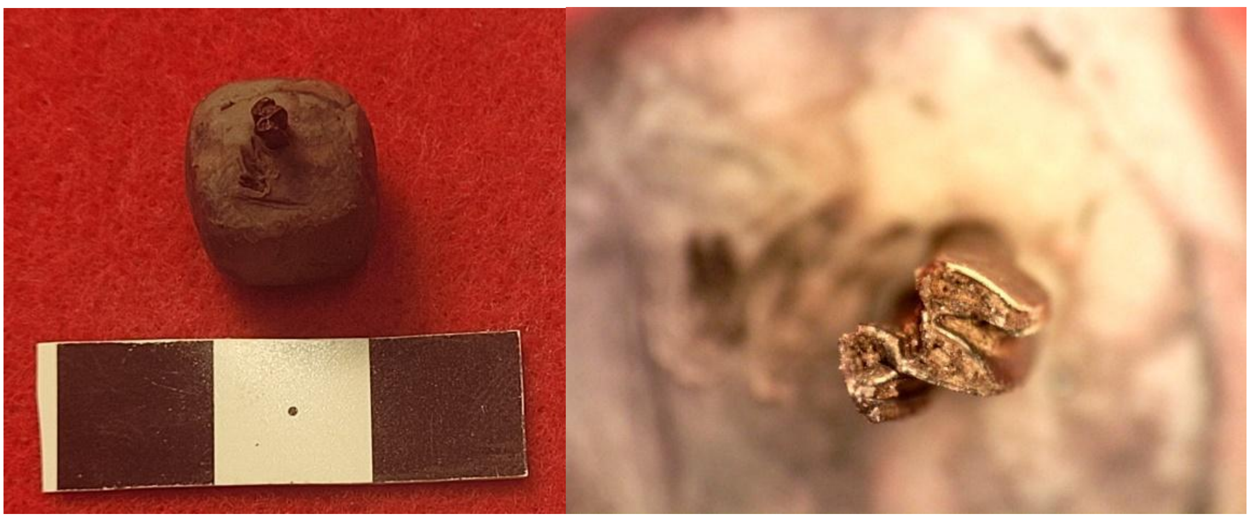

Figure 4. *Ondatra zibethicus* (muskrat) upper incisor identified via comparative specimen UTCM1235.

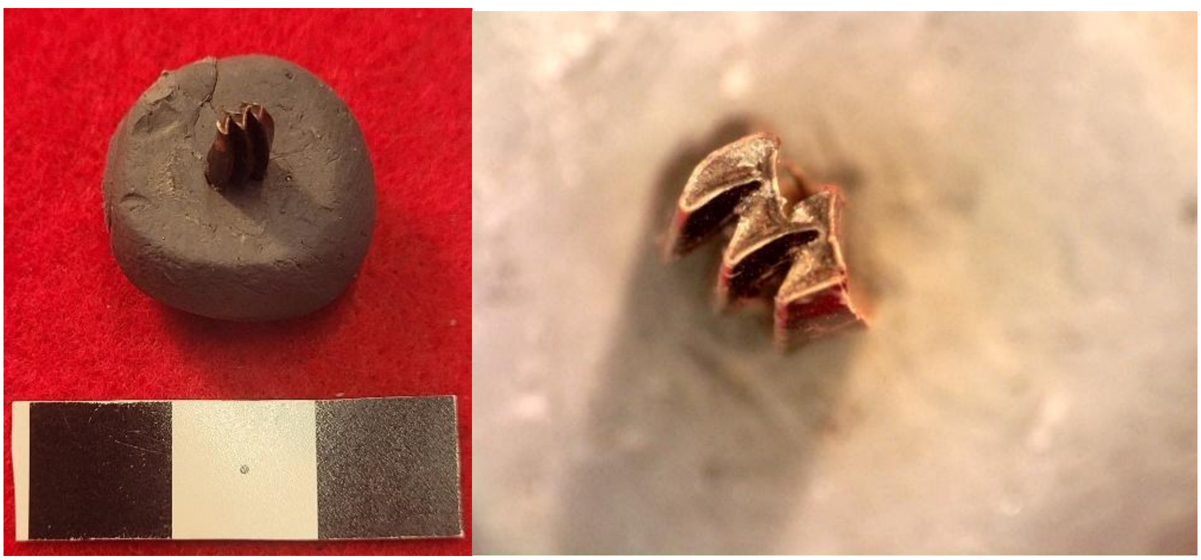

Figure 5. *Ondatra zibethicus* (muskrat) lower right second molar identified via comparative specimen UTCM1235.

Figure 6. *Neatoma floridana* (eastern woodrat) upper left second molar identified via comparative specimen UTCM1357.

Figure 7. *Didelphis virginiana* (North American opossum) right upper incisor identified via comparative specimen UTCM1974.

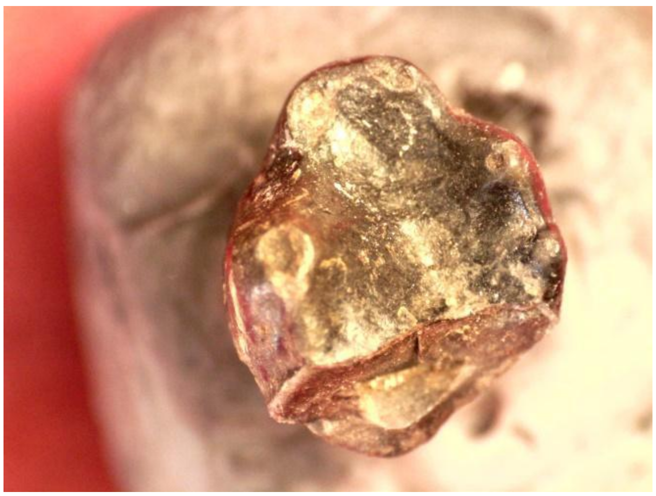

Figure 8. *Procyon lotor* (raccoon) upper right second molar identified via comparative specimen UTCM189.

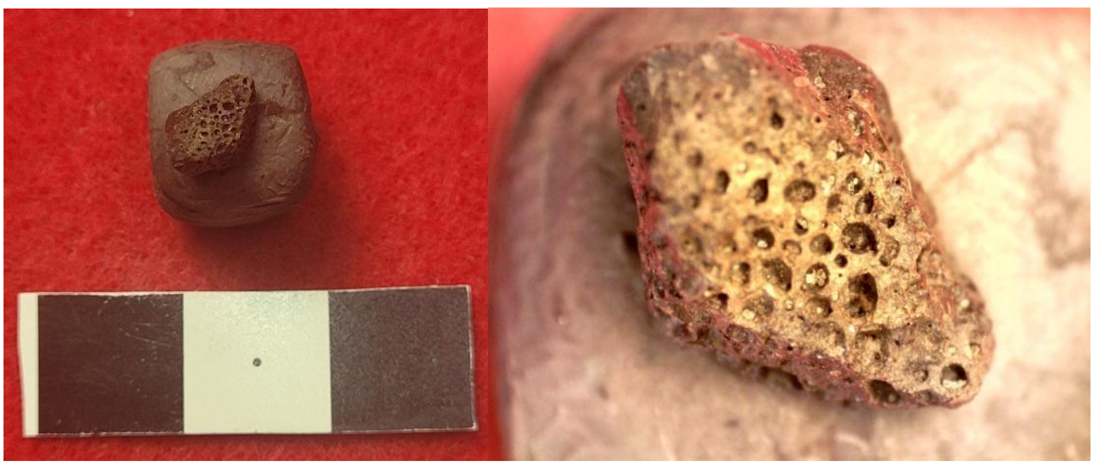

Figure 9. *Aplodinotus grunniens* (freshwater drum) tooth plate.

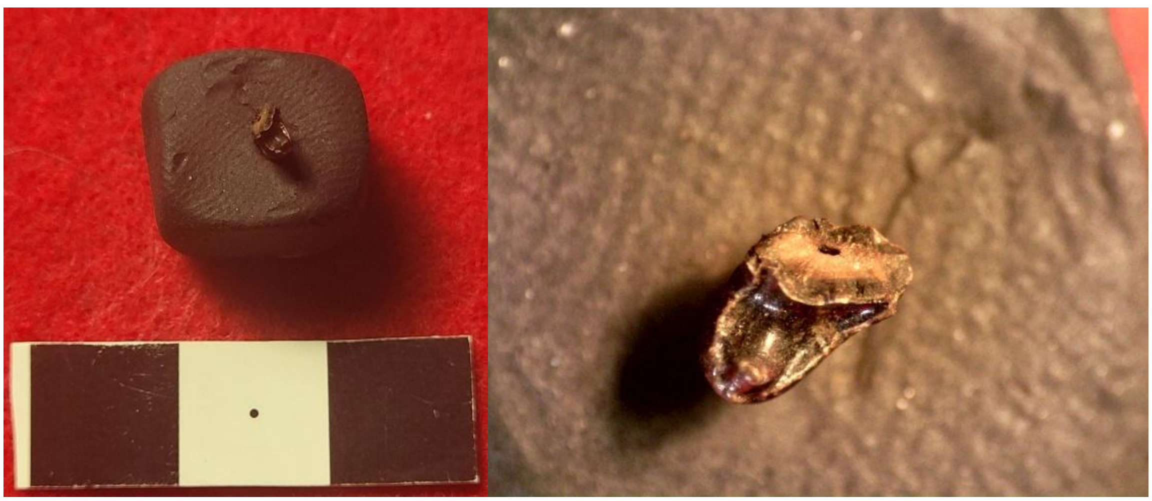

Figure 10. *Neovison vison* (mink) lower left fourth premolar identified via comparative specimen UTCM2088.

Figure 11. *Neovison vison* (mink) upper left canine identified via comparative specimen UTCM2088.

Figure 12. *Neovison vison* (mink) half of the right third premolar identified via comparative specimen UTCM2088.

Figure 13. *Neovison vison* (mink) lower right fourth premolar identified via comparative specimen UTCM2088.

Discussion

The excavations by Dunbar (2005) yielded a majority of the prior faunal remains recovered at the Ryan-Harley site to date. All the specimens collected during these excavations were from either surface findings or 1/8 inch screenings. The animal remains did not have any collagen preserved in them and were therefore unable to be radiometrically dated; however they were associated with the Suwannee artifact horizon. This association allows for the animal remains to be used to draw conclusions about the paleoenvironment at the site and dietary preferences of Suwannee people. Due to the density of the remains and their location within the soil horizon, it is highly likely that these remains are evidence of human occupation and the site's use as a midden.

Dunbar and colleauges (2005) recovered many freshwater species such as mollusks, turtles, fish, reptiles, amphibians, and mammals, with some mixed wetland and upland species present as well (Balsillie et al. 2005; Dunbar and Vojnovski 2006). The mollusks present were mainly generalists that required well oxygenated water to survive. Paired with the presence of *Terrapene Carolina,* this suggests they likely lived in a spring run similar to the present day Wacissa river (Balsillie et al. 2005). The fish identified as present were *Amia calva* (Bowfin), *Lepisosteus* spp (Gar), *Micropterus salmoides* (Largemouth bass), *Lepmis microlophus* (redear sunfish), and Ictaluridae (Bullhead and madtom catfish) (Dunbar et al. 2005). The environmental reconstruction provided by the presence of these animals is that of a shallow low energy freshwater stream or pond that was a permanent nearby water source, the Wacissa river basin was likely at least seasonally a series of freshwater ponds during dryer climatic conditions (Balsillie et al. 2005; Dunbar et al. 2006). The reptile species present include *Alligator mississippiensis* (American alligator), *Trionyx ferox* (softshell turtle), *Trachemys scripta* (yellow bellied slider), Kinesternidae (musk turtle), *Gopherus polyphemus* (gopher tortoise), *Agkistrodon piscivorus* (cottonmouth moccasin), and *Geochelone crassiscutata* (Dunbar et al. 2005). Several mammal species were also identified that were important for interpreting Ryan-Harley, including *Ondatra zibethicus* (Muskrat), *Sylvilagus* spp (rabbit, *Neovison vison* (Mink), *Odocoileus virginianus* (White tail deer), *Procyon lotor* (raccoon), *Tapirus veroensis* (modern tapir), *Equus sp* (horse) (Balsillie et al. 2005; Dunbar et al. 2005). The presence of muskrat, mink, and rabbit is of particular interest due to the nocturnal habits and size of these animals and the work involved in capturing and processing them (Whitaker 1992). They would be considerably harder to hunt than other animals with projectile point tools and may be evidence of the use of traps being used during this period. These types of tool kits would not be preserved under the climate conditions in the southeast due to them being made of organic materials. Deer and other large mammals likely provided a predictable source of food and skins seasonally within the river basin; however, the smaller mammals, especially the muskrat, would have likely been used for their furs more than their meat (Dunbar et al. 2005; Hughen et al. 1996).

There are implications that the procurement of muskrat and mink fur would include the use of traps or special tools outside of what is currently observed at the site (Dunbar et al. 2005). These would likely have been made of wood and a form of rope. This organic matter would have been more easily degraded in the preservation conditions of the early Holocene (Balsillie et al. 2005; Dunbar et al. 2006). The Suwannee component occurred during the Younger Dryas when glacial maximum conditions occurred, making the pelts from these animals – especially the muskrat - more valuable (Dunbar et al. 2005; Whitaker 1992). There is also evidence (Dunbar et al. 2005) that megafaunal species were able to survive beyond the Younger Dryas boundary (11,000 BP) so Paleoindian people had access to Pleistocene fauna within the basin and southeast longer than they had in the western United States (Balsillie et al 2005).

In Dunbar and colleagues (2006) analysis , it is acknowledged that the use of smaller screenings than the 1/8 inch may be useful in further analyzing the faunal remains. As a result, Smith's later excavations utilized a 1/16 inch screen during in field processing (Smith 2020) in order to look for lithic, shell, floral, and faunal specimens. Accordingly, in the current analysis, the bone fragments from the 1/16 screen were analyzed resulting in the identification of several key species including mink, muskrat, and deer, along with more data regarding the presence of fish and reptiles in the site.

The differences and similarities of faunal specimens found in Dunbar's 1/8th inch and those found in Smith's 1/16th inch screenings are of significance and comprise the final point of this paper. Screened material is not always well analyzed, or even looked at all, with many past excavations focusing on the macrofaunal remains to base their analysis on. This presents the issue of there being critical missing components of a site's data set being left out and the creation of a analysis bias on site interpretation. The 1/8th inch and surface findings yielded more species overall due to lack of bone destruction, however, some species were not recorded by the larger analysis, including the madtom catfish, freshwater drum, both squirrel species, and the woodrat presented here (Dunbar 2006; Dunbar and Vojnovski 2007; Smith 2020). The madtom catfish is a particularly good find for reconstructing the paleoenvironmental conditions since they are considered an indicator species for water conditions. They require well oxygenated freshwater to survive, and prefer riverine pools in streams to spawn their young (Burr et al. 2019). That they are present in the current study indicates that the aquifers supplying the river was likely seasonally recharged by storms coming in on the coast.

Similarly, the squirrels' presence on the site are another big find that has implications for both cultural use and environmental conditions. Both fox and grey squirrels are heavily dependent on mast producing tree species such as hickory, oak, and walnut. Though the seeds of these trees do not necessarily preserve well in coastal conditions, the presence of these species indicates these mast producing species were likely present. Not only are the squirrels themselves an important resource for protein and fur, but their food sources would have also been used by foraging groups in the area. Freshwater drum are also good indicators for environmental change and environmental analysis. Their diet relies heavily on bottom feeders like mollusks and crustaceans that require higher dissolved oxygen amounts to survive. The presence of these species does not necessarily change the environmental reconstruction of this site but they do offer a deeper understanding of the paleolandscape. The current study also presents evidence for analysis bias towards larger specimens that may not allow for the full environmental reconstruction or understanding of sites. Most site analyses do not include screenings with mesh smaller than 1/8th inch, but this investigation of 1/16th inch material demonstrates that significant findings can be lost in the discarding of smaller material. It stands that if certain species were left out of analysis that it could negatively affect the interpretation of a site and its use.

Fauna found in this site are of interest because the site being an open air occupation, making it one of the few not found in a rock shelter in the southeast. A key southeastern site is Dust Cave. The Dust Cave site in Alabama offers good comparative data for the differences in preservation between open air sites and rock shelters. Differences in what is found at each type of site could show preservation bias or possible subsistence differences. The Dust Cave site has excellent stratigraphy including a late Paleoindian component that is estimated to be 10,500 – 10,000 YBP (Driskell 1992) and is supported by 39 radiocarbon dates from surrounding strata. Data collected from the site included lithic and floral specimens, but only the faunal remains will be discussed here. Species identified within the cave include those found at Ryan-Harley, such as mink, opossum, muskrat, squirrel, rabbit, gar, freshwater drum, and deer, as well as several that are not such as shrew, moles, bats, weasel, otter, fox, woodchuck, and beaver (Walker 1998). Of note is the large amount of avian fauna present in the cave, mainly waterfowl including geese and duck, and pigeon (Walker 1998). The species present at the site consists of mammals, mainly deer and squirrel, with amphibians being the least represented group. Overall, the taxa found were highly diverse, representing how vast the hunting range and diet of the people was. Their knowledge of animal procurement at this time could point towards prolonged site occupation and familiarity with local resources. The taxa present also indicates the paleoenvironment and possible landscape and resource changes people were encountering. According to habitat exploitation data, those in the Paleoindian period relied heavily on aquatic and semi-aquatic open environment fauna based food sources, such as waterfowl, mussels, turtle, swamp rabbit, and muskrat (Peterson 1980; Walker 1998). The heavy presence of waterfowl and other aquatic species indicates that the people occupying Dust Cave had access to freshwater marsh and river sources relatively close by (Delcourt and Delcourt 1983). As the late Paleoindian period progressed, the forest became more deciduous in response to the climate shifting from a cooler and wetter ecotone to the warmer seasonal conditions experienced today. The majority of fish specimens present are represented by skull fragments, birds by wing fragments, amphibians by hindlimb, and mammals by teeth (Walker 1998). The elements found suggest that the animal carcasses were being transported in full back to the cave to be processed and discarded, instead of being processed and then brought back (Walker 1998).

Seasonality of the assemblage was based on several species, including migratory birds such as geese and passenger pigeons, as well as seasonal bone growth such as deer antler (Schorger 1973). The passenger pigeon would have been present during the fall and winter, other migratory waterfowl in the spring and fall, and buck skulls with intact antlers would have been available in the fall and winter (Brown 1997; Griffin 1962). The presence of these animals within the assemblage is proof of the site's occupation throughout multiple seasons as the targeted collection of seasonal resources is specifically within the fall, summer, and spring (Hollenbach 2009).

The Dust Cave assemblage makes for a great comparative and standard for Paleoindian sites in the southeast due to its excellent stratification and preservation. The site's stratigraphy means the faunal analysis can be confidently associated with the Paleoindian period, which is ideal when looking at changes in the diet and resources of foraging groups. When compared to an open-air camp such as Ryan-Harley, it is clear that they were likely encountering many similar animal resources, such as deer, squirrel, mink, opossum, muskrat, rabbit, gar, and freshwater drum. These species ranges cover a majority of the east making them a likely seasonally secure source of food regardless of camp placement. The elements of these species found were also similar for some species, which may suggest some similar processing strategies of the fauna across camp types. The large amount of fish, waterfowl, and marsh fairing mammals from Dust Cave also aligns with the mostly aquatic and semi-aquatic habitat of animal types from the Ryan-Harley site (Dunbar 2006; Walker 1998). At both of these sites, people were relying heavily on the access to resources they found at and near water sources. The uniformity of the use of these animals indicates that there was a heavy dependence and familiarity with this aspect of their environment across the southeast. The species from Dust Cave that were not present at Ryan-Harley included shrews, moles, bats, weasel, fox, and woodchuck (Walker 1998). Ecological differences between the coastal open-air camp and inland rock shelter explain the differences in fauna presence. The Ryan-Harley site has a border range of fish and reptile species (Dunbar and Vojnovski 2007) whereas Dust Cave has more avian and mammalian species (Walker 1998). Both sites' faunal remains are evidence for the full exploitation of the resources present at the site and show varied differences in the diet of Paleoindian groups. Adaptability in hunting strategies and knowledge of existing resources that can be tied back to the Central Place Foraging Theory to better understand their subsistence strategies.

Based on the analysis of the specimens identified using 1/16th screens there is strong evidence that doing smaller screenings is important to gaining a fuller understanding of archeological sites. Specimen that would not have otherwise been identified were found during the sorting of the material. Some of the species found were completely absent from the initial screenings. Without further analysis, it could be assumed that these species simply were not present within the midden at all. This provides an incomplete understanding of the diet and resources within the region. Smaller screenings provide a fuller understanding of a site's materials and a broader data set of foraging people's diets and environment.

Works Cited

Anderson, D. G., & Sassaman, K. E. (1996). *The Paleoindian and early archaic southeast*. University of Alabama Press.

Anderson, D. G., Delcourt, H. R., Delcourt, P. A., Foss, J. E., & Morse, P. A. (1989). *Cultural Resource Investigations in the L'Anguille River Basin, Lee =, Francis, Cross, and Poinsett Counties, Arkansas*.

Anderson, D. G., O'Steen, L. D., & Sassaman, K. E. (1996). Environmental and Chronological Considerations. In *The Paleoindian and early Archaic Southeast* (pp. 3–15). essay, The University of Alabama Press .

Balsillie, J. H., Means, G. H., Dunbar, J. S., & Means, R. (2005). Geoarchaeological consideration of the Ryan-Harley Site (8JE1004) in the Wacissa River, northern Florida. *Bulletin of the Florida Museum of Natural History*, *45*(4), 541–562. https://doi.org/10.58782/flmnh.feyj8338

Bindord, L. R. (1979). Organization and Formation Processes: Looking at Curated Technologies. *Journal of Anthropological Research*, *35*(4), 255–273. https://doi.org/10.1086/jar.35.4.3629547

Bird, R. (1999). Cooperation and conflict: The behavioral ecology of the sexual division of Labor. *Evolutionary Anthropology: Issues, News, and Reviews*, *8*(2), 65–75. https://doi.org/10.1002/(sici)1520-6505(1999)8:2<65::aid-evan5>3.0.co;2-3

Blumenthal, M. E., & Kirkland, G. L. (1976). The Biology of the Opossum, Didelphis virginiana in Southcentral Pennsylvania . *Proceedings of the Pennsylvania Academy of Science*, *50*(1), 81–85.

Boyd, C. C. (1989). Paleoindian Paleoecology and Subsistence in Virginia . *Paleoindian Research in Virginia: A Synthesis*, 139–156.

Burr, B. M., Warren , M. L., & Bennett, M. G. (n.d.). Ictaluridae: North American Catfishes . In *Freshwater Fishes of North America* (pp. 23–100). essay.

Daniel , R. I., & Wisenbaker , M. (1987). *Harney Flats: A Florida Paleo-Indian Site*.

Delcourt , P. A., & Delcourt , H. R. (n.d.). Quaternary Palynlogy and Vegetational History of the Southeastern United States. . *Pollen Records of Late-Quaternary North American Sediments* , 1–37.

Driskell, B. N. (1996). Stratified Late Pleistocene and Early Holocene Deposits at Dust Cave, Northwestern Alabama. In *The Paleoindian and Early Archaic Southeast* (pp. 315–330). essay, The University of Alabama Press.

Dunbar , J. S., Hemmings , A. C., Vojnovski, P. K., Webb, D. S., & Stanton, W. M. (2006). The Ryan/Harley Site 8Je1004: A Suwannee Point Site in the Wacissa River, North Florida. In *Paleoamerican Origins: Beyond Clovis* (pp. 81–96). essay, A Peopling of the Americas.

Dunbar, J. S., & Vojnovski, P. K. (2007). Early Floridians and late Megamammals: *Early Floridians and Late Megamammals: Some Technological and Dietary Evidence from Four North Florida Paleoindian Sites* , 167–202. https://doi.org/10.2307/j.ctt1djmct7.14

Dunbar, J. S., & Webb, D. S. (1996). Bone and Ivory tools from Submerged Paleoindian Sites in Florida. In *The Paleoindian and early Archaic Southeast* (pp. 331–353). essay, The University of Alabama Press.

Elston, R. G., & Zeanah, D. W. (2002). Thinking outside the box: A new perspective on diet breadth and sexual division of labor in the PREARCHAIC great basin. *World Archaeology*, *34*(1), 103–130. https://doi.org/10.1080/00438240220134287

Enders, R. K. (1952). Reproduction of the Mink (Mustela vison). *Proceedings of the American Philosophical Society* , *96*(6), 691–755.

Errington, P. L. (1941). Versatility in Feeding and Population Maintenance of the Muskrat . *The Journal of Wildlife Management* , *5*(1), 68–89.

Essner, R. L., Patel, R., & Reily, S. M. (2014). Ontogeny of Body Shape and Diet in Freshwater Drum (Aplodinotus grunniens). *Transactions of the Illinois State Academy of Science*, *107*, 27–30.

Gardner, A. L. (1982). Virginia opossum Didelphis virginiana . *United State Geological Survey* .

Goodyear, A. C. (1982). The chronological position of the Dalton Horizon in the Southeastern United States. *American Antiquity*, *47*(2), 382–395. https://doi.org/10.2307/279909

Goodyear, A. C. (1989). A Hypothesis for the Use of Cryptocrystalline Raw Materials among Paleoindian Groups of North America. *Eastern Paleoindian Lithic Resource Use*, 1–9. https://doi.org/10.4324/9780429049743-1

Grimm, E. C., Watts, W. A., Jacobson Jr., G. L., Hansen, B. C. S., Almquist, H. R., & Dieffenbacher-Krall, A. C. (2006). Evidence for warm wet Heinrich events in Florida. *Quaternary Science Reviews*, *25*(17–18), 2197–2211. https://doi.org/10.1016/j.quascirev.2006.04.008

Hawkes, K. (1993a). Why hunter-gatherers work: An ancient version of the problem of public goods. *Current Anthropology*, *34*(4), 341–361. https://doi.org/10.1086/204182

Hawkes, K. (1993b). Why hunter-gatherers work: An ancient version of the problem of public goods. *Current Anthropology*, *34*(4), 341–361. https://doi.org/10.1086/204182

Hawkes, K. (1996). Foraging differences between men and women. *The Archaeology of Human Ancestry: Power, Sex, and Tradition*, 283–305.

Haysmith, L. (1995). Neotoma Floridana Floridana Natural History, Populations, and Movements in North-Central Florida. *Bulletin Florida Museum Natural History, 38*.

Hollenbach, K. D. (2009). *Foraging in the Tennessee River valley, 12,500 to 8,000 years ago*. University of Alabama Press.

Homsey-Messer, L. (2015). Revisiting the role of caves and rockshelters in the hunter-gatherer taskscape of the archaic Midsouth. *American Antiquity*, *80*(2), 332–352. https://doi.org/10.7183/0002-7316.80.2.332

Hoppe, K. A., & Koch, P. L. (2006). The biogeochemistry of the Aucilla River Fauna. *First Floridians and Last Mastodons: The Page-Ladson Site in the Aucilla River*, *26*, 379–401. https://doi.org/10.1007/978-1-4020-4694-0_13

Hunt, J. L., & Best, T. L. (2020). *Mammals of the Southeastern United States*. University of Alabama Press.

Kelly, R. L. (1995). *The Foraging Spectrum*.

Kelly, R. L., & Todd, L. C. (1988). Coming into the country: Early Paleoindian hunting and Mobility. *American Antiquity*, *53*(2), 231–244. https://doi.org/10.2307/281017

Koprowski, J. L. (1994). Sciurus niger. In *Mammalian Species* (pp. 1–9). essay.

Koprowski, J., Edelman, A. J., & Munroe, K. E. (2016). Gray not grey: the ecology of Sciurus carolinensis in their native range in North America . *Ecology and Management of Invasive Species in Europe*.

Lantz, D. E. (1910). *The Muskrat*. U.S. Department of Agriculture.

McCauley , D. J. (1983). *Feeding and Distribution of Larval Freshwater Drum (Aplodinotus Grunniens) in Pool 7 of the Upper Mississippi River*.

McGahey, S. O. (1996). Paleoindian and Early Archaic Data from Mississippi. In *The Paleoindian and early Archaic Southeast* (pp. 354–384). essay, The University of Alabama Press.

Meltzer , D. J., & Smith , B. D. (1986). *Paleoindian and Early Archaic Subsistence Strategies in Eastern North America. In Foraging, Collecting, and Harvesting: Archaic Period Subsistence and Settlement in Eastern Woodlands* (S. W. Neusius, Ed.). Center for Archeological Investigations, Southern Illinois University, Carbondale.

Orians, G. H., & Pearson, N. E. (1979). On the Theory of Central Place Foraging. *Analysis of Ecological Systems*, 155–177.

Panter-Brick, C. (2002). Sexual division of labor: Energetic and evolutionary scenarios. *American Journal of Human Biology*, *14*(5), 627–640. https://doi.org/10.1002/ajhb.10074

Pritchard, E. E., & Ahlman, T. M. (Eds.). (2009). *TVA Archeology: Seventy-Five Years of Prehistoric Site Research* . The University of Tennessee Press.

Sherwood, S. C., Driskell, B. N., Randall, A. R., & Meeks, S. C. (2004). Chronology and Stratigraphy at Dust Cave, Alabama. In *American Antiquity* (3rd ed., Vol. 69, pp. 533–554). essay.

Smith, M. F. (2020). Geoarchaeological investigations at the Ryan-Harley Paleoindian site, Florida (8JE1004): Implications for human settlement of the Wacissa River basin during the younger Dryas. *Geoarchaeology*, *35*(4), 451–466. https://doi.org/10.1002/gea.21784

Smith, M. F., Joy, S. A., Waters, M. R., Halligan, J. J., Faught, M. K., Thulman, D. D., Perrotti, A. G., Fenerty, B., Duggins, R., & Burke, A. M. (2022). Contributions of Submerged Archeological Research to the Late Pleistocene and Early Holocene Record of the Southeast . In *The American Southeast at the end of the Ice Age* (pp. 213–229). essay, The University of Alabama Press.

Walker, R. B. (1998). *The Late Paleoindian Through Middle Archaic Faunal Evidence from Dust Cave, Alabama*.

Walker, R. B., Detwiler, K. R., Meeks, S. C., & Driskell, B. N. (2001). Berries, Bones, and Blades: Reconstructing Late Paleoindian Subsistence Economy at Dust Cave, Alabama. *Midcontinental Journal of Archeology*, *26*(2), 169–197.

Walker, R., Hill, K., Kaplan, H., & McMillan, G. (2002). Age-dependency in hunting ability among the ache of eastern Paraguay. *Journal of Human Evolution*, *42*(6), 639–657. https://doi.org/10.1006/jhev.2001.0541

Widga, C., Anderson, D. T., & Whitman, R. B. (2022). Plant and Animal Communities in the Southeastern United States during the Late Pleistocene. In *The American Southeast at the end of the Ice Age* (pp. 250–277). essay, The University of Alabama Press.

Zeanah, D. W. (2000). Transport Costs, Central Place Foraging, and Hunter-Gatherer Alpine Land Use Strategies. *Intermountain Archeology*, 1–14.