The Vertebrate Fauna of Zebree's Big Lake Phase

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ABSTRACT

Excavated during the late 1960's and mid 1970's, Zebree (3MS20) serves as a well-known yet under-analyzed example of a Terminal Late Woodland/Early Mississippian (A.D. 800 to 1000) site in the Eastern Lowlands of the Central Mississippi Valley. In particular, a large portion of the vertebrate fauna collected during Zebree's multi-season excavations has remained unidentified and unanalyzed since the initial site report. This research seeks to readdress the Terminal Late Woodland/Early Mississippian Big Lake phase (A.D. 800 to 1050) faunal collection in order to gain a more in-depth understanding of subsistence strategies at the Zebree site during a transitional time frame in the prehistory of this region.

While taxonomic identifications employed here are on par with previous faunal studies completed by Guilday and Parmalee (1975) and Roth (1980), the amount of detail recorded and the use of various analytical methodologies provide a more complete picture of the Big Lake Zebree village site. Results show that aquatic resources were most commonly procured and served as the foundation for the Big Lake vertebrate diet, yet significant biomass contributions were obtained from certain terrestrial taxa. Although no convincing evidence of social differentiation is found in the content or distribution of the samples, the data do show signs of a multi-season subsistence strategy and supports the idea that the Big Lake component at Zebree was a year-round settlement. A comparison of Zebree to two other Transitional Late Woodland/Early Mississippian sites in the Central Mississippi Valley suggests that this time frame is characterized by localized subsistence strategies that may correlate with changes in the horticultural regime.

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CHAPTER ONE: INTRODUCTION

The Zebree site (3MS20) is a multi-component archaeological site in the Big Lake area of Mississippi County, Arkansas. It lies within the Eastern Lowlands region of the Central Mississippi Valley (Figure 1). The site was excavated over the four field seasons from 1968 to 1976 in preparation for the expansion of a drainage ditch (Morse and Morse 1990:51). Although four temporal components were identified during excavations, the Terminal Woodland/Early Mississippian Big Lake phase occupation was the most substantial of them all. Dating from A.D. 900 to 1100, this small village site likely held a population of 130 to 140 individuals (Morse and Morse 1990:55).

Vertebrate faunal analysis for the first large scale excavations at the site in 1969 excavation was completed by John E. Guilday and Paul W. Parmalee (1975). As was standard at the time, results were provided in the appendix of the site report in the form of a brief write-up and taxonomic list that included number of individual specimens (NISP) and minimum number of individuals (MNI) counts (Guilday and Parmalee 1975). Included in the discussion are some general comments on taphonomic characteristics, limited to the presence of butchering marks. Unfortunately, contextual information is not included and the results are presented as a single unit with no separation of fauna collected from the four components. Although the results provide a thorough picture of the general environment of the Big Lake area and thus resources available to its occupants, the utility of the data set for finer-scale analysis is limited.

For the 1975 and 1976 excavations, Eric Roth was hired as an on-site zooarchaeologist and completed the vertebrate analysis reported in the 1977 appendix and 1980 site report. This included random square analysis at the class level (Roth 1977),

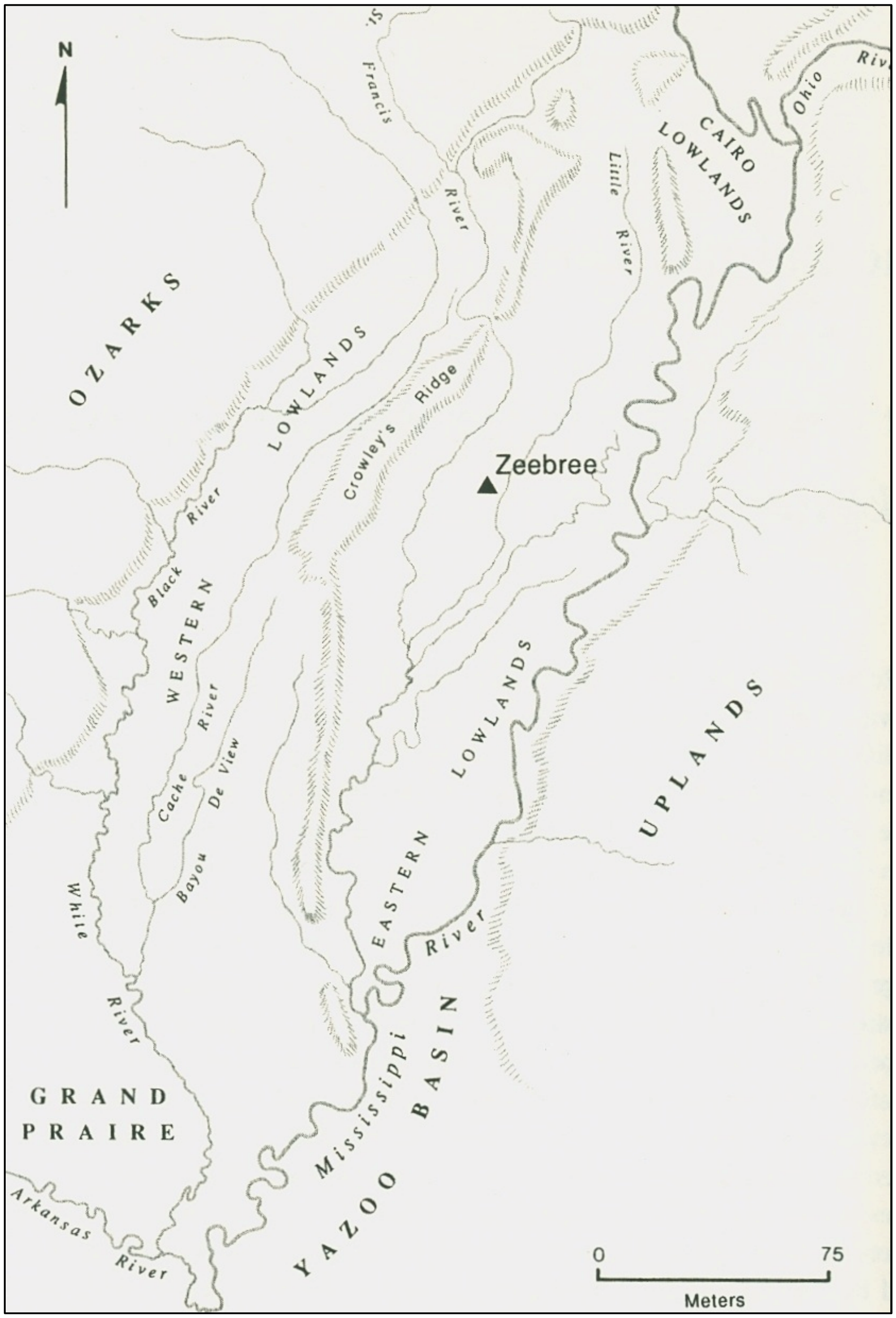

Figure 1: Zebree site location within the Central Mississippi Valley (adapted from Morse and Morse 1990:52).

and the specific identification of fauna from select contextualized features (Roth 1980). Data of the latter nature was provided for only the Dunklin and Big Lake components in the form of taxonomic tables listing the number of individual specimens (NISP), the minimum number of individuals (MNI), and the potential meat yield for identified species (Morse 1980b:15-16; Roth 1980:2-6). No mention is made of the number of unidentifiable remains. Furthermore, observations and discussion of taphonomic effects are limited to the degree of bone preservation, while bone modification is addressed in terms of bone tool identification (Anderson 1980c; Morse 1980c).

Roth's analysis of the Zebree faunal assemblage supported Bruce Smith's (1975) regional model of Mississippian vertebrate subsistence strategies in the Central Mississippi Valley. Although the Zebree faunal reports from both the 1969 and 1975 excavations support the idea that settlements in the Eastern Lowlands relied on seasonal exploitations of migratory waterfowl and fish (Smith 1975:129), the lack of detail in these data sets makes analysis and interpretation difficult and does not provide sufficient comparative data to support any regional conclusions other than at the most general level. J. Matthew Compton's (2009) dissertation sought to test Smith's 1975 model through both fine-scale and large-scale analysis, incorporating all available and usable vertebrate data for both the Woodland and Mississippian periods in the Central Mississippi Valley. Although he incorporated as much of the Zebree data as possible, the aforementioned concerns limited the utility of this site's data set (Compton 2009:418). To provide an extensive, detailed, and comparatively friendly vertebrate data set for the Zebree site, this thesis concentrates on previously unanalyzed Terminal Late Woodland/Early

Mississippian Big Lake phase vertebrate fauna. Due to an insufficient sample size of unanalyzed Late Woodland features, the Dunklin phase is not included in this study.

Although one of the main research goals of this thesis is to conduct a more thorough and contextualized analysis of the Big Lake fauna from the Zebree site, this general objective can be broken down into more specific research questions concerning the socio-economic behavior of the Zebree village. This study seeks to evaluate the degree of prey selectivity, the dietary contribution of various vertebrates, the seasonality of resource procurement, as well as the degree to which there was restricted access to certain categories of vertebrate resources.

CHAPTER TWO: LITERATURE REVIEW

Environmental Background

The environment of the Zebree site and its periphery are critical in this zooarchaeological analysis for a number of reasons. The geography, geology, hydrology, and climate of the region influence the natural plant life available to the peoples that once inhabited this Early Mississippian village. Furthermore, these factors also influence the general fertility of the land, which, certainly by the Early Mississippian period, when agricultural food production is assumed to have been important, drives settlement patterns. Moreover, the floral environment, climate, and geographic setting heavily dictate the fauna that occupy various habitats surrounding the Zebree site.

The Zebree site lies on the northern edge of the Eastern Lowlands, a physiographic subregion within the Central Mississippi Valley, which is defined as the lowland region of the Mississippi River running from the Ohio River in the north to the Arkansas River in the south (Figure 1; Morse and Morse 2009:1). Zebree is situated in the St. Francis lowlands ecoregion of the St. Francis River Basin in the greater Mississippi Alluvial Plain, just west of the Right Hand Chute of the Little River near Big Lake. The landscape in this area typically consists of alluvial plains that incorporate braided stream surfaces as a result of the ever-changing course of the Mississippi River and its tributaries. The landscape of the Eastern Lowlands includes two braided-stream terraces that were formed by glacial outwash and the progressive movement of the Mississippi River eastward during the late-glacial interval of the late Wisconsin Age and early Holocene times (Delcourt and Delcourt 1996; Delcourt et al. 1999; Royall et al. 1991:159; Saucier 1994:247). Zebree is located on the younger of these two terraces. The

Mississippi River began adopting a meander-belt regime by about 8000 B.C., and fully transitioned by the end of the Hypsithermal circa 2000 B.C. (McNutt 1996:198; Saucier 1994:267). Evidence of a Mississippi River regime change from braided-stream to meandering can be found in the sedimentary record of the Big Lake area and dates to around 8000 B.C. (Delcourt and Delcourt 1996; Guccione et al. 1988:77; Royall et al. 1991). This change in gradient and pattern fostered the development of aquatic resource concentrations within the lowlands, such as oxbow lakes.

The typical landscape of the St. Francis lowland ecoregion includes sand dunes and terraces, depressions, interfluvial areas, relict channels, backswamps and wetlands. Although the lowlands are generally flat, these landforms provide breaks in the otherwise level environment. The typical geological makeup of the St. Francis lowlands consists of alluvial sand, silt, and gravel, as well as Quaternary sand sheets and Pleistocene glacial outwash deposits of sand and gravel (Saucier 1994; Woods et al. 2004). Higher elevation levees and dunes provide sandy and loamy soils that offer well drained and therefore prime habitable and arable locations on the floodplain (Morse and Morse 2009:14).

The alluvial plains of the Mississippi Valley are located within the modern-day Southeastern Evergreen Forest region, which can be further subdivided into three bottomland forest types. The first consists of the swamp forests found in areas of standing water throughout the St. Francis River Basin. Bald cypress, water tupelo, and overcup oak are more likely to thrive in these lower wetter regions, with the cypress and tupelo species being the most predominant of the three (Braun 1950:291; Woods et al. 2004). Additional flora found in swamp forests includes silver and red maple, pumpkin ash, pecan, and water-elm, as well as various species of mosses, liverworts and swamp herbs (Braun 1950:292-293).

Hardwood bottoms can be found in areas that may experience seasonal inundation (Braun 1950:291). These forests are typically dense. In particular bottomland hardwood forests contain sweetgum, red maple, oaks, water hickory, American elm, green ash, sassafras, hackberry, pawpaw, dogwood, and hornbeam (Braun 1950:293; Woods et al. 2004).

Ridge-bottom forests contain hardwood bottom species and are located in areas of higher elevation. Soils in these forests are better drained and aerated, as they are only submerged during occasional flood episodes (Braun 1950:291, 295). Sweetgum is the principal tree, but is found alongside various hickory and oak species supported by the higher terrain, though species common in the lower wetter elevation are also found in ridge-bottom forests. The tree profile includes regional species such as shagbark hickory, pecan, white oak, Nuttall oak, willow oak, and cherry bark oak (Braun 1950:291, 295; Woods et al. 2004). Acorns of these various oak species are not only a staple of white-tailed deer diet, but also help to sustain waterfowl populations such as ducks (Morse and Morse 2009:14). It is also thought that these areas may have, at one time, supported large stands of cane (Braun 1950:295).

Although modern climate data for the Central Mississippi Valley region is not directly applicable to the climate of the Early Mississippian period due to global climate changes over the past millennium, it can still be used to discern general seasonal trends. The Central Mississippi Valley region typically experiences very short and mild winters (mean temperature of 4°C/40°F in January) and long, hot summers (mean temperature of

27°C/80°F in July). Although the annual rainfall of 125 cm is typically spread throughout the year, droughts are always a threat during the summer months with the right combination of decreased rainfall, spikes in temperature, and low humidity (Morse and Morse 2009:10).

The Big Lake component of the Zebree site falls right on the transition from the Late Woodland to the Early Mississippian period. Radiocarbon dating of nine Big Lake samples places the site predominately within the range of A.D. 800-1000 (Morse et al. 1980:18). This time period corresponds with a warming period in global climate. The Medieval Warm Period began around A.D. 800, during which the Northern Hemisphere experienced increases in temperature, providing a climate similar to that of modern day (Anderson 2001:166; deMenocal 2001:668). Prehistoric populations in the previous centuries of the Late Woodland faced a gradual cooling. With the onset of this increase in temperature, agricultural societies began to expand, spread and intensify in the Southeast (Anderson 2001:166; Pauketat and Loren 2005:19).

Researchers have conducted decades of geological research in the Lower Mississippi Valley region, including paleoecological reconstructions of the environment throughout prehistoric times. Pollen core analysis from Big Lake and Pemiscot Bayou in Mississippi County, Arkansas provide a picture of a changing environment throughout the Eastern Lowlands. During the early and mid-Holocene the landscape consisted of closed bottomland forests. Principle trees included oak, hickory, sweetgum, and tupelo gum. Between 4000 and 1800 B.C. the climate became more arid in the Big Lake region as a result of the Hypsithermal warming. Oak species began to replace many of the hardwood swamp trees such as tupelo. As conditions returned to a cooler, wetter climate, a variety of biotic communities developed on the landscape in addition to arboreal habitats. These included open-swamp forests comprised of willow, elm and bald cypress. In addition, herbaceous wet-meadow marshes and areas of standing water rich in aquatic plants occupied the landscape of the Eastern Woodlands. Weedy flowering plants such as ragweed, goosefoot, amaranth, flowering shrubs, marshelder, and cocklebur, as well as aquatic plants like quillwort, bur-reed and cattail were present (Delcourt and Delcourt 1996:236; Guccione et al. 1988:74-76).

More localized environmental data were compiled thanks to Dan and Phyllis Morse's excavation and analysis of the site during the late 1960's and mid 1970's, which, in part, focused on recreating the environment of the Zebree site prior to modern day agricultural alterations. Suzanne E. Harris, a researcher on the Zebree team, used nineteenth-century documents including Government Land Office Surveys to reconstruct the nineteenth-century landscape (Harris 1980:1). Through cross-tabulations of soil and land survey information, Harris (1980:1-14) compiled a series of likely biotic communities and their locations in respect to Zebree. It is assumed that the environmental makeup of this time period is very similar to that of the Early Mississippian period, and therefore her results can provide a map of the environmental conditions and resources during this prehistoric time period. The analysis not only includes summaries of soil types and vegetation, but also the abundant and sundry fauna. The diverse ecosystems accessible to Zebree occupants offer an array of both terrestrial and aquatic resources. Furthermore, Dan Morse and Michael Million describe various biotic resources available around Zebree in the final site report (Morse and Million 1980). Morse and Morse (1990, 2009) also discuss both environmental conditions and resources in their volume, *Archaeology of the Central Mississippi Valley*, as well as in their chapter on Zebree published in Bruce Smith's (1990) edited volume *The Mississippian Emergence*. A condensed summary of all of the above site-specific environmental references is provided (Figure 2; Table 1).

As previously mentioned, the Zebree site lies just west of Big Lake, now a large National Wildlife Refuge in northeastern Arkansas. This environment serves as home to many aquatic species of both plants and animals that were exploited by prehistoric peoples, including migratory waterfowl that move seasonally through the Mississippi Flyway (Table 1). The Big Lake sunk lands were once thought to be the result of seismic activity, in particular the New Madrid Earthquakes in early 1811-1812. The origins of this area are presently attributed to a series of westward pushes by the Mississippi River during a foundered course change. This redirection initiated a new stream that flowed to the southern edge of Big Lake where the development of natural levees eventually created an alluvial damming process resulting in the lake-like formation roughly around A.D. 800 (Morse and Morse 2009:9). Although the modern day Big Lake is not a deep body of water, the prehistoric swamp and lake environment was likely shallower and only further subsided as a result of the nineteenth century earthquakes (Morse and Morse 1990:59; 2009:9; Saucier 1994:268,296).

Like many other prehistoric populations, the inhabitants of Zebree were not necessarily restricted to those resources locally available. Trade and travel provided access to resources at much greater distances. To the west of the lowlands is Crowley'

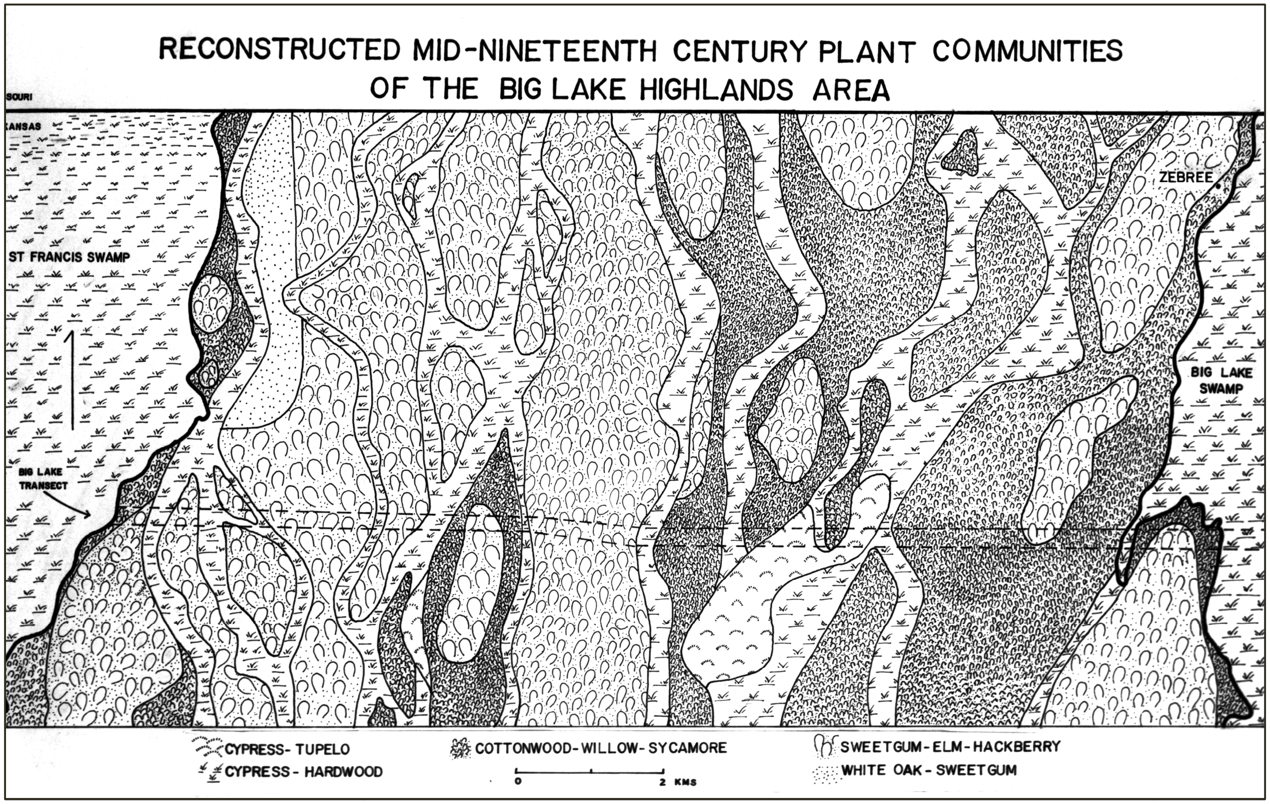

Figure 2: Biotic communities adjacent to Zebree (adapted from Harris 1980:11).

Table 1: Biotic Communities Locations and Associated Resources.*

Biotic Community	Location	Soil Type	Flora	Fauna
White Oak-Sweetgum	Highest and driest elevations; mainly east of St. Francis River (approx. 25 km west of Zebree)	Loamy and sandy; low agricultural potential	Ash, blackgum, boxelder, elm, hickory, maple, oak species (including white oak), sycamore, and walnut	Deer, bear, mountain lion, bobcat, wolf, opossum, raccoon, cottontail rabbit, squirrel, and turkey
Sweetgum-Elm-Hackberry	Big Lake Highlands, the most common habitat around Zebree	Silty loam and loamy sand; highest agricultural potential	Oak species (water, Nuttal, willow, Shumond, but excluding white), hickory, pecan, persimmon, hackberry, redgum, grape, and catbriar	Same as listed above
Cottonwood-Willow-Sycamore	Lower elevations found near rivers and west of the Big Lake highlands	Sandy loam, silty loam, and loamy sand; low agricultural potential	Cottonwood, willow, sycamore, ash, hackberry, mulberry, persimmon, grape and other vine species	Deer, bear, raccoon, opossum, marsh rabbit, muskrat, beaver, otter, wood duck, migratory bird species (mallard, sandhill crane, Canada goose, teal, pintail, merganser, shoveler, and cormorant)
Cypress-Hardwood	Sloughs and swamps	Silt loam, silty clay loam, silty clay, and clay; high agricultural potential in some areas	Cypress, oaks (overcup, Nuttal, pin), water hickory, cyprus, hackberry, persimmon, maple species, sycamore, cottonwood, elm, and cane	Raccoon, marsh rabbit, beaver, muskrat, otter, mink, rice rat, wood duck, migratory bird species, fish species following spring flooding (largemouth bass, suckers, drum, gar, and walleye), deer during drier seasons

Table 1 (cont.): Biotic Communities Locations and Associated Resources.*

Biotic Community	Location	Soil Type	Flora	Fauna
Cypress-Tupelo	Marshes and areas of standing water	Clay and sandy clay; low agricultural potential	Cypress and tupelo	Same as listed above
Littoral	Lakes, ponds, and sloughs	Clay, silty clay, and sandy clay; low agricultural potential	American lotus, yellow water lily, knotweed, water parsnip, lizard tail, arrow arum, cattail, water millet, willow and button bus, water fern, and duckweed	Beaver, muskrat, river otter, mink, wood duck, duck, geese, and other migratory birds, turtles, newts, frogs, catfish, buffalo fish, largemouth bass, suckers, drum, gar, and walleye
Limnetic	Open water in parts of Big Lake and St. Francis swamps	Same as listed above	Algae species	Similar to above with higher concentrations of fish species

*Note: Compiled from Howell 1980; Morse and Million 1980; Morse and Morse 2009; Morse and Morse 1990

Ridge, a geographic barrier consisting of a stretch of hills that separates the Eastern Lowlands from the Western Lowlands (Figure 1). The Crowley's Ridge landform runs about 320 km north to south, beginning in southeastern Missouri and ending in the eastern edge of central Arkansas (Fenneman 1938:87). It is an erosional remnant, the byproduct of hydraulic movement and erosion of embayment deposits along the alluvial floodplains as the Mississippi River moved eastward to meet the Ohio River (Morse and Morse 2009:7; Saucier 1994). The width and height of Crowley's Ridge ranges depending on location, but it tends to be wider in the northern portion, averaging 19 km in width with a maximum height of 76 m, while the southern half averages 5 km in width and measures a maximum of 46 m in height (Fenneman 1938:87). Zebree is closer in proximity to the northern portion of the ridge, which is around 40 km away. Crowley's Ridge offers numerous resources in its slopes and valleys, including knappable stone of value to prehistoric peoples and the upland flora and fauna of its oak-hickory forests (Woods et al. 2004). Chert, agate, and quartzite outcrops can be found in the area, in addition to local iron-rich sandstone that can be harvested to produce artifacts like abraders. Resource mining of this landscape has been documented through lithic scatters on the banks of both Big Creek and Crow Creek near gravel beds containing some of these materials (Morse and Morse 2009:7).

The Ozark Mountains are located approximately 100 km west of the Zebree site. Travel to the area first requires passage through Crowley's Ridge and the Western Lowlands. The limestone and dolomite bedrock of the Ozark Plateau is covered with chert outcrops that emerge from deep soil deposits in its eastern areas, which border the Central Mississippi Valley lowlands (Saucier 1994:32). The Ozarks provided more chert sources to the prehistoric populations inhabiting the neighboring lowlands (Morse and Morse 2009; Saucier 1994). Prehistoric populations occupying the Central Mississippi Valley utilized a variety of Ozark cherts, particularly Ozark Burlington chert (Morse and Morse 2009:205). In addition to chert, the westernmost portions of the Ozarks also offer raw materials such as basalt, copper, galena and hematite (Morse and Morse 2009).

Other natural resources were locate north of Zebree, such as Crescent Quarry chert, and salt springs located in east central Missouri near the American Bottomlands (Morse and Morse 2009:205, 207). In addition, Mill Creek chert was farmed from outcrops in this southwestern Illinois landscape. This particular type of chert played an important role in Mississippi Valley prehistory, especially during the Mississippian period. Mississippian populations frequently made use of Mill Creek chert to make both agricultural tools and ceremonial pieces (Morse and Morse 2009:205).

Cultural Background

The Central Mississippi Valley has been occupied from the Paleoindian period through modern times. Although the diachronic changes that have occurred throughout this great expanse of time are fascinating as a whole, this particular research project concentrates on a synchronic perspective of the Big Lake phase, A.D. 800 to 1000, in the Central Mississippi Valley (Morse and Morse 2009:201). As a result, the following summary will cover only the Late Woodland period that precedes the Big Lake component at Zebree, as well as the concurrent Terminal Woodland/Early Mississippian cultural period. The information that follows will concentrate mainly on cultures represented in the Central Mississippi Valley where the site is located.

Late Woodland Period: Baytown

With the end of the Middle Woodland Marksville period and the decline of the Hopewellian Interaction Sphere, the prehistoric Southeast entered a time of social reorganization and population growth that characterizes the Late Woodland period. In the Southeast this time period generally refers to the years between A.D. 600 and 900 and is marked by the disappearance of exotic trade goods as well as typical Middle Woodland ceramic styles (Nassaney 2000). It is during the Late Woodland that archaeologists see a southward shift in populations and ritual behavior (Anderson and Sassaman 2012:126). Significant changes that occur during this time frame include the adoption of the bow and arrow and the incorporation of maize agriculture into the preexisting horticultural complex, as well as increasing evidence for more complex levels of social organization. The order and rate at which these two features developed during the Late Woodland period is not homogenous throughout the Southeast (Nassaney 2000:718).

Morse and Morse (1996:126) have previously noted the lack of Early and Middle Woodland sites in northeast Arkansas; both are represented only by a handful of examples scattered throughout the Central Mississippi Valley. Though this scarcity may be the result of their being obscured by Late Woodland occupations, in addition to even more recent prehistoric and protohistoric sites in the area, rather than evidence of sparse habitation during earlier centuries, their general absence is nonetheless notable.

In the Central Mississippi Valley, the Late Woodland begins earlier than in other southeastern regions. The Baytown Period serves as the designated cultural period during the Late Woodland in the Central Mississippi Valley, beginning around A.D. 400 and lasting until approximately A.D. 700 (Morse and Morse 2009:181; Rolingson 2004:537). The type-site for this period is the Baytown site, which is a multi-mound center located off of the White River in the southern portion of the Western Lowlands in the Central Mississippi Valley (Rolingson 2004:537). In addition to its Early Mississippian component, the Zebree site shows evidence of a Dunklin-phase occupation during the later part of the Baytown period. The details of this Late Woodland occupation at Zebree are discussed in greater detail in the next section.

The number of prehistoric sites in the Central Mississippi Valley greatly increases during the Late Woodland period (Morse and Morse 1996; Rolingson 2004). Most of these settlements tend to be small, single-household, seasonal habitation sites, though there are a select number of larger, possibly multi-seasonal or year-round occupations like Hayti Bypass and Hoecake (Morse and Morse 2009:184; Rolingson 2004:538; Rolingson and Mainfort 2002:33).

The Late Woodland shows an increasing reliance on cultigens in addition to the expected presence of wild plants. Late Woodland sites in the Central Mississippi Valley have produced hickory, acorn and walnut. Starchy seeds like those of maygrass, chenopod, and knotweed are also found during this time period. In addition the seeds of the American lotus have been found at the Indian Camp Lake site. Meanwhile evidence of oily plant cultigens like sunflower and sumpweed have been recovered from sites such as Hayti Bypass in the northern extent of the region (Rolingson and Mainfort 2002:33).

Significant amounts of maize do not appear in the Central Mississippi Valley until the Terminal Late Woodland/Early Mississippian period (Lynott 1986).

Subsistence practices during the Late Woodland period, like those of the Early and Middle Woodland, were extremely regionalized (Lapham 2006). Populations mainly took advantage of fauna that were locally available. Predominant taxa exploited by Late Woodland societies include deer, raccoon, rabbit, squirrel, and turkey (Jackson and Scott 2002). Those settlements located in areas of seasonal resources, like the Mississippi Flyway in Zebree's case, often display heavy exploitation of specific taxa in addition to universally exploited species such as white-tailed deer. In a study of various Midwestern Late Woodland sites, Styles (2000:83) found that two long-term village sites located in the Central Mississippi River drainage of east-central Missouri, the Burkemper and Boschert sites, show evidence of intense fish exploitation in particular.

Technological changes that also affected prehistoric subsistence patterns were introduced during this time, specifically, the adoption of the bow and arrow, which occurred in the Southeast around A.D. 700 (Nassaney 2000; Nassaney and Pyle 1999). This new implement increased a hunter's accuracy and efficiency. New projectile points appeared along with this technological adaptation. These points were smaller notched artifacts better suited for the smaller arrow that accompanied the hunting bow. These smaller corner-notched arrow points have not been recovered in any Dunklin contexts, although they are found in contemporaneous sites in the American Bottom and Midwest (Morse and Morse 2009:189). Only a few points with somewhat similar characteristics have been found within the Central Mississippi Valley during the Late Woodland (Rolingson and Mainfort 2002:32).

In addition, shell tempering was introduced in some areas around the onset of the Late Woodland and began to disseminate throughout the Southeast (Lafferty 2008; Nassaney 2000). The proliferation of shell tempered ceramics in the Central Mississippi Valley most likely originated in the Ozarks where some of the earlier dates for shell pottery have been established (Lafferty 2008:187; Nassaney 2000:720). Although shell-tempered ceramics have been found at Late Woodland sites in the Central Mississippi Valley such as the Double Bridges site, most Baytown sites are primarily correlated with grog and sand tempering (Rolingson 2004:538), and the slow adoption of shell-tempering did not begin until A.D. 800 (Lafferty 2008:181). As Anderson and Sassaman (2012:127) pointed out in their recent analysis of southeastern archaeology, these technological advances likely increased autonomy among prehistoric Late Woodland populations.

Discourse on the Origins of Early Mississippian Culture

The earliest point of origin for the Mississippian period is not clear. The development of what archaeologists deem Mississippian in nature is still a hazy chapter in southeastern prehistory (Cobb 2003:63). This is not to say that the topic has not been investigated. The means of transition between degrees of societal complexity has continually been a topic of interest in anthropological research. Like any other geographic area that exhibits variations in monumentality and pan-regional interactions over time, research in the prehistoric Southeast invokes these same developmental questions. Mississippian-period societies, which have left a visible mark on the southeastern landscape, are of particular interest in terms of social complexity. The large settlements, monumental architecture, elaborate material culture and expansive interaction networks developed and maintained throughout this period have garnered attention since the beginnings of American archaeology. The allure of Mississippian culture eventually led to questions concerning its source. The direct intent to identify, explore and explain Mississippian origins can first be seen in the massive Lower Mississippi Valley survey undertaken by James B. Griffin, James A. Ford and Philip Phillips in 1939 (Phillips et al. 1951). Although little success was had in terms of unearthing Early Mississippian occupations, it was nonetheless the start to a major research avenue in prehistoric southeastern archaeology (Williams 1990). In the last thirty plus years, interest in this transitional period has peaked as regional archaeologists continue to fine-tune chronologies through large-scale surveys, in-depth site analysis, and methodical collection studies (Anderson and Sassaman 2012; Cobb and Garrow 1996:21).

Although Bruce Smith is best known for his work concerning the origins of agriculture and plant domestication in the Eastern Woodlands, he is also one of many notable southeastern archaeologists who has taken an interest in Mississippian beginnings. Some of his earliest research addressed Mississippian subsistence patterns in the Central Mississippi Valley, which will be more thoroughly reviewed later in this thesis (Smith 1974, 1975). A later publication by Smith (1978) was directed towards general Mississippian lifeways and focused on questions concerning settlement patterns and origins. He defined the Mississippian phenomenon as:

> those prehistoric human populations existing in the eastern deciduous woodlands during the time period A. D. 800-1500 that had a ranked form of social organization, and had developed a specific complex adaptation to linear, environmentally circumscribed floodplain habitat zones [Smith 1978:486].

In particular, they developed an adaptation to the meander-belt habitat that served as the basis for Mississippian cultural expression. These highly productive areas provided the energy and resources needed to support the development of Early Mississippian societies, which consisted of a number of smaller homesteads connected to one another by local centers that balanced the need for both resource and defense optimization (Smith 1978:490).

Smith (1986) identified the development of early behavioral and technological features that later define complex Mississippian society. Material innovations such as Mill Creek hoes, as well as limestone and shell tempering are seen during this A.D. 750 to 1000 time frame. This occurred around the same time maize began to increase in the archaeological record within the Central Mississippi Valley. Smith (1986:54) pointed out that population growth can be seen not only in the site size, but also in the increased volume of cooking vessels and storage capacity of pit features. He noted a change in spatial patterning, with communal space becoming increasingly important through the construction of group storage features, plazas, and even early fortifications (Smith 1986:56).

In his study on Mississippian emergence in the American Bottom, John Kelly (1990) cites five overarching transitional qualities of the Late Woodland/Mississippian interim that are very much in step with those previously outlined by Smith. The first of these is “dramatic” material culture alterations. Second is the adoption of a more intensive maize economy. The third area of change concerns establishing wide-ranging exchange networks that work to connect communities and aid in the flow of information as well as people. His fourth point of transformation is marked population growth coupled with increasing organizational complexity. Kelly's final general trend is the appearance of more resounding evidence for social differentiation (Kelly 1990:117). These characteristically Mississippian qualities have foundations in Late Woodland societies and further developed into the core of Mississippian chiefdoms.

Following the publication of Bruce Smith's (1990) edited volume *The Mississippian Emergence*, which includes Kelly's argument in addition to a number of other regional and site-specific analyses pertaining to this time frame, Michael O'Brien (1991) reviewed the piece. Though he praised the degree of detail and depth of analysis contained in the volume, he expressed some concern with the way in which it focused on cultural transition, as well as "the continual, and in [his] opinion fruitless, search for behavioral correlates in the archaeological record" (O'Brien 1991:148). He lamented the de-emphasis of variation, a trend that only masks the true evolutionary pathways of these prehistoric populations.

Nassaney and Cobb (1991) addressed various Late Woodland characteristics that could have resulted in the appearance of more cohesive and sedentary Mississippian societies within the Southeast, while they also acknowledged the regional variation evident despite vague patterning at this early stage. The two authors cited subsistence intensification as one of the contributing factors, which can develop as a greater reliance on either maize or indigenous seed crops depending on the location in the Southeast. Population growth and movement is another element of prehistoric society that may have led to more sedentary and socially stratified lifestyles across the southeastern landscape. Nassaney and Cobb (1991:300) stated that "broadly speaking, the Late Woodland period seems to have witnessed steady population growth and a shift to increasing consumption of cultigens", though these escalations are not universal during the time period, nor do they ineluctably lead to the development or adoption of chiefly societies. The pair's conclusions concerning the intricacy of the Late Woodland period and what its study has to offer to southeastern prehistory are summed up as follows: "the undoing of the Middle Woodland and all it entailed is *simultaneously* the emergence of the Mississippian" (Nassaney and Cobb 1991:314; emphasis in original).

While certain camps view Early Mississippian societies as a somewhat natural progression from earlier Woodland stages, others equate the origin of diagnostic Mississippian culture, at least in certain areas like the American Bottom, to that of a revolution (Pauketat 1997; Fortier and McElrath 2002). Fortier and McElrath (2002:201) directly challenged Kelly's (1990) "Emergent Mississippian" argument, which they stated is almost entirely built on shaky interpretations of the Range site. They rejected the evolutionary mechanisms employed in Kelly's explanation and argued instead for Pauketat's (2001) historical processualism, which highlights the role of social action. In this manner, the transition into full-blown Mississippian society was not a smooth or progressive trend, but rather the result of a series of social events that culminated in the sudden Mississippian "Big Bang" in the American Bottom (Pauketat 1997). As a result, it has been suggested that the term "Emergent Mississippian" be abandoned and this transitional phase be designated the "Terminal Late Woodland" in an attempt to refrain from defining preceding traditions retroactively through the patterns of subsequent populations (Fortier and McElrath 2002:202).

In response to this critique, Smith (2007:xxiii) argued that this stance takes the focus away from the development of primary chiefdoms and places the spotlight on later complex chiefdoms. Sweeping Emergent Mississippian into the Woodland period undermines the actual process of change over time in order to emphasize the revolutionary nature of Mississippian inception. Much of this debate centers specifically on the American Bottom region in which Cahokia is located, yet these patterns are often applied not only to the Central Mississippi Valley directly south, but also to the entirety of the Southeast.

What can be said with some measure of confidence is that despite having similar characteristics at their height, there is an undeniable plurality in terms of the underlying factors for initial development of Mississippian culture. As Nassaney and Cobb (1991:285) pointed out in regard to the Late Woodland and thereafter, "we still know too little about this interval to make panregional generalizations that are equally valid for all regions and indeed doubt whether this objective is desirable or possible." Different regions within the prehistoric Southeast varied in social interactions within and between localized populations, the role played by subsistence strategies, and the resources available in local environmental landscapes. In the new preface to *The Mississippian Emergence*, Smith (2007:xxiv) pointed out "the value and importance of first selectively constructing detailed local-scale developmental histories for those 'hotspot' river valley segments that witnessed the initial emergence of primary chiefdoms." Through the thorough local analysis of this transitional period in prehistory we can better understand the overall development of chiefdoms in the Southeast. Fine-tuning regional patterns will help clarify the likeness as well as the uniqueness underlying the emergence of the vast and multifarious Mississippian culture.

Cobb and Garrow (1996) did just that in their analysis of the Woodstock culture in northwestern Georgia. The Woodstock period exhibits few Mississippian qualities despite falling inside the emergent Mississippian time frame. In this area sites are present in both upland and lowland contexts. Fortifications and mounds are rare, but do exist, and the same applies to evidence of maize at Woodstock sites. Ceramic traditions from the earlier Woodland period are maintained. In general, Woodstock culture is “marked by a very strong retention of localized traits that show a continuity from the Woodland period” (Cobb and Garrow 1996:30), while other regions seem to change at a more rapid pace. The two insisted that viewing this transitional period through a multiscalar historical framework rooted in agency and structure is the best way to approach the duality of varied and generalized trends seen in the archaeological record (Cobb and Garrow 1996:23, 25). This manner of analysis allows for both an ecological and social perspective to be taken (Cobb and Garrow 1996:25), painting a less homogeneous but still overwhelming spread of the traditional Mississippian culture beginning around A.D. 800.

Pauketat (2005) critiqued the systems approach that archaeologists like Smith used as a framework for analysis during the Mississippian period. The reduction of Mississippian peoples to a conglomeration of polities originating from an adaptation to intensive riverine maize farming limits our analytical abilities. Pauketat (2005:187) stated that this conceptualization of Mississippian culture has pushed our concentration solely towards the development and level of complexity throughout this cultural period. Like

Cobb and Garrow before him, Pauketat highlighted the fact that Mississippian populations differed not only linguistically, but also in complexity, density, level of centralization, and their degree of reliance on maize agriculture. He argued that instead of focusing on degrees of complexity, archaeologists should concentrate on the mechanisms behind the making of histories and shaping of cultural identities under the guidance of a historical-processual framework of analysis (Pauketat 2005:208). It is only then that archaeologists can start to answer "big" questions like those of cultural emergence and proliferation.

Mississippian peoples and culture seem to have originated in the Mississippi Valley and American Bottom and then radiated outwards in the form of migration and diffusion, being adapted to varying extents throughout the Eastern Woodlands and changing along with fluctuations in the organization of chiefly polities (Pauketat 2005). Pauketat (2005:196) cited the earliest evidence of burgeoning Mississippian characteristics at the Toltec site and its related Plum Bayou culture. These societies built platform mounds and exhibit centralized patterns of organization, though social hierarchy was minimally expressed. With the end of the Plum Bayou culture around A.D. 1000, these and other cultural groups from the northeastern Arkansas and Missouri areas may have moved towards the American Bottom where earlier Mississippian traits further developed (Pauketat 2005:196). Likewise, Anderson and Sassaman (2012:130, 155), suggested that the roots of what has come to be defined as Mississippian initially developed south of the American Bottom, which makes research within the transitional Terminal Late Woodland/Early Mississippian period throughout the Central Mississippi Valley vital to understanding the development of Mississippian societies.

Terminal Late Woodland/Early Mississippian Period: Big Lake

From A.D. 700 to 1000 there is a notable shift in archaeological patterns within the Central Mississippi Valley that marks the Terminal Late Woodland and the Early Mississippian during what archaeologists working in the southern regions of the Central Mississippi Valley term the Plum Bayou phase (Anderson and Sassaman 2012:129; Rollingson 2004). At this time, sites began to increase in both prevalence and size (Rolingson 2004:538). Although larger sites do appear throughout the landscape, there is still great variation in site size within the Central Mississippi Valley. Multi-mound sites like the Toltec Mounds with its 18 mounds and two plazas and the Hoecake site that once housed on the upwards of 30 conical mounds over its 80-hectare territory, occupy one end of the spectrum. Meanwhile Zebree with its possible plaza but no mounds is more along the middle range (Rolingson 2004:538-540). It is during the beginning of this time frame that the "village-mound-plaza" spatial pattern typical of the Mississippian period becomes increasingly apparent throughout the Central and Lower Mississippi Valley (Anderson and Sassaman 2012:128). In addition to the larger spatial patterns, structures start to transition into smaller rectangular nuclear residences (Morse and Morse 1996:127). Despite the growth of settlement size and increase in site patterning, abundant evidence for social differentiation is still lacking. Rolingson (2004:539) stated that "the evidence from most sites in the region suggests that sociopolitical organization continued to be egalitarian, but with a continuing increase in population and more sedentary way of life than previously."

Judging from numerous radiocarbon dates at Zebree, the Early Mississippian Big Lake phase seems to begin around approximately A.D. 900 and lasts until A.D. 1100 (Morse and Morse 1990). Morse and Morse (2009:202) cite this transition from the Terminal Late Woodland to the Early Mississippian as somewhat of a "cultural revolution" since the use of new technologies, resource patterns, and other cultural characteristics appear relatively quickly in the archaeological record.

One of these characteristics is the appearance of shell-tempered pottery within the Central Mississippi Valley. The diagnostic ceramic type within the Big Lake phase is the Varney Red variety. This new ceramic technology is associated with increases in the variety of shapes and sizes of ceramic vessels during the Early Mississippian (Smith 1986:54). The introduction of shell-tempered pottery by no means implies the total replacement of former types. In fact, sand- and grog-tempered ceramics typical of the Woodland period are still found in northeast Arkansas during this time frame (Rolingson 2004:539). In addition to shell-tempered pottery, arrow points indicative of bows and arrows, as well as Mill Creek chert hoes, can be found throughout the region.

Most Mississippian settlements in the Central Mississippi Valley are found in areas of well-drained soils good for agriculture and in close proximity to meandering streams and other natural resources (Morse and Morse 2009:203). These locations provided a good platform for agricultural lifestyles, which during this time period began to increasingly incorporate non-native crops such as maize. This is not to say that there was a full-scale transition to corn agriculture at this early date. In fact, maize appears only in finite quantities at select sites in this region and at this point in time. Examples include the Gooseneck, Owl Bend, Hayti Bypass, Zebree, Priestly, Toltec Mounds, and

McNight sites (Rolingson 2004:539). Despite an increase in the appearance of corn, isotopic studies have shown that Early Mississippian populations in both southeast Missouri and northeast Arkansas maintained their dependence on native cultigens (Lynott et al. 1986:61).

In addition to these plant resources, the placement of Mississippian sites within the boundaries of converging ecosystems provided access to a variety of fauna. Although major meat contributions still come from white-tailed deer, studies completed by Styles (2000) in the lower Illinois and Mississippi river valley in the American Bottom region have shown that the percentage of deer elements represented in Early or Emergent Mississippian sites greatly decreases from the Late Woodland. Meanwhile, the number of fish specimens increased overtime, and particularly within this transitional period (Styles 2000:90). Faunal subsistence trends specific to the Central Mississippi Valley are addressed in greater detail in the following section. Although the exploitation of these plant and animal resources was nothing new to Early Mississippian populations, and it seems that many of the same subsistence strategies were used, the increasing appearance of maize in the record coupled with possible evidence for differential access to resources marks a significant change in foodways (Lapham 2006:403).

Studies in Central Mississippi Valley Subsistence Patterns

Bruce Smith's *Middle Mississippi Exploitation of Animal Populations* (1975) is the earliest comprehensive regional analysis of Mississippian subsistence strategies in the Central Mississippi Valley. The study focused on a series of questions that addressed species availability and selection, seasonality of resource extraction, regional specialization, and population pressure inflicted by human predation (Smith 1975:4). Smith (1975:6) analyzed collections from seven Early to Late Mississippian sites spread throughout the Central Mississippi Valley and Ozark escarpment (Gooseneck, Powers Fort, Lilbourn, Banks, Chucalissa, Turner, and Snodgrass sites).

To determine the potential dietary contribution provided by vertebrate fauna from these seven sites, Smith ranked identified taxa based on their collective projected meat yield. He reports thirteen taxa groups with the most significant protein contributions. In order of highest ranking first, the taxa are as follows: white-tailed deer, raccoon, fish, migratory waterfowl, wild turkey, beaver, opossum, rabbits, snapping turtles, domestic dog, squirrels, black bear, and elk (Smith 1975:10). According to Smith's (1975:12) calculations, these 13 groups represent a range of 92.2 percent (Lilbourn; Structure 12) to 99.2 percent (Turner Site) of the total projected vertebrate meat yield at these Mississippian sites.

Based on the natural histories of these various taxonomic groups and historical data concerning hunting and foodways of Eastern Woodland Indian populations, Smith (1975:123) concluded that this array of fauna provides seasonally staggered resources that support long-term, year-round site occupation (Figure 3). In the spring, communities harvested fish and migratory waterfowl. Summer resources included fish, aquatic turtles, and rabbits (deer and raccoon may have been occasionally procured as well). The winter, particularly the transitional fall-to-winter months, was a time of potential resource abundance with migratory waterfowl, turkey and terrestrial mammals all available (Smith 1975:121-125). Although Smith identified this seasonal pattern of exploitation as the standard for Mississippian populations within the Central Mississippi Valley, he did also mention regional differences between the meander belt/lowland and upland strategies. Smith (1975:129) noted that while both areas rank white-tailed deer as their primary source of meat, aquatic resources including waterfowl and fish are exploited at higher levels in lowland occupations.

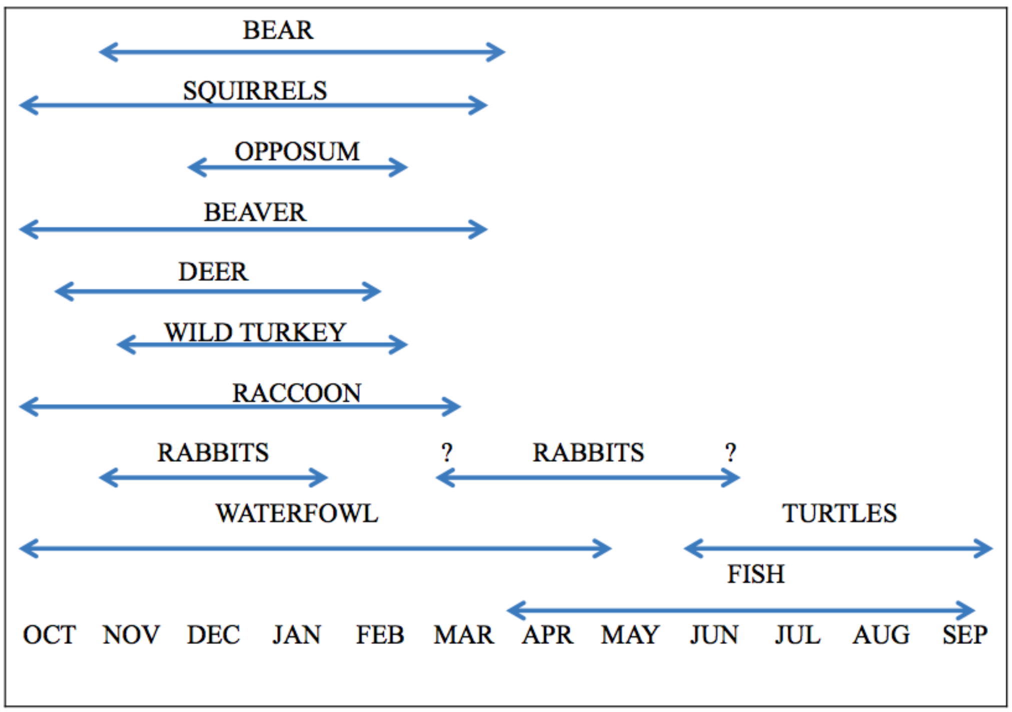

Figure 3. Seasonality of Central Mississippi Valley animal resources (adapted from Smith 1975:123).

In his 2009 dissertation, J. Matthew Compton tested the model proposed by Smith (1975) using a data set comprised of three faunal collections (one Woodland and two

Mississippian) from three Eastern Lowland sites (Parkin, Upper Nodena, and Meador). In order to provide a robust data set for the identification of regional patterns, this original analysis was combined with the previously reported faunal analysis of 65 Woodland and Mississippian sites within or near the Central Mississippi Valley (Compton 2009:19). Compton's (2009:10-15) research sought to determine the degree of regionalism in Central Mississippi Valley subsistence strategies and whether animal use patterns changed throughout the Woodland and Mississippian periods.

At the level of regional analysis, Compton (2009) utilized number of individual specimens (NISP) and ubiquity to quantify the compiled data. Based on these two values, Compton ranked the top 25 resource groups for general regions, including the Eastern Lowlands. According to his results, the top five Eastern Lowlands vertebrate resources procured during the Woodland and Mississippian periods based on NISP rank in the following order: white-tailed deer, gars, bowfin, swans/geese/ducks, and freshwater catfishes. Based on ubiquity measurements, these top five change to white-tailed deer, freshwater catfishes, gars, rabbits, and tree squirrels (Compton 2009:331).

In terms of general subsistence strategies for the Central Mississippi Valley, Compton's research corroborated much of Smith's model. Yet there are some discrepancies. For example, Compton pointed out that Smith's use of meat yields and minimum number of individuals (MNI) may have biased his conclusions in terms of dietary contributions of the snapping turtle, beaver, opossum, black bear, and elk. Contrary to Smith's study, these animals are rarely incorporated into the regional diet. In their place, emydid turtles and tree squirrels were more commonly consumed (Compton 2009: 292). In terms of the Eastern Lowlands, Compton (2009:297) confirmed Smith's model for increased fish and waterfowl use in this area, which exhibited the most significant reliance on aquatic resources of all the Central Mississippi Valley subregions (Compton 2009:297).

In order to address change over time, Compton (2009:285) employed cluster analysis to a select number of data groups spanning the Woodland and Mississippian periods. Results showed that resource type and geographic location (aquatic vs. terrestrial) trump cultural period in terms of how the data groups within the dendrogram (Compton 2009:299, 314), therefore implying that general subsistence strategies were relatively consistent over time. Yet Compton's fine-scale analysis of the three aforementioned sites offered a more detailed look at diachronic changes. He pointed out temporal similarities in resource use between the two Late Mississippian collections, which differed from the earlier Late Woodland and Middle Mississippian patterns. These included a rise and fall in white-tailed deer use over time, and inversely a decrease and subsequent increase over time in aquatic and other terrestrial resources. Of the three time periods represented, the Late Woodland collection offered the most resource diversity (Compton 2009:300). Compton (2009:302) attributed this increased reliance on white-tailed deer during the Middle Mississippian period to more constricted schedules centered on intensive agriculture, as well as environmental changes due to agricultural practices that may have attracted more white-tailed deer to the area. The only problem with this more fine-tuned comparative study is that Meador (NISP: 909), Parkin (Middle Mississippian NISP is not reported; Late Mississippian NISP: 19,692), and Upper Nodena (NISP: 7,287) contain varying amounts of fauna, making them less than ideal comparisons for the MNI and biomass-based computations used by Compton (2009).

Zebree Site History: Excavations and Findings

Excavations

The Zebree site, 3MS20, was first discovered during a surveying operation by the Arkansas Archaeological Survey in 1967 (Morse and Morse 2009:217). The site is located in Mississippi County, Arkansas. Although excavations took place in 1968 and 1969, the crux of the Zebree project occurred in 1975 and 1976 as the result of drainage ditch construction to manage the silting of Big Lake (Morse and Morse 1990:51). The site was tested and officially recorded in 1968, when multiple prehistoric components were identified. In view of both the extent and significance of Zebree, funding was acquired for more extensive excavations in 1969 and 1975, with final fieldwork occurring in 1976 as the site was being destroyed (Anderson 1980b; Morse and Morse 1990:217-218).

Led by Dan and Phyllis Morse, and under the auspices of Arkansas State University, the newly founded Arkansas Archaeological Survey (1967) was tasked with testing designated areas within the refuge prior to drainage ditch construction. Test units were selectively placed throughout the area. This 1968 investigation identified two major prehistoric components at Zebree: a Baytown period Dunklin phase and an Early Mississippian period Big Lake phase. These occupations were somewhat discrete with a relatively sterile sediment layer segregating the two (Morse and Morse 1990:51, 2009:217). In addition, the remnants of a Middle Mississippian and Euro-American settlement were noted (Morse and Morse 2009:217).

Funded by the National Park Service, the 1969 excavation aimed to better define the occupation's scale across both the Big Lake landscape and through time (Morse and Morse 1990:51). This initial mitigation stage field season concentrated on collecting and identifying substantial data for each of the identified components. Morse and Morse developed a research design that not only focused on the ceramic and lithic collections, but also formulated and tested environmental and resource-oriented questions. The two block excavations and various test pits revealed "over 100 pit features, 8 structures and 8 burials" (Morse and Morse 2009:218). One of the most significant results of this early stage of site analysis was evidence indicating a separationbetween Late Woodland Dunklin and Early Mississippian Big Lake populations (Morse and Morse 1990:51). A rapid transition between these two occupations was observed in the site stratigraphy. The Zebree site was subsequently added to the National Register of Historic Places following the 1969 excavations and analysis (Morse and Morse 2009:218).

The site was not excavated again until 1975, when the U.S. Army Corps of Engineers initiated the construction of a drainage ditch within the boundaries of the Zebree site. The Morse's formed an interdisciplinary research team comprised of a zooarchaeologist (Eric Roth), a paleoethnobotanist (Suzanne Harris), and a ceramics specialist (Michael Million) in order to best identify, analyze, and interpret this multi-faceted site. In addition, 20 technicians, a field supervisor and two field assistants were employed to operate the excavation and separate faunal, botanical, and ceramics labs (Anderson 1979, 1980b:24). A series of block units, backhoe trenches, and random sample test pits were executed so as to most efficiently obtain site information with the time and resources at hand. In order to recover an accurate representation of Zebree artifacts and data, fine-screening techniques including 3.18-mm water screening and flotation were employed in most cases (Morse and Morse 1990:52).

A year later, a salvage project was coordinated with the site's construction contractor. During this cooperative enterprise, final efforts were made to recover all visible features in transects removed by a bulldozer (Morse and Morse 1990:53). Unlike the 1975 excavations, hand picking was the main means of recovery due to the urgency and lack of funding for this 1976 project (Anderson 1980a:15, 18).

Site Structure

The rectangular-shaped Big Lake village at Zebree covers 1.5 hectares (2.84 acres) (Morse and Morse 2009:226). The initial settling of Zebree by its Big Lake population incorporated large-scale cooperative architectural feats. Site construction included the movement of dirt across the area in order to level the landscape. Some of the displaced deposits were removed from a ditch that surrounds the site's perimeter (Morse and Morse 2009:230). Morse (1980a:22) proposed that the Zebree site had a rectangular site plan oriented slightly east of north and fixed on a central post (Figure 4). The lack of artifacts in the southeastern portion of the Zebree site is interpreted as evidence for a community plaza (Morse 1980a:23). Unlike the typical plaza/post orientation at Mississippian site, the supposed plaza area is offset from the central post feature.

In addition to the plaza and post, Morse and Morse (1990:63) identified the remnants of a ditch feature in 10 backhoe transects, suggesting that it surrounds the perimeter of the village (Figures 4 and 5). Likely functions of the ditch include sources of fill and for drainage. Morse (1980a:26) also suggested that a defensive palisade could

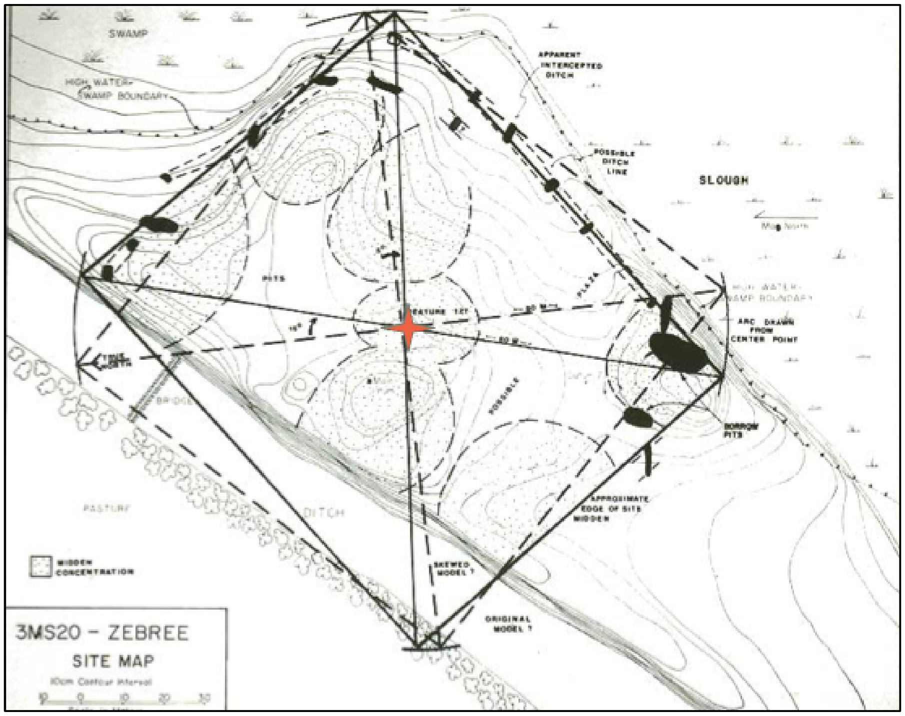

Figure 4: Zebree site orientation. The central post feature is marked in red. (adapted from Morse 1980a:25).

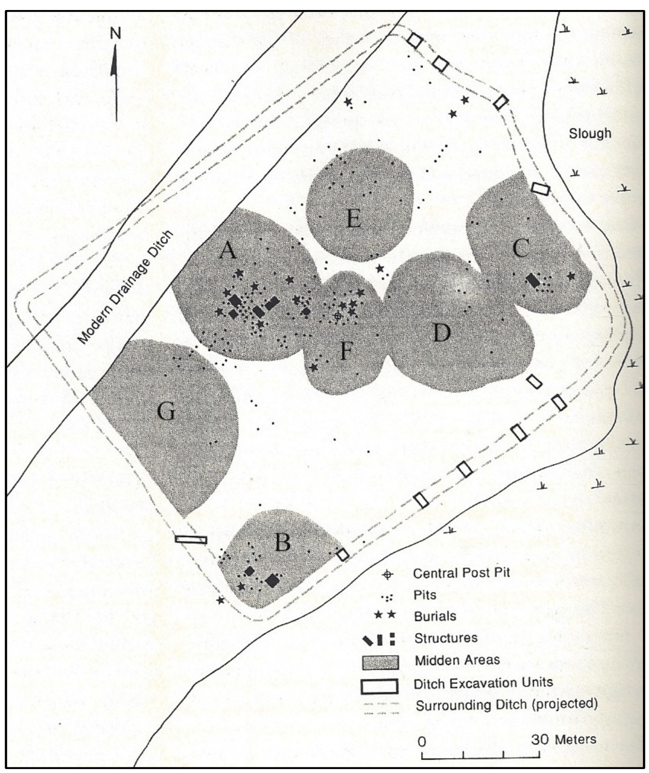

Figure 5: Midden clusters (adapted from Morse and Morse 1990:62).

have been constructed within or outside of the ditch, although evidence for possible postholes and other related stains were only found in the base of the Area B ditch during the 1969 excavations (Morse 1975:28).

In order to elucidate residential site structure, density maps were created based on artifact frequencies. General midden concentrations were identifiable throughout the site and may represent residential areas. Morse (1980a:14) suggested the presence of seven distinct midden areas (Figure 5), and extrapolated the existence of seven house clusters. Ceramic, lithic, bone, and shell debris from tool manufacturing were recovered from all household structures and midden areas, suggesting a lack of task specialization within the community (Morse and Morse 2009:231).

A total of nine possible Big Lake phase residential structures, four complete and five partial, were identified through block excavations in select areas at the Zebree site (Morse 1980a:14; Morse and Morse 1990:61). The typical Big Lake house was a rectangular structure that covered an average area of 8.5 sq m outlined by 6-8-cm wide postholes spaced 20-30 cm apart. In addition to postholes, one Big Lake structure showed evidence of wall trenches (Morse and Morse 2009:230). Houses were oriented with the long axis typically facing the respective northeast and southwest directions. Morse (1980a:1) believed that the doorways were located on the southward-facing long side in order to maximize sun exposure during the winter and minimize it during the summer. He also proposed that houses would have been placed so as not to shade one another during the winter months (Morse 1980a:1-2). Based on the spacing and number of houses in different areas, approximately 28 houses occupied the site at any one time (Morse 1980a:23).

Zebree residential structures likely housed nuclear families of five (Morse and Morse 2009:231). Each house was paired with both a midden concentration and storage pits. Approximately 68 pits were linked to the nine houses and respective midden clusters (Morse and Morse 1990:62). Most Big Lake pits were cylindrical with flat, sometimes bell-shaped, bottoms that held on average two cubic meters of storable goods and were often times sealed with a fabric and clay barrier (Morse and Morse 2009:231).

The site probably housed a population size of 130 to 140 individuals during its circa 200 years of occupation, which Morse and Morse (2009:232) argued is a typical village size for a major Early Mississippian site. Population estimations were calculated using a variety of techniques and took a number of different factors into consideration, including spatial clustering of houses, population predictions at other sites, average number of homes per midden cluster, the size of cooking jars, skeletal population, and storage pits (Morse 1980a:18).

Ceramic Data

Three different shell-tempered ceramic types were found at the Zebree site: Varney Red Filmed, Neeley's Ferry Plain, and Wickliffe Thick. Varney sherds, which are a variation of the Old Town Red type, represent a large portion of the overall ceramic collection at Zebree. This ceramic type garners its name from the distinct hematite-based slip most commonly applied to the vessel's interior. The exception to this standard is the bottle form, which exhibits exterior slipping. Other sherd types occasionally show exterior slipping, but it is not nearly as thick as the interior slips, nor do they have signs of burnishing. Although a variety of vessel forms were found, including shallow pans, hooded bottles, and bowls, around 60 percent of the Varney sherds recovered were jar fragments (Million 1980:9)

The ubiquitous Varney vessels have been separated into different size categories. Large vessels have a minimum mouth diameter of 30 cm, a height of 40 cm, and hold an average of 52 liters. In addition to their size, these large vessels are characterized by rim reinforcement. Morse and Morse (2009:220) hypothesized that the biggest Varney jars played a specific role in Big Lake phase food practices. These large containers were possibly used for storage, as well as the preparation of corn, during which dried kernels may have been soaked in the vessels until softened. Jars measuring around 25 cm in diameter and 30 cm in height, with an average volume of 13 liters, are classified as medium-sized. Small-sized jars are characterized by a 12-cm diameter and 20-cm height, holding only 3 liters. Both medium and small jars were thought to be cooking vessels (Morse and Morse 2009:220).

Shallow Varney pans were another notable Big Lake vessel type. These pans typically measured between 50 and 70 cm in diameter and 12 to 15 cm tall, with a volume of around 13 liters (Million 1980:15). They exhibited impressive uniformity, all with multiple layers of slip and a standardized vessel shape and thickness, which suggests they held a particular function. Most likely they served as saltpans possibly used to extract sodium and potassium from plants such as the American lotus (*Nelumbo lutea*) that grows rampant around Big Lake (Million 1980:18, 20). The shallow nature of these Varney pans is conducive to evaporation. The Wickliffe Thick globular funnels were most likely used in tandem with Varney saltpans, possibly to hold lotus ashes during the salt production process. These coarsely shell-tempered funnels were the only Wickliffe forms found at Zebree (Morse and Morse 2009:221). Perforated pottery disks found at the site may have served as funnel strainers (Morse and Morse 2009:224).

Although less common, another interesting vessel form recovered from Zebree is the Varney hooded bottle. The bottle's shape resembled that of a gourd, and even had an indentation on the hood for the stem. With a wall thickness between 4 to 5 mm, these vessels were comparatively thin. Clay plugs were used to seal the mouth of these gourd bottles, which may have been used to store food and/or seeds (Million 1980:22). Million (1980:22) suggested that the estimated 4.4-liter capacity of these bottles could store enough grain to "sow several acres."

The predominance of internal slipping could indicate that this diagnostic characteristic of Varney was functional in nature. The slipping technique used, which included burnishing, was extremely time consuming, likely more so than the initial steps of vessel production (Million 1980:6). Morse and Morse (2009) proposed that the film formed by the surface treatment may have played a role in strengthening vessels and decreasing porosity. They reached this conclusion based on the immensity of Varney fragments as compared to other sherd types found at Zebree, which they attributed to the slip's capacity to prevent any leaching of the shell temper (Morse and Morse 2009:220).

In addition to Varney Red Filmed ceramics, a more utilitarian shell-tempered Neeley's Ferry Plain type was used, also known as Mississippian Plain. Both jars and bowls of various sizes were employed for cooking and food consumption; though, like the Varney assemblage, jars dominated the collection (Million 1980:26).

Non-utilitarian ceramic items included 14 toy vessels, as well as unperforated ceramic disks and clay beads. Twelve plain ware and two red-filmed toy bowls and jars were recovered during excavations. In addition, a possible toy ladle (approximately 3.4 cc) was discovered. Toy vessels are thought to serve as practice for Zebree children learning the craft of ceramic production (Morse and Morse 2009:222). The ceramic disks may have held a less functional role in community life. Based on the shape of the ceramic discoidals (convex on one side), Morse and Morse (2009:224) suggest they functioned as rolling parts of dice or guessing games.

Lithic Data

Lithic production at Zebree was diverse and included the use of Mill Creek and Crescent Quarry chert, as well as orthoquartzite and basalt to produce a variety of lithic types. A few serrated Scallorn or Seqouyah type projectile points were recovered from Zebree (Morse and Morse 2009).

Zebree produced the largest collection of Cahokia microliths found at any site in the Central Mississippi Valley south of the American Bottom. Dan Morse first identified the Cahokia microlithic industry in 1959 (Morse and Morse 2009:222). The chert used in the microlithic production at this site is the Crescent Quarriy variety that can be found near modern-day St. Louis. The blocky shatter pattern produced by this chert type provided cores fit for microlithic manufacture. As a result, Crescent Quarry chert served as the primary raw material for microliths (Morse and Morse 2009:222).

Blades were knapped from the larger cores, some of which were tabular and others cylindrical in shape. Cylindrical blades are the foremost blade form found at Zebree (60 percent), and through retouch were shaped into awls and drills (Morse and Morse 2009:222). Those drills with rounded tips were most likely used to manufacture shell beads, while microliths with tapered tips may have served as gravers for the manipulation of both shell and bone raw materials (Morse and Morse 2009). Michael Sierzchula's (1980:36) thesis on the experimental reproduction of the Cahokia microlith industry found at Zebree demonstrated that round-tipped drills could perforate a shell in approximately 10 minutes. In addition to making shell beads, microlith drills could also be used to bore through wood and bone. Furthermore, microlithic drills could pierce a green dog canine in less than two minutes (Sierzchula 1980:43). Drill bits were found throughout the site, implying that bead manufacturing was a communal activity (Morse and Morse 2009:224).

Botanical Data

Ethnobotanical analysis identified a large amount of burned acorn and hickory nuts (Harris 1977a, 1977b, 1977c). In addition, wood charcoal from the following species was recovered: "cypress, willow, maple, oak, hickory, and leguminous wood" (Morse and Morse 1990:60). Furthermore, analysis revealed remains of "grape, persimmon, hackberry, gromwell, chenopodium, and polygonum" (Morse and Morse 1990:60).

Evidence of corn was also found during analysis. In contrast to the undisturbed Late Woodland Dunklin phase features that produced no evidence of corn, three different types were identified in a variety of Big Lake features. North American Pop (Tropical Flint) was recovered, including both 12- and 14-rowed cobs. The second type found at Zebree was the Eastern Eight Row (Northern Flint), which exhibited both 8- and 10-rowed cobs. In addition, Midwest Twelve Row was identified, but found only sparingly at the site (Morse and Morse 1990:60).

Corn remains were found in 29 Big Lake features. Evidence of corn in various Big Lake storage pits suggests it was being produced in large enough quantities to not only be consumed, but also stored for later use. Morse and Morse (1990:60) stated "[although] corn was obviously a regular part of the diet in the Big Lake phase, it was apparently not as important as it was during middle period Mississippian." Stable carbon isotope tests of three Zebree skeletons were compared to other later Mississippian populations, the results of which show that corn consumption in Zebree individuals was not significant enough to create a recognizable signature in bone isotopes (Lynott et al. 1986).

Bioarchaeological Data

Excavations at Zebree uncovered 28 human burials. In addition, various discrete elements were found throughout the site during excavation. Most burials could be linked with midden and structural clusters (Powell 1977:71). Morse believed that more human burials originally existed, but that the 1920s drainage ditch, coupled with episodes of looting, potentially destroyed additional interments that may have been located outside of the identified habitation areas (Powell 1980).

Out of the total 28 individuals recovered, 23 were likely members of the Big Lake phase population, while five were part of the Middle Mississippian Lawhorn phase population. Age categories were assigned to all burials. Of the 23 Big Lake burials, 82.6 percent were aged between 20 and 55 years. Analysis identified four infant skeletons between the ages zero to nine months. Ages 36 to 45 held the highest number of deceased with seven individuals. No individuals between the ages one and 20 were recovered.

Twenty Big Lake individuals were assigned a sex, 13 were identified as female and seven as male (Powell 1980:4-5).

Demographic data was compared to the Dickson Mounds' Mississippian-acculturated Late Woodland skeletal population of 224 individuals. In the Dickson population, 62.9 percent of the deceased sample were younger than 25, a stark contrast to the Zebree Big Lake death profile. In addition, sex distribution was even at Dickson with both 61 females and 61 males identified. Due to the limited sample size of skeletal material found at Zebree, only tenuous demographic information was derived from the data. After the comparison to the larger Dickson sample, Powell's (1980:5) conclusions stated the "Zebree samples most probably do not reflect the actual sex and age distributions of the living populations."

Much of the bioarchaeological analysis concentrated on the role of corn in prehistoric Zebree diet. In order to best address this question, Powell (1977, 1980) pursued a variety of research avenues including stature estimation, dental analysis, and isotope analysis. Stature estimations for the Big Lake individuals were compared to later Mississippian populations. In general, the skeletal population at Zebree was taller than other populations at later Mississippian sites, suggesting that corn consumption was not as frequent at this Early Mississippian site (Morse and Morse 2009:61).

On the other hand, dental analysis provided evidence supporting a high, or at least increased, level of carbohydrates such as maize in the Big Lake diet. The number and frequency of dental caries as compared to those from individuals at the Dickson Mounds site, showed that the diet was one low in protein and other gritty foods, and thus higher in soft carbohydrates, which are apt to gather and infect recesses of teeth (Powell 1980:9).

In addition the number of hypoplastic lesions is higher than the comparative Late Woodland Dickson Mounds population, indicating a more stressful weaning period typically linked with decreasing amounts of protein and increasing amounts of carbohydrates in agricultural diets (Powell 1977:57).

As was briefly mentioned earlier, isotope analysis was also completed on six aged and sexed individuals who exhibited varying ranges of periosteal infection, and therefore likely represent a decent spectrum of health within the society (Powell 1977:58). Four elements were analyzed for dietary patterns: zinc, copper, iron, and strontium. The results were then compared with individuals from Mound 72 at Cahokia (Powell 1980:3). Levels of iron and strontium at Zebree seem to suggest that the red meat consumption was lower than at Cahokia, though Powell (1980:4) stated that the results were somewhat tenuous. In total, skeletal data painted a rough picture of a village population transitioning from an indigenous horticultural lifeway to primarily corn agriculture (Morse and Morse 1990:61).

Faunal Data

John Guilday and Paul Parmalee (1975) conducted the faunal analysis for remains recovered by hand collection and limited 6.35 mm screening during the 1969 excavation (Anderson 1979:100). Documentation of fauna identified from the 1969 excavations is not phase specific though Morse stated that most of the deposits were from Big Lake contexts (Morse 1980a:7), which is logical since the Big Lake component is the largest of the four represented at Zebree. Faunal analysis from the 1969 sample identified 6,082 fragments of the 9,372 that were submitted. These results account for 64 species and 279 individuals, the majority of which are aquatic in nature. Upland resources such as deer and turkey, heavily exploited at most southeastern sites, represented only 4% of the total sample identified at Zebree (Guilday and Parmalee 1975:228). Due to the disproportionally high ratio of waterfowl to aquatic turtle and fish, Guilday and Parmalee (1975:229) suggested that the Zebree site was a seasonal spring and/or fall occupation that exploited bird migrations through the Mississippi Flyway. In addition to general resource trends, Guilday and Parmalee (1975:230) noted that their identification of nine thirteen-lined ground squirrel (*Spermophilus tridecemlineatus)* specimens (MNI:2) was the first record of this species in the state of Arkansas (Guilday and Parmalee1971).

Eric Roth, the resident zooarchaeologist during the 1975 field work, completed subsequent faunal analysis. These later specimens were obtained using a variety of sampling methods including the standard practice of 6.35-mm water screening, while 7.6-liter bucket samples from random squares and feature fill were processed via 3.18mm water screening. A 3.8-liter sample of each random square level, as well as a 3.8-liter sample from general feature fill were also taken for flotation (Morse et al. 1980:2-3).

Zooarchaeological analysis of the 1975 excavations included 13,839 faunal specimens, 1,842 of which were identified to either genus or species. This represents 231 individuals and 44 species, the majority of which were aquatic animals. Analyzed fauna was pulled from select locations (Morse et al. 1980:2-3). Vertebrate fauna was identified from two Dunklin contexts, feature 249 and area D in Random Square 126 (Morse 1980b:14). Invertebrate Dunklin specimens were pulled from features 114, 248, and 288 (Morse 1980b:18). Features 238 and 155 provided vertebrate and invertebrate fauna from Big Lake contexts (Roth et al. 1980:3, 6). While the invertebrate data appeared in tables for both the Dunklin and Big Lake samples, it is discussed only briefly (Morse 1980b:19). Although the number of identified specimens is provided for Dunklin (N = 424) and Big Lake (N = 1,418), unidentified numbers were not provided for either collection (Morse 1980b:18; Roth et al. 1980:3).

The Big Lake vertebrate fauna is comprised of majority fish, followed by bird, mammal, and reptile. Dominant fish taxa included bass, catfish, and walleye/sauger. A myriad of bird species were identified, the vast majority of which were waterfowl (approximately 79 percent). The MNI for mammal taxa was nearly equivalent to that of birds, yet 21 percent of these individuals were mice and rats (Roth 1980:206). Although these species can be processed for food, it is also likely that they are commensals in nature. Like Guilday and Parmalee (1975), Roth (1980:11) concludes that the Big Lake occupation relied almost completely on surrounding aquatic environments and their resources.

To further unravel the subsistence patterns of the Big Lake occupation, Roth divided species into six preferred habitat groups (riverine, swampland, lake, deciduous forest, and forest edge) based on the habitat scheme developed by Charles Cleland (1966). He then assigned a meat weight value for each identified species. Based on the projected meat yield, Roth (1980:11) concluded that terrestrial animals offered the most valuable contribution to the prehistoric diet at Zebree in the form of 65 percent of the total useable meat weight. Using these results, he asserted that the forest "edge effect" was the most valuable aspect of the surrounding environment as it attracted many valuable terrestrial species (Roth 1980:11). One potential problem with Roth's methodology is the absence of a citation or source for the usable meat weight he assigns to each species. Some of his numbers seem questionable. For example, Roth gave an individual fox squirrel (*Sciurus niger)* 1.5 lbs of usable meat while this species' natural weight ranges between one and three pounds (Reid 2006:227). Possible exaggerations and minimizations created by this system may have skewed Roth's results. In addition, Roth identified five marsh rabbit (*Sylvilagus palustris*) elements (MNI:2), yet the Zebree site is located a great distance outside of this animal's natural range (Reid 2006:346).

Roth also examined seasonal patterns based on the presence of various species in the Zebree collection. Using Smith's (1975:71, 123) seasonal exploitation and availability charts, particularly that of migratory waterfowl in the Central Mississippi Flyway, Roth interpreted a strong fall/winter exploitation of avian resources. He based this interpretation on the presence of many migratory waterfowl that winter in the area (Roth 1980:16). Additionally, Roth (1980:18) stated that the abundance of fish elements suggests summer harvests of receding oxbow lakes. In terms of seasonality based on mammal and turkey remains, Roth (1980:18-19) reasoned that most of these animals represent fall hunting exploits due to a variety of ethnographic and sociobiological reasons.

In order to compare the subsistence patterns of the earlier Barnes occupation to the later Big Lake occupation, Roth (1980:2) calculated a species diversity index based on MNI using what appears to be the inverse Simpson index for each faunal collection. Results showed a diversity index of 0.9237 for the Barnes phase and 0.9669 for the Big Lake phase (based on a maximum value of 1; Roth 1980:7). The closeness of these two values lead Roth to the conclusion that despite disparate cultural environments, the Big Lake peoples had almost identical subsistence strategies in terms of vertebrate fauna.

Therefore horticultural intensification, the introduction of corn into the diet, as well as increased settlement size evident during the Big Lake phase had little effect on hunting strategies (Roth 1980:19).

It is important to note that elsewhere in the site report Morse disagreed with Roth's conclusions. For example, Morse (1980a) pointed out that while turkey is absent from the Barnes phase fauna, it is present in small quantities during the Big Lake occupation. He suggested that although it may be the result of a smaller Barnes sample, it could also be evidence for the "control of upland resources including turkey by the Big Lake phase" (Morse 1980a:7). Furthermore Morse (1980a:7) interpreted the greater diversity of waterfowl in the Big Lake sample as verification of Big Lake's existence at this point in prehistory, which would inherently attract more migratory birds.

In addition to specific and generic identification of vertebrate remains, fauna from random square excavations were rough-sorted into class, following which, counts and weights were recorded. These measurements were then used to create distribution maps for each class (Roth 1977). Morse and Morse (2009:231) drew attention to patterns visible in the mammal distribution map, which showed the highest counts and weights for mammals in the northwest corner of the site designated as midden A. They suggested that despite the consistencies in house structures and tool manufacture throughout Zebree depicting a relatively egalitarian society, the distribution of mammal remains may indicate social differentiation in terms of dietary practices (Morse and Morse 2009:231).

In addition to subsistence data, the faunal record provided technological data in the form of worked bone. A suite of bone tool types was recovered from Big Lake contexts. Artifacts included awls, scrapers, harpoons, fishhooks, and a chisel. Bone awls were constructed from both mammal and bird resources. Antlers were used to fashion tine points, batons, and scrapers. In addition projectile points were made from gar scales, and a few modified turtle shell bones may have been used as either scrapers or containers (Morse 1975:173). Bone beads were made from mammal and bird long bone shafts, while mammal jaws and teeth were used as pendants. One deer skull was found with the anterior nasal portion removed and a hole in the upper brain cavity. Morse (1975:174) suggests that this modification may be due to brain extraction and skinning, or perhaps use of the skull as a rattle-type instrument. Additional fragments of worked bone were recovered exhibiting evidence of polishing, abrasion, and/or groove-and-snap techniques.

Shell was also used as a raw material at the Zebree site. Hoes were constructed from the valves of mussel shells. A mussel shell spoon was also recovered from a Big Lake storage pit (Morse 1975:182). Shell was also processed for use as temper in Big Lake phase ceramics. In addition to utilitarian uses, beads were created from both bivalve and gastropod shells, while gorgets were fashioned from mussel shells (Morse 1980c:45).

CHAPTER THREE: SAMPLING AND METHODS

Random Sampling of Big Lake Features

In order to compile a representative sample of the Zebree vertebrate faunal data, a random subset of features was sorted out from the Zebree collection for analysis. Features containing animal bone and determined by excavation and previous analyses to date to the Big Lake phase were separated from earlier Dunklin and later Middle Mississippian Lawhorn features. Big Lake features were ordered from lowest to highest by number. Each feature was given a separate number from one to 54 based on its position in the order. Next, 16 features were selected for identification using a random numbers table, constituting approximately 30 percent of the unexamined Big Lake features containing bone. This sampling method was used to prevent biases associated with arbitrary sampling, such as an overrepresentation of large mammal remains (VanPool and Leonard 2011). Of these 16 features, 14 are classified as pits and represent general subsistence byproducts (Table 2). The remaining features were the product of different types of formation processes. One is a ditch segment, Feature 285, and the other is a midden layer associated with Burial 15, Feature 287 (Figure 6; Table 2). The sample analyzed provides a representative spread of the site and includes features from all midden areas except for area E (Figures 5 and 6). One feature’s exact location is unknown, Feature 203, though excavation documents state that it was located within area B. The 16 features drawn for analysis should offer a more complete picture of the subsistence data than the two analyzed by Eric Roth, which represent only area A (Feature 155; though its exact location is also unknown) and area B (Feature 238) (Figure 6).

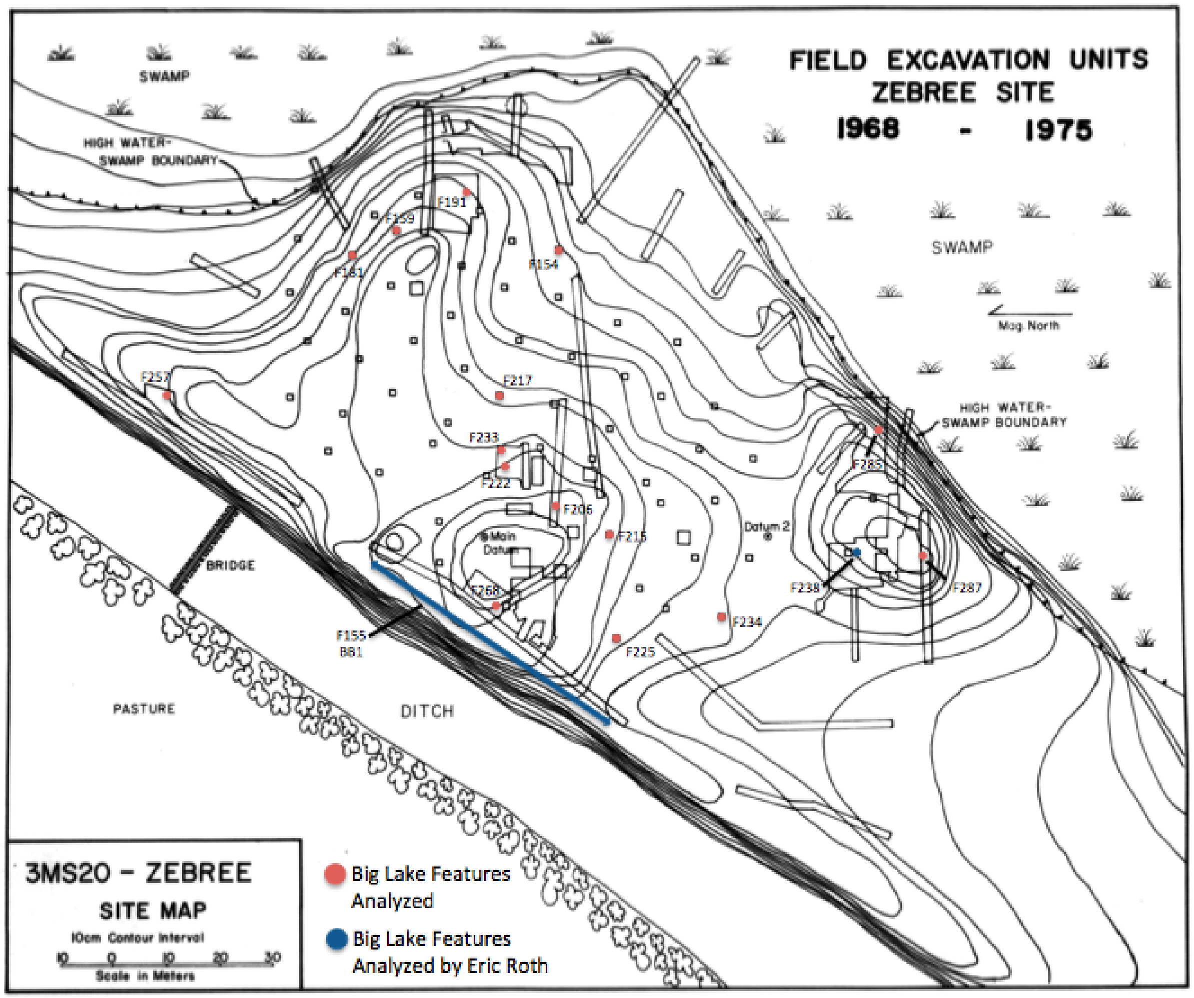

Figure 6: Big Lake features analyzed from the 1975 excavations (map base adapted from Anderson 1976:33)

Table 2: Features Analyzed from the 1975 Zebree Excavation.*

Feature #	Midden Area	Proximity to House Clusters	Feature Type	Horizontal Location	Vertical Location (cm below surface)
154	D	Outside	Pit	Random Square 65	50
159	C	Outside	Pit	Random Square 38	50-76
181	C	Outside	Pit	Random Square 24	131-142
191	C	Inside	Pit	Backhoe Block 1	45
203	B	Inside	Pit	Square 16R16; Area B	63
206	A	Inside	Pit	Backhoe Trench 3	90-148
215	A	Inside	Pit	Random Square 78	78
217	D	Outside	Pit	Random Square 57	88
222	F	Outside	Pit	Backhoe Block 3	92
225	G	Outside	Pit	Random Square 76	77
233	F	Outside	Pit	Backhoe Block 3	70
234	G	Outside	Pit	Random Square 103	78
257	E	Outside	Pit	Backhoe Trench 13	38
268	A	Inside	Pit	Backhoe Block 5	35
285	B	Outside	Ditch Segment	Backhoe Block 7	70-100
287	B	Outside	Burial 15 Midden	Backhoe Trench 7	disturbed by backhoe

*Note: Compiled from Anderson 1977; Arkansas Archeological Society 1975 Excavation Feature Forms and Feature Records

Vertebrate Identification

The Arkansas Archeological Society (AAS) loaned the Zebree faunal collection to the University of Tennessee Zooarchaeological Lab for completion of this thesis research. Animal bone had already been separately bagged and catalogued as bone by the AAS during lab processing. As a result, one feature may have multiple catalog bags containing bone. These catalogue bags were also assigned specific box numbers by AAS, and therefore, multiple boxes contained bags from the same feature. Care was taken during analysis to maintain the integrity of catalogued bag contents, avoiding comingling of elements.

Elements were identified to various taxonomic levels dependent upon their integrity, the most general being class and the most refined being species. Identification was completed using the extensive vertebrate comparative collection housed at the University of Tennessee Zooarchaeological Lab. Nomenclature follows the most recent taxonomic classification published on the government website by the Integrated Taxonomic Information System (2013), a federal agency tasked with providing taxonomic standardization for North American organisms. Each identifiable specimen was assigned a taxonomic group and then weighed prior to being bagged and tagged. In addition, this study noted the portion of bone represented by the identified element (for example proximal, shaft or distal if part of a long bone), as well as any bone modification (such as burning, cutting, gnawing, and so on). General mammal and bird categories were further broken down according to size (Table 3). Unidentifiable elements were separated into burn categories, weighed, tagged and bagged together since many of these were extremely small bone fragments. Ceramic, stone, shell, and other invertebrate materials found in vertebrate faunal samples were also bagged separately. All data was logged into the "Master Spread Sheet for Big Lake Fauna" with any known provenience or contextual information (File 1, ZebreeBigLakeFauna_Carmody2013.xls).

Table 3: Mammal and Bird Size Categories.

Mammal Size	Examples of Corresponding Mammals	Bird Size	Examples of Corresponding Birds
Large Mammal	gray wolf, white-tailed deer	Large Bird	swans, geese, turkey, sandhill crane
Medium Mammal	opossum, beaver, coyote, foxes, raccoon	Medium Bird	most dabbling ducks, night-heron
Small Mammal	squirrels, rabbits, skunk, weasel, mink	Small Bird	teals, broad-winged hawk, short-eared owl, lesser scaup, bufflehead, grebe, passenger pigeon, grackle
Very Small Mammal	moles, rats, mice	Very Small Bird	bobwhite, most perching birds

Quantitative Analysis

Various methods of data quantification exist within the field of zooarchaeology, many of which are employed here to help tease out general patterns and trends. The most basic of these is the number of individual specimens (NISP), which provides a count for the faunal data analyzed. This method of quantification includes all bone specimens from all taxonomic classification, including those that are identifiable and unidentifiable, complete or incomplete. These numbers provide the base for all further data interpretation, and are therefore the most rudimentary, but also the most important part of the data set. This is not to say that it is a perfect quantification method. Like any other measurement, NISP has its methodological issues. For example, it is biased to more diagnostic elements that are most easily identifiable (Peres 2010:26). In terms of this particular data set, bowfin (*Amia calva*) is the only surviving fish within the order Amiiformes, not to mention that its elements are easily recognizable as they are dense bones with a uniquely patterned surface. As a result, bowfins are much easier to identify and differentiate than other fish bones whose identifications are limited to class or family levels. Furthermore, NISP is biased towards larger denser bones, such as large mammal bones, that can survive better over time even in fragmented states (Lyman 1994; Peres 2010; Reitz and Wing 2008). Another problem with NISP counts is that they are interdependent (Grayson 1979:202), meaning that many bones may derive from the same individuals, and therefore represent ordinal-scale abundance data (Grayson 1979:223).

One way to combat the overrepresentation of more diagnostic or denser bone specimens is the calculation of minimum number of individuals (MNI). Though this method is still subject to preservation and identification biases, it can at least clarify differences that may initially seem overwhelming in terms of general counts. To calculate this number, the most abundant element for each taxon is taken as a representation of the absolute minimum number of individuals present within the collection. If this element is paired within the skeleton, one takes the greater of the two counts as the representative MNI (Grayson 1984; Peres 2010; Reitz and Wing 2008; White 1953). For example, if one has 3 left bear femurs and 5 right bear femurs, the MNI would be 5. Though this seems straightforward, factors such as portions of elements (i.e. proximal or distal fragments of a long bone), epiphyseal fusing, and even size must also be taken into account (Peres 2010). This measurement is calculated for taxa below class.

The context in which MNI is calculated can determine how conservative the calculation will be (Grayson 1973). Here MNI is calculated for the entire faunal collection, rather than feature-by-feature. This results in a more conservative estimation. Because MNI totals are not conducive to aggregation (Grayson 1978:204, 1979; O'Connor 2000:61), NISP, rather than MNI counts, are used to combine and discuss Roth's data along with this sample. Furthermore, MNI is driven by sample size, meaning that the larger a sample is, the more likely that its abundant taxa are underrepresented, while its rarer taxa are overrepresented by MNI counts (Grayson 1978:60). This can cause serious issues in comparative studies. As such, NISP is used instead of MNI to compare Zebree to other contemporary sites. In this study MNI is used only as a secondary line of evidence to look at the data from another vantage point.

In addition to recording basic counts in the form of NISP, it has also become standard to note weights in some form or fashion. This study records the weight in grams of most individually identified elements, as well as general element, taxonomic, and modification groups. For example, the individual weight of an identified gar dentary would be recorded, while gar scales would be grouped into burn categories (unburned, burned, and calcined) and then weighed together. General weights can provide a variety of relevant information, and, like NISP counts, serves as the basis for further quantitative methods (Jackson and Scott 2002:466; Peres 2010).

One way in which recorded bone weights can be used is to calculate allometric biomass estimates, an alternative to traditional methods used to predict relative dietary contributions for different taxa, such as projected meat weights (Roth 1980; Smith 1975). This method calculates biomass from only the bones recovered, and is based on biology rather than possibly biased determinations of edible portions (Peres 2010:28). Allometric formulae are linear regression equations founded on the allometric principle of body growth and can be used to predict the biomass of an animal. Different classes of animals (i.e. birds, turtles, snakes, and mammals) are given separate Y-intercepts and slopes based on previous observations (Reitz and Wing 2008:66-68). Although a general Y-intercept and slope are calculated for bony fish, when applicable some taxa can be treated separately according to family, as patterns of growth vary greatly within this class of animals (Compton 2009:397; Reitz and Wing 2008:68). Like MNI, biomass predictions can vary depending on the context in which they are calculated. Refined predictions (i.e. feature-by-feature) will be less conservative than overall calculations (i.e. total site) (Reitz and Wing 2008:239). Here biomass is calculated at the site level to provide an overall picture of differential dietary contribution for each taxon represented. The allometric formulae used here were provided by Tanya Peres (2013) and adapted slightly using refined formulae from Compton (2009:397). A list of corresponding Y-intercepts and slopes are provided (Table 4).

Table 4: Allometric Formulae.*

Taxon	Slope (*b*)	Y-intercept (log *a*)
Mammals	0.90	1.12
Birds	0.91	1.04
Turtles	0.67	0.51
Snakes	1.01	1.17
Bony Fish (Osteoichthyes)	0.81	0.90
Gars (Lepisostidae)	0.87	1.13
Bowfin (Amiidae)	1.10	1.10
Catfishes (Siluriformes)	0.95	1.15
Sunfishes (Centraarchidae)	0.84	0.76
Perches (Perciformes)	0.83	0.93
Drums (Sciaenidae)	0.74	0.81

**Note*: $Y=ax^b$ where Y is the estimated biomass of taxon (kg) and x is the skeletal or specimen weight. Table adapted from Compton 2009:397; Peres 2013; Reitz and Wing 2008:68.

Like most methods for calculating biomass, bone weight allometry has certain faults and biases that one must be aware of when processing and interpreting data. The most vocal opponent of bone weight allometry is Lee Lyman. His argument is multi-faceted. For one, Lyman (2008:105,107) stated that biomass calculations are redundant measurements of NISP, since they are based on bone weight measurements, which he asserted are correlated with and thus superfluous reports of NISP. Secondly, his application of this technique to five hypothetical collections resulted in a consistently underestimated biomass value. Furthermore, Lyman's (2008:105) study showed that the larger the sample, the greater the difference between predicted and actual biomass. Due to these issues, Lyman stated that "biomass data determined by the skeletal mass allometry method are likely at best ordinal scale" (2008:105), and therefore can only be used as relative rankings of respective taxa.

To supplement traditional methods of faunal data quantification, ubiquity is also calculated for identified taxa. Ubiquity is a calculation more commonly used in paleoethnobotanical studies, but can also be applied to faunal data (Lyman 2008; Vanderwarker 2010). The calculation is simply a nominal representation of the presence or absence of a particular taxon within the collection. The number produced is useful for both within- and between-site analyses. Here ubiquity is calculated by feature sample; therefore ubiquity represents the frequency of the taxa within the site ([# of features present/total # of features analyzed] x 100). This number helps to clarify the degree to which resources are represented throughout the site versus limited to certain areas. Like all other methods of quantification, ubiquity has its biases and is subject to differential preservation. Vanderwarker (2010:66) also notes that ubiquity measurements may be warped in sample sizes smaller than 10, and are more robust the larger the overall sample size.

In order to address the type of subsistence practices that may have produced this faunal sample (e.g. diffuse versus specialized economies) by way of what Lyman (2008:172) refers to as " measuring the taxonomic structure and composition" of the sample, measurements of diversity and equitability will also be employed. Both types of data calculations produce a standardized index and were also used by Compton (2009), therefore they can be employed as comparative values. The diversity index used here is the Shannon-Wiener index, which is calculated as follows:

$$H = -\sum P_i(\ln P_i),$$

where P_i is the total number, or proportion, of a single taxon (i) in the sample. Once this value is computed for all taxa present in the collection, they are then summed. The resulting total has a negative value due to the natural log, so it is then multiplied by -1 to end up with a positive index value. This calculation serves as a numerical expression of the sample's heterogeneity and can range from 0 to 4.6, with larger numbers representing greater sample diversity (Lyman 2008:192).

Since the diversity index takes into account both taxonomic richness and evenness, sometimes the result can be difficult to interpret. To address the issue of evenness separately, the resulting diversity index can then be used to calculate an equitability index, also known as the Shannon index of evenness. Here, just the degree to which taxa are equally represented within the overall sample is determined "by scaling the heterogeneity measure to the theoretical maximum" (Rietz and Wing 2008:112). The number is calculated as:

$$e = H / \ln S,$$

where *H* is the diversity index and *S* is the total number of represented taxa within the target sample (i.e. taxonomic richness). The value of this index falls between 0 and 1 (Lyman 2008:195). Both the diversity and equitability indices are useful tools, yet their interpretation is sometimes less than straightforward. Values may be biased due to sample size, with larger samples having greater heterogeneity (Lyman 2008:193).

Statistical Analysis

As has been previously mentioned, prior faunal analysis was interpreted as possibly representing differential access to more limited mammalian resources, driven by association with particular midden areas. It was suggested that individuals inhabiting midden A were of higher status within the village. This interpretation is based on general class identifications of bone from random square excavations. Since Roth's more fine-tuned analysis only included two features, these assumptions could not be confidently verified through his data. With the identification of 16 features spread throughout the site, the results of this thesis offer an opportunity to reassess the degree of differential resource access determined by social spaces.

Due to the small sample size, the Kruskal-Wallis test was used as a nonparametric equivalent to an ANOVA in order to assess the degree of variance between the contents of features located in different midden area. The Kruskal-Wallis test provides a statistically robust method to compare distributions through averaged ranks in samples with two or more group assignments (VanPool and Leonard 2011:267). Each feature was assigned a midden area depending on its location on the site (Table 2). Corresponding features were compared as a group. Feature 257 was omitted from the tests because it is not located in any of the identified midden groups. Two sets of the Kruskal-Wallis test were run. The first round grouped features by midden areas assigned by Morse and Morse (1990; Table 2). The second round decreased the number of groups to three in order to determine whether insignificant values were the result of excessive grouping. Features in midden D with those in midden C, and those in midden F with midden A, and then allocating Feature 234 to midden B and Feature 225 to midden A. Based on these group assignments, percentage of total identified NISP and percentage of total identified bone weight were compared according to the following animal classes: mammal, bird, fish, reptile, and amphibian. If, as was previously thought, there is a spatial relationship between feature location and the amount of mammal consumed, then there should be a significant difference between groups for the mammal variable. There might also be significant variance for other resources such as fish that may have been more frequently consumed elsewhere on the site where mammal resources were theoretically scarce. If there is no differential access to resources, then between-group variance will be insignificant.

Fish Scale Analysis

Fish constitute a significant portion of the human diet in the Central Mississippi Valley. Only recently have archaeologists begun to clearly decipher the role this resource played in prehistoric and historic foodways. With the common application of more rigorous recovery methods in the past 30 to 40 years, such as the use of less-than-6.35 mm screens and the flotation of cultural features, the prevalence of fish remains has significantly increased in archaeological excavations. Small skeletal specimens, such as fish scales, are now found in larger quantities. Furthermore, water screening and flotation have allowed this more fragile element to retain its integrity, increasing its research potential. Although identifiable, fish scales are often overlooked during comprehensive analyses.

The identification of fish scales was primarily introduced into the field with Richard Casteel's 1974 article issued in *American Antiquity* and his subsequent book on the zooarchaeology of fish published in 1976. Archaeological fish scale identification became more prominent in the 1980s, along with an overall rise in general faunal analyses during this same time frame (Artz 1980; Scott 1989; Yerkes 1980, 1981). Since then, fish scale analysis has again faded into the background of zooarchaeology. Despite the presence of fish scales in numerous faunal collections, they are often brushed aside during comprehensive analyses. The identification of fish scale taxa requires a complete or nearly complete scale and access to some sort of collection or manual. Although researchers will acknowledge fish scales as one of the many fish bones recovered during excavation, and sometimes provide generalized counts or weights, very few take the time to identify scale specimens and glean any additional information from this potential resource.

At the Zebree site, many such scales were recovered thanks to the fine-screen excavation techniques. In addition to identifying diagnostic skeletal fish elements, this study will look at the research potential of these fish scales. When compared to other identifiable fish remains from the site, diagnostic fish scales help clarify the role this resource played in prehistoric foodways. Not only can they potentially shed light on site use patterns, but they can also be the part of the scant remains of fish taxa whose bones do not survive as well as others. For example, pike, carp, cod, perch, salmon, mackerel, and tuna have stronger and more robust bones that have a better chance of survival in the archaeological record. Meanwhile other fish, such as boxfishes, sunfish, herrings, and lumpsucker, have more fragile skeletons that often succumb to taphonomic pressures (Wheeler and Jones 1989:62-3). The ability to identify the scales of these more delicately boned fish offers archaeologists the opportunity to potentially identify resources that have been previously overlooked.

A variety of fish scales exist. Typically ichthyologists divide scales into four different types: cosmoid, placoid, ganoid, and elasmoid. Cosmoid scales were found on now-extinct marine specimens. Placoid scales are typically of cartilaginous fish and exhibit spines as well as an enamel-like surface coating. Ganoid scales are generally rhomboidal in shape and have a distinct surface appearance due to the enameled look of the substance from which they get their name, ganoine. Paddlefish, sturgeon, bowfin, and gar all possess this scale type. Elasmoid scales are found on most bony fish. These bony-ridge scales consist of two main layers that form a more flexible scale type than the previous three. The bony surface layer is made up of both calcium phosphate in the form of hydroxiapatite and calcium carbonate. In addition, there is a fibrillary plate made of collagen (Daniels 1996). The ratio of bone to collagen varies depending on the fish taxon (Helfman 2009:37). Bony-ridge scales can be further divided into two types, cycloid and ctenoid scales, the only difference being the lack of spike-like ctenni on cycloid scales (Daniels 1996).

In order to identify fish scales, one must first understand the basic landscape of this element. Major features include the following (Daniels 1996; Figure 7):

- **Focus (F):** the point on the scale that is the center of the system of concentric lines and also the center of growth.
- **Anterior Field (AF):** the area of the scale embedded in the epidermis layer.
- **Posterior Field (PF):** the area of the scale exposed, which may exhibit ctenni or teeth-like spines.
- **Circulli (C):** the concentric lines or bony ridges that form around the focus.
- **Raddii (R):** the grooves in the scale that run through the circulli.

Because all of the characteristics that are exhibited in each of these fields must be taken into account, it is necessary to have a nearly complete scale for confident identification (Wheeler and Jones 1989:64-65).

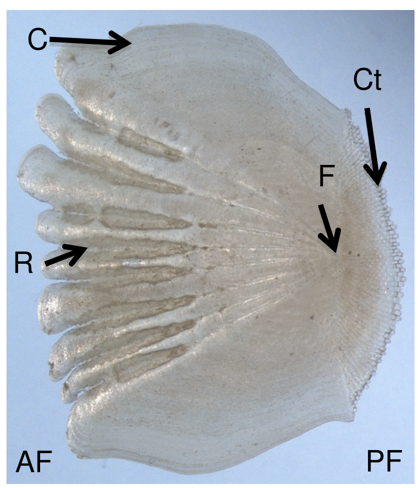

Figure 7: Diagnostic markers of a ctenoid scale (Casteel 1976; Daniels 1996).

As previously stated, both comparative collections and reference manuals should be used in the identification of fish scales. In particular, this research draws from the following guides: Casteel (1976), Daniels (1996), Lagler (1946), and Wheeler and Jones (1989). With no previously established comparative fish scale collection available, a temporary collection was compiled using existing fish specimen held in the zooarchaeological collection at the University of Tennessee. Fish scale analysis is done on a microscopic level in which comparative scales are separated from the rest of the fish remains and housed on individual microscope slides. Both modern comparative scales and archaeological scales are visible through a dissecting microscope with base illumination (Daniels 1996). Comparative scales were collected from a variety of freshwater taxa known to inhabit the aquatic environment of northeast Arkansas that include specimen from the following families: Amiidae, Clupeidae, Catostomidae, Centrarchidae, Percidae, and Sciaenidae.

Although scales are similar to other bones, composed of both hydroxyapatite and collagen (Helfman 2009), their size and fragility can make diagnostic markers hard to see. Thus scales are often dyed in order to make features like the circuli and foci stand out. All scales had previously undergone maceration when the original whole specimen was processed. In order to best view the characteristics outlined above, scales were dyed. As suggested by Daniels (1996), Alizarin Red S dye was first employed. This dye is commonly used in archaeology, as well as other osteologically oriented fields, to prepare bone materials for analysis. The substance efficiently binds to calcium deposits in bone, and thus would theoretically enhance calcium-rich areas of the scale, like the circuli. Unfortunately, this technique did not work for the scales in this collection. As suggested, the scale was immersed for approximately two minutes in a small amount of Alizarin Red S dye mixed with potassium hydroxide (Daniels 1996). Instead of highlighting diagnostic characteristics of fish scales, the red dye completely washed out all areas of the scales and only further complicated identification (Figure 8). One possible explanation for this trend is that the scales used in this study were pulled from previously macerated specimen already housed in the collection, so the potency of the dye may correlate with this higher intensity of scale processing. With the failure of the recommended alizarin technique, this study instead used a natural coffee dye, the results of which were much more amenable to identification. Scales were left in room-temperature coffee brew for up to four hours in order to enhance details of the element prior to photographic documentation. This alternative method offers many benefits. The coffee dying agent is not only readily accessible and inexpensive, but it also adequately highlights areas needed to identify the fish scales (Figure 8).

Specimens were rinsed in distilled water following the coffee bath. Excess water was then removed, and scales were pressed between two microscope slides to dry. The slides were taped and labeled with the individual’s catalogue number, common name, genus, and species. At least two mounted scales were photographed for each individual specimen using a Leica MZ6 microscope.

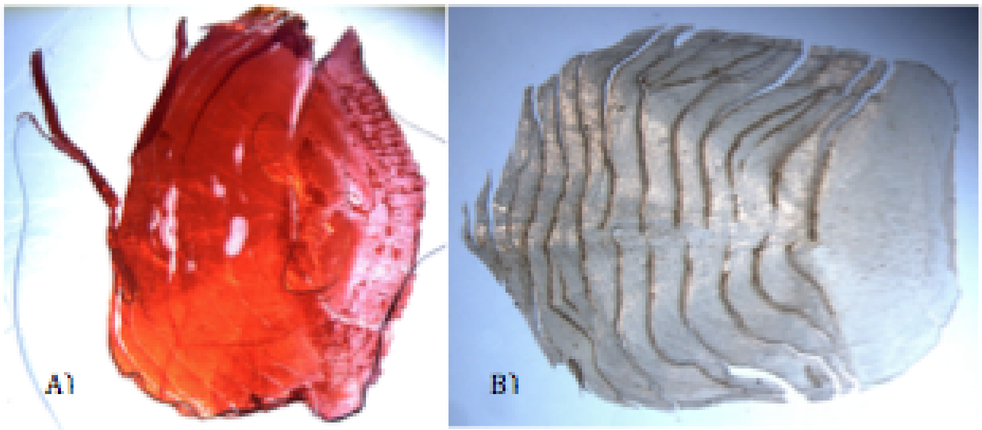

Figure 8: Dyed Clupeidae scales: a) Alizarin Red S dying agent B) coffee dying agent

CHAPTER FOUR: RESULTS

Subsistence Data

The vertebrate faunal collection analyzed for this thesis is composed of 25,623 bone specimens. A total of 11,399 specimens are identified to class or below (Table 5), while 14,224 specimens are classified as unidentifiable. Fish are the most abundantly identified class, representing 80.40 percent of the total identifiable NISP, and 41.57 percent of the total MNI. Mammals are the second most abundant in terms of NISP (10.54 percent), and represent 19.10 percent of the MNI. Mammals are followed by birds (NISP: 6.28 percent; MNI: 26.97 percent), reptiles (NISP: 2.58 percent; MNI: 8.99 percent), and amphibians (NISP: .2 percent; MNI: 3.37 percent). In terms of dietary contributions, mammals provide the majority of the overall 14.10 kg estimated biomass (8.84 kg; 62.15 percent), followed by fish (2.76 kg; 19.41 percent), bird (2.05; 14.39 percent), and reptiles (0.58 kg; 4.05 percent). Biomass equations are not available for amphibians.

Resources were grouped according to general taxonomic relationships and ranked by NISP, biomass, and ubiquity in order to determine patterns in the Big Lake subsistence strategies (Table 6). The placement of the commensal taxa of New World mice and rats is shown in the table, but a rank is not assigned to the group, as it is unclear whether these animals are pests or food. In terms of abundance, bowfin and gars dominate the sample. The high number of gar specimens can be attributed to the durability of their scales, which total at 645 and comprise the vast majority of the gar sample. Considering the fact that just the lateral line of a gar can contain between 54 to 64 scales depending on the species (Pflieger 1975:69-71), gar scales are not a good

Table 5: Taxa Identified by NISP, Specimen Weight, MNI and Estimated Biomass.

Taxon	Common Name	NISP		Weight		MNI		Biomass	
		Qty.	%	g	%	Total	%	kg	%
Vertebrata	**vertebrates**								
Osteichthyes	**bony fishes**								
Osteichthyes	bony fishes	7438	65.25	84.46	9.60			1.07	7.55
Lepisosteidae	gars	755	6.62	19.85	2.26	1	0.56	0.45	3.13
Lepisosteus oculatus	shortnose gar	1	0.01	0.07	0.01	1	0.56	0.00	0.02
Amia calva	bowfin	583	5.11	50.44	5.74	10	5.62	0.47	3.31
Anguilla rostrata	American eel	2	0.02	0.001	0.00	1	0.56	0.00	0.00
Clupeidae	herrings and shad	1	0.01	0.01	0.00	1	0.56	0.00	0.00
Alosa sp.	river herrings	1	0.01	0.02	0.00	1	0.56	0.00	0.01
Dorosoma sp.	gizzard shad	1	0.01	0.03	0.00	1	0.56	0.00	0.01
Cypriniformes	minnows, carp, and suckers	18	0.16	0.63	0.07	2	1.12	0.02	0.14
Cyprinidae	minnows and carp	2	0.02	0.01	0.00	1	0.56	0.00	0.00
Notropis spp.	eastern shiner	2	0.02	0.06	0.01	1	0.56	0.00	0.02
Catostomidae	suckers	8	0.07	1.54	0.18	1	0.56	0.04	0.29
Ictiobus sp.	buffalo suckers	1	0.01	0.001	0.00	1	0.56	0.00	0.00
Ictiobus bubalius	smallmouth buffalo	4	0.04	5.72	0.65	1	0.56	0.12	0.85
Ictiobus niger	black buffalo	1	0.01	0.22	0.03	1	0.56	0.01	0.06
Moxostoma sp.	redhorse	1	0.01	0.14	0.02	1	0.56	0.01	0.04
Ictaluridae	catfishes	121	1.06	7.29	0.83	9	5.06	0.13	0.93
Ictaulurus punctatus	channel catfish	5	0.04	3.11	0.35	2	1.12	0.06	0.41
Ictalurus furcatus	blue catfish	18	0.16	3.13	0.36	4	2.25	0.06	0.41
Ameiurus spp.	bullheads	42	0.37	2.61	0.30	8	4.49	0.05	0.35
Ameiurus melas	black bullhead	1	0.01	0.08	0.01	1	0.56	0.00	0.01
Ameiurus cf. *melas*	cf. black bullhead	1	0.01	0.06	0.01	1	0.56	0.00	0.01
Pylodictis olivaris	flathead catfish	4	0.04	0.19	0.02	2	1.12	0.00	0.03

Table 5 (cont.): Taxa Identified by NISP, Specimen Weight, MNI and Estimated Biomass.

Taxon	**Common Name**	**NISP**		**Weight**		**MNI**		**Biomass**	
		Qty.	**%**	**g**	**%**	**Total**	**%**	**kg**	**%**
Esox spp.	pikes	7	0.06	0.78	0.09	2	1.12	0.02	0.17
Esox americanus	grass pickerel	1	0.01	0.001	0.00	1	0.56	0.00	0.00
Centrarchidae	sunfishes	13	0.11	0.35	0.04	3	1.69	0.01	0.05
Pomoxis spp.	crappie	15	0.13	0.5	0.06	3	1.69	0.01	0.07
Micropterus sp.	black basses	17	0.15	0.98	0.11	3	1.69	0.02	0.12
Micropterus salmoides	largemouth bass	12	0.11	0.59	0.07	2	1.12	0.01	0.08
Micropterus punctulatus	spotted bass	3	0.03	0.03	0.00	1	0.56	0.00	0.01
Lepomis sp.	sunfish	28	0.25	0.47	0.05	2	1.12	0.01	0.06
Lepomis microlophus	redear sunfish	1	0.01	0.01	0.00	1	0.56	0.00	0.00
Sander spp.	walleye and sauger	8	0.07	0.21	0.02	1	0.56	0.01	0.05
Aplodinotus grunniens	freshwater drum	49	0.43	7.17	0.82	3	1.69	0.17	1.18
Reptilia	**reptiles**								
Testudines	turtles	94	0.82	7.75	0.88	1	0.56	0.12	0.88
Chelydra serpentina	snapping turtle	6	0.05	2.29	0.26	1	0.56	0.06	0.39
Kinosternidae	mud and musk turtles	4	0.04	0.49	0.06	1	0.56	0.02	0.14
Sternotherus odoratus	musk turtles	12	0.11	2.71	0.31	2	1.12	0.06	0.43
Kinosternon subrubrum	mud turtles	8	0.07	2.92	0.33	1	0.56	0.06	0.46
Emydidae	water and box turtles	5	0.04	0.73	0.08	1	0.56	0.03	0.18
Terrapene carolina	box turtles	1	0.01	0.07	0.01	1	0.56	0.01	0.04
Trachemys scripta	sliders	1	0.01	0.2	0.02	1	0.56	0.01	0.08
Chrysemys picta	painted turtles	6	0.05	1.96	0.22	1	0.56	0.05	0.35
Deirochelys reticularia	chicken turtle	1	0.01	0.38	0.04	1	0.56	0.02	0.12
Apalone spp.	softshell turtles	27	0.24	4.43	0.50	1	0.56	0.09	0.60
Squamata	lizards and snakes	9	0.08	0.13	0.01	1	0.56	0.00	0.00
Scincidae	skinks	1	0.01	0.01	0.00	1	0.56	0.00	0.00

Table 5 (cont.): Taxa Identified by NISP, Specimen Weight, MNI and Estimated Biomass.

Taxon	**Common Name**	**NISP**		**Weight**		**MNI**		**Biomass**	
		Qty.	**%**	**g**	**%**	**Total**	**%**	**kg**	**%**
Colubridae	typical snakes	118	1.04	4.02	0.46	1	0.56	0.06	0.40
Nerodia sp.	water snakes	1	0.01	0.04	0.00	1	0.56	0.00	0.00
Amphibia	**amphibian**								
Amphibia	amphibian	4	0.04	0.03	0.00				
Anura	frogs and toads	16	0.14	0.19	0.02	4	2.25		
Rana sp.	frogs	1	0.01	0.02	0.00	1	0.56		
Bufo sp.	toads	2	0.02	0.02	0.00	1	0.56		
Aves	**birds**								
Aves, large	large birds	5	0.04	1.13	0.13			0.02	0.16
Aves, medium to large	medium to large birds	69	0.61	7.91	0.90			0.13	0.94
Aves, medium	medium birds	28	0.25	5.16	0.59			0.09	0.64
Aves, small to medium	smallto medium birds	1	0.01	0.04	0.00			0.00	0.01
Aves, small	small birds	17	0.15	1.5	0.17			0.03	0.21
Aves, very small to small	very small to small birds	69	0.61	3.06	0.35			0.06	0.40
Aves, very small	very small birds	2	0.02	0.01	0.00			0.00	0.00
Aves	birds	294	2.58	17.42	1.98			0.28	1.93
Anatidae	swans, geese, and ducks	36	0.32	6.54	0.74	3	1.69	0.11	0.79
Branta canadensis	canada goose	3	0.03	9.66	1.10	1	0.56	0.16	1.13
Cygnus spp.	swans	2	0.02	1.35	0.15	1	0.56	0.03	0.19
Cygnus columbianus	tundra swan	1	0.01	0.1	0.01	1	0.56	0.00	0.02
Anatinae	dabbling ducks	23	0.20	4.27	0.49	4	2.25	0.08	0.54
Aix sponsa	wood duck	2	0.02	2.15	0.24	1	0.56	0.04	0.29
Anas spp.	ducks	2	0.02	0.76	0.09	1	0.56	0.02	0.11
Anas strepera	gadwall	3	0.03	0.77	0.09	1	0.56	0.02	0.11
Anas rubripes	american black duck	8	0.07	1.24	0.14	2	1.12	0.02	0.17

Table 5 (cont.): Taxa Identified by NISP, Specimen Weight, MNI and Estimated Biomass.

Taxon	**Common Name**	**NISP**		**Weight**		**MNI**		**Biomass**	
		Qty.	**%**	**g**	**%**	**Total**	**%**	**kg**	**%**
Anas platyrhynchos	mallard	27	0.24	11.64	1.32	2	1.12	0.19	1.34
Anas cf. *platyrhynchos*	cf. mallard	1	0.01	0.3	0.03	1	0.56	0.01	0.05
Anas acuta	northern pintail	6	0.05	6.06	0.69	1	0.56	0.11	0.74
Spatula clypeata	northern shoveler	5	0.04	1.41	0.16	1	0.56	0.03	0.20
Anas sp.	teals	1	0.01	0.009	0.00	1	0.56	0.00	0.00
Anas carolinensis	green-winged teal	2	0.02	0.09	0.01	1	0.56	0.00	0.02
Aythya collaris	ring-necked duck	6	0.05	0.75	0.09	1	0.56	0.02	0.11
Aythya affinis	lesser scaup	1	0.01	0.13	0.01	1	0.56	0.00	0.02
Bucephala albeola	bufflehead	1	0.01	0.2	0.02	1	0.56	0.00	0.03
Meleagris gallopavo	wild turkey	7	0.06	30.51	3.47	2	1.12	0.46	3.22
Colinus virginianus	bobwhite	1	0.01	0.05	0.01	1	0.56	0.00	0.01
Podilymbus podiceps	pied-billed grebe	2	0.02	0.19	0.02	1	0.56	0.00	0.03
Nycticorax nycticorax	black-crowned night heron	1	0.01	0.12	0.01	1	0.56	0.00	0.02
Grus canadensis	sandhill crane	1	0.01	0.35	0.04	1	0.56	0.01	0.06
Buteo platyperus	broad-winged hawk	1	0.01	0.06	0.01	1	0.56	0.00	0.01
Fulica americana	american coot	2	0.02	0.21	0.02	1	0.56	0.00	0.03
Gallinula chloropus	common moorhen	1	0.01	0.17	0.02	1	0.56	0.00	0.03
Ectopistes migratorious	passenger pigeon	44	0.39	4.3	0.49	4	2.25	0.08	0.54
cf. *Ectopistes migratorious*	cf. passenger pigeon	5	0.04	0.24	0.03	1	0.56	0.01	0.04
Strigidae	typical owls	1	0.01	0.04	0.00	1	0.56	0.00	0.01
Asio sp.	short and long-eared owls	1	0.01	0.12	0.01	1	0.56	0.00	0.02
Asio flammeus	short-eared owl	2	0.02	0.65	0.07	1	0.56	0.01	0.10
Passeriformes	perching birds	25	0.22	0.36	0.04	2	1.12	0.01	0.06
Cyanocitta cristata	blue jay	1	0.01	0.04	0.00	1	0.56	0.00	0.01
cf. *Hylocichla mustelina*	cf. wood thrush	1	0.01	0.02	0.00	1	0.56	0.00	0.00

Table 5 (cont.): Taxa Identified by NISP, Specimen Weight, MNI and Estimated Biomass.

Taxon	Common Name	NISP		Weight		MNI		Biomass	
		Qty.	**%**	**g**	**%**	**Total**	**%**	**kg**	**%**
cf. *Cardinalis cardinalis*	cf. northern cardinal	1	0.01	0.03	0.00	1	0.56	0.00	0.01
Quiscalus quiscula	common grackle	4	0.04	0.28	0.03	1	0.56	0.01	0.05
Mammalia	**mammals**								
Mammalia, large	large mammals	93	0.82	95.22	10.83			1.59	11.17
Mammalia, medium	medium mammals	78	0.68	26.72	3.04			0.51	3.56
Mammalia, small	small mammals	51	0.45	4.56	0.52			0.10	0.72
Mammalia, very small	very small mammals	44	0.39	0.41	0.05			0.01	0.08
Mammalia	mammals	663	5.82	99.72	11.34			1.66	11.64
Didelphis virginiana	opossum	1	0.01	0.1	0.01	1	0.56	0.00	0.02
Rodentia	rodents								
Castor canadensis	beaver	1	0.01	0.08	0.01	1	0.56	0.00	0.02
Sciurus spp.	tree squirrels	5	0.04	0.52	0.06	1	0.56	0.01	0.10
Sciurus carolinensis	eastern gray squirrel	3	0.03	0.46	0.05	1	0.56	0.01	0.09
Sciurus niger	fox squirrel	9	0.08	1.13	0.13	2	1.12	0.03	0.21
Sigmodontinae	new world rats and mice	30	0.26	0.44	0.05	3	1.69	0.01	0.09
Peromyscus spp.	white-footed mice	10	0.09	0.08	0.01	2	1.12	0.00	0.02
Peromyscus maniculatus	deer mouse	1	0.01	0.001	0.00	1	0.56	0.00	0.00
Peromyscus leucopus	white-footed mouse	20	0.18	0.48	0.05	2	1.12	0.01	0.10
Oryzomys palustris	marsh rice rat	20	0.18	0.82	0.09	3	1.69	0.02	0.15
Sigmodon hispidus	hispid cotton rat	6	0.05	0.31	0.04	1	0.56	0.01	0.06
Sylivilagus spp.	cottontails	15	0.13	2.53	0.29	2	1.12	0.06	0.43
Sylivilagus aquaticus	swamp rabbit	8	0.07	5.51	0.63	1	0.56	0.12	0.86
Sylivilagus floridanus	eastern cottontail rabbit	24	0.21	7.87	0.89	2	1.12	0.17	1.18
Scalopus aquaticus	eastern mole	3	0.03	0.06	0.01	1	0.56	0.00	0.01

Table 5 (cont.): Taxa Identified by NISP, Specimen Weight, MNI and Estimated Biomass.

Taxon	**Common Name**	**NISP**		**Weight**		**MNI**		**Biomass**	
		Qty.	**%**	**g**	**%**	**Total**	**%**	**kg**	**%**
Carnivora	carnivores	1	0.01	2.94	0.33	1	0.56	0.07	0.49
Canidae	wolf, coyote, dog, and fox	1	0.01	1.62	0.18	1	0.56	0.04	0.29
Canis spp.	wolf, coyote, and dog	2	0.02	1.56	0.18	1	0.56	0.04	0.28
Procyon lotor	raccoon	4	0.04	8.26	0.94	1	0.56	0.18	1.24
Mephitis mephitis	striped skunk	1	0.01	0.68	0.08	1	0.56	0.02	0.13
Mustela frenata	long-tailed weasel	2	0.02	0.11	0.01	1	0.56	0.00	0.03
Neovison vison	american mink	1	0.01	0.06	0.01	1	0.56	0.00	0.01
Odocoileus virginianus	white-tailed deer	104	0.91	276.62	31.45	3	1.69	4.15	29.16
TOTALS		**11399**	**100**	**879.42**	**100**	**178**	**100**	**14.22**	**100**

Table 6: Comparison of NISP, Biomass, and Ubiquity Rank Order for Zebree Big Lake Phase.

Taxon	NISP	Taxon	Biomass (kg)	Taxon	Ubiquity (n=16)
1. Gars	756	1. White-tailed deer	4.15	1. Bowfin	75
2. Bowfin	583	2. Swans, geese, and ducks	0.83	2. Gars	68.75
3. Freshwater catfishes	192	3. Bowfin	0.47	3. Softshell turtles	68.75
4. Swans, geese, and ducks	130	4. Wild turkey	0.46	4. Swans, geese, and ducks	62.5
5. Lizards and snakes	129	5. Gars	0.45	5. White-tailed deer	56.25
6. White-tailed deer	104	6. Rabbits	0.35	6. Rabbits	56.25
7. Sunfishes	89	7. Freshwater catfishes	0.31	7. Freshwater catfishes	56.25
New World mice and rats	*87*	8. Minnows, carp, and suckers	0.20	8. Mud and musk turtles	56.25
8. Passenger pigeon	49	9. Raccoon	0.18	9. Minnows, carp, and suckers	50
9. Freshwater drum	49	10. Freshwater drum	0.17	10. Passenger pigeon	50
10. Rabbits	47	11. Mud and musk turtles	0.15	11. Sunfishes	50
11. Minnows, carp, and suckers	37	12. Emydid turtles	0.11	12. Freshwater drum	43.75
12. Perching birds	32	13. Passenger pigeon	0.09	13. Amphibians	43.75
13. Softshell turtles	27	14. Softshell turtles	0.09	*New World mice and rats*	37.5
14. Mud and musk turtles	24	15. Canids	0.08	14. Lizards and snakes	37.5
15. Amphibians	23			15. Perching birds	31.25

indicator of this genus' taxonomic prominence within an assemblage. That being said, bowfin does in fact seem to be a dominant resource within the collection. Although the bone of this fish is dense and diagnostic, possibly skewing its relative abundance in the collection, the fact that bowfin has the largest MNI (10) of any other species or taxonomic group solidifies its high rank. While lizards and snakes place within the top five based on NISP, this can be attributed to what is most likely a nearly complete water snake specimen in one feature. It is notable that aside from a few terrestrial taxa including white-tailed deer, the majority of the high-ranking resources are aquatic. Even eight of the rabbit specimens can be designated as the remains of at least one semi-aquatic swamp rabbit.

The ranked species composition changes when resources are listed according to biomass contribution and ubiquity (Table 6). Though less abundant than bowfin, white-tailed deer contributes the most predicted biomass of any individual species or group. As a unit, migratory waterfowl rank second in biomass, offering nearly two times more than bowfin and almost three times more than gars. Two rare taxa, wild turkey and raccoon, are within the top ten when biomass is used as the standard, which may highlight their value when acquired. The relative dietary importance of rabbits also rises significantly according to biomass. Additionally, all three turtle taxa rank when biomass is considered.

The ubiquity rankings do not change significantly and serve to support the NISP and biomass lists (Table 6). As can be expected, white-tailed deer is distributed relatively evenly throughout the features. Bowfin, gars, and softshell turtles are the most ubiquitous, yet they are also some of the most durable and identifiable specimen, a fact that may skew this data to an extent. Furthermore, the ubiquity calculations substantiate the importance of rabbits at Zebree since they not only contribute a good deal of biomass, but are also equally as prevalent as white-tailed deer.

Since white-tailed deer is the most significant of the terrestrial resources at Zebree, the bones of this particular species are given a more detailed discussion. Using aging diagrams (Giles 1971:388-389; Schwartz and Schwartz 1959:322-323) paired with the University of Tennessee collections, one mandible, two molars, and a premolar all provide pertinent age data. A lower first molar from Feature 191 suggests that the deer was approximately 2.5 years old or less. Meanwhile the lower second molar and upper third premolar of Feature 268 age somewhere around five years. The nearly complete left mandible in Feature 287 is from a deer that was four to seven months old. Only seven of the 104 deer specimen were unfused (Table 7), and like the teeth, display a wide age bracket for this prey. An unfused pelvis from Feature 287 provides a lower limit of < 8-11 months (Reitz and Wing 2008:72), and is most likely from the same individual as the aforementioned mandible. Meanwhile, an unfused tibia head in Feature 225 and ulna head from Feature 257 give a maximum of 42 months (Reitz and Wing 2008:72).

By looking at the element composition and taphonomy of white-tailed deer bones found at the site, patterns of use become apparent. Like the lack of selectivity for deer of a certain age, there is no apparent discrimination between elements (Table 7). The presence of deer bones attributed to both the axial and appendicular skeleton suggest that the animal was procured locally and butchered on-site. Additionally, the distribution of deer ribs and vertebrae in seven features throughout the site indicates, to a certain extent, equal access to decent cuts of meat (Lyman 1994; Metcalfe and Jones 1988). The modification of nearly all deer elements, either by burning, cutting, or chopping, reflects the thorough use of all deer parts (Table 7).

Table 7: White-tailed Deer Elements and Modifications.

Element	Total NISP	Unfused NISP	Burned/ Calcined NISP	Cut/Chop NISP	Carnivore NISP
Antler	3	-	-	1	-
Mandible	2	-	-	-	-
Tooth	16	-	7	-	-
Scapula	11	-	1	2	-
Humerus	2	-	1	-	1
Ulna	6	1	1	4	-
Radius	2	1	-	1	1
Vertebra	11	1	7	-	-
Rib	17	-	9	3	-
Pelvis	2	1	1	-	-
Femur	10	-	5	3	2
Tibia	2	1	-	1	-
Metapodial	6	2	3	2	-
Calcaneum	1	-	-	-	-
Carpal/tarsal	5	-	3	-	-
Phalange	8	-	3	-	-
Total	104	7	41	17	4

Bone Modifications

Bone modifications are also noted for the various taxonomic categories (Table 8). Mammal and bird bones are most intensively modified. Yet in terms of burning, the overwhelming majority of reptiles are either burned or calcined. Approximately half of the recovered reptilian bones are plastron and carapace fragments, and over two thirds of

Table 8: Bone Modifications by Taxonomic Class.

Class	Natural	Burned	Calcined	Worked	Cut	Chopped	Digested	Carnivore	Rodent
Fish	6314	2447	402	0	2	0	1	0	1
Reptile	55	210	29	0	5	0	0	1	0
Amphibian	10	12	1	0	0	0	0	0	0
Bird	305	222	188	2	17	1	10	1	1
Mammal	609	379	213	7	24	9	1	7	0
UID	9570	3956	701	1	1	0	1	0	0
Total	16863	7226	1534	10	49	10	13	9	2

those have been either burned or calcined. These burning patterns may indicate that turtle resources were prepared for consumption via in-shell roasting and/or baking rather than boiling. Carnivore and rodent scavenging is noted to some degree in all but the amphibian class. Carnivore punctures and gnawing was evident on the remains of general mammal, white-tailed deer, black duck, and box turtles bones. All of these specimens were found in two locations, Feature 257 and Feature 287, which are both located on the outer limits of the site. Meanwhile, rodent gnawing was identified on one turkey humerus and one bowfin operculum. Both were recovered from Feature 191, which is associated with a residential area. Like the rodent-gnawed bones, digested bones were also retrieved from interior features: 191, 203, 206, 215 and 268 (Table 2). Whether these digested specimens are the remnants of human or canine consumption is unclear.

Only a few examples of worked bone were recovered from the selected features, whose raw materials included both mammal and bird bone. Identifiable tools amount to three examples of broken awls and one possible bone pin, all made from mammal bone. These were found in Features 191, 206, 268, and 287. A wild turkey humerus shaft, possibly grooved and snapped, was collected from Feature 191, and was recorded as a bone bead during the original excavations. Another example of grooved and snapped bird bone was identified in Feature 268.

Fish Scale Results

Due to time constraints, fish scales were only identified from six of the ten features in which they were found. As a result, only the gar scales were specified in the overall taxonomic data, while all other fish scales were recorded in the bony fish NISP count (Table 5). The detailed results from this portion of the analysis are reported in a separate table (Table 9). In addition the conventionally identified gar scales, a variety of scales from additional fish taxa were discernible in the Zebree collection. These included those from bowfin, herring, shad, suckers, sunfishes, crappie, perches, and freshwater drum. Aside from gar scales, the two most abundantly represented taxa include freshwater drum and sunfishes. Despite the fact that bowfin constitute most of the identifiable fish elements, their scale count is relatively low, yet their scales are brittle when dry and may fragment more easily than the scales of other species. Furthermore, the scales of herrings and shad are present in three of the six identified features, though of these six, only Feature 206 produced an actual Clupeid bone. These results suggest that fish of the Clupeidae family are in fact more common on the site than their element distribution would suggest. The role of herrings and shad in subsistence patterns is still debatable. These fish are common prey for gars, bowfin, catfishes, and sunfishes such as largemouth bass and crappies (Pflieger 1975:69-73, 261), and they may have entered into the Big Lake collection via the stomach contents of the aforementioned fish. Yet some Clupeidae species are also valuable to certain persons. For example, the Alabama shad (*Alosa alabamae*) is prized by contemporary fisherman for its tasty flesh (Pfleiger 1975:78), and though not considered palatable by modern standards, the skipjack herring (*Alosa chrysochloris*) is still used today for bait since their oil is known to attract catfishes (Pflieger 1975:77).

Despite the fact that time did not allow for their complete identification, the number and distribution of fish scales offers useful data. The three features with the highest frequency of fish scales included Feature 191, 206 and 203. While the exact

Table 9: Fish Scales.

Taxon		Identified Features							Unidentified Features				
		159	**206**	**234**	**285**	**287**	**268**	**Total**	**191**	**203**	**215**	**257**	**Total**
Lepisosteidae	gar	2	71	14	1	1	224	313	40	170	60	42	312
Amia calva	bowfin	0	43	4	0	0	7	54					
Clupeidae	herrings and shad	0	15	0	0	0	0	15					
Alosa spp.	river herrings	0	16	1	0	0	0	17					
Dorosoma spp.	gizzard shad	0	15	4	1	0	0	20					
Catostomidae	suckers	0	16	4	0	0	0	20					
Centrarchidae	sunfishes	0	92	14	1	288	5	112					
Pomoxis spp.	crappie	0	26	3	0	0	0	29					
Percidae	perches	0	5	4	2	0	0	11					
Aplodinotus grunniens	freshwater drum	0	107	15	1	0	4	127					
Osteoichthyes	bony fishes	0	526	22	4	0	16	568	827	1202	392	149	2570
Total		2	932	85	10	1	256	**1286**	867	1202	452	191	**2882**

location of Feature 203 is unknown, excavation records state that it is located somewhere in area B, one of the major occupation areas of the site. Feature 191 is also placed in close proximity to a residential structure, Feature 273, on the east corner of the settlement in area C. Moreover, Feature 206 sits just east of the area A house cluster. The large number of fish scales near residential areas within the site suggests that fish were caught and transported back to home areas where they were then cleaned and butchered prior to preparation and consumption. The high frequency of fish spines deposited in Feature 203 (N = 100) and Feature 206 (N = 75) further corroborate this hypothesis.

Results by Feature

Feature 154

This circular, basin-shaped pit feature was identified during the excavation of Random Square 65 in the southeastern portion of the site. Its faunal contents are meager (N = 2), amounting to one medium mammal long bone fragment and one bony fish fragment.

Feature 159

Located in Random Square 38, this feature is classified as a cylindrical, flat-bottomed pit. Although the number of contents is relatively small (NISP = 40), faunal taxa recovered from Feature 159 represent individuals from the mammal, bird, fish and reptile classes. White-tailed deer and eastern cottontail were the only two identifiable mammals. Diagnostic bird bones are from a mallard, as well as a species of dabbling duck. Represented fish include bowfin, gar, and crappie. Two reptile bones were identified, one from softshell turtle and the other from a colubrid snake.

Feature 181

Feature 181 constitutes the base of a large, basin-shaped pit located in Random Square 24. Specimens identifiable to genus and/or species include mallard, bowfin, softshell turtle, and musk turtle. The total number of specimens identified within this feature is only 23.

Feature 191

This circular, basin-shaped pit was excavated in Block 1 near the remnants of a house (Feature 273). Its contents are numerous (N = 2,478). Only three discernible white-tailed deer fragments were recovered. Other mammals represented include eastern cottontail, fox squirrel, marsh rice rat and white-footed mouse. A great deal of bird bone was found in this pit feature, including both terrestrial and aquatic species. All but one of the wild turkey elements found in this assemblage derive from Feature 191. In addition to turkey, this feature contains 17 passenger pigeon fragments, and another 5 specimen that compare favorably with passenger pigeon. Other bird taxa represented include Anatidae like mallard, black duck, gadwall, lesser scaup, and bufflehead. Additional bird taxa include the American coot, short-eared owl, grackle, and cf. northern cardinal. An abundance and variety of fish taxa are also present: bowfin, catfishes, freshwater drum, gars, sunfishes, perches, minnows, carp, and suckers. A comparatively small amount of turtle was recovered (N = 10), including a musk turtle carapace fragment and a softshell turtle carapace/plastron. Just one frog/toad bone was identified in the contents of this feature.

Feature 203

Located in Square 16R16, somewhere in area B, Feature 203 consisted of a cylindrical, bell-shaped pit. Although Feature 203 produced a collection of 8,246 bone specimens, less than half are identifiable to class or below. The vast majority of these were fish bones (N = 2,794). The most dominant taxa include bowfin, catfishes and sunfishes. Also identified in this sample was one American eel vertebra. Mammal specimens include white-tailed deer, eastern cottontail, eastern gray squirrel, and commensal rodents. Bird bones are comprised of passenger pigeon, perching birds, and Anatidae such as mallard and black duck. Although a smaller amount of reptile and amphibian were recovered, identifiable specimens represent a variety of taxa including softshell turtle, mud turtle, snake, skink, toad, and frog/toad.

Feature 206

Feature 206 is a cylindrical, flat-bottomed pit located in the northwest wall of Backhoe Trench 3. This pit feature contains a large amount of fauna (N = 4,164), and nearly half consist of fish remains (N = 1961). The second most abundant class is mammal (N = 55), which includes white-tailed deer, raccoon, swamp rabbit, eastern gray squirrel, white-footed mouse, and eastern mole. One of the two eastern gray squirrel elements is an unfused juvenile tibia. A relatively small amount of bird was uncovered in this feature (N = 39) and encompasses Anatidae (tundra swan, mallard, wood duck), American coot, and perching birds (cf. wood thrush). Reptile and amphibian bones do not constitute a large portion of the feature, but do offer evidence of softshell turtle, snapping turtle, musk turtle, lizard, and frog/toad.

Feature 215

Uncovered in Random Square 78, Feature 215 is a cylindrical, flat-bottomed, clay-lined pit. The most numerous class represented in this feature is fish (N = 670). The most numerous diagnostic taxa are bowfin and gars. Although a number of bird bones were recovered (N = 24), only one northern shoveler element was identifiable below class. A very small amount of mammal, reptile, and amphibian was identifiable, representing white-tailed deer, mud turtle, Colubrid snake, and frog/toad.

Feature 217

This circular, basin-shaped pit in Random Square 57 produced only one medium mammal long bone fragment.

Feature 222

Located in Excavation Block 3, this feature yielded a small collection of fauna in its irregular, basin-shaped pit. The contents included a large mammal long bone fragment, a cranial fragment from an eastern cottontail, two bowfin specimens, and a turtle plastron.

Feature 225

Feature 225 is a cylindrical, flat-bottomed pit excavated in Random Square 76. Mammal and fish bones are most abundant in this feature. Of the 23 mammal bones, only five are identifiable below class, all of which are white-tailed deer. Of the identifiable fish remains, bowfin dominates while catfishes, largemouth bass, and gar are also present. Bird and reptile are rare, consisting mostly of passenger pigeon, but also represented are dabbling duck and softshell turtles.

Feature 233

This feature consists of a cylindrical, flat-bottomed pit situated in Excavation Block 3. It contains six bone specimens. Three are mammal and three are passenger pigeon.

Feature 234

A circular, basin-shaped pit found in Random Square 103, this feature produced a variety of fauna. Fish constitutes the majority (N = 172), and primarily consists of bowfin, catfishes, and freshwater drum. This feature also produced one of the largest single concentrations of turtle (N = 17). Taxa identifiable to genus or species include softshell turtle, snapping turtle, and chicken turtle. Additionally, two carapace fragments from the mud and musk turtle family were present. A smaller amount of mammal and bird was found. Most of the mammal could not be identified beyond class, spare one opossum premolar. Swan, pied-billed grebe, and passenger pigeon constitute three of the 10 bird specimens. A single toad vertebra was also noted.

Feature 257

The contents of this pit feature produced a sizable faunal sample (N = 2,223). A little more than half of these bone specimens are classified as unidentifiable (N = 1214). The vast majority of identifiable specimens are fish (N = 671), dominated by bowfin, catfishes, and sunfishes. Numerous bird bones were also recovered from Feature 257. These include not only Anatidae, but also rails, passenger pigeon, wild turkey, and perching birds. Identifiable mammals include white-tailed deer, raccoon, eastern cottontail, and commensal rodents. Turtle, snake, and lizard elements represent the reptile class. In particular, it appears that the remains of a water snake specimen were included in this feature. Softshell turtle, snapping turtle, box turtle, and musk turtle are all distinguishable as well. Frog/toad specimens were also identified.

Feature 268

Feature 268, a circular, basin-shaped pit in Excavation Block 5, produced the largest collection of faunal material in this study (N = 6,909). As is the trend in most of the larger feature-based samples, over half of the specimens are classified as unidentifiable vertebrates (N = 4,288). The two largest subsets in this sample are fish (N = 1,405) and mammal (N = 822). Bowfin, catfishes, freshwater drum, and sunfishes are all relatively abundant. An assortment of mammal taxa is also represented. White-tailed deer, fox squirrel, swamp rabbit, eastern cottontail, and commensal rodents are the most profuse mammal remains, although more infrequent taxa include beaver, raccoon, Canid, skunk, weasel, and mink. Frequently represented bird taxa include an array of Anatids, passenger pigeon, and perching birds. Meanwhile the more uncommon specimens are sandhill crane, broad-winged hawk, black-crowned night heron, and bobwhite. A variety of turtle elements were also recovered, including slider, softshell turtle, snapping turtle, painted turtle, mud turtle, and musk turtle. A few Colubrid and lizard specimens also comprised part of the overall reptile sample. Meanwhile, only two frog/toad elements were recovered.

Feature 285

Feature 285 is the remnant of a ditch segment uncovered in Excavation Block 7. Its relatively limited contents (N = 78) consist of primarily fish and some mammal, of which no one particular taxon dominates.

Feature 287

This feature consists of the general midden fill surrounding Burial 15 from Backhoe Trench 7, which held an elderly female interred in a semi-flexed position. A notable amount of fauna was recovered from this context (N = 222). Most of the bone specimens fall into the mammal class (N = 65), and elements more specifically identified are white-tailed deer, eastern cottontail, and canid. Also included are particularly large freshwater drum, smallmouth bass, catfish elements. Identified bird specimens almost entirely consist of anatids, aside from one passenger pigeon carpometacarpus. Only one turtle bone was recovered from the feature, an unfused ischium from a musk turtle.

Statistical Results

As previously stated, faunal data was run through two sets of Kruskal-Wallis tests to determine whether significant differences in subsistence patterns exist between residential clusters within the Zebree site. The results of these tests are all insignificant (Table 10), indicating that the site's Big Lake inhabitants enjoyed equal access to vertebrate resources.

Table 10: Kruskal-Wallis Test for Features Grouped by Midden Association.

Feature Groups	Percent of Total Bone Weight (g) Significance					Percent of Total NISP Significance				
	Fish	Reptile	Amphibian	Bird	Mammal	Fish	Reptile	Amphibian	Bird	Mammal
Original Midden Assignments (N=6)	.119	.115	.128	.208	.362	.092	.124	.192	.123	.123
Condensed Group Assignments (N=3)	.699	.392	.214	.779	.301	.364	.352	.263	.429	.193

CHAPTER FIVE: DISCUSSION

Subsistence Patterns

The newly identified sample represents a collection similar to Roth's (1980) data. A few more taxa were identified, including but not limited to beaver, hispid cotton rat, eastern mole, pickerel, herring, shad, and bullheads. Although Roth (1980) identified muskrat and black bear in Big Lake samples, they are absent from this data set. Big Lake population took advantage of the wide variety of vertebrate resources inhabiting the surrounding environments. It appears that aquatic taxa were more frequently procured, though terrestrial resources were certainly important as evident from the estimated biomass rankings. In terms of individual taxa, the keystones of the Zebree diet may have been white-tailed deer and bowfin when one considers relative abundance, ubiquity, and biomass contributions.

One goal of this thesis was to test for any discernible signs of social differentiation as expressed through resource distribution. Previous analysis of vertebrate fauna recovered from random squares throughout the site a grouped by class seemed to suggest that individuals residing in midden area A consumed more mammal than the rest of the inhabitants (Morse and Morse 2009:231). As was reported in the statistical results, the Kruskal-Wallis test produced insiginifcant results. Therefore, the current sample shows no apparent preferential access to any of the resources based on vertebrate classes, and thus does not offer evidence for a ranked society at Zebree.

Although there are no apparent spatial trends based on different taxonomic classes, another distribution pattern is identifiable. Most of the vertebrate-rich feature assemblages are found in central residential communities (e.g. Features 168, 206, 191, and possibly 203). This pattern is also evident in the concentration of fish scales discussed previously. It appears that once caught and killed, vertebrate resources were returned to the site where they were then processed, cooked, and disposed of near the home base. Furthermore, this trend suggests that prey transport costs were negligible and vertebrates were procured nearby. There are some outliers that would not naturally inhabit the immediate surroundings, such as blue catfish (addressed below), broad-winged hawk, and short-eared owl. The broad-winged hawk, for example, prefers upland deciduous forests (James and Neal 1986:143). While the short-eared owl is more of an open grassland bird (James and Neal 1986:210), it is also drawn to areas of high rodent populations, which the Zebree village may have provided.

Another significant spatial trend is the location of most faunal remains in higher-elevation features. The three lowest-elevation features (Feature 154, Feature 181, and Feature 285; Figure 6) contained a combined total of only 103 vertebrate specimens. Nearly half of these elements are fish (N = 42), although mammal, bird, and turtle were also recovered. Although one mallard element was identified in Feature 181, small numbers of this species have been known to summer in the Big Lake area (Sealander and Heidt 1990:110). This evidence suggests that these lower-elevation areas were only used during the drier summer and early fall periods, and perhaps were inundated at other times of the year. Meanwhile higher-elevation areas were most commonly utilized for storage facilities and later refuse.

The conveniently located Big Lake is the likely source of many vertebrate resources, particularly aquatic ones, while the surrounding Big Lake highlands provided terrestrial hunting grounds. Although their immediate surroundings offered a variety of prey, the presence of blue catfish, a big-river fish, suggests that Zebree inhabitants traveled at least as far as swift-water areas of the Little River (Robison and Buchanan 1988:293). To reach larger river systems, the people of Zebree would need to travel either west to the St. Francis or east to the Mississippi. Aside from blue catfish, many of the major fish species can be characterized as backwater fish, preferring sluggish habitats such as Big Lake and its surrounding seasonally flooded swamp areas.

Fishing was obviously an important part of the Zebree subsistence regime, a practice manifest not only in the numerous fish remains but also in the material culture. Fishnet impressions were noted in burned clay and show evidence of repair work. Morse (1980c:37) suggested that these were dragnets, or seines, used to catch small- to medium-sized fish in backwater areas. In addition, bone fishhooks and even harpoon tips were found. The fishhooks recovered are sizeable and may have been used to target larger fish. The harpoons' lengths range from 7-11 cm (Morse 1980c:38). Three of the four harpoons exhibit a single barb, while the fourth has triple barbs. The four Zebree bone harpoons were significant finds as none had previously been reported in the Central Mississippi Valley (Morse and Morse 2009:224). Morse (1980c:38) proposed that the triple barb harpoon was used to snag large soft-fleshed fish such as catfishes, suckers, and drum. Bowfin and gars could be caught using bow and arrow (Morse 1980c:38), since these fish are known for periodically surfacing in order to replenish their air supply (Pflieger 1975:66, 72). The mix of both small and large fish elements in this collection can be attributed to the use of both indiscriminate (netting) and discriminant (hook and line, spearing, and bow and arrow) fishing technologies. Other methods of fishing noted in ethnographic records of southeastern Indians could have been used as well, such as poisoning and basket traps (Adair 2012 [1775]:403-404), though archaeological evidence of these practices is hard to recover.

Like fish, birds were likely hunted using bow and arrow technology along with nets. As is shown in the ranked resources (Table 6), waterfowl are the dominant bird taxon consumed at Zebree. Of the 231 individual bird bone specimens identified below class, 130 are members of the Anatidae family (56 percent). The seasonal migration of these migratory waterfowl no doubt served as an important and anticipated resource harvest. In addition to swans, geese, and ducks, land fowl including wild turkey and passenger pigeon also comprised a substantial portion of the diet when available. Although wild turkey is rarely found, biomass estimates show that what little bone was recovered supplied a substantial amount of meat. Passenger pigeon was more common in the sample, ranking higher by NISP, biomass, and ubiquity (Table 6). Unlike the wild turkey, which is a year-round resident, passenger pigeon was a winter migrant, like many of the waterfowl (James and Neal 1986). Though now extinct, the bird was once known for its dense migratory populations that often roosted in the Arkansas lowlands (James and Neal 1986:164-166). Historical accounts suggest that passenger pigeons were hunted in their roosts using long poles, bows and arrows, and nets (Schorger 1973:139-140). Reports also state that in addition to general consumption, passenger pigeon was processed for fat and oil that is used like butter, similar to bear fat (Schorger 1973:133-135).

Seasonality

Limited seasonality data is available. Although both tooth eruption/wear and bone fusion data from white-tailed deer offer seasonal information, the tooth data are more specific and thus more reliable. White-tailed deer teeth at Zebree display three different age ranges: < 4-7 months, 2.5 years, and 5 years of age. According to the natural history of modern white-tailed deer in northeastern Arkansas, the rut runs from late September through February, peaking in October and November, and most fawns are born between late March and late June (Sealander and Heidt 1990:247). These trends suggest that at least two of the deer from the Zebree site were killed during the fall rut season. The youngest was procured sometime between September and December, while the 2.5-year-old specimen may have been hunted around October.

Many of the birds found in this sample are migratory, and are therefore naturally present at only certain times of the year. Most migratory patterns follow either a fall/winter/spring or a spring/summer/fall model. With this fact in mind, a table of seasonality for all identified bird species is provided (Table 11). Species present during both the winter and summer ranges are represented in the Zebree collection, indicating resource procurement and thus site occupation was year-round. Furthermore, some species that are seasonally restricted to the fall/winter/spring category are found in the same features as those available during only the summer time frame. One example is Feature 268 where black-crowned night heron and broad-winged hawk are together with mallard, black duck, pintail, and passenger pigeon. Another is Feature 257 where an element from the common moorhen, a summer residents, is found alongside Anatids, passenger pigeon, and a short-eared owl specimen.

Table 11: Seasonality Data for Identified Bird Species.*

Bird Species		Fall/Winter/Spring	Spring/Summer/Fall
Cygnus columbianus	tundra swan	X	
Branta canadensis	canada goose	X	
Aix sponsa	wood duck	X	X
Anas strepera	gadwall	X	
Anas rubripes	american black duck	X	
Anas platyrhynchos	mallard	X	X
Anas acuta	northern pintail	X	
Spatula clypeata	northern shoveler	X	
Anas carolinensis	green-winged teal	X	
Aythya collaris	ring-necked duck	X	
Aythya affinis	lesser scaup	X	
Bucephala albeola	bufflehead	X	
Meleagris gallopavo	wild turkey	X	X
Colinus virginianus	bobwhite	X	X
Podilymbus podiceps	pied-billed grebe	X	X
Nycticorax nycticorax	black-crowned night heron		X
Grus canadensis	sandhill crane	X	
Buteo platyperus	broad-winged hawk		X
Fulica americana	american coot	X	X
Gallinula chloropus	common moorhen		X
Ectopistes migratorious	passenger pigeon	X	
Asio flammeus	short-eared owl	X	
Cyanocitta cristata	blue jay	X	X
Hylocichla mustelina	wood thrush		X
Cardinalis cardinalis	northern cardinal	X	X
Quiscalus quiscula	common grackle	X	X

*Note: Data from Sealander and Heidt 1990.

Seasonal data from fish are more complicated to interpret since their incremental growth pattern reflects overall well being and is influenced not only by seasonal rounds, but also the quality of their environment (Wheeler and Jones 1989:156). Although the most commonly used and accurate seasonal data for fish is gathered from otolith sectioning (Wheeler and Jones 1989:155), this method was not applicable to the sample as no otoliths were recovered from the contents of these features. Another seasonal indicator of sorts is the general size of fish (Wheeler and Jones 1989:138, 159). Most fish present in this collection spawn during the spring; therefore juveniles are more abundant during the summer months. This is also the time when waters recede and fish, particularly less mature ones, are sometimes trapped in backwater ponds, proving easy prey (Smith 1975:58, 2009:172). At the Zebree site there is a large collection of small fish elements, many of which weigh less than .05 g. For example, 89 complete or nearly complete fish elements (scales not included) fall into this category. When all vertebrae except for first and last vertebrae are excluded, this number is 59 and includes sunfishes, catfishes, bowfin and drum. Although the evidence is by no means conclusive, this collection of particularly small individuals could be the result of fishing exploits during summer months, although it is likely that fish were caught throughout the year.

Regional Comparison

Both similarities and differences appear when the Zebree faunal assemblage is compared to regional data (Compton 2009). When vertebrate resources are ranked according to NISP, its contents are similar to the Eastern Lowlands taxonomic rankings with a few notable differences (Table 12). White-tailed deer falls to a rank of six, both in this analysis alone and once data analyzed by Roth (1980) are included. The ranking of lizards and snakes has already been addressed, and is determined to be an inflated value. Most fish taxa correlate with greater regional patterns, though sunfishes are ranked much higher at Zebree than in the greater subregion. Furthermore, softshell turtles are more numerous. These turtles are fully aquatic and may have been hunted both directly and indirectly though fishing endeavors. An account from the travels of William Bartram details the hunting and consumption of this resource by the Seminole Indians of Florida,

Table 12: A Comparison of NISP Rank Order for Central Mississippi Valley, Eastern Lowlands, and Zebree.*

Central Mississippi Valley		Eastern Lowlands		Zebree Big Lake Phase		Zebree Big Lake Phase (Roth 1980 included)	
Taxon	NISP	Taxon	NISP	Taxon	NISP	Taxon	NISP
1. White-tailed deer	26780	1. White-tailed deer	12020	1. Gars	756	1. Gars	986
2. Gars	11566	2. Gars	11192	2. Bowfin	583	2. Bowfin	587
3. Bowfin	6428	3. Bowfin	5387	3. Freshwater catfishes	192	3. Freshwater catfishes	368
4. Swans, geese, and ducks	4253	4. Swans, geese, and ducks	4138	4. Swans, geese, and ducks	130	4. Swans, geese, and ducks	253
5. Freshwater catfishes	4177	5. Freshwater catfishes	3977	5. Lizards and snakes	129	*New World mice and rats*	*202*
6. Emydid turtles	3230	*New World mice and rats*	*2644*	6. White-tailed deer	104	5. Sunfishes	182
New World mice and rats	*2656*	6. Rabbit	2396	7. Sunfishes	89	6. White-tailed deer	167
7. Rabbit	2544	7. Emydid turtles	2265	*New World mice and rats*	*87*	7. Freshwater drum	157
8. Tree Squirrels	2160	8. Suckers	1554	8. Passenger pigeon	49	8. Lizards and snakes	140
9. Raccoon	2014	9. Raccoon	1269	9. Freshwater drum	49	9. Minnows, carp, and suckers	113
10. Suckers	1620	10. Tree Squirrels	1186	10. Rabbits	47	10. Rabbits	99
11. Mud and musk turtles	1483	11. Freshwater drum	1134	11. Minnows, carp, and suckers	37	11. Tree squirrels	89
12. Freshwater drum	1172	12. Sunfishes	896	12. Perching birds	32	12. Emydid turtles	83
13. Sunfishes	1033	13. Coyote, wolf, or dog	636	13. Softshell turtles	27	13 Passenger pigeon	63
14. Wild turkey	1029	14. Passenger pigeon	598	14. Mud and musk turtles	24	14. Amphibians	63
15. Passenger pigeon	726	15. Mud and musk turtles	597	15. Amphibians	23	15. Softshell turtles	50

Note: Central Mississippi Valley and Eastern Lowlands data taken from Compton 2009.

and recounts the turtles' pleasant taste (Slaughter 1996:158). While raccoon does not make the top fifteen vertebrate resources, its biomass yields are significant (Table 6).

Although one can question the fine-scale analysis presented by Compton (2009) based on his use of disparately sized collections, I will nonetheless address his research, as it is one of the few regional data sets available. As Compton (2009:299) notes, a representative sample from the Transitional Late Woodland/Early Mississippian period is conspicuously absent from his small-scale Eastern Lowlands data set. The comparison of this faunal collection representing the Big Lake phase component at the Zebree site to Compton's Meador, Parkin, and Upper Nodena data can bridge this temporal gap and provide a more complete picture of subsistence trends over time in the Eastern Lowlands (Figure 9). Like the other three sites, Zebree is located in the St. Francis drainage of the Eastern Lowlands in the Central Mississippi Valley and therefore provides an ecological correlation for the Transitional Late Woodland/Early Mississippian time frame.

When charted by relative biomass alongside the Late Woodland, Middle Mississippian, and Late Mississippian collections analyzed by Compton (2009), Zebree compares most favorably with the Late Woodland Meador sample (Figure 10). White-tailed deer contributions are nearly identical for both the Meador and Zebree sites. These two sites also have the highest diversity and equitability indices. One notable difference in the Zebree collection is the higher degree of biomass attributed to aquatic taxa, which may underwrite its significantly higher diversity index. According to biomass trends, it appears that there are substantial consistencies between the Late Woodland and Transitional Late Woodland/Early Mississippian period subsistence patterns, both of

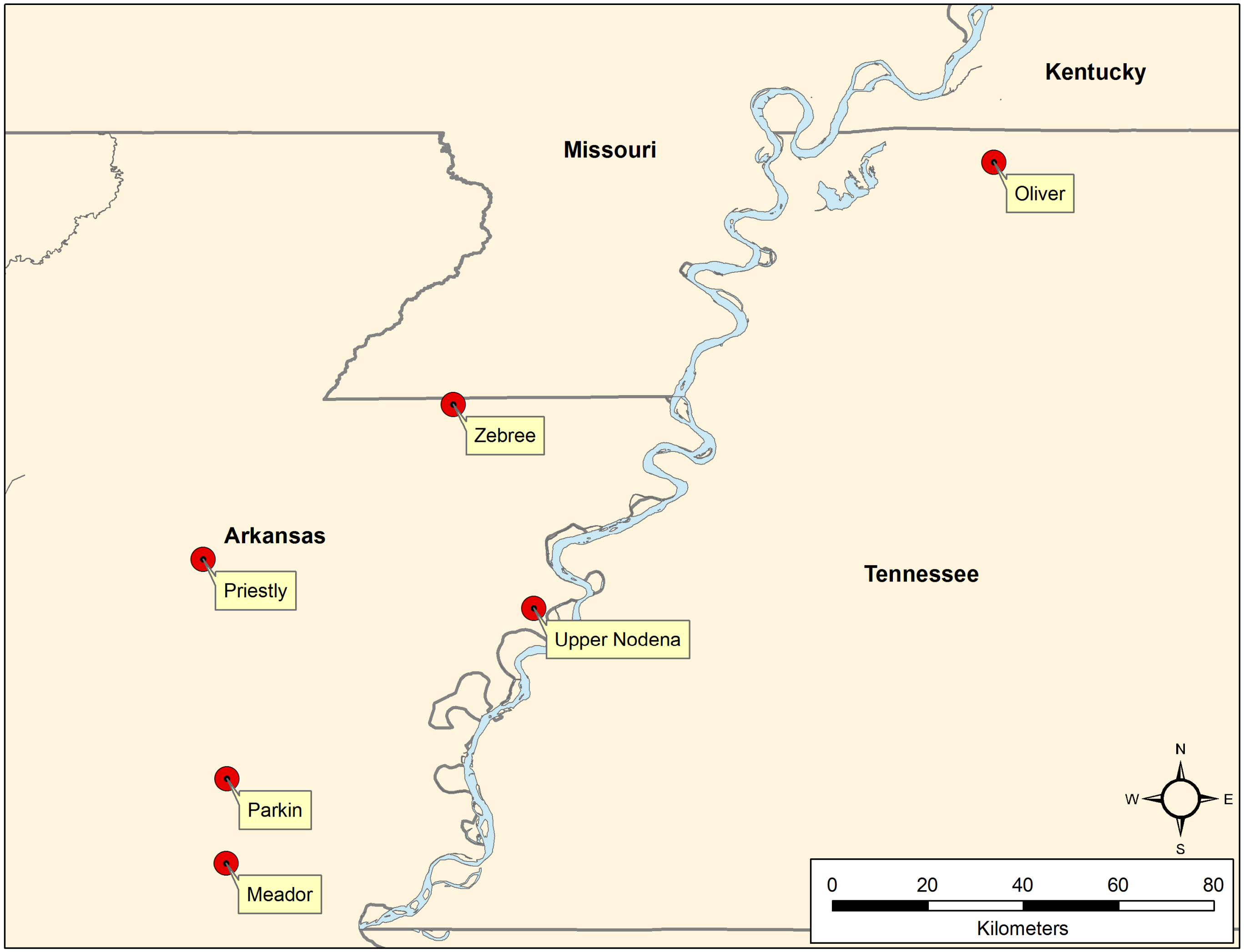

Figure 9: Map of sites mentioned in the regional discussion (map provided by Thaddeus Bissett).

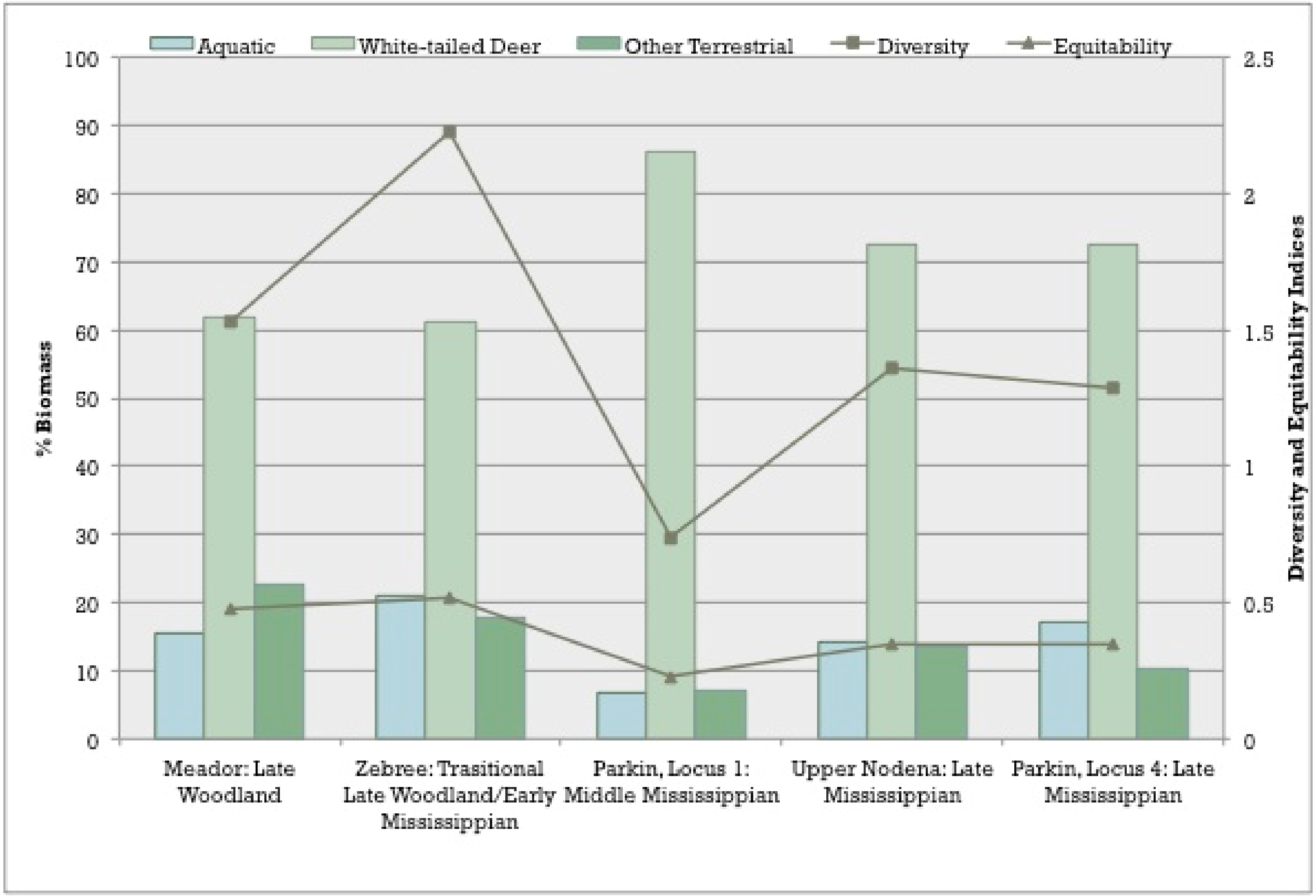

Figure 10: A Summary of Temporal Trends in Resources and Indices Based on Estimated Biomass (data from Compton 2009).

which are more diverse economies than the ensuing periods. Despite these patterns, it should be kept in mind that the Meador sample is much smaller than any of the other samples analyzed, which may result in higher indices.

In order to determine whether Zebree is an accurate representation of this time frame in the Eastern Lowlands, it is compared to the Priestly site (3PO490). The Priestly site is also located in the Eastern Lowlands, situated between the St. Francis River and Crowley's Ridge. The excavation was conducted in 1988 by the Center for Archaeological Research at Southwest Missouri State University and uncovered a Terminal Late Woodland/Early Mississippian hamlet dating from A.D. 700 to 1050 (Benn 1990a). The Priestly fauna were collected using both 3.65-mm screening and flotation methods and were analyzed by Kelly (1990). The total vertebrate NISP was 6,636, of which only 3,063 where identifiable to class or below (Kelly 1990:328).

Using the individually reported feature data, the vertebrate resources are ranked both by NISP and ubiquity values (Table 13). Some of the apparent differences can be contributed to environmental settings. While Zebree sits on the edge of Big Lake, the closest permanent water source for the Priestly site is Big Bay located approximately 2.4 km to the west (Kelly 1990:332). Although migratory waterfowl are still an important resource due to Priestly's location within the Mississippi Flyway, they were hunted along with land fowl including wild turkey, bobwhite, prairie chicken and grouse that also rank in the top ten for both NISP and ubiquity. Despite being the most abundant resource, waterfowl are not the most ubiquitous. In addition to aquatic birds, fish are also present in the ranked taxa. Like Zebree, the Priestly fishing industry focused on backwater species,

Table 13: A Comparison of Vertebrate Collections from the Zebree and Priestly Sites.*

Zebree (3MS20)				Priestly (3PO490)			
Taxon	NISP	Taxon	Ubiquity (n=16)	Taxon	NISP	Taxon	Ubiquity (n=74)
1. Gars	756	1. Bowfin	75	1. Swans, geese, and ducks	120	1. White-tailed deer	29.73
2. Bowfin	583	2. Gars	68.75	2. Sunfishes	115	2. Freshwater catfish	27.03
3. Freshwater catfishes	192	3. Softshell turtles	68.75	3. White-tailed deer	103	3. Sunfishes	24.32
4. Swans, geese, and ducks	130	4. Swans, geese, and ducks	62.5	4. Freshwater catfish	96	4. Rabbits	21.62
5. Lizards and snakes	129	5. White-tailed deer	56.25	5. Rabbits	62	5. Bowfin	18.92
6. White-tailed deer	104	6. Rabbits	56.25	6. Suckers	61	6. Tree squirrels	17.58
7. Sunfishes	89	7. Freshwater catfishes	56.25	7. Bowfin	54	7. Perching birds	17.58
New World mice and rats	*87*	8. Mud and musk turtles	56.25	8. Passenger pigeon	47	8. Swans, geese, and ducks	14.86
8. Passenger pigeon	49	9. Minnows, carp, and suckers	50	9. Tree squirrels	37	*Small Rodents*	13.51
9. Freshwater drum	49	10. Passenger pigeon	50	10. Land fowl	34(7)	9. Suckers	12.16
10. Rabbits	47	11. Sunfishes	50	11.Perching birds	30	10. Land fowl	10.81
11. Minnows, carp, and suckers	37	12. Freshwater drum	43.75	*Small Rodents*	27	11. Pikes	10.81
12. Perching birds	32	13. Amphibians	43.75	12.Amphibians	14	12. Passenger pigeon	9.46
13. Softshell turtle	27	*New World mice and rats*	37.5	13. Pikes	10	13. Raccoon	8.12
14. Mud and musk turtles	24	14. Lizards and snakes	37.5	14. Coyote and/or dog	8	14. Amphibians	6.76
15. Amphibians	23	15. Perching birds	31.25	Turtles	357	Turtles	60.81

*Note: Priestly data taken from Kelly 1990.

but here sunfishes and catfishes outrank bowfin and gars. This may be the result of broadcast fishing methods (Kelly 1990:332) and/or a particular distaste for these species.

Despite the fact that turtle taxa are conspicuously absent from Priestly's ranked resource, they were indeed utilized at this site. There are 357 specimens identified to the general turtle taxonomic group, which has a ubiquity of 60.81. As such, their absence from the ranked taxa is by no means a reflection of subsistence patterns, but rather of their unidentifiable nature. On the other hand, the pocked appearance of softshell turtles is recognizable even in some of the smallest specimens, yet they are fairly rare (NISP:7; Kelly 1990:359). One assumption that can be made is that softshell turtles were not as frequently consumed, which further exhibits a more balanced extraction of aquatic and terrestrial resources at Priestly versus Zebree.

Though there are differences between Zebree and Priestly, their similarities are highlighted when juxtaposed with the Eastern Uplands Oliver site (40OB161; Table 14). Dating from approximately A.D. 800 to 1000, it is located across the Mississippi River in the Obion River drainage of northwestern Tennessee. The site was excavated by the Tennessee Division of Archaeology in 1992 as part of a larger cultural resource survey (Mainfort and Lawrence 1994). Analysis of fauna from the Oliver site was completed by Brietburg and included approximately 2,830 specimens, of which 2,829 were identifiable to at least class (Breitburg and Mainfort 1994:164-166). Recovery methods for the faunal collection are unclear, yet excavation methods and paleoethnobotanical analysis incorporate both 3.65-mm screening and flotation. The dominance of upland terrestrial species is evident. Passenger pigeon, white-tailed deer, and box turtle are the three most numerous taxa at the Oliver site. Aquatic species are relatively few. Of those recovered,

Table 14: A Comparison of the Zebree, Preistly, and Oliver Sites.*

Zebree (3MS20) Big Lake Phase (Roth 1980 included)		Priestly (3PO490)		Oliver (40OB161)	
Taxon	NISP	Taxon	NISP	Taxon	NISP
1. Gars	986	1. Swans, geese, and ducks	120	1. Passenger pigeon	1181
2. Bowfin	587	2. Sunfishes	115	2. White-tailed deer	676
3. Freshwater catfishes	368	3. White-tailed deer	103	3. Emydid turtles	260(258)
4. Swans, geese, and ducks	253	4. Freshwater catfish	96	4. Tree squirrels	209
New World mice and rats	*202*	5. Rabbits	62	5. Land fowl	142(37)
5. Sunfishes	182	6. Suckers	61	6. Snake	65
6. White-tailed deer	167	7. Bowfin	54	7. Rabbits	64
7. Freshwater drum	157	8. Passenger pigeon	47	8. Raccoon	47
8. Lizards and snakes	140	9. Tree squirrels	37	9. Freshwater catfish	41
9. Minnows, carp, and suckers	113	10. Land fowl	34(7)	10. Gars	28
10. Rabbits	99	11. Perching birds	30	11. Opossum	24
11. Tree Squirrels	89	*Small Rodents*	27	12. Skunk	11
12. Water and box turtles	83	12. Amphibians	14	13. Beaver	10
13 Passenger pigeon	63	13. Pikes	10	14. Hawk	10
14. Amphibians	63	14. Coyote and/or dog	8	15. Freshwater drum	9
15. Softshell turtles	50	Turtles	357	16. Perching birds	9

*Note: Priestly data taken from Kelly 1990. Oliver data taken from Breitburg and Mainfort 1994.

freshwater catfish and gars are the most abundant, ranking within the top ten resources. The striking amount of passenger pigeon at Oliver is unique, prompting the suggestion that a seasonal roosting spot may have played a role in this site's location (Breitburg and Mainfort 1994).

The Zebree sample identified in this thesis is nearly four times larger in terms of NISP than both the Priestly and Oliver sites, possibly biasing some trends in the data. Yet the general similarities in the lowland data sets when compared to the upland site cannot be ignored. All three of these Transitional Late Woodland/Early Mississippian sites suggest that populations concentrated on resources found in the immediate vicinity of their settlement area. For the greater Eastern Lowlands and the Big Lake component at the Zebree site, this pattern does not seem differ greatly from the Late Woodland resource strategies, but only becomes more pronounced and more general with increased population size and sedentism.

CHAPTER SIX: CONCLUSION

The subsistence study presented in this thesis was designed to meet several research goals. Firstly, it offers a more accessible, in-depth, and detailed analysis of the Big Lake phase vertebrate resources at the Zebree site. The provided attachment (File 1, ZebreeBigLakeFauna_Carmody2013.xls) records all of the analyzed faunal data included in this thesis. Details such as element type, portion, side, weight, modification, and any other comments are all documented and available to be incorporated in future studies.

In addition to contributing an accessible data set, this thesis also sheds light on the lifeways and foodways of the prehistoric Big Lake peoples. Statistical analysis implies that the community was not, to any significant extent, socially ranked in respect to their foodways. Its inhabitants shared equal access to Zebree's wide range of resources.

In terms of regional patterns within the Eastern Lowlands, this data seems to correspond with previous research by Compton (2009). Like the Late Woodland assemblage included in Compton's (2009) study, the Transitional Late Woodland/Early Mississippian Zebree data displays higher resource diversity than the subsequent Mississippian periods. Additionally, the Priestly and Oliver sites show a trend of localized resource extraction during this time frame, with a different spectrum of fauna utilized in lowland versus upland sites. Yet notable distinctions are apparent even between the two lowland sites, and these seem to be driven by their location on the landscape.

Furthermore, the results confirm that Zebree was a permanent settlement based on a diverse subsistence strategy that consisted of a significant dependency on aquatic taxa with the critical supplementation of white-tailed deer and other terrestrial resources. In addition to these vertebrate resources, previous analysis provides evidence for a variety of freshwater mussel and plant taxa that also comprise the overall diet of Big Lake individuals (Harris 1977a, 1977b, 1977c; Morse 1980b:19; Roth 1980:6-7). In terms of diachronic patterns, almost all of the species identified in the 1975 Barnes sample are present in the collection reported here. The only three species absent from this sample are blue-winged teal, hooded merganser, and little blue heron (Morse 1980b:15-17), and only little blue heron is missing from both this collection and Roth's analysis (1980:2-6). Major differences include the greater quantity, slightly increased diversity, and evidence for multi-seasonal cultural deposits.

What changes we do see can possibly be linked to changes in the botanical regime. According to the paleoethnobotanical data at each of these sites, a variety of wild and domestic plant taxa were recovered. Maize is found to an extent at the Zebree, Priestly, and Oliver sites (Harris 1977a, 1977b, 1977c; Pearsall and Hunter 1990; Shea and Mainfort 1994); in addition, commonly cultivated indigenous plants were utilized. Although the Zebree archaeobotanical collection is in need of more thorough analysis, it is apparent from the available data that knotweed is a primary cultigen (N = 550+ seeds; Harris 1977a, 1977b, 1977c). Furthermore, one maygrass seed was found in a faunal sample during recent analysis (Feature 206; identified by Stephen Carmody). The combination of maize, sunflower, knotweed, and maygrass remains at Zebree possibly suggests a year-round planting routine (Harris 1977a, 1977b, 1977c). Morse and Morse (1990:60) also stated that chenopod was recovered from Zebree. Knotweed, chenopod, maize, and sunflower are harvested in the fall, while maygrass ripens in the spring (Scarry 2008:399). According to Scarry (2008), the heightened use of maize in concert with a strong reliance on starchy annuals likely required a multi-practice and multi-field farming regime that was more labor intensive and time-consuming than past horticultural regimes. These demands seem to be reflected in the faunal subsistence patterns apparent in this study. The Transitional Late Woodland/Early Mississippian of the greater Eastern Lowlands, like those at Zebree, settled in ecologically rich and diverse areas that not only supported the suite of agricultural crops they were reliant upon, but also offered an abundance of locally available wild animal and plant resources.

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