A ZOOARCHAEOLOGICAL PERSPECTIVE

OF

WEST KENDALL TREE ISLAND SITE (8DA1081)

by

Ryan Steeves

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This thesis was prepared under the direction of the candidate's thesis advisor, Dr. Arlene Fradkin, Department of Anthropology, and has been approved by all members of the supervisory committee. It was submitted to the faculty of the Dorothy F. Schmidt College of Arts and Letters and was accepted in partial fulfillment of the requirements of the degree of Master of Arts.

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ABSTRACT

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The West Kendall Tree Island site (8DA1081) is a black dirt midden situated on the northeast end of an everglades tree island. The site has been intensely disturbed by excavation pits, particularly on the highest elevations of the site, and becomes increasingly disturbed by a growing Kendall population. Faunal remains recovered in 2008 are examined to reconstruct past ecological habitats, comparing the faunal composition to tree island sites within the Florida Everglades. Based upon identifications, the composition of the site is similar to those of the region, being comprised primarily of freshwater aquatic species and aquatic reptiles, with minimal selection of terrestrial faunal resources.

DEDICATION

To Khawla and Bonnie.

A ZOOARCHAEOLOGICAL PERSPECTIVE

OF

WEST KENDALL TREE ISLAND SITE (8DA1081)

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CHAPTER ONE: INTRODUCTION

The present study examines the faunal assemblage recovered from the West Kendall site (8DA1081) which is located on a large tree island in the eastern Everglades, Miami-Dade County, Florida. This site had been impacted by multiple bulldozing and invasion by exotic plant species. In accordance with federal, state, and local historic resources laws, excavations at the site were performed to mitigate the impact of a proposed road-widening project (Franklin et al. 2008:3, 23-25).

Like other Everglades tree island sites, West Kendall consists of a black earth midden that is rich in cultural and faunal deposits. The site was occupied for over 2,500 years, spanning from the end of the Late Archaic through the Glades and into the historic period (Franklin et al. 2008:27). Material remains recovered provide evidence for subsistence and habitation activities.

Although a substantial number of tree island sites have been excavated and analyzed, only a few zooarchaeological assemblages have been collected using fine recovery techniques and subsequently identified and studied in detail. This research contributes to the relatively small corpus of existing data. The resultant findings are compared to those from zooarchaeological studies conducted from a number of sites in the region. All of these studies are synthesized in order to gain further insight into pre-Columbian subsistence patterns in the Everglades.

Objectives of Study

Research questions to be addressed in studying the faunal assemblage from the West Kendall Site include the following:

- What was the degree of specialization in animal resource procurement and use at the site?
- What habitats were being used by the site occupants?
- Were the site occupants using locally available animal resources, or obtaining resources from outside their immediate locality?

Organization of Thesis

This thesis is organized into seven chapters. Chapter two presents the environmental setting and the cultural history of the Everglades. Chapter Three presents previous archaeological and zooarchaeological research, placing an emphasis on sites that are representative of southeast Florida and especially those of the Florida Everglades. Chapter Four is a description of the Kendall Site, including setting and site description, a summarization of field excavations that took place at the site, and finally a description of faunal materials and zooarchaeological methods used. The fifth chapter includes the results and analysis of faunal remains recovered from the Kendall Site. Chapter Six is a comparison of the faunal analysis at Kendall to that of other Everglades tree island sites. The seventh and final chapter includes a summary of the research findings and conclusions.

CHAPTER TWO: ENVIRONMENTAL SETTING AND EVERGLADES REGIONAL CULTURAL HISTORY

Environmental Setting

The Everglades constitute the southern part of an expansive and distinctive hydrological drainage system covering an area of 23,310 km^2 in central and southern Florida. The system begins at the headwaters of the Kissimmee River near Orlando. This system flows south into Lake Okeechobee and subsequently through the Everglades as a sheet of water flowing towards Florida Bay. Prior to drainage, water overflowed an area ranging between 30 and 51 km on the lake's southern shore. Today, water management drainage systems control the flow of water in and around the Everglades (Parker 1984:28).

The Everglades vegetation communities depend upon the region's seasonal hydrological regime of water-level fluctuations, fires, and hurricanes (Layne 1984:269). The hydrological regime of the Everglades consists of two distinct hydroperiods: wet and dry. The wet hydroperiod extends from June to November, while the dry hydroperiod extends from December to May, with the peak of high water usually occurring in October and the minimum levels being reached in May (Sklar and van der Valk 2002:10). The sheer size of the region minimizes the effects of these natural forces and ensures that suitable, specialized habitats will survive within its boundaries (McCally 1999:23-26). Four dominant and intertwined habitats within the Everglades are sawgrass marsh, marl prairie (wet prairie), tree islands, and pinelands (Olmstead and Loope 1984:170-172).

Sawgrass marshes cover 70 percent of the Everglades and are saturated with surface water most of the year. The most characteristic and dominant plant in this habitat is sawgrass (*Cladium jamaicense*), which is a sedge whose leaves are long and blade-like with saw-toothed margins. Sawgrass has the potential to reach heights over 3 m and grow in rich organic soils of peat and muck. Uniform as it appears, the marsh is not a monocrop of sawgrass. Other plants include cattail (*Typha latifolia*), spikerush (*Elocharis cellulose*), arrowhead (*Sagittaria lancifolia*), and maidencane (*Pancium hemitomon*) (Kushlan 1990:340; Lodge 1998:19,23,30-31, Table 3.1; Swift 1984:97; Uchytil 1992). Where the water is too deep for sawgrass, spikerush (*Eleocharis* spp.) and bladderworts (*Utricularia* spp.) begin to dominate (Whitney et al. 2014:63).

Marl prairies, often referred to as wet prairies, are characterized by low-lying vegetation that tend to be tolerant of the alternate flooding and drying typical of the Everglades region. Plant species include grasses, sedges, and flowering forbs. Most dominant is the gulf hairawn muhly or sweetgrass (*Muhlenbergia filipes*), with localized patches of Florida little bluestem (*Schizachyrium rhizomatum*) and black bogrush (*Schoenus nigricans*). Marl prairies are more frequently subjected to fires which, in dry years, are burnt down to the water table (Kushlan 1990:341-342; Olmstead and Loope 1984:167-171, Table 2).

Tree islands are small elevated tropical hardwood hammocks that stand out as islands above the surrounding sawgrass marsh vegetation and are oriented parallel to the direction of water flow (Sklar and van der Valk 2002:3). Because of their slight elevation, these hammocks rarely flood, and acids from decaying plants dissolve the surrounding limestone creating a natural moat, protecting it from fire (National Park Service 2007). It is this protection from the surrounding elements which allows for the growth of these tropical hardwood hammocks. The upstream portions, called heads, are the oldest and highest areas on tree islands and usually feature the greatest density of vegetation (McCally 1999:25-36). Flood intolerant species predominate and include live oak (*Quercus virginiana*), pigeon plum (*Cocoloba diversifolia*), lancewood (*Nectandra coriacea*), willow bustic (*Bumelia salicifolia*), inkwood (*Exothea paniculata*), wild tamarind (*Lysiloma latisiliquum*), Florida poisontree (*Metopium toxiferum*), marlberry (*Ardisia escalloniodes*), white stopper (*Eugenia axillaris*), gumbo limbo (*Bursera simaruba*), strangler fig (*Ficus aurea*), and West Indian cherry (*Prunus myrtifolia*) (Olmsted and Loope 1984:180, Table 2). The tails of tree islands extend downstream from the head with gradually falling elevation and less dense vegetation before disappearing into the surrounding marsh (Sklar and van der Valk 2002:4). Flood tolerant plants dominate here and include redbay (*Persea borbonia*), sweet bay (*Magnolia virginiana*), dahoon holly (*Ilex cassine*), willow (*Salix caroliniana*), wax myrtle (*Myrica cerifera*), coco plum (*Chrysobalanus icaco*), and pond apple (*Annona glabra*) (Olmsted and Loope 1984:171).

Pinelands are found in relatively dry areas at higher elevations in the Everglades (Snyder et al. 1990:250-264). The loose canopy which is formed by a single species, Dade County slash pine (*Pinnus elliottii* var. *densa*), allows a great deal of light to reach the forest floor but offers very little protection from such climatic extremes as droughts and freezes. The understory consists of over 90 species of shrubs and over 250 species of herbaceous plants. The most common shrubs are saw palmetto (*Serenoa repens*), cabbage palm (*Sabal palmetto*), cocoplum, strangler fig, wax myrtle, and redbay. Herbaceous species include pineland cluster vine (*Jacquemontia curtissii*) and angadenia (*Angadenia sagre*) (Lodge 1998:57-61; Olmsted and Loope 1984:172; Snyder et al. 1990:250-264). The pineland community is regulated by and dependent on fire. Mature slash pine trees are rarely killed by fire, whereas most of the woody shrubs and herbaceous plants are burned to the ground. These understory species eventually re-sprout within a few months (Lodge 1998:60; Olmsted and Loope 1984:172; Snyder et al. 1990:250-264).

The sawgrass marshes, marl prairies, tree islands, and pinelands of the Everglades host an extensive diversity of fauna. Native mammals include white-tailed deer (*Odocoileus virginianus*), river otter (*Lutra canadensis*), raccoon (*Procyon lotor*), and opossum (*Didelphis virginiana*). Among the several hundred species of birds are pied-billed grebe (*Podilymbus podiceps*), great blue heron (*Ardea herodias*), green heron (*Butorides virescens*), and ducks such as mallard (*Anas platyrhynchos*), wood (*Aix sponsa*), and mottled (*Anas fulvigula*). The region is home to many kinds of reptiles: freshwater turtles including Florida softshell (*Apalone ferox*) and peninsula cooter (*Pseudemys floridana*); snakes such as Florida water snake (*Nerodia fasciata*) and brown water snake (*Nerodia taxispilota*); and American alligator (*Alligator mississippiensis*). Many amphibians, including toads, frogs, and salamanders, also occupy the region (Dineen 1984:258-268; Fogarty 1984:211-212; Layne 1984:269-296; Robertson and Kushlan 1984:219-226).

The Everglades fish population consists of approximately 43 species. The most common fish is the Eastern mosquitofish (*Gambusia holbrooki*), followed by golden topminnow (*Fundulus chrysotus*), bluefin killifish (*Lucania goodie*), and Seminole killifish (*Fundulus seminolis*). Additionally, bowfin (*Amia calva*), bluegill (*Lepomis* *macrochirus*), redear sunfish (*Lepomis microlophus*), black crappie (*Pomoxis nigromaculatus*), largemouth bass (*Micropterus salmoides*) longnose gar (*Lepisosteus osseus*), and Florida gar (*Lepisosteus platyrhincus*) are all considered to be important Everglades species (Dineen 1984:258-259; Kushlan 1990:350-351).

Due to water control management in modern times, the Everglades has been extensively modified. Several drainage projects were initially sponsored in 1880-1881 by developer Hamilton Disston and later by a number of governors and entrepreneurs. All of these initial projects were considered to be failures. Beginning in the 20th century, more effective projects to reclaim the Everglades were carried out. Three phases evolved in the drainage and reclamation of the Everglades: drainage (1904-1928), flood control (1928-1948), and comprehensive water management (1948-present) (McCally 1999:87; Sklar and van der Valk 2002:6-7).

Drainage was successfully accomplished between 1904 and 1928, beginning with Governor W.S. Jennings and his successor Governor Napoleon Bonaparte Broward. During that time, five major canals were constructed: North New River, Hillsboro, Miami, Saint Lucie, and West Palm Beach. Moreover, a muck dike was built at the southern rim of Lake Okeechobee to prevent waters entering into the Everglades. Everglades soils began to dry out and subside and consequently were consumed by fire, thereby lowering the surface of the land (DeGrove 1984:22-23; Grunwald 2006:130-137; McCally 1999:87; Sklar and van der Valk 2002:6).

Additional problems arose as two hurricanes struck south Florida and Lake Okeechobee, one in 1926 and another in 1928. Floodwaters from both hurricanes overwhelmed the muck dike that had been erected at the lake's southern shore sending a flash flood rushing south through the floodplain. The floods from the 1926 hurricane killed nearly 400 people and left 40,000 homeless. During the 1928 hurricane, the rebuilt muck dike collapsed and 2,500 people were killed by the storm's flash flooding, which inundated the northern Everglades towns of Belle Glade, Pahokee, Chosen, South Bay and Miami Locks (Grunwald 2006:186-194; McCally 1999:135-138).

Following these two disasters, the need for flood control became apparent and further drainage programs were eliminated. The Army Corps of Engineers was instructed to carry out flood control projects over the next two decades. The Corps constructed a more substantial and taller dike on the lake's southern rim and named it in honor of President Herbert Hoover. The Corps gained control over the flow of waters between the Atlantic and Gulf coasts, via the St. Lucie Canal, Lake Okeechobee, and the Caloosahatchee River (DeGrove 1984:23; Grunwald 2006; McCally 1999:139; Sklar and van der Valk 2002:6-7; USACE 2009:2, 2011).

These flood control efforts were largely successful. Nevertheless, there were concerns about soil subsidence and saltwater encroachment. New scientific knowledge was available on Everglades regional geology. Following the hurricane in September 1947, which had a tremendous impact on much of the southeast Florida region, it became apparent that there was a need for comprehensive water control management. Consequently, the Army Corps of Engineers constructed an integrated water management system of pumps, locks, and canals. The Kissimmee River was channelized; the St. Lucie Canal and Caloosahatchee River were enlarged; and the Hoover Dike was expanded to completely encircle Lake Okeechobee. Water conservation areas were established to the southwest of the Everglades Agricultural Area (EAA) that were designed to relieve southeast Florida of flooding and stop saltwater intrusion into the Biscayne aquifer, the region's main source of potable water (McCally 1999:147-153). The dike and water drainage systems are still in place today and are integral to the Everglades water control plan (USACE 2009:2, 2011).

Everglades Regional Cultural History

Archaeologists include the Everglades as part of the Glades cultural region. The prehistory of this area is divided into three periods: Paleoindian, Archaic, and Glades. This summary is based upon the synthesis presented by Milanich (1994).

Paleoindian Period

Human habitation of Florida began during the Paleoindian period (10,000 - 7,500 B.C.) (Milanich 1994:40). These earliest people were nomadic hunters and gatherers who subsisted on megafauna, such as mammoths and mastodons, as well as smaller game animals and plant resources. During this time, Florida was much cooler and dryer, and nearly twice as wide as the sea level was 49 m lower than it is today. Because of these arid conditions and lack of surface water bodies, sinkholes became an important resource for Paleoindians and animals alike. Consequently, many Paleoindian sites are located near such waterholes (Milanich 1994:32-44), such as the Cutler Fossil site (8DA2001) in Miami-Dade County, where human remains have been found in association with those of extinct fauna (Carr 1986:323). By the end of this period, a trend toward warmer and wetter climatic conditions and rising sea levels, as well as the extinction of Pleistocene megafauna, led to changes in human adaptations and to the onset of the Archaic period.

Archaic Period

The Archaic Period (7,500 - 500 B.C.), is divided into three temporal divisions: Early, Middle, and Late. This division is based on artifact assemblages, settlement patterns, and environmental and climatic conditions (Milanich 1994:61-62).

The Early Archaic (7,500 - 5,000 B.C.) is characterized by cultural changes caused by the onset of milder climatic conditions. Many of the Pleistocene animals that Paleoindians had depended upon for subsistence were extinct, so people had to adapt to the changing environment and smaller animal species. Nevertheless, they continued a nomadic hunting and gathering existence. In terms of artifacts, there was a transition from Paleoindian lanceolate to Archaic stemmed points, reflecting a change in wild resources procured (Milanich 1994:63-64, 75).

The Middle Archaic (5,000 - 3,000 B.C.), is marked by a continuing trend toward warmer and wetter conditions. By this time, water sources were typically both larger and more available. Both the Everglades and Lake Okeechobee were forming. People were able to live in a greater number of locales, as evidenced by the presence of sites in a variety of locations (Milanich 1994:75-79).

The Late Archaic (3,000 - 500 B.C.), is characterized by the onset of modern environmental and climatic conditions. With sea levels stabilized, Florida was reduced to its present geographical extent. Populations were increasing and occupying most of the habitable areas of Florida, as clearly demonstrated in the archaeological record. During this period, the earliest pottery was being made in Florida. At approximately 2,000 B.C., fiber-tempered pottery began to appear. During the Late Archaic, peoples were adapting to their local environment and practicing a number of distinct lifeways. By the end of the period, ca. 500 B.C., the development of regional cultures within Florida occurred as people adapted to their local environment (McCally 1999:10; Milanich 1994:85-104).

Glades Period

The Glades period (500 B.C. - A.D. 1513) spans over 2,000 years and is defined by the presence of ceramics. After 500 B.C., people continued their hunting, gathering, and fishing lifestyle, and they began making sand-tempered pottery. Glades culture settlements occurred mainly along the Atlantic coastal ridge, but tree islands in the Everglades were utilized as well. The largest sites were located on the ridge where rivers drain interior wetlands (Milanich 1994:107, 277-279, 298-299).

The chronology of the region is separated into three divisions: Glades I, II, and III. Glades I (500 B.C. - A.D. 750) is characterized by the appearance of sand-tempered pottery called Glades Plain and decorated pottery near the end of the period. Characteristic pottery types of Glades II (A.D. 750 - 1200) are Key Largo Incised, Opa Locka Incised, Miami Incised, Matecumbe Incised, and Plantation Pinched pottery. The appearance of Surfside Incised marks the onset of the Glades III period (A.D. 1200 - 1513), the pinnacle of Glades culture. Glades III was marked by increasing social stratification, mound building, and increasing contacts with neighboring peoples (Carr and Beriault 1984:2; Goggin 1940:23-32, 1947:120-121: Milanich 1994: 300-304).

CHAPTER THREE:

PREVIOUS EVERGLADES ARCHAEOLOGICAL AND ZOOARCHAEOLOGICAL RESEARCH

Previous Everglades Archaeological Research

Prior to serious archaeological research in Florida, a number of sites were first described by several observers in the 18th and 19th centuries. In 1776, surveyor and cartographer Bernard Romans (1776:288,291) described abandoned sites in the Florida Keys as the remnants of "savage villages." In 1823, railroad engineer Charles Vignoles (1823:82) described hills of rich soil among the mangroves in the Ten Thousand Islands as remnants of Calusa cultivations. Between 1824 and 1831, civil engineer William Adee Whitehead described two Key West mounds consisting of shells and bones (Peters 1965:36,37).

The American public initially became familiar with south Florida's archaeological past through accounts of the Second (1835-1842) and Third (1855-1858) Seminole Wars (Griffin 2002:180-182; McCally 1999:61). Scientific interest in south Florida began in 1847 when the U.S. Senate requested Harvard-educated lawyer Buckingham Smith to conduct the first survey of the Everglades region (McCally 1999:88). Smith focused on reclamation of the Everglades and never mentioned archaeological sites in his report to Congress. Smith noted old maps showed "something like cuts or canals." Military personnel discovered an ancient canal during the Second Seminole War. Smith attributed this public work to the Spanish as he believed it would have been too much of an undertaking for Florida's first aboriginal inhabitants (U.S. 30th Congress, Senate 1848:11,12). In 1847, within a letter to Smith, American surveyor George Mackay, who had surveyed the eastern Everglades on Smith's behalf, wrote that there were no indications of civilization on the islands in the Everglades except for the remains of a stone building, broken pottery, and oddly shaped bottles found on an island at the head of the Miami River (U.S. 30th Congress, Senate 1848:62). The first artifacts collected in the Everglades were pottery sherds recovered by Smith in 1848 (Carr 2002:188).

Soon after the end of the Civil War in 1865, Jeffries Wyman, the first curator of the Peabody Museum at Harvard University, began the first serious and sustained archaeological investigations in Florida. Wyman made a visit to Biscayne Bay in 1869-1870 where he became interested in two stone mounds, one on each side of the mouth of the Miami River. He excavated the mound on the southern bank and reported that nothing was found (Griffin 2002:52; Wyman 1870:8-9). In 1884, avocational archaeologist Andrew E. Douglass from New York described two mounds on the banks of the Miami River as the only ones along Florida's Atlantic coast constructed solely of loose rock, probably the result of removing rocks as obstacles to cultivation by the Spanish, English, or Indian residents (Douglass 1884:601). It is not known if these are the same mounds as described by Wyman.

The first archaeological exploration of the Everglades was in 1892, when fiction writer Kirk Monroe of Coconut Grove collected artifacts to display at the Florida pavilion of the Columbian World's Fair (Carr 2002:188). M. R. Harrington, an anthropologist and archaeologist at the Museum of the American Indian, is noted for his studies of Native American culture. In 1908, Harrington discovered a series of middens and a shell mound located along the north side of the New River, west of Fort Lauderdale, where he collected many potsherds and shell tools during multiple surface collections. He continued west into the Everglades and arrived at Long Key (near Pine Island in present-day Broward County) where he unexpectedly found a large archaeological deposit. Harrington continued farther west to a small tree island, "Pumpkin Hammock," and found yet another archaeological deposit. He noted that a great proportion of the items collected were animal bone remains of turtles, alligators, birds, and fish (Harrington 1909:139-142).

The first serious archaeological investigations of Everglades tree islands occurred in the 1930s when the Smithsonian Institution directed Works Progress Administration (WPA) excavations at sites in Opa-locka and Hialeah. In 1932, archaeologist John Goggin began visiting Everglades sites (Carr 2002:188) and, from the late 1930s to the early 1950s, excavated sites in Everglades National Park (Goggin 1947:119; Milanich 1994:276). Based on his excavations, he demonstrated that human occupation of the region spanned a long period of time well represented by a sequential succession of pottery types and decorations (Goggin 1950:244-246). During the 1950s, Goggin excavated the Tamiami Trail I (8DA33) and Tamiami Trail III (8DA34) sites, both Glades I-III black dirt middens, located off U.S. Highway 41 (Tamiami Trail) approximately 10 km west of Miami. Faunal materials from the Tamiami Trail sites were identified during the early 1960s by Elizabeth S. Wing (Fradkin 1996).

For 20 years starting in 1953, avocational archaeologist Dan Laxson of Hialeah excavated sites in the eastern Everglades which were being threatened by development. He maintained good records and published reports with the encouragement of Ripley P.

Bullen of the Florida Museum of Natural History (Griffin 2002:65). In 1957, Laxson excavated the Madden's Hammock site (8DA45), located west of Hialeah just south of the Miami River, where he described an earthen pyramid-shaped mound that reached a height of 6 m and covered an area of 46 m x 15 m. Located on the sides of the mound were two cache features containing turtle bone. Laxson's excavations at an adjacent mound recovered materials indicating occupation during the Glades III period (Laxson 1957:1-4).

During the 1960s, more archaeological studies were conducted in the Everglades region. In 1964, John Griffin began to systematically survey the area, visited 21 sites and tested those at Onion Key, Walter Hamilton Place, and Hamilton Garden Patch. The Broward County Archaeological Society, an avocational group which was formed in 1968 under the direction of Wilma Williams, began a program conducting digs across Broward County and published a number of articles in *The Florida Anthropologist*. Another avocational group, the Miami-West India Archaeological Society, exclusively excavated endangered tree island sites. Their work at one such site, Tamiami Trail III (8DA34), where John Goggin originally conducted several test excavations in 1959, resulted in the recovery of large amounts of artifacts and the discovery of previously undocumented mortuary areas (Carr 1981:40, 2002:188-189). In 1969, Griffin conducted test excavations at Bear Lake mounds near Flamingo. During the following two decades, from the late 1970s through the 1980s, the National Park Service conducted archaeological surveys and excavations in the Big Cypress National Preserve and Everglades National Park under the general direction of Griffin (Griffin 2002:70-71).

The Honey Hill site (8DA411) is of particular importance, as aceramic Archaic and later Glades periods are represented, as well as possible historic Seminole habitation (Keel 1990: 68; Masson and Hale 1990:11-13; Wheeler 2004:18). Honey Hill was first identified as the North Dade site in 1975 by the State of Florida Archives, History, and Records Management (Carr et al. 1990:1). Salvage archaeology was conducted at the site by the Archaeological and Historical Conservancy, Inc. (AHC), prior to its development for the Joe Robbie Stadium parking lot. Four test units were excavated and a 20 cm x 20 cm column sample was taken from each unit. Like other Everglades sites, Honey Hill is situated on a black dirt midden (Carr et al. 1990).

Guy Bailey (8DA4752) is a tree island site in the eastern Everglades and was excavated by Robert Carr in 1989. The site is located on a small tree island in northern Miami-Dade County. Based upon the ceramic assemblage, the site dates to the Glades IIa-IIb periods (AD 750-1100) (Keel 1990).

The MacArthur #2 (8BD2591) and Sheridan Hammock (8BD191) sites were first reported in an archaeological survey conducted by Robert Carr, Joe Davis, and Willard Steele in 1993 (Carr et al. 1994). The two sites were subsequently excavated by Robert E. Johnson of Florida Archeological Services, Inc. (Johnson et al. 1996). Both sites are black dirt middens located on small relict tree islands situated in the former eastern Everglades. MacArthur #2 dates to the Archaic period and Sheridan Hammock (8BD191) contains a Glades II occupation (Johnson et al. 1996).

Beginning in 2004, the National Park Service's Southeast Archeology Center (SEAC), under the direction of Margo Schwadron, began to investigate the Everglades National Park's Eastern Expansion Area, which runs along the eastern edge of the Shark

River Slough. All of the sites identified were pre-Columbian, black earth middens dense with material cultural and faunal remains. Five of the sites identified indicate that the Everglades region was inhabited considerably earlier than previously thought. The five sites—Sour Orange, Poinciana, Irongrape, Heartleaf, and Grossman's hammocks—all contain evidence that Archaic people hunted, fished, and processed food in the developing Everglades tree island ecosystem of 5,000 years ago (Schwadron 2006).

The West Kendall site is located on land that is historically part of the eastern Everglades and is situated at the northern end of a large prominent tree island in Miami-Dade County. The site was first reported by the Peninsular Archaeological Society, operating out of the Miami Museum of Science in the 1970s. The Society noted multiple types of artifacts, including celt and shell tools, bone points, and ornaments. In 1983, Robert Carr visited the site and supervised volunteers who completed surface collections. In 2002, a Phase I archaeological survey was completed by the AHC. A Phase III excavation was conducted in 2008, also by AHC (Beriault et al. 2002; Franklin et al. 2008).

Previous Everglades Zooarchaeological Research

Although there is a large and growing body of archaeological studies that have been conducted for the Everglades region, only a few have involved detailed zooarchaeological analysis. Consequently, there is a relative need for more investigations. Only then will a more complete picture of pre-Columbian lifeways in the Everglades begin to emerge. The following sites are representative of inland tree island sites where zooarchaeological analysis was completed.

The faunal assemblage for the Honey Hill site was retrieved from four column samples in consultation with Robert Carr and Amy Felmley. Faunal samples were collected during excavations at the site by Marilyn A. Masson and AHC staff from January through May 1988. The dimensions of column samples measured 50 cm x 50 cm, and depths varied according to stratigraphy observed. The levels sampled generally included a surface zone, high midden zone, low midden zone, and levels below the midden until sterile. Some variables considered in column sample selection included the horizontal location of the samples across the site and their cultural association. Columns were screened in the field, with 3.2 mm (1/8 inch) and 1.6 mm (1/16 inch) fractions bagged separately (Carr et al. 1990). Carr and Felmley identified areas of the site which corresponded to Archaic and Seminole components in addition to the dominant late pre-Columbian Glades material. A total of 136,720 bones and bone fragments were analyzed from a sample volume of over 2 m^3. Laboratory analysis was conducted using the National Park Service SEAC Lab zooarchaeological collection at Florida State University (Carr et al. 1990).

Frank J. Keel (1990) conducted an analysis of faunal samples at the Guy Bailey site for his Master's thesis at Florida State University. Faunal samples consisted of collections made in 3.2 mm (1/8 inch) and 1.6mm (1/16 inch) screens from levels 2, 3, 4, and 5 from a single test pit excavated near the highest point of the island. Additional samples were retrieved through surface collection and within the backfill and spoil piles at the site (Keel 1990:50). Keel focused on the reconstruction of subsistence strategies and site function. He concluded that this site functioned as a resource procurement site, with occupation occurring seasonally. The faunal remains indicate an intense focus on local wetland resources (Keel 1990:48,57).

The faunal assemblages for both MacArthur #2 and Sheridan Hammock were recovered from excavations conducted in 1995 and 1996. Excavation units were dug in 10 cm arbitrary levels within natural strata. Archaeologists at each site removed a column soil sample from a test unit excavated within the most concentrated portion of the midden deposit; a 50 cm x 50 cm area was dug in 10 cm levels in the corner of the test unit. Remains were recovered through flotation, divided into three fractions, 6.4 mm (1/4 inch), 3.2 mm (1/8 inch), and 1.6 mm (1/16 inch) (Fradkin 1996, 2004, 2007; Johnson et al. 1996). Fradkin analyzed the faunal remains from one level of the column sample at each site: at MacArthur, Level 2 (10-20 cm below surface), and for Sheridan Hammock, Level 3 (20-30 cm below surface). Both samples examined contained over 15,000 identifiable specimens (Fradkin 1996, 2004, 2007).

Archaeological deposits at Heartleaf Hammock (8DA2192) suggest that this was a campsite used primarily for subsistence resource procurement, with inhabitants involved in a fishing-hunting-gathering subsistence pattern (Fradkin 2016; Graf et al. 2008; Schwadron 2006). A column sample excavated to bedrock at a depth of 185 cm, measuring 50 cm x 50 cm for each 10-cm arbitrary level, was sieved through 6.4 mm (1/4 inch), 3.2 mm (1/8 inch), and 1.6 mm (1/16 inch) nested screens. Faunal materials from the bottommost level of the shovel test were used for the study, and at a depth of 170 to 180 cm below surface (Fradkin 2016; Schwadron 2005). Fradkin notes an enormous quantity of materials recovered in the screened soil sample, whereupon she analyzed faunal remains from a certain percentage of the total weight of the 6.4 mm and 3.2 mm fractions (Fradkin 2016).

Previous zooarchaeological research discussed in this chapter is representative of sites where in-depth faunal analysis has been completed, and are typical black dirt middens located within the context of the Everglades environment. As camping and procurement sites, zooarchaeological analysis provides an understanding to the lifeways of the pre-Columbian peoples who inhabited the tree islands of the Everglades. As a resource procurement site, it is expected that the inhabitants would bring with them only the materials needed to exploit the resources available surrounding the tree island. Habitation is likely to occur only in specific times of the year when resources are most easily procured, those being resources meant for consumption. Hunting-fishing-gathering lifestyles were observed at all of the mentioned sites, thus understanding substance patterns through faunal analysis is paramount for understanding Everglades cultures.

CHAPTER FOUR: MATERIALS AND METHODS

The West Kendall Site

The West Kendall site (8DA1081) is located in the West Kendall neighborhood in central Miami-Dade County. Franklin (2008:3) describes the site as a black dirt midden situated on the northeast end of an Everglades tree island. The site measures approximately 15 m in diameter with a maximum elevation of about 75 cm to 1 m above the adjacent wetlands. Existing features include both a midden and a burial (Franklin et al. 2008:19). The surface of the site was greatly disturbed and covered with fill and redeposited sediment. According to the 2008 site report, however, intact sediments with cultural deposits were encountered below the fill (Franklin et al. 2008:25-27).

Figure 1: Location of West Kendall site

The West Kendall site was first reported in 1973 by the Peninsular Archaeological Society in *Muse News*, the journal published by the Archaeological Society of Museum of Science. The Society conducted excavations in 1971 and 1972. The society had to stop excavations in 1972 because part of the site was being bulldozed. The Society collected artifacts including incised ceramics dating from Glades I to Glades III periods, such as Fort Drum Incised, Miami Incised, Opa Locka Incised, Glades Tooled, and a non-local type classified as Englewood Incised (Archaeological Society of Museum of Science 1973).

In the late 1970s, Dr. John Reiger, a history professor at the University of Miami, conducted several surface collections at the West Kendall site. Robert Carr recognized the importance of the West Kendall site and compiled all the then-known information concerning the site in his archaeological survey of Miami-Dade County sites in 1979

(Carr 1981; Franklin et al. 2008:11). Carr visited the site in January 1983, supervising surface collecting in transects along the bulldozed property. Volunteers recovered Surfside Incised sherd, a poll fragment from a basaltic celt, diagnostic shell tools, a Russian blue faceted trade bead dating to 1880-1900, and fragmentary human bone from multiple locations. Dr. Yasar Iscan of Florida Atlantic University subsequently assessed the human remains (Franklin et al. 2008:11). After 1983, archaeological research would not take place for another nine years, leaving the site open to more disturbance, and ultimately leading to it being removed from eligibility in the National Register of Historic Places.

In May 2002, the AHC began a Phase I archaeological assessment for Biscayne Environmental Services Inc., and completed in accordance to a Certificate to Dig issued by the Office of the Miami-Dade County Historic Preservation (Beriault et al. 2002:1). With the principal project goal was to conduct systematic subsurface testing across the site to determine its physical boundaries (Beriault et al. 2002:13). The secondary goal of the project was to determine the degree of disturbance due to bulldozing since 1983. Prior to conducting fieldwork, the AHC conducted an archival and literature search, studying archaeological reports of Miami-Dade County, to clarify that the site was within the project area of previous investigations conducted in 1972 and 1983 (Beriault et al. 2002:13). The project area was surveyed to locate any archaeological or historical sites that might be affected by proposed development at the parcel, including the site itself and the surrounding area also to be impacted. Prior to this assessment, numerous episodes of clearing had occurred at the site and the parcel of land that the site sits upon, resulting in bulldozing of the midden mound nearly level to the surrounding area. Ceramic sherds recovered in the Phase I survey included Incised Glades Series ceramics, faceted Russian Blue trade beads, and non-local imported stone artifacts. Frequency of such items, however, was not listed in the Phase I report (Beriault et al. 2002:4).

Following the Phase I assessment, the AHC conducted a Phase III data recovery excavation in 2008. A 2 m^2 unit was excavated in the site's north end and two 1 m^2 units were excavated on top of exposed fire-altered features in the center and south, respectively. Soils were excavated in 20 cm arbitrary levels within the natural strata, within the midden on the northern section of the site. A total of 2,182 ceramic sherds were recovered, of which 2,101 were sand-tempered plain (Franklin et al. 2008:23). Human remains were highly fragmented and non-articulated, recovered from discrete locations in the northern block of the site within the midden. (Franklin et al. 2008:25). Human remains were received by the AHC Osteology Laboratory for processing and analysis, while all other cultural materials were bagged, labeled, numbered, and transferred to the AHC Collections Lab in Davie, Florida (Franklin et al. 2008:16,25). Human remains were later reinterred in the adjacent West Kendall Archaeological Zone (Franklin et al. 2008:1). Archaeologists from AHC consulted with Miami-Dade County Archaeologist Jeff Ransom and determined that the rest of the project area would be excavated by backhoe removing all sediments and exposing the bedrock, which was monitored by both AHC and Ransom. A field map was created in which Surveyor Tedd Riggs established elevations for bedrock across the site and showed the location and boundaries of the site's rocky substrate.

Based upon the archaeological findings, the site was occupied for over 2,500 years, from the end of the Late Archaic Period through the Glades Period (Franklin et al.

2008:27). Occupations were probably seasonal, with resource exploitation occurring at specific times of the year. Artifacts recovered from the site include lithics, ceramics, both worked and unworked shell, as well as human and animal remains. While human remains were present at the site, it was never determined that this would represent a burial site, as the remains were too fragmentary (Franklin et al. 2008:1).

Materials

The vertebrate faunal remains analyzed in this thesis were recovered during Phase III excavations conducted at the site from March through July of 2008 by the AHC with Robert S. Carr as Principal Investigator. Prior to fieldwork, the project area was cleared of invasive flora by Miami-Dade Public Works, which was monitored by AHC. Five north-south trenches and two east-west trenches were excavated by backhoe to expose intact sediments. One 2 m x 2 m unit was excavated at the parcel's northern end and two 1 m x 1 m units were excavated at fire-altered features near the project area's center and southern end. Soils were excavated systematically in 20 cm arbitrary levels within natural strata. A column sample was collected from the western wall of Test Unit 1 and consisted of four levels (Franklin et al. 2008:16,17,40).

Soils were screened through 6.4 mm (1/4") mesh hardware cloth. Recovered materials were bagged, labeled, numbered, and transferred to the AHC Collections Lab. The column sample was floated and processed using nested 6.4 mm (1/4 inch), 3.2 mm (1/8 inch), and 1.6 mm (1/16 inch) screens, and then submitted to the Department of Anthropology at Florida Atlantic University for analysis. The 6.4 mm (1/4 inch) materials from each level of the column sample were examined for this study.

Methods

Analysis of the vertebrate faunal materials followed standard zooarchaeological procedures (Reitz and Wing 2008). Specimens were identified to the lowest taxon possible using the comparative collection at the Department of Anthropology at Florida Atlantic University. A record was made for each specimen identified, the element represented, the portion of the element recovered (proximal, distal, and/or shaft), its side (left or right), and any evidence of modification (Reitz and Wing 2008). The identifications were completed by Arlene Fradkin.

Quantification of faunal materials included a count of the total number of identified specimens of each taxon (NISP) and calculated estimates of the minimum number of individual animals represented (MNI) (Casteel 1976:93-102; Grayson 1984:172-174; Reitz and Wing 2008:171-238). Each level of the column sample was treated as a discrete sample and quantified separately. The MNI determinations were calculated for every lower level taxon (genus, species) identified and were based on the most abundant elements represented. Specimens from higher taxon identifications (class, order, family) were not used in determining MNI unless such specimens represented individuals at a more precise taxonomic classification were not included in identification.

CHAPTER FIVE: THE VERTEBRATE FAUNAL ASSEMBLAGE AT WEST KENDALL

Taxa Representation

A total of 5,632 vertebrate fragments representing at least 108 individuals were identified in the portion of the West Kendall site faunal assemblage that was studied. All taxa identified in the assemblage are listed in Table 1. Calculations for the cumulative stratigraphic levels are included in Table 2, while each of the four stratigraphic levels are presented individually by taxonomic account in Appendices A, B, C, and D.

Table 1: Taxonomic List

SCIENTIFIC NAME	**COMMON NAME**
CARTILAGINOUS FISHES	
Euselachii	Sharks
RAY-FINNED FISHES	
Lepisosteus spp.	Gar
Amia calva	Bowfin
Ictaluridae	North American freshwater catfish
Lepomis microlophus	redear sunfish
Micropterus salmoides	largemouth bass
Centrarchidae	Sunfishes
Actinopterygii	ray-finned fishes
AMPHIBIANS	
Amphiuma means	two-toed amphiuma
Siren lacertina	greater siren
Caudata	Salamanders
Anura	frogs/toads
REPTILES	
Chelydra serpentine	common snapping turtle
Sternotherus spp.	musk turtle
Kinosternidae	mud/musk turtles
Apalone ferox	Florida softshell
Pseudemys spp.	cooter/slider

SCIENTIFIC NAME	**COMMON NAME**
REPTILES (continued)	
Terrapene carolina	eastern box turtle
Emydidae	pond and marsh turtles/box turtle
Testudines	turtles
Alligator mississippiensis	American alligator
Viperidae	pit vipers
Nerodia spp.	water snake
Colubridae	colubrids
Serpentes	snakes
Reptilia	reptiles
MAMMALS	
Didelphis virginiana	opossum
Procyon lotor	raccoon
Odocoileus virginianus	white-tailed deer
Rodentia	rodents
Sylvilagus spp.	rabbit
Small Mammalia	small mammals
Medium Mammalia	medium mammals
Mammalia	mammals
OTHER	
Tetrapoda	four-footed vertebrates

Table 2: Totals of All Taxa Identified - All Levels

Taxon	**NISP**	**Percent**	**MNI**	**Percent**
Euselachii	4	0.07%	2	1.85%
Lepisosteus spp.	1047	18.59%	13	12.04%
Amia calva	341	6.05%	11	110.19%
Ictaluridae	12	0.21%	4	3.70%
Lepomis microlophus	20	0.36%	3	2.75%
Micropterus salmoides	324	5.75%	20	18.52%
Centrarchidae	1	0.02%		
Actinopterygii	857	15.22%		
Amphiuma means	2	0.04%	2	1.85%
Siren lacertina	29	0.51%	4	3.70%
Caudata	27	0.48%		
Anura	1	0.02%	1	0.93%
Chelydra serpentina	34	0.60%	5	4.59%
Sternotherus spp.	2	0.04%	2	1.85%
Kinosternidae	138	2.45%	5	4.56%
Apalone ferox	53	0.94%	4	3.70%
Pseudemys spp.	3	0.05%	1	0.93%
Terrapene carolina	37	0.66%	1	0.93%
Emydidae	12	0.21%	3	2.75%
Testudines	503	8.93%		
Alligator mississippiensis	3	0.05%	2	1.85%
Viperidae	50	0.89%	5	4.59%
Nerodia spp.	36	0.64%	4	3.70%
Colubridae	58	1.03%	7	6.48%
Serpentes	604	10.72%		
Reptilia	5	0.09%		
Didelphis virginiana	2	0.04%	1	0.93%
Procyon lotor	6	0.11%	2	1.85%
Odocoileus virginianus	4	0.07%	1	0.93%
Rodentia	2	0.04%	1	0.93%
Sylvilagus spp.	12	0.21%	3	2.75%
Small Mammalia	4	0.07%		
Medium Mammalia	5	0.09%		
Mammalia	17	0.30%	1	0.93%
Tetrapoda	100	1.78%		
Vertebrata	1277	22.67%		
Totals	**5632**	**100.00%**	**108**	**100.00%**

Table 3: NISP and MNI by Vertebrate Class

Class	**NISP**	**Percent**	**MNI**	**Percent**
Chondrichthyes	4	0.09%	2	1.85%
Actinopterygii	2602	61.15%	51	47.22%
Amphibia	59	1.39%	7	6.48%
Reptilia	1538	36.15%	39	36.11%
Mammalia	52	1.22%	9	8.33%
Totals	**4255**	**100.00%**	**108**	**100.00%**

Ray-finned fish and reptiles were the two most abundant classes represented in terms of NISP and MNI (Table 3). Among the entire faunal assemblage, mostly freshwater aquatic taxa were represented (Table 4).

Table 4: Comparison of Freshwater Aquatic vs Terrestrial Vertebrates

HABITAT	**TAXA**	**NISP (%)**	**MNI (%)**
Freshwater Aquatic	*Lepisosteus* spp.	1047 (34.58)	13 (14.44)
	Amia calva	341 (11.26)	11 (12.22)
	Ictaluridae	12 (0.40)	4 (4.44)
	Lepomis microlophus	20 (0.66)	3 (3.33)
	Micropterus salmoides	324 (10.70)	20 (22.22)
	Centrarchidae	1 (0.03)	
	Actinopterygii	857 (28.30)	
	Amphiuma means	2 (0.07)	2 (2.22)
	Siren lacertina	29 (0.96)	4 (4.44)
	Caudata	27 (0.89)	
	Chelydra serpentina	34 (1.12)	5 (5.56)
	Sternotherus spp.	2 (0.07)	2 (2.22)
	Kinosternidae	138 (4.56)	5 (5.56)
	Apalone ferox	53 (1.75)	4 (4.44)
	Pseudemys spp.	3 (0.10)	1 (1.11)
	Alligator mississippiensis	3 (0.10)	2 (2.22)
	Viperidae	50 (1.65)	5 (5.56)
	Nerodia spp.	36 (1.19)	4 (4.44)
	Total Freshwater Aquatic	**2979 (98.38)**	**85 (94.44)**
Terrestrial	*Terrapene carolina*	37 (1.22)	1 (1.11)
	Didelphis virginiana	2 (0.07)	1 (1.11)
	Procyon lotor	6 (0.20)	2 (2.22)
	Odocoileus virginianus	4 (0.13)	1 (1.11)
	Total Terrestrial	**49 (1.62)**	**5 (5.56)**
Totals		**3028 (100)**	**90 (100)**

Species Richness and Diversity Testing

SHE Test

A SHE test (Hayek and Buzas 2008:342) was conducted to assess species richness, diversity, and evenness across levels at the West Kendall site (Figure 2). The SHE test was conducted Paleontological Statistics Software Package for Education and Data Analysis (PAST) (Hammer et al. 2001). SHE is a distribution free methodology that allows the researcher to understand the observed data in a holistic manner. Species richness (S) is the number of species in the sampling units, while evenness refers to distribution of species individuals in each environment (Salarian et al. 2014:30). Evenness refers to the uniformity of distribution of individuals within taxa (E). The SHE approach combines richness and evenness into each other and then assess the sharing amount of each composition. The Shannon (H) diversity index is formed by information theory. SHE index may serve to distinguish spatial and temporal changes of plant or animal species (Salarian et al. 2014:30) Pairwise addition of individual species to group assemblages so that no overall view of the structure of the community exists. The development covers multiple successive samples from a biome, ecosystem, or ecological community that gives a snapshot of the total assemblage over space or time and provides a complete synthesis of the observed data (Hayek and Buzas 2010:343).

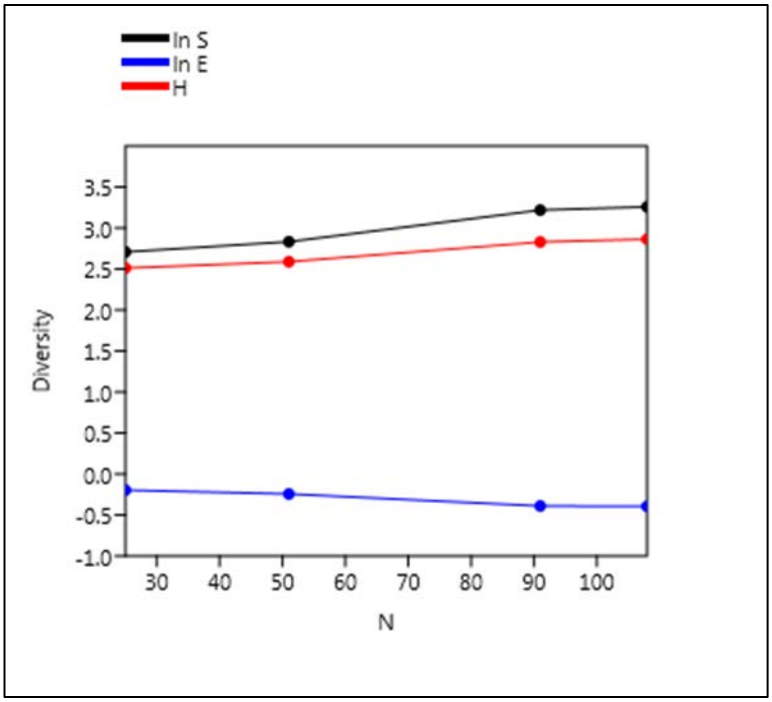

Figure 2: SHE Test of West Kendall site

The SHE test was completed using MNI of taxon within the designated FS. (Appendices A-D) Species richness and diversity show a general positive trend, while evenness is evident of a negative trend. The data suggests relative ecological or subsistence stability over time.

Diversity Testing

Diversity indices were utilized to assess species diversity at a localized scale. Diversity indices were examined using PAST software (Hammer et al. 2001). MNI for each level (Appendices A-D) were assessed to calculate diversity indices. The Berger-Parker index is used to examine abundance in areas of disturbance to assess dominance patterns (Caruso et al. 2007:3278-3280).

$$D = N_{max} / N$$

Berger-Parker analysis indicates that at all levels, rates of abundance are similar. The Berger-Parker index expresses the proportional importance of the most abundant species. The Berger-Parker index is particularly useful when considering ecosystem and habitat. This method may be used to express dominance within an assemblage. The Simpson’s index may be used to measure the proportional abundance of the most common food resource (Caruso et al. 2007).

$$\boldsymbol{\lambda = \sum_{i=1}^{R} p\frac{2}{i}}$$

The Simpson’s index considers the number and relative abundance of each species, so as richness and evenness increase, diversity will continue with it. McCartney and Glass (1990) recommend the Shannon Diversity index to study richness in sampling, suggesting that interpretations of change in animal economy may be addressed, specifically heterogeneity of the sample. The Alpha diversity indices quantified at the West Kendall site demonstrate consistency over time.

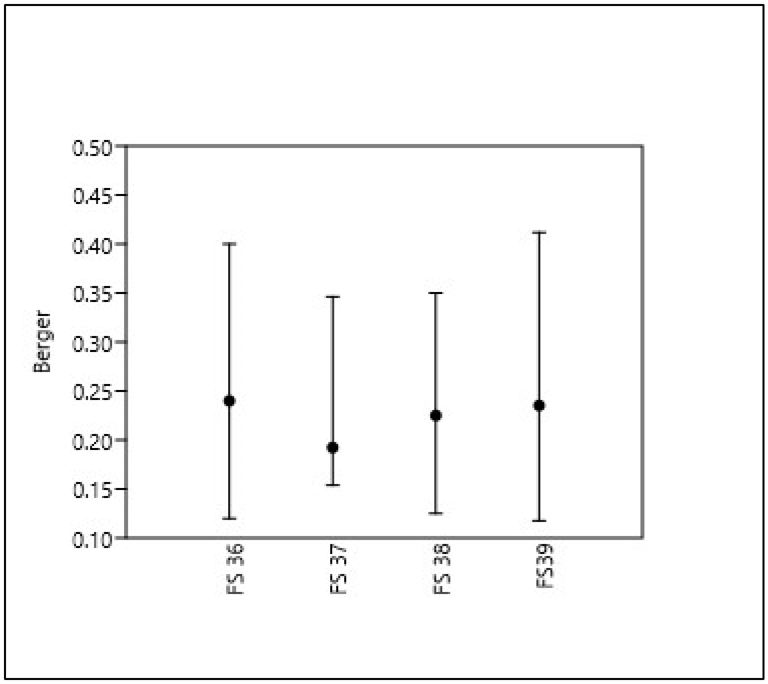

Figure 3: Berger-Parker Measure of Dominance – West Kendall site

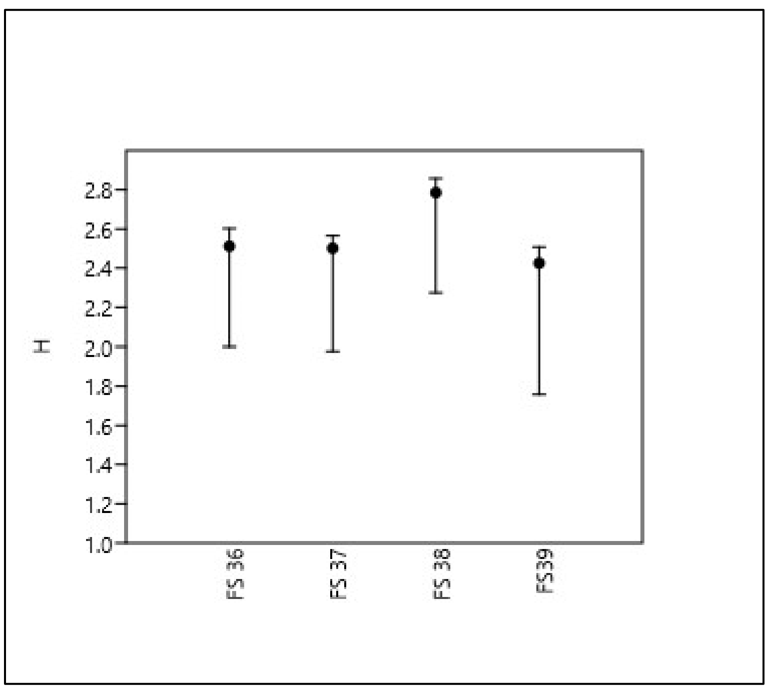

Figure 4: Shannon Diversity Index (H) – West Kendall site

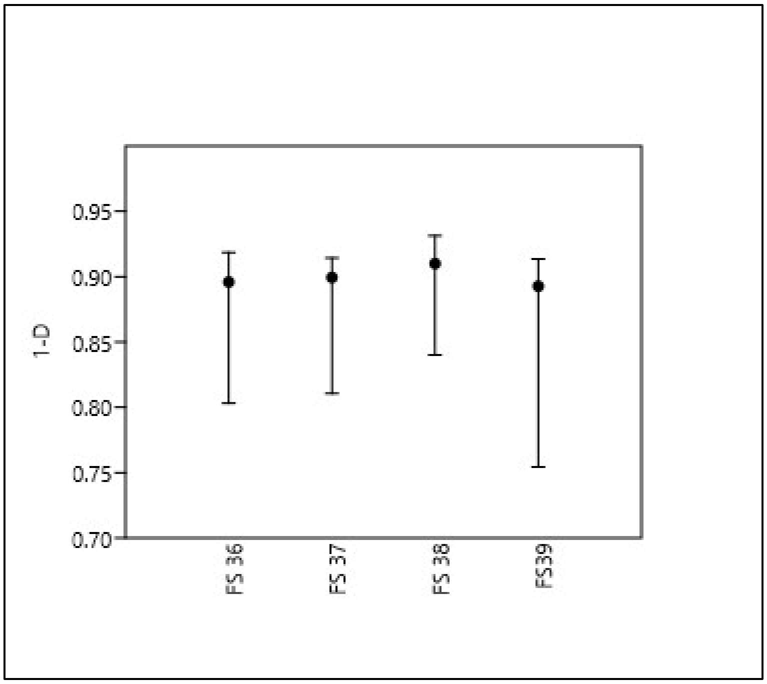

Figure 5: Simpson's Diversity Index - West Kendall site

Beta Diversity Testing

Beta Diversity indices assess presence-absence, and provide detail as to where diversity exists between levels. PAST (Hammer et al. 2001) was utilized to determine beta diversity. Beta diversity is a measure of presence-absence (1/0) data. While all levels are indicative of low levels of diversity, it is important to assess exactly where we expect to see changes in taxonomic composition. A Whittaker test (Whittaker, 1960) was conducted to compare diversity between levels of the West Kendall site.

$$\frac{\boldsymbol{S}}{\overline{\boldsymbol{\alpha}}} - \mathbf{1}$$

A Whittaker test may be used to assess species distribution in relation to environmental gradients (Whittaker 1960). Whittaker originally suggested that beta diversity should be measured as the proportion by which species richness of a region exceeds the average richness of a single locality within that region (Whittaker

1960;Koleff et al 2003:368). This assessment is confirmed with a Wilson-Schmida test, which was initially developed to assess differences in habitat conditions based on species diversity (Shmida and Wilson 1985:6).

$$\frac{\boldsymbol{g(H) + l(H)}}{\boldsymbol{2\bar{_\alpha}}}$$

Shmida and Wilson (1985) maintain that no matter how homogeneous, all ecosystems are susceptible to variation.

Table 5: Wilson-Shmida Beta Diversity – West Kendall site

	FS 36	FS 37	FS 38	FS 39
FS 36	0	0.13333	0.2973	0.21429
FS 37	0.13333	0	0.35135	0.28571
FS 38	0.2973	0.35135	0	0.37143
FS 39	0.21429	0.28571	0.37143	0

Discussion

Diversity analysis demonstrates a relatively consistent pattern in animal procurement at the West Kendall site. Richness, diversity, and evenness of species demonstrated no major variation throughout levels. This stasis demonstrates consistency in both subsistence strategy as well as resource availability.

Description of Taxa

Ray-finned fish were predominant throughout all levels of the column sample. Many of the fish species represented in the zooarchaeological assemblage still exist in the Everglades today (Dineen 1984; Loftus and Kushlan 1987).

The most common types of fishes include largemouth bass, gar, and bowfin. Largemouth bass (*Micropterus salmoides*) is the largest sunfish occurring in the

Everglades where it may reach 6.4 kg (Dineen 1984:261; Loftus and Kushlan 1987:245). It prefers warm quiet waters with vegetation (Gilbert and Williams 2002:351; Lee et al. 1980:608; McClane 1978) and tends to be more common in deeper portions of the Everglades marsh (Dineen 1984).

Gar (*Lepisosteus* spp.) may be found year-round in shallow open marsh areas of the Everglades. They are widely dispersed during the wet season and concentrate in large numbers in gator ponds as water levels drop during the dry season (Dineen 1984:264; Loftus and Kushlan 1987:180-182). The most common species of gar found in the Everglades is Florida gar (*Lepisosteus platyrhincus*) (Dineed 1984:264), though specimens could be identified only to the genus level.

Bowfin (*Amia calva*) is a heavy-bodied fish with a depressed head and wide mouth. Its head is covered with bony plates dorsally and a gular plate ventrally. This fish may reach a maximum length of 86 cm (Gilbert and Williams 2002:89). Like gar, bowfin is highly predaceous, feeding primarily upon other fish (Lee et al. 1980:53). Gar and bowfin are adapted for surviving the conditions of the Everglades dry season. A modified swim bladder allows them to absorb atmospheric oxygen at the water's surface, surviving in oxygen-deficient waters (Dineen 1984:260,264; Gilbert and Williams 2002:86,90; Loftus and Kushlan 1987:182,183; McClane 1978:179; Page and Burr 1991:29,31).

Other fish represented include redear sunfish and North American freshwater catfishes. Red-eared sunfish (*Lepomis microlophus*) is a small sunfish. Its sheer abundance makes it an easily acquired resource in the Everglades system. This particular species of sunfish has highly developed molar-like grinding teeth that are set into large pharyngeal plates located on the back of its mouth, which are used to crush aquatic snails (Dineen 1984:261; McClane 1978:129-130).

North American catfishes (Ictaluridae) typically do well in calm waters (Lee et al. 1980; Page and Burr 1991) and are found throughout the Everglades marsh (Dineen 1984:264; Loftus and Kushlan 1987:193). Several species may be found in the Everglades, though specimens could be identified only to the family level.

Fishing may have been carried out more frequently in the dry season when water levels were low and fish were concentrated in the few available wet areas. Gar and catfishes tend to congregate in gator holes as waters recede (Dineen 1984; Loftus and Kushlan 1987:283-284) and therefore would have been easier to catch in the dry season.

Cartilaginous fish were minimally represented. Four shark (Euselachii) teeth were identified. These teeth may have been brought from the coast for ornamentation or for tool use.

Reptiles represented consisted of turtles, alligator, and snakes. Turtles consisted of snapping, mud/musk, softshell, cooter/slider, and box turtle. Snapping turtle (*Chelydra serpentina*) is highly aquatic, occurring in quiet or slow-moving waters with abundant vegetation (Bartlett and Bartlett 2011a:77) and is quite common in the Everglades. Mud and musk turtles (Kinosternidae) are very small turtles. The most common species of Kinosternidae found in the Everglades is musk turtle (*Sternotherus odoratus*). Both musk and mud turtles are strongly aquatic, only occasionally venturing onto land (Bartlett and Bartlett 2011a:79; Conant and Collins 1998:149).

Florida softshell (*Apalone ferox*) is a large freshwater turtle. It is considered a powerful and agile swimmer and prefers ponds, lakes, marshes, and other quiet still waters (Bartlett and Bartlett 2011a:115; Conant and Collins 1998:194,199). Cooters and sliders (*Pseudemys* spp.) are found in a variety of permanent freshwater sources, including ponds, lakes, rivers, marshes, and sloughs. They prefer to remain within aquatic environments, only exiting for purposes of sunning themselves (Bartlett and Bartlett 2011a:98; Conant and Collins 1998:174).

Box turtle (*Terrapene carolina*) is the only terrestrial turtle species represented. It has a hinged plastron, allowing the species to withdraw completely into its shell (Conant and Collins 1998:160).

The American alligator (*Alligator mississipiensis*) is not found in abundance at the West Kendall site. Dermal scutes are the primary remains recovered at archaeological sites. This is true of the Kendall site as well. While alligators tend to be abundant in the Everglades and seemingly a good source of meat, Griffin (1988) believes that religious avoidance or taboo of alligators may explain their absence in archaeological sites.

Snakes represented included both nonpoisonous and poisonous kinds. Nonpoisonous snakes consisted of colubrids (Colubridae), such as water snakes (*Nerodia* spp.). Several species of water snakes are very abundant in the Everglades. Pit vipers are poisonous snakes. The most common kind of pit viper in the Everglades is the cottonmouth moccasin (*Agkistrodon piscivorus*), a freshwater species, though specimens were only identified to the family level. Colubrids can be distinguished in the wild for having a more oval head shape than their pit viper counterparts.

Amphibian remains included salamanders and toad/frog. Salamanders consisted of both greater siren (*Siren lacertina*) and two-toed amphiuma (*Amphiuma means*). Both species are aquatic and are typically found in shallow freshwater habitats (Bartlett and

Bartlett 2011b:132,168). Greater siren remains were far more common in the faunal samples. Only one frog/toad (Anura) bone was identified.

Several kinds of mammals were represented, though by a relatively small number of specimens. Rabbit (*Sylvilagus* spp.) was the most abundant mammal identified. Although two species populate South Florida, eastern cottontail (*Sylvilagus floridanus*) and marsh rabbit (*Sylvilagus palustris*), only the latter is found in the Everglades (Layne 1984:273) and is most likely the one represented at the site.

Medium-sized mammals include opossum and raccoon. Opossum (*Didelphis virginiana*) is the only marsupial in Florida. Raccoon (*Procyon lotor*) is a medium-sized long-tailed mammal and is the most abundant carnivore in south Florida, occurring in a wide range of habitats (Layne 1984:279). White-tailed deer (*Odocoileus virginianus*) is the largest mammal identified in the faunal assemblage, although those found in Florida tend to be much smaller than their northern counterparts.

The small- and medium-sized mammals may have been clubbed or snared, whereas deer were most likely hunted with spears. Terrestrial mammals are forced onto tree islands in the summer, meaning that it may be more efficient to hunt them in the wet season. During this time, they are forced to seek shelter upon the elevated tree islands, the only dry land above the flood waters (Parker 1984:31).

Birds were not represented in the documented faunal assemblage at the West Kendall site. Birds tend to be uncommon at Everglades sites, despite the fact that they would have been readily available. It is possible that birds may have been honored for their aesthetic qualities, and thus not used as a food resource (Griffin 1988; Keel 1990).

The dominance of aquatic resources at the West Kendall site would indicate a reliance upon fishing and harvesting of aquatic resources. Fishing would have been more likely carried out during the dry season, when water levels are much lower and fish and aquatic reptiles would be concentrated in fewer areas. This exploitation of aquatic environments (Dineen 1984:Fradkin 2016:467; Loftus and Kushlan 1987:283,284)

CHAPTER SIX:

COMPARISONS WITH OTHER SOUTH FLORIDA EVERGLADES SITES

Comparative Everglades Sites

The zooarchaeological assemblage at West Kendall can be compared to that of other pre-Columbian sites in the Everglades. The sites selected for comparison were Guy Bailey (8DA4752), MacArthur #2 (8BD2591), Sheridan Hammock (8BD191), and Heartleaf Hammock (8DA2192). These are all inland sites located on Everglades tree islands where detailed faunal analysis had been completed. The sites were compared in terms of taxonomic composition (Table 7) and the relative abundance of taxa based upon MNI figures. Heartleaf Hammock and MacArthur #2 are noted for Archaic occupation, while West Kendall, Guy Bailey, and Sheridan Hammock are considered occupations of the Glades periods when discussing faunal materials.

Guy Bailey (8DA4752)

The Guy Bailey site is a black dirt midden located on an Everglades tree island in northern Miami-Dade County. Ceramics recovered from the Guy Bailey site place the time of occupation at roughly 200 years within the Glades II period (Keel 1990:53). Keel (1990:57) suggests that the site was likely a short-term camp or resource procurement site. The Archaeological and Historical Conservancy (AHC) conducted salvage work on the western edge of the island in February 1989 (Keel 1990:48). Faunal remains were recovered from a single test unit and were screened in 3.2 mm (1/8 inch) and 1.6 mm (1/16 inch) mesh from levels 2, 3, 4, and 5. Level 5 additionally included a 6.4 mm (1/4 inch) sample (Keel 1990:50). This test unit was situated at a high part of the tree island away from the bulldozed area (Keel 1990:53). The faunal remains were analyzed by Keel for his Master's thesis at Florida State University. The 3.2 mm (1/8 inch) samples and the 6.4 mm (1/4 inch) samples produced a total of 159,148 fragments, of which 47,723 fragments were identified. Keel (1990:57) describes an intense focus on the local wetland resources associated with other Everglades tree island sites, with a heavy reliance upon freshwater fish and reptiles. Ray-finned fish accounted for 62% of the MNI. Reptiles contributed 22% of the MNI. Among reptiles, turtles accounted for 12% of the MNI and snakes an additional 10%. Freshwater species were dominant at the site, with 74% of the total MNI (Keel 1990:99).

MacArthur #2 (8BD2591)

The MacArthur #2 site is a black dirt midden located on a tree island in the eastern half of the Everglades in Broward County. MacArthur occupation dates to approximately 5000 B.C. to 2000 B.C. during the Middle Archaic or pre-ceramic Late Archaic (Carr et al. 1993; Johnson et al. 1996). Cultural materials recovered indicate that this was most likely a type of campsite, used primarily for subsistence procurement (Johnson et al. 1996). AHC began work on the MacArthur Tract began in November of 1993 and terminated by December of the same year (Carr et al. 2:1993). The faunal materials studied were recovered in 1995 and 1996 by Florida Archeological Services (Johnson et al. 1996). A column sample was taken with a total of nine 10-cm levels; each 10-cm level was bagged and floated, with recovery divided into 6.4 mm (1/4 inch), 3.2 mm (1/8 inch), and 1.6 mm (1/16 inch) nested screens. Faunal remains from one level of the column sample, Level 2 (10-20 cm below surface level), were examined (Fradkin

2004:60). A total of 16,833 bone remains, representing 48 vertebrate taxa, were identified at MacArthur #2 (Fradkin 1996, 2004). Fish represented the most dominant resource with an MNI of 82%. This was followed by reptiles at 9% MNI with snakes representing 4% of those individuals identified and other reptiles accounting for the remaining 5% of individuals identified. Mammals, birds, and amphibians only accounted for a small percentage of the MNI, less than 5% each (Fradkin 1996, 2004).

Sheridan Hammock (8BD191)

Sheridan Hammock is a black dirt midden, located within the MacArthur tract, approximately 1.6 km west MacArthur #2 (Johnson et al. 1996). Habitation at the site dates from AD 1200-1513, indicating a Glades III occupation (Carr et al. 1993:22; Johnson et al. 1996). Sheridan Hammock, like MacArthur #2, was also likely a campsite used primarily for subsistence resource procurement (Johnson et al. 1996). As with MacArthur #2, AHC conducted excavations from November to December of 1993 (Carr et al. 2:1993). Faunal remains studied were recovered from excavations later conducted by Florida Archeological Services (Johnson et al. 1996). Recovery methods at this site were the same as completed at the MacArthur #2 site; faunal remains at Sheridan Hammock were collected from Level 3 (20-30 cm below surface) of a column sample. At Sheridan Hammock, 15,585 specimens were recovered, representing 48 vertebrate taxa (Fradkin 1996, 2004). Fish represented an important resource at 50% of the MNI. This site is noted for a particularly high abundance of reptiles, contributing 36% of the MNI. Snakes were found in especially high concentrations, contributing 25% of the MNI. Mammals, birds, and amphibians again were representative of only a minimal portion of the MNI, each accounting for less than 7% of the total MNI (Fradkin 1996, 2004).

Heartleaf Hammock (8DA2192)

Heartleaf Hammock is a black dirt midden site, situated within a hardwood hammock on the easternmost part of the Everglades. It is noted for its early occupation, with people intensively harvesting resources as early as 4,400 years ago, just after the formation of the Everglades (Fradkin 2016:463). The archaeological deposits suggested that this was a campsite used primarily for subsistence resource procurement, with inhabitants involved in a fishing-hunting-gathering subsistence pattern (Fradkin 2016; Graf et al. 2008; Schwadron 2006). The faunal assemblage was recovered from excavations conducted in fall of 2004 by the National Park Service (Schwardron 2006). Systematic shovel testing was conducted and a total of eight shovel tests were dug at the site. A column sample measuring 50 cm X 50 cm for each 10-cm arbitrary level, was sieved through 6.4 mm, 3.2 mm, and 1.6 mm nested screens. Faunal samples were recovered from the bottommost level of this column sample at a depth of 170 to 180 cm below surface (Fradkin 2016:465). The faunal assemblage analyzed was very similar to that of other Everglades tree island sites in both quantity and type of animal represented (Fradkin 2016:465). Over 9,600 bone and tooth fragments representing 165 individuals were identified (Fradkin 2016:465). Ray-finned fish predominated with 72% of the MNI, while reptiles accounted for 16% of the MNI. Mammals, birds, and amphibians each represented less than 7% of the total MNI.

Discussion

The faunal remains identified at these sites are indicative of relative long-term stability within the Everglades ecosystem. Across all sites, we see an abundance of local freshwater aquatic resources over time. Despite cultural shifts occurring from the Archaic into Glades III, there does not seem to be any major shift in subsistence procurement away from aquatic resources on Everglades tree island sites. The West Kendall site rests approximately 20 km southwest of the Guy Bailey, 10 km southeast of Heartleaf Hammock sites, and approximately 45 km southwest of MacArthur #2 and Sheridan Hammock. All of these sites represent inland Everglades tree island sites. As with the West Kendall site, the faunal assemblages at Guy Bailey, MacArthur#2, Sheridan Hammock demonstrated a predominance of freshwater aquatic fauna. Fish, turtles, and snakes were by far the most common types of taxa selected and harvested by pre-Columbian peoples of the Everglades.

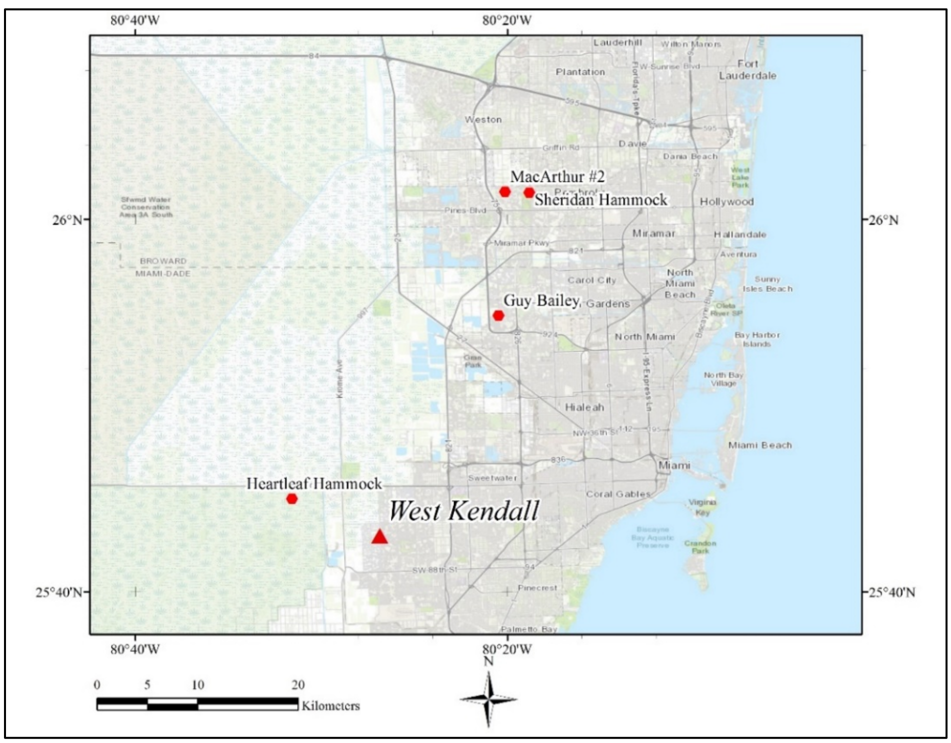

Figure 6: Map of Everglades Tree Island Sites Compared

Ray-finned fish represented accounted for the highest MNI by percentage across all sites. West Kendall and Sheridan Hammock were representative of the lowest MNI by percent, with both sites close to 50%, while all other sites were between 70% and 83% of the MNI. Gar, bowfin, largemouth bass, and other sunfishes were all found in relative abundance at each site; at Guy Bailey, however, no largemouth bass was identified. Freshwater catfish was recorded at West Kendall, MacArthur #2, and Sheridan Hammock. No catfish were recorded at Heartleaf Hammock. The high abundance of local freshwater fish could relate to   across Everglades tree island sites. Gar and bowfin are year-round residents of the Everglades; these fish, however, tend to congregate in gator ponds as water levels drop in the dry season. This would make procurement much easier in the dry season than in the wet season when these species could expand their range. These species remain abundant in the Everglades ecosystem today.

Several species of fish were minimally represented, with recovery only taking place at certain sites. Eels (Anguilliformes) were represented only at Sheridan Hammock. Jacks (*Caranx* spp.) were only identified at Sheridan Hammock and Heartleaf Hammock, and mullet (*Mugil* spp.) was only identified at Heartleaf Hammock. Jack and mullet are marine and brackish water species, although both fish are able to enter coastal rivers, ascending into fresh water. Pickerel (*Esox* spp.) was only documented at Heartleaf Hammock. This is a predatory freshwater fish that prefers vegetated lakes and swamps (Lee et al. 1980:131,137; Page and Burr 1991:60-62).

Turtles and snakes were common across all sites, indicating they were likely important food resources. West Kendall and Sheridan Hammock were similar in MNI of reptiles, with both sites just above 35% of the MNI. Guy Bailey and Heartleaf Hammock were both slightly above 15%, while the MNI of reptiles at MacArthur #2 was just above 8%. Freshwater aquatic turtles such as snapping turtles, mud turtles, musk turtles, cooters and sliders, and Florida softshell were identified at all five sites. Additionally, a terrestrial species, the eastern box turtle was identified at West Kendall, Guy Bailey, and Heartleaf Hammock. There is substantial representation of snakes at tree island sites as well. Water snakes were common at all sites. These snakes tend to be strong swimmers occurring in freshwater sources throughout Florida. Pit vipers were also identified at all sites. Mud snake (*Farancia abacura*) was noted at Guy Bailey and Heartleaf Hammock. The common kingsnake (*Lampropeltis getula*) was represented by a single cranial bone at MacArthur #2 (Fradkin 2004:65). The abundance of aquatic reptiles is significant as snake and turtle consumption are well documented at Everglades tree island sites. West Kendall appears to continue this subsistence trend, equaling or surpassing the four compared sites in MNI of aquatic reptiles.

Several other reptiles were recovered, though never in consistent numbers at any site. American alligator was identified at four sites, with Heartleaf Hammock being the exception, and at no site in abundance. Lizards (Lacertilia) were documented at MacArthur #2 and Sheridan Hammock, and Carolina anole (*Anolis carolinensis*) was identified at Heartleaf Hammock.

Amphibians consistently represented about 5%-7% of the MNI across all sites. Salamanders (Caudata) were represented at all sites, with two-toed amphiuma (*Amphiuma means*) and greater siren (*Siren lacertian*) identified at all but the Guy Bailey site. Frogs (Anura) were identified at all sites, albeit minimally.

Mammals contributed only a small percentage of the MNI at any given site. Deer were recovered from four sites, the only exception being MacArthur #2. Medium mammals such as opossum were recovered in small percentages from all sites, with raccoon recovered from West Kendall, Guy Bailey, and Sheridan Hammock. Mustelids were recovered from MacArthur #2 and Sheridan Hammock. With the exception of river otter (*Lontra canadiensis*) and American mink (*Neovison vison*), the medium and large mammals documented tend to favor terrestrial habitats. Rabbits were within the collections at all five sites. Aquatic habitats are more favorable to marsh rabbits who are much stronger swimmers than eastern cottontail who prefer dryer more upland locations. Rodents were identified at all sites as well; however, it is difficult to determine if they simply were a product of site disturbance. Rodents may be attracted to food resources living commensally or may represent an actively procured resource. The relative low abundance of these mammal species may indicate that seasonality played a role in resource procurement, as mammals would have been more readily harvested in the wet season, when they would have sought tree islands as refuge from higher water levels.

While several species of aquatic birds were recovered at MacArthur #2, Sheridan Hammock, and Heartleaf Hammock, at no site where they a significant portion of the MNI. Keel (1990) only reported two individuals of unidentifiable bird, and no species were recovered from West Kendall. The species that were recovered include aquatic birds that typically occur year-round in the Everglades, such as pied-billed grebe (*Podilymbus podiceps*) and great blue heron (*Ardea herodias*). Fradkin also identified ducks (*Anas* spp.) at MacArthur#2 and Sheridan Hammock. The overall absence of birds despite year-round availability suggests that they did not contribute significantly as a food resource to pre-Columbian peoples at Everglades tree island sites, and that this was likely a choice of food preference or perhaps such bones were not preserved in the archaeological record.

Shark remains were found only at West Kendall, Guy Bailey, and Heartleaf Hammock and consist primarily of teeth. One tooth at the West Kendall site appeared to have a drilled hole, suggesting that it would have been used in a tool or in ornamentation. It is likely that marine remains would have been part of a tool-kit and brought to the site from an alternate habitation zone.

The zooarchaeological evidence shows very similar taxonomic composition across Everglades tree island sites, with a clear reliance upon locally available resources. This evidence demonstrates the same fishing-hunting-gathering subsistence economy was practiced from the Late Archaic through the end of the Glades cultural periods. Comparison of these five Everglades tree island sites demonstrates that freshwater aquatic resources played a key role in Everglades subsistence patterns, with the possibility that seasonal habitation patterns may exist. For this relative stability, it could be inferred that a relative environmental stasis occurred in the south Florida Everglades throughout pre-Columbian habitation. These five sites were similar in taxa composition, despite representing several cultural periods, indicating not only a continuing reliance upon certain species, but also a continuation of cultural preference adhered by pre-Columbian peoples of the Everglades.

Table 6: Taxa Identified at Examined Everglades Sites

SCIENTIFIC NAME	8DA1081	8DA4752	8BD2591	8BD191	8DA2192
CARTILAGINOUS FISHES					
Galaeocerdo culveri		X			
Euselachii	X	X			X
RAY-FINNED FISHES					
Lepisosteus spp.	X	X	X	X	X
Amia calva	X	X	X	X	X
Anguilliformes				X	
Ameiurus spp.			X	X	
Ictaluridae	X		X	X	
Siluriformes		X			
Esox spp.					X
Mugil spp.				X	
Lepomis microlophus	X	X	X	X	X
Lepomis spp.			X		X
Micropterus salmoides	X		X	X	X
Centrarchidae	X	X	X	X	X
Caranx spp.					X
Carangidae				X	
Actinopterygii	X	X	X	X	X
AMPHIBIANS					
Amphiuma means	X		X	X	X
Siren lacertina	X	X	X	X	X
Caudata	X		X	X	X
Rana spp.		X	X	X	X
Anura	X		X	X	X
REPTILES					
Chelydra serpentine	X	X	X	X	X
Kinosternon spp.			X	X	
Sternotherus spp.	X		X	X	X
Kinosternidae	X	X	X	X	X
Apalone ferox	X	X	X	X	X
Pseudemys spp.	X		X	X	X
Terrapene Carolina	X	X			X
Trachemys spp.		X			
Emydidae	X		X	X	X
Testudines	X	X			X

Table 6 Continued: Taxa Identified at Examined Everglades Sites

Alligator mississippiensis	X	X	X	X	
Anolis carolinensis					X
Lacertilla			X	X	
Agkistrodon piscivorus conanti			X	X	
Viperidae	X	X			X
Farancia abacura		X			X
Lampropeltis getula			X		
Nerodia spp.	X	X	X	X	X
Colubridae	X		X	X	X
Serpentes	X	X	X	X	X
Reptilia	X		X	X	
AVES					
Podilymbus podiceps			X	X	X
Ardea Herodias			X	X	
Anas spp.				X	
Anatinae			X		
Cathartidae			X		
Small Aves			X		
Aves		X	X	X	X
MAMMALS					
Didelphis virginiana	X	X	X	X	X
Lontra canadensis			X	X	
Neovison vison				X	
Procyon lotor	X	X		X	
Carnivora		X			
Odocoileus virginianus	X	X		X	X
Neofiber alleni			X	X	X
Oryzomys palustris			X		
Sigmodon hispidus			X		
Small Rodentia	X		X		
Rodentia	X	X	X	X	X
Sylvilagus spp.	X	X	X	X	X
Small Mammalia	X		X	X	X
Medium Mammalia	X		X	X	X
Large Mammalia					X
Mammalia	X	X	X	X	X

CHAPTER SEVEN: SUMMARY AND CONCLUSIONS

The faunal assemblage analyzed for the West Kendall site indicates that the inhabitants were primarily harvesting local aquatic resources. Resource utilization maintained a similar pattern over time, even with changes in culture that occurred at the site. This site lends support to the idea that resources could be gathered locally, in a relatively stable and reliable environment. The similarities of West Kendall to other Everglades sites suggests a subsistence pattern that remained common throughout the Everglades. Aquatic animal resources, especially fish and reptiles, played a significant role for the pre-Columbian peoples of the Everglades.

The importance of the West Kendall site cannot be understated, as it provides an additional reference point for subsistence patterns of Everglades tree island sites over time. Occupation at the West Kendall site occurred across multiple cultural periods, from the Late Archaic and into the Glades cultural periods, with faunal materials recovered representing at least the Glades cultural periods. The site shows relative consistency across all levels (see Appendices), where aquatic resources remain the dominant form of protein-based subsistence. The West Kendall site provides further evidence regarding the relative stasis of both cultural practices and the environment of the Everglades for pre-Columbian peoples. This site lends further support to conclusions from previous faunal studies that the fishing-hunting-gathering subsistence pattern remained relatively the same throughout pre-Columbian occupations.

While indications of seasonality could not clearly be defined at any site, certain animals are procured more efficiently in particular seasons. While fish recovered from all sites are available year-round, these species tend to be more readily available in the dry season, when they congregate in gator holes as water levels drop. Mammals are easier to hunt in the wet season, when water levels are higher and they seek refuge on elevated tree islands. The abundance of aquatic resources could be an indicator that Everglades tree islands were primarily utilized and inhabited during the dry season.

Based upon relative consistency over time, the environment of the south Florida Everglades changed very little from its formation, approximately 5,500 years ago, until modern disturbance. Human-made changes in the early 20th century marked the first major alteration of this ecosystem after its formation. Despite these disturbances, many of the fish and reptile species relied upon by pre-Columbian peoples may still be found in abundance within the Everglades ecosystem today. Continued disturbance could potentially create disruption, and modern anthropogenic driven climate change remains a threat to the health of the Everglades. Tree island sites are disappearing as modern development continues in south Florida, and with that archaeological and environmental information is being destroyed. With a lack of stability in the modern ecosystem, and development a constant threat, we cannot be sure of the impact the future will have on the Everglades ecosystem.

The West Kendall site provides additional detail to cultural patterns of the pre-Columbian peoples of Florida. Tree islands were important as a refuge and a source of subsistence for the peoples who inhabited the Everglades. Each site is crucial to the understanding of the peoples of the Everglades, and their ability to adapt to and efficiently utilize the resources available within this ecosystem.

APPENDICES

Appendix A: West Kendall (8da1081) FS 36
1/4" Column Sample

Taxon	**NISP**	**Percent**	**MNI**	**Percent**
Lepisosteus spp.	356	23.34%	2	8.00%
Amia calva	91	5.97%	2	8.00%
Ictaluridae	4	0.26%	1	4.00%
Lepomis microlophus	5	0.33%	1	4.00%
Micropterus salmoides	49	3.21%	6	24.00%
Actinopterygii	282	18.49%		
Siren lacertina	2	0.13%	1	4.00%
Caudata	4	0.26%		
Chelydra serpentina	5	0.33%	1	4.00%
Kinosternidae	34	2.23%	2	8.00%
Apalone ferox	14	0.92%	1	4.00%
Emydidae	1	0.07%	1	4.00%
Testudines	124	8.13%		
Alligator mississippiensis	1	0.07%	1	4.00%
Viperidae	2	0.13%	2	8.00%
Nerodia spp.	10	0.66%	1	
Colubridae	8	0.52%	1	4.00%
Serpentes	79	5.18%		
Reptilia	1	0.07%		
Sylvilagus spp.	11	0.72%	2	8.00%
Small Mammal	1	0.07%		
Mammalia	6	0.39%		
Tetrapoda	18	1.18%		
Vertebrata	417	27.34%		
Totals	**1525**	**100.00%**	**25**	**100.00%**

Appendix B: West Kendall (8da1081) FS 37
1/4" Column Sample

Taxon	**NISP**	**Percent**	**MNI**	**Percent**
Lepisosteus spp.	231	20.48%	5	19.23%
Amia calva	92	8.16%	3	11.54%
Ictaluridae	1	0.09%	1	3.85%
Lepomis microlophus	4	0.35%	1	3.85%
Micropterus salmoides	88	7.80%	4	15.38%
Centrarchidae	1	0.09%		
Actinopterygii	110	9.75%		
Siren lacertina	9	0.80%	1	3.85%
Caudata	3	0.27%		
Chelydra serpentine	19	1.68%	1	3.85%
Kinosternidae	28	2.48%	2	7.69%
Apalone ferox	9	0.80%	1	3.85%
Pseudemys spp.	3	0.27%	1	3.85%
Emydidae	2	0.18%		
Testudines	121	10.73%		
Viperidae	20	1.77%	1	3.85%
Nerodia spp.	14	1.24%	1	3.85%
Colubridae	10	0.89%	2	7.69%
Serpentes	177	15.69%		
Reptilia	2	0.18%		
Procyon lotor	2	0.18%	1	3.85%
Sylvilagus sp.	1	0.09%	1	3.85%
Small Mammal	3	0.27%		
Mammalia	4	0.35%		
Tetrapoda	26	2.30%		
Vertebrata	148	13.12%		
Totals	**1128**	**100.00%**	**26**	**100.00%**

Appendix C: West Kendall (8da1081) FS 38
1/4" Column Sample

Taxon	**NISP**	**Percent**	**MNI**	**Percent**
Euselachii	4	0.15%	2	5.00%
Lepisosteus spp.	453	16.59%	5	12.50%
Amia calva	132	4.84%	2	5.00%
Ictaluridae	7	0.26%	2	5.00%
Lepomis microlophus	11	0.40%	1	2.50%
Micropterus salmoides	176	6.45%	9	22.50%
Actinopterygii	430	15.75%		
Amphiuma means	1	0.04%	1	2.50%
Siren lacertina	12	0.44%	1	2.50%
Caudata	15	0.55%		
Anura	1	0.04%	1	2.50%
Chelydra serpentina	9	0.33%	2	5.00%
Sternotherus spp.	2	0.07%	2	5.00%
Kinosternidae	67	2.45%		
Apalone ferox	23	0.84%	1	2.50%
Terrapene carolina	37	1.36%	1	2.50%
Emydidae	5	0.18%	1	2.50%
Testudines	199	7.29%		
Alligator mississippiensis	2	0.07%	1	2.50%
Viperidae	25	0.92%	1	2.50%
Nerodia spp.	10	0.37%	1	2.50%
Colubridae	32	1.17%	2	5.00%
Serpentes	319	11.68%		
Reptilia	2	0.07%		
Didelphis virginiana	2	0.07%	1	2.50%
Procyon lotor	4	0.15%	1	2.50%
Odocoileus virginianus	4	0.15%	1	2.50%
Rodentia	2	0.07%	1	2.50%
Medium Mammalia	5	0.18%		
Mammalia	5	0.18%		
Tetrapoda	49	1.79%		
Vertebrata	685	25.09%		
Totals	**2730**	**100.00%**	**40**	**100.00%**

Appendix D: West Kendall (8da1081) FS 39
1/4" Column Sample

Taxon	**NISP**	**Percent**	**MNI**	**Percent**
Lepisosteus spp.	7	2.81%	1	5.88%
Amia calva	26	10.44%	4	23.53%
Micropterus salmoides	11	4.42%	1	5.88%
Actinopterygii	35	14.06%		
Amphiuma means	1	0.40%	1	5.88%
Siren lacertina	6	2.41%	1	5.88%
Caudata	5	2.01%		
Chelydra serpentine	1	0.40%	1	5.88%
Kinosternidae	9	3.61%	1	5.88%
Apalone ferox	7	2.81%	1	5.88%
Emydidae	4	1.61%	1	5.88%
Testudines	59	23.69%		
Viperidae	3	1.20%	1	5.88%
Nerodia spp.	2	0.80%	1	5.88%
Colubridae	8	3.21%	2	11.76%
Serpentes	29	11.65%		
Mammalia	2	0.80%	1	5.88%
Tetrapoda	7	2.81%		
Vertebrata	27	10.84%		
Totals	**249**	**100.00%**	**17**	**100%**

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