FLORIDA STATE UNIVERSITY

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THE GRAND SHELL RING: A STUDY OF SITE SEASONALITY, HARD CLAM EXPLOITATION, AND RESOURCE SCHEDULING

By

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ABSTRACT

The Grand site (8DU1) on Big Talbot Island (northeast of Jacksonville, Florida) is a mound complex containing a Mississippian period shell ring and an overlying sand burial mound. The shell ring dates almost exclusively to the St. Johns II period (ca. A.D. 900-1250) and is the subject of this study. I examine site seasonality and resource scheduling with a focus on the exploitation of *Mercenaria mercenaria*, also known as northern quahog clams or hard clams. Incremental growth techniques revealed that occupants collected clams primarily during the spring and during the latter half of the winter as well. Feature 1, which was located beneath the ring deposit, demonstrated a slightly different collection pattern: occupants collected clams equally throughout the winter and spring. Vertebrate faunal analysis indicated that the site was used throughout the year, yet occupants collected clams only during the winter and spring. I explore several reasons for this seasonal pattern of collection, and I conclude that occupants gathered clams on a seasonal schedule at times when their biomass and nutrition were highest.

CHAPTER 1

THE ARCHAEOLOGY OF SHELLS

Introduction

In the following chapter, I provide a brief summary of the goals, hypotheses, and benefits of this study. I then discuss the role of shells in archaeology, including the archaeological assessment of shell middens and shell rings. I discuss feasting, as archaeologists have found evidence for feasting at many shell rings. I provide a brief summary of archaeomalacology, the study of mollusks in archaeological contexts (Bar-Yosef Mayer 2005:1), followed by a detailed summary of incremental growth studies and technique.

A Seasonality Study of Northern Quahog Clams

The goal of this study is to develop an understanding of which season(s) northern quahog clams (*Mercenaria mercenaria*) were consumed, and thus which season(s) the Grand shell ring (8DU1) was in use. I will accomplish this by cross-sectioning a sample of the shells and examining their interior growth rings to determine their season of death, a standard approach to determining clam seasonality (Quitmyer et al. 1985a, 1985b; Claassen 1986a, 1998). However, the seasonality of one resource should not be used to determine the seasonality of a site. Many resources are collected on a seasonal schedule, depending on their availability and the availability of other foods. Because this study focuses on a single resource, I will compare my findings to the vertebrate faunal analysis (see Ashley et al. 2007:113-136) to present a stronger argument for seasons of site use.

Regarding site seasonality, there are three hypotheses I can test with this study. (1) Year-round exploitation of quahog clams occurred at the site, indicating year-round occupation and deposition. (2) Specific seasonal usage of quahog clams occurred at the site, despite longer periods of deposition (indicated by the faunal remains of other seasonal species). (3) Limited site usage and deposition occurred only during a specific season(s) at the site, indicated by limited seasonal evidence of both quahog clams and other seasonal fauna.

The Grand site (8DU1) is a mound complex consisting of the only known Mississippian Period shell ring as well as an overlying sand burial mound. The site dates to the St. Johns II period, which corresponds with the Early Mississippian period in the broader Southeast. Understanding the seasonal usage of the site is imperative for determining the function of the ring, and may indicate whether the ring was constructed for special purposes or simply for midden refuse. The ring and the associated burial mound may indicate that the site had some type of ceremonial use. The results of this study will be valuable for understanding the Grand site and for comparison with other sites in the region. Because this region is characterized by both St. Johns and St. Marys ceramics along with a ubiquitous sand-tempered plain ware, subsistence studies may become important in differentiating archaeological cultures and developing an understanding of site patterning.

Shell Midden Archaeology

Shell middens have a long and important history within the discipline of archaeology. Early on, shell middens were thought to be naturally occurring phenomena that were created when the earth was covered with water. Following extensive excavation undertaken by a group of Danish scholars, Streenstrup announced in 1851 that the kitchen [shell] middens were the product of human activity, and not natural accumulations (Waselkov 1987:139). In America, early archaeologists did not believe the Indians they interacted with were capable of constructing the numerous earthworks, burial mounds, and shell heaps they encountered. They hypothesized that an ancient and extinct race had built the mounds, not ancestors of the extant American Indians, a notion that is now referred to as the "Mound-Builder Myth."

For over a century Americans and early archaeologists alike held to the Mound-Builder Myth. John Rowzee Peyton, an escaped prisoner, wrote the earliest known account of the Mound-Builder Myth in 1774 (Blakeslee 1987). After Peyton escaped, he stopped to excavate a burial mound and wrote a letter detailing the excavation and his thoughts that America had been inhabited by a civilized race before the extant Indians (Blakeslee 1987). Others excavated mounds and attributed their construction to various cultural groups including Toltecs, Welshman, Vikings, Druids, Hindus, and others. These accounts were accepted and published in scholarly arenas, despite the fact that a few early ethnographers and travelers had witnessed American Indians and other indigenous groups building such mounds.

According to Blakeslee (1987), it was not until Cyrus Thomas' comprehensive study of mounds was published in 1894 that the Mound-Builder myth lost dominance in archaeology and popular culture. Despite this claim, elements of the myth still appeared in scholarly publications such as *American Anthropologist*. Following Thomas' 1894 article, archaeologists began to accept the fact that the American Indians were responsible for at least some mounds and earthworks, but few archaeologists still held on to the notion that a single cultural group built the mounds and earthworks who had either died out entirely or were ancestral to groups of extant American Indians. As late as 1927, archaeologist Vernon Allison (1927) was still trying to solve the "problem" of identifying the mound builders, whom he believed to be a single culture or group. Gradually archaeologists accepted the fact that the mounds and earthworks they observed had been built by groups ancestral to American Indians.

Shell middens present some unique attributes that are not shared by other types of archaeological sites. Particularly, shell middens are well known for their excellent preservation of both vertebrate and invertebrate faunal remains. At the Grand site, large amounts of bone were recovered as well as individual fish scales. The shell itself causes the excellent preservation that shell middens provide. The shells' calcium carbonate ($CaCO_3$) is leached into the soil and neutralizes the acids in soils, creating a higher pH level that may even reach alkaline conditions (Waselkov 1987:155). Because the acidity in the soil is greatly reduced in these conditions, organic remains are not leached of their calcium, and the deterioration process is significantly slowed.

Massive quantities of shell can preserve the original shape and size of the mound because the shell does not decompose. Shell orientation can help to indicate what type of deposit created the midden. Waselkov (1987:147) proposed that shells lying parallel to the surface of the pile with the concave side up are suggestive of being tossed onto the pile individually, whereas shells with random orientation were dumped. Shells oriented parallel to the sides of the feature and perpendicular or skewed to the surface indicate secondary deposits (Waselkov 1987:147).

One problem encountered at shell matrix sites is the movement of objects through the matrix following deposition. Downward migration of artifacts occurs when the shell matrix is poorly consolidated and objects slide downwards. Shell mixing is also a problem, where smaller shells and large shells are sorted over time. Larger shells move up towards the surface and smaller shells move lower in the matrix.

Throughout the years, faunal remains at archaeological sites have become an important source of information about the past. Because of their excellent preservation, shell middens have provided the remains for reconstructing subsistence patterns, settlement patterns, site seasonality, paleoenvironmental conditions, and more. The application of methodologies including screening and flotation have provided a wealth of knowledge about past subsistence techniques and preferences. The study of faunal material in archaeological contexts has benefited and drawn from several different disciplines outside the realm of archaeology. The blending of techniques and methodologies has resulted in specializations within the field of archaeology, including archaeomalacology, which is particularly relevant for this work and will be discussed below.

Shell Rings

Shell rings are circular, arc, and horseshoe shaped deposits of shell found in southeastern North America along the Atlantic coast (from South Carolina to Mississippi). They range from 30 to 250 m in diameter and up to 6 m in height, although they often demonstrate irregularities in shape and height (Saunders 2004:251). Most rings are not perfectly circular, and many are affected by rising sea levels and erosion (Figure 1.1). Although some rings were designed with an opening on one end, others may have developed an open ending due to post-depositional processes. Shell ring sites can contain a single ring, multiple rings, shell ridges, shell mounds, or a combination of these. Over

60 shell rings are known in the southeastern United States (Russo et al. 2002:32), most of which are located in South Carolina, Georgia, and Florida.

The unusual shape of shell rings has led to many speculations as to the function of these sites. William McKinley first described shell rings in 1873, and the debate over their use and meaning has continued into current times. Early propositions for ring function include gaming arenas, astronomical observatories, torture chambers, houses of state, and fish traps, however most archaeologists view shell rings as subsistence remains from hunter-gatherers (Russo and Heide 2001:491). During the last ten years research on shell rings has increased, yet the primary focus of shell ring research is still that of ring function. Models of ring function fall into three basic categories: secular, ceremonial, or a combination of both.

Models positing a secular function of shell rings argue that they were formed incidentally from refuse disposal in circular villages (e.g., DePratter 1976; Trinkley 1985, 1997; Waring and Larson 1968). This model became popular in the 1980s and came to be known as the Gradual Accumulation Model (Heide and Russo 2003). This model views shell rings as quotidian refuse disposal lacking any intentional mounding or maintenance of the ring shape (ceremonial models often argued for intentional mounding and maintenance). The lenses of crushed shell found between layers of unconsolidated oyster shell are thought to be living surfaces on the ring (Heide and Russo 2003).

Models positing a ceremonial function of shell rings propose that shell rings were purposefully constructed in a ring shape and are the result of ceremonial activities at the site (e.g., Cable 1997; Saunders 2002, 2004). The lenses of crushed shell are viewed not as living surfaces, but as capping events that occurred following a ceremonial event or feast (Cable 1997). Feasting is often cited as an important ceremonial event at the site; and rings are viewed as piles of feasting refuse that were piled around a central plaza where ceremonial activities occurred.

Ceremonial and habitation models hold that both kinds of events and activities resulted in the ring shape (e.g., Russo 2004; Russo and Heide 2003; Thompson 2007). The general idea is that ring sites are the result of both habitation and ceremonial functions. Thompson’s (2007) Developmental Model, is an example of this type of theory. His model posits that shell rings were formed from quotidian refuse disposal in circular villages (shell filled pits and basins adjacent to residences that gradually filled in). Thompson argues that once the ring took on a circular shape, residence shifted toward the inside of the ring. Although ceremonies likely took place at the site through time, shell rings may have taken on a primarily ceremonial function (instead of a residential function) at some point. The Developmental Model further argues that multiple behaviors and processes formed these sites, and function may have changed throughout time (Thompson 2007:104). This type of model allows archaeologists to view rings as diachronic constructions and eliminates the need to determine a single cause to explain the primary function of all shell rings.

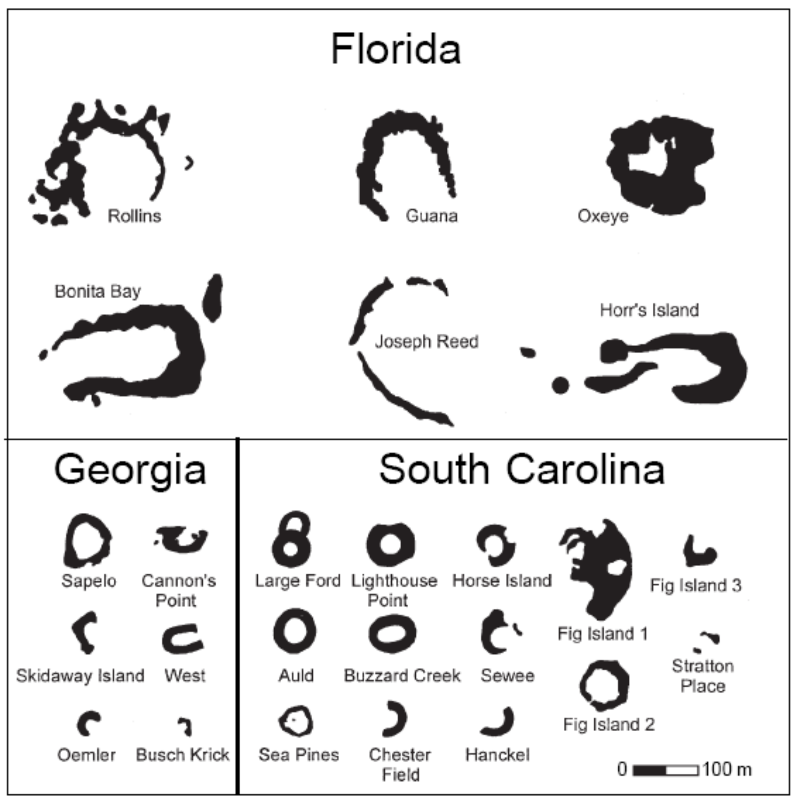

Figure 1.1
Archaic Shell Rings in the Southeastern United States
(Russo et al. 2002:36)

Some rings appear to be the result of intentional mounding and/or feasting, whereas others appear to be the result of daily refuse discard. It is possible that ring function varied according to place and time, and that more than one of these models is applicable. Shell rings provided evidence for the earliest year-round occupations, earliest pottery, and earliest large-scale monumental architecture along the coastal Southeast (Russo and Heide 2001:491). Florida has several shell rings and ring middens[1]. The shell rings found in Florida are both larger and more structurally complex than shell rings in Georgia and South Carolina (Russo and Heide 2001:491).

Until recently, southeastern shell rings were known exclusively from the Late Archaic period. Several Woodland period shell rings are known in Florida and several are currently under study (see Russo et al. 2006). However, the vast majority of shell rings date to the Late Archaic period. The Grand ring dates to ca. A.D. 900 – 1250, and is the only Mississippian period shell ring known to date. Like other shell rings, fauna (primarily oyster) composed the matrix of the Grand ring. Because the Grand shell ring is an unusual architectural form for the Mississippian period, understanding site function is all the more important.

Feasting

Feasting has been cited as evidence for ceremonial activity at many shell rings, and has been identified at most of the shell rings in Florida (Table 1.1). Dietler and Hayden (2001:3) define feasting as the consumption of food and drink separate from everyday meals. Russo and Heide (2003:43) argued that meals that took place in the center of the ring were in the public eye, and as such should be considered feasting events. Feasting has been found in all socioeconomic levels of complexity (Russo 2004:29). Much work has been done to determine feasting from faunal remains at inland Mississippian period sites. Feasting events on the coasts, however, probably looked substantially different from inland feasts. Due to the predictability of coastal resources, it is possible that planning and procuring food for a feast would be a simpler affair for coastal societies. Russo (2004:46-47) has argued that daily subsistence remains in coastal settings are likely to demonstrate more faunal diversity than large-scale feasting remains. Animals such as deer would be more difficult and costly than other coastal resources (which could be obtained with mass capture techniques in relatively predictable locations). Following Russo's argument, coastal feasts geared towards feeding the general population would yield many low-cost food items, whereas more rare animals, such as deer, would be less common.

Archaeologists have used several different traits to identify feasting in coastal settings. Subterranean features such as hearths, roasting pits, storage pits, and midden deposits found under and on the interior edge of rings have been used to argue for feasting at several Florida shell rings (Russo and Heide 2002:74). Large deposits of loose, whole oyster and shell with no orientation (indicative of dumping) as well as large deposits of lower trophic level fauna have been also used to argue for feasting (e.g., Saunders 2004). Deposits of shell with little accumulated dirt have been argued to represent relatively fast deposition (Quitmyer et al. 1997:837), which may indicate feasting. Shell rings often contain large quantities of fauna that are can be acquired in large numbers, such as oysters, clams, and estuarine fish (that can be captured in nets). Foods such as these which can be gathered and processed in mass quantities would be ideal for providing food for large amounts of people (see Jackson and Scott 2002:46). Furthermore, when the goal of a feast is social solidarity, it is likely that everyday foods will be included (Hayden 2001:38), with few unusual or elite faunal goods. In addition to lower trophic-level fauna, highly seasonal deposits are also supportive of feasting activities. I will review the evidence for feasting at the Grand shell ring in Chapter 5.

Archaeomalacology

Archaeomalacology is the study of mollusks[2] in archaeological contexts (Bar-Yosef Mayer 2005:1). Archaeomalacology developed out of new interest in past subsistence strategies in the late 1960s and early 1970s. Malacologists had demonstrated that mollusk shells could be used to evaluate past climatic conditions, as well as provide the season of the mollusks' death, and archaeologists began to employ these techniques to better understand archaeological deposits.

Table 1.1 Selected Shell Rings from Florida

RING	DATE	PERIOD	CERAMICS	ARTIFACTS	SHAPE	FEASTING
Grand	ca. 700-1050 BP	Mississippian	St. Johns II	Few shell tools, few bone pins, fossilized alligator scute	Circular	?
Joseph Reed[a]	ca. 3500-2800 BP	Late Archaic	St. Johns plain and Glades plain	Bone pins, few chipped lithics; No shell tools	Roughly U-shaped	Yes
Rollins[b]	ca. 3700-3500 BP	Orange III	Fiber tempered	Bone pins were common, few lithics or other artifacts	Roughly circular; ring and ringlets	Yes
Meig's Pasture[b]	ca. 3900 BP	Late Archaic	None	Baked clay objects, chipped and ground stone objects including steatite	Arc or horseshoe; Series of shell piles& pit features	Not determined
Guana River[b]	Ca. 3900-5900 BP	Orange with later St. Johns occupation	Fiber tempered	Bone pins common, few lithics or other artifacts	Roughly U-shaped	Yes
Horr's Island[b]	ca. 4100-4400 BP	Late Archaic	None	Sandstone and/or limestone artifacts, bone pins, abundant shell tools	Elongated U	Yes
Bonita Bay[b]	ca. 4100-4400 BP	Late Archaic	None	Sandstone artifacts, bone pins, shell tools	Elongated U shape	Not determined
Buck Bayou[b]	None	Elliot's Point	None except on surface	Baked clay objects, chipped & ground stone objects including steatite, bone pins, shell beads and tools	Arc or horseshoe-shaped	Not determined
Oxeye[b]	ca. 4500 BP	Late Archaic	None	Few baked clay balls & few lithic flakes	Circular	Yes

[a]Data from Russo et al. 2002 and Russo and Heide 2002
[b]Data from Russo et al. 2002

Mollusk shells are the most common invertebrate remains recovered from archaeological sites (Bar-Yosef Mayer 2005:1). The earliest shell collecting is found 300,000 years ago at the habitation site of Terra Amata, France (Claassen 1998); however, shell collecting does not become evident in other places until much later. Shellfish were exploited during the Paleolithic by coastal people, but it was not until the Mesolithic period that shellfish were exploited worldwide (Evans 1969:480). The oldest shell middens (in which shell is the primary component of the matrix) are found in coastal South Africa dating from 130,000 to 30,000 years ago (Waselkov 1987:125). Shell midden construction (freshwater and/or terrestrial mollusks) occurred along the St. Johns River as early as ca. 5,600 B.C. (Waselkov 1987:130). It is possible that earlier shell middens were destroyed by sea level rise or covered by sediment in marshes.

Mollusks and other invertebrates represent one of the most abundant resources available to prehistoric cultures inhabiting coastal and estuarine areas (Quitmyer 1985:28). Mollusks are a valuable resource for several reasons. Gathering mollusks typically requires low energy expenditure and simple technology (such as digging sticks, rakes, or simply one's hands). They can be obtained and cooked in mass quantities in fire pits, are found in predictable locations, and can be gathered by people of all ages. Although shellfish are low in calories, they are high in protein, calcium, iodine, electrolytes, and other minerals (Yesner 1980:733). Shellfish also offer carbohydrates that other animal foods do not (Table 1.2). They can withstand higher rates of human predation that mammalian fauna cannot tolerate (Yesner 1980:729), and therefore serve as a valuable resource capable of sustaining relatively large populations.

Because Florida has such an extensive coastline, marine resources played an important role in the economic and cultural development of many prehistoric Florida groups. Most coastal areas have high resource biomass and diversity, and are extremely productive (Yesner 1980). Primary productivity in coastal zones is approximately 2,000 kcal per square meter (Yesner 1980:728), and productivity in intertidal zones and estuaries can be as much as ten times greater than coastal zones (Odum 1971, Lieth and Whittaker 1975 cited in Yesner 1980:728). Estuaries are extremely productive – more

Table 1.2 Average Nutritional Value of Select Species Available at the Grand Site

Species	Individual meat yield (g)	Edible portion (%)	Kcal (per 100 g)	Protein (g per 100 g)	Fat (g per 100 g)	Carbohydrate (g per 100 g)
Clam (unspecified)	18-30	15	68	8.4-10.7	1.2-1.8	2.7-3.4
Oyster (*Crassostrea virginica)*	5	15	66	8.4-12.0	1.8-2.5	3.4-6.5
Catfish (*Ictalurus sp.)*	500	67	103	17.6	3.1	0
Deer (*Odocoileus virginianus)*	32,500	58	126-198	20.0-35.0	4.0-6.4	0

Note: Compiled from Waselkov 1987:120-121

than 90 percent of the marine species we eat depend on the estuary at some point in their life (MacMahon and Marquardt 2004:9). An estuary produces four to ten times the organic matter produced by a cultivated cornfield of the same size; although humans do not directly consume the organic matter, it provides food and nutrients for many of the marine animals that humans consume (MacMahon and Marquardt 2004:8).

Because coastal regions yield massive quantities of rich resources, groups with access to these foods can achieve higher population densities that other ecological zones would not permit (Yesner 1980:730). A good example of a complex group dependent on coastal resources is the proto-historic Calusa of southwest Florida. This group achieved a socially complex chiefdom despite their lack of agriculture, and even received tribute from other groups in Florida (Widmer 1988). Although St. Johns II people in northeastern Florida did not reach this level of complexity, the abundant resources available along the coast and in nearby estuaries were likely an important factor in the choice of site location. These resources provided Grand inhabitants with a dependable subsistence base capable of sustaining the group throughout the year.

Incremental Growth Studies

Mollusks are available throughout the year; therefore, their presence or absence alone cannot be used to infer site seasonality. Incremental growth studies examine growth-line structures in shells to determine the season of death. Archaeologists conduct seasonality studies on mollusks to infer resource scheduling and seasons of site use. This technique has been applied to archaeological remains since 1969, and has been utilized by ecologists and biologists since the beginning of the 20th century (Claassen 1986a:21). A significant body of literature has focused on reviewing and experimenting with clam seasonality methods, and has proven the incremental growth technique to be a sound and effective research tool (Quitmyer et al. 1985a, Quitmyer et al. 1997).

Both archaeological and ethnographic data demonstrate that a number of different groups gathered shellfish year-round, despite Eurocentric notions of shellfish being unsuitable for consumption during summer months (see Waselkov 1987 pp. 110-113). One reason for the modern aversion to shellfish during summer months is risk of water-borne diseases such as PSP (paralytic shellfish poisoning) and DSP (diarrhetic shellfish poisoning). These two diseases are transmitted by eating shellfish that have accumulated toxic amounts of dinoflagellates and diatoms, which can occur during red tides. It is important to note that the geographic scope, intensity and frequency of red tide has increased world-wide, indicating that PSP and DSP may not have been such a threat in previous years (Claassen 1998:33). The geographic areas where red tides and PSP are common and have temporal depth are limited to the northwest coast of the US and New Guinea; in fact, many areas documented their first cases of PSP and DSP in the 1970s and 1980s (Claassen 1998:33). It is quite possible that these risks were not present for prehistoric shellfishers, and the taboo of eating shellfish during the summer is a fairly recent adaptation. Although spawning and heat stress reduce biomass and caloric value during summer months (Quitmyer 1985:29), research at Southeastern sites showed that mollusks were gathered during summer months at several sites (Braley et al. 1986; Quitmyer 1985, 1989, 1992, 1995; Quitmyer and Massaro 1999; Quitmyer et al. 1985a; Quitmyer et al. 1997; Russo et al. 1989; Russo et al. 1993; Saunders and Russo 1989).

Shells grow as a result of the daily deposition of calcium carbonate ($CaCO_3$) (Quitmyer et al. 1985a:61). Shell growth is affected by water temperature, salinity, sediment type, currents, valve opening times, and possibly photoperiod (Wilbur 1976:100, 102 cited in Claassen 1998:25). Shell growth is divided into three stages: (1) a juvenile stage during which the shell grows rapidly, (2) an adult phase, and (3) a senile phase during which the shell grows very slowly (Claassen 1998:25-26).
Figures 1.2 and 1.3 offer a limited terminology to familiarize the reader with some basic clam biology. Clams are composed of two valves, a right and a left, which are distinguishable from each other. If you hold an articulated clam with the umbo facing away from you (and with the margin pointing down), the right valve will be on the right side and the left valve will be on the left side.

Like trees, *M. mercenaria* lay down distinctive growth rings (called annuli) biannually. The shell consists of two alternating types of annuli: (1) a translucent ring, laid down during slow growth periods when the animal is under stress due to spawning and/or temperature extremes, and (2) an opaque layer, laid down during fast growth periods in moderate temperatures. By cross-sectioning the shell and comparing its terminal growth layer with previous growth layers, it is possible to determine what stage of growth the specimen was in at the time of its death.

Mollusks lay down annuli at different times in different locations due to variation in the onset of seasons and temperature changes. In other words, the growth rings laid down by mollusks do not form at the same time in different locations. In northeast Florida, slow growth occurs during the warmer months due to extremely high water temperatures, and fast growth occurs during cooler months due to more moderate water temperatures. In areas further north, the reverse is true: slow growth occurs in cooler months due to extremely low temperatures and fast growth occurs in warmer months when water temperature is mild. Because of this variation, it is essential to have a modern comparative collection that is locally acquired. The comparative collection allows the researcher to determine when annuli typically form in a specific area, facilitating interpretations of the archaeological mollusks. Modern collections should be gathered from a nearby source for at least one year (although some scholars argue at least two or more years are needed – see Claassen 1998).

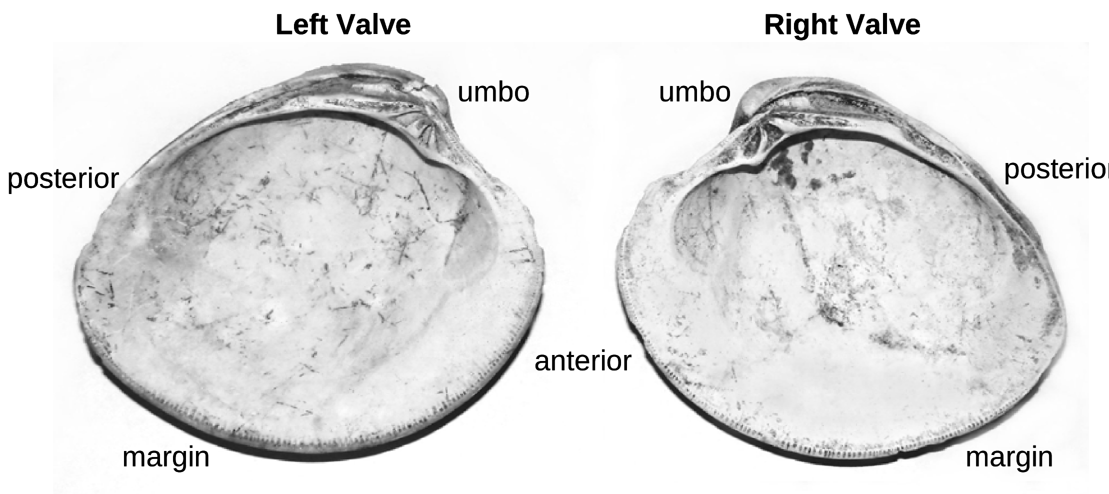

Figure 1.2 Interior View of Quahog Clam Valves with Terminology

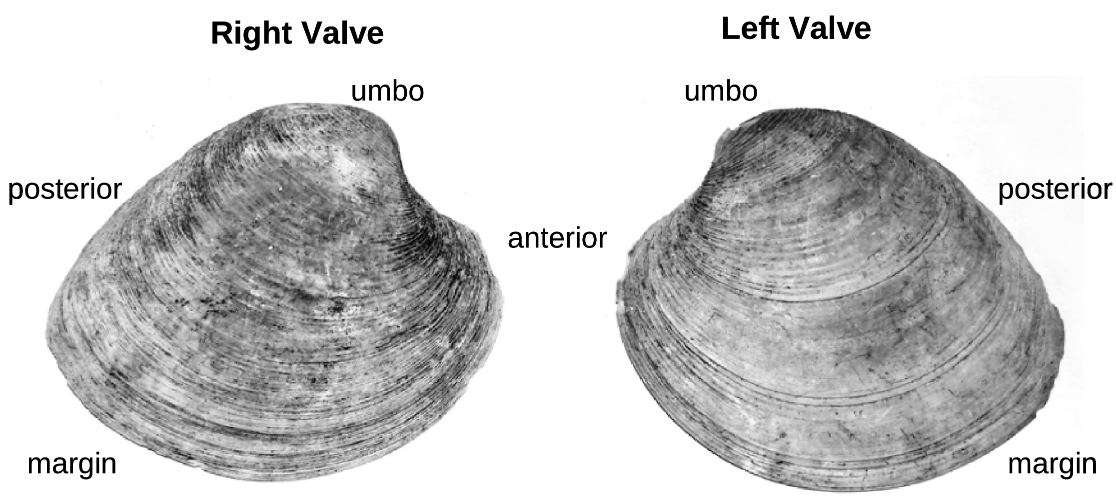

Figure 1.3 Exterior View of Quahog Clam Valves with Terminology

Several species of saltwater and freshwater mollusks have been used in archaeological incremental growth studies. These include *Chione stutchburyi* (Coutts 1970), *Lampsilis radiata luteola* (Claassen 1986a), *Mercenaria campechiensis* (Quitmyer and Jones 1992), *Mercenaria mercenaria* (Quitmyer et al. 1985a, Quitmyer et al. 1985b, Russo et al. 1993), *Rangia cuneata* (Claassen 1986a) (although the validity of using this specimen has recently been called into question), and *Protothaca crassicosta* (Coutts 1970). Other species are currently being evaluated for their potential for incremental growth studies.

Incremental growth studies of mollusk remains allow archaeologists to determine season(s) of harvest, and when combined with other faunal remains, this information can be used to infer season(s) of site usage. Knowing the season of site usage is important for understanding site function, subsistence patterns, resource scheduling, and settlement patterns. The literature on successful clam seasonality studies employing the incremental growth technique continues to grow (e.g., Bernstein 1990; Claassen 1986a, 1998; Coutts 1970; Clark 1979; Deith 1983, 1986; Quitmyer 1992, 1998; Quitmyer and Jones 1992, 2000; Quitmyer and Massaro 1999; Quitmyer et al. 1985a, 1985b, 1997, 2005; Russo et al. 1993). Growth increment studies, though time consuming can be relatively inexpensive to perform and can provide important information from their results. Despite these facts, the technique has remained relatively underutilized in the field of archaeology. Mollusk shells are often discarded during excavation, or little other than identification and quantification is typically done. Mollusk remains are a valuable archaeological resource that archaeologists should systematically recover and study to further our knowledge of the subsistence patterns and degree of sedentism of archaeological groups. By discarding mollusk remains, archaeologists are losing a valuable piece of the puzzle.

Summary

This research seeks to determine the seasons of site usage and clam exploitation at the Grand shell ring. To accomplish this goal, I will cross-section a number of clams to determine their season of death. I will then compare the seasons of clam exploitation to the seasons of exploitation of other fauna at the site. I have laid out three hypotheses that I can test with this research: (1) Year-round exploitation of quahog clams occurred at the site, indicating year-round occupation and deposition. (2) Specific seasonal usage of quahog clams occurred at the site, despite longer periods of deposition (indicated by the faunal remains of other seasonal species). (3) Limited site usage and deposition occurred only during a specific season(s) at the site, indicated by limited seasonal evidence of both quahog clams and other seasonal fauna. I discuss these hypotheses further in later chapters.

Shell middens have a long and important history within the discipline of archaeology. They continue to yield important archaeological information, particularly because of their exceptional preservation qualities. Shell rings are a unique type of shell midden, having a ring, arc, or horseshoe shape. Archaeologists have identified shell rings in North America only along the coastal zone of the Southeast. Determining the function of these unique sites has been a primary goal for archaeologists. I have discussed several different models for the development of shell rings, including explanations such as gradual accumulation, ceremonial, and ceremonial and habitation. It is possible that the function of shell rings varied according to time and place, and that more than one explanation is applicable.

I have provided a discussion and brief history of archaeomalacology, the study of mollusks in archaeological contexts (Bar-Yosef Mayer 2005). Archaeomalacology is a developing subdiscipline in archaeology, and has the potential to provide important information about prehistoric subsistence patterns. In this chapter, I have given an introduction to clam biology and provided a description of the methodology of the incremental growth technique. The incremental growth technique provides archaeologists with a way to reconstruct past clam exploitation. When these results are compared with the seasonality of other fauna, archaeologists can infer site use and occupation, as well as examine patterns of resource exploitation.

Notes

1. Current research distinguishes between shell rings and ring middens. Shell ring are characterized by a matrix composed primarily of shell, whereas ring middens are composed primarily of earth. These sites are referred to collectively as ring sites (Russo, et al. 2006). This work is specifically concerned with shell rings. All the rings discussed in this chapter were identified by the referenced authors as shell rings, not ring middens. However, as the classification system of these sites has recently changed, some sites may be reclassified as ring middens.

2. The phylum mollusca includes clams, oysters, scallops, snails, whelks, slugs, chitons, squids, octopuses, and others (Abbot and Morris 1995:xxvi). This paper is specifically interested in bivalves, which are comprised of a pair of valves connected by a hinge. Bivalves and marine snails compose the group known as shellfish, which also includes crabs, lobster, and other crustaceans (Evans 1969:480).

CHAPTER 2

ARCHAEOLOGICAL BACKGROUND

Introduction

In the following chapter, I discuss the Grand Site and its archaeological significance. I outline the history of research at the Grand site and provide several site maps. I discuss the radiocarbon dates obtained from the excavation as well as the ceramic assemblage, which firmly date the shell ring to the St. Johns II period. I then provide a brief summary of the St. Johns archaeological culture, as well as a more in-depth discussion of the St. Johns II period in northeast Florida.

The Grand Site (8DU1)

The Grand site (8DU1) is a shell ring and sand burial mound complex. It is located on the southern end of Big Talbot Island northeast of Jacksonville, Florida. This research focuses on the shell ring, which measures approximately 65 by 70 meters in size and one meter in height (Ashley and Rolland 2006:3). The site is located in an oak hammock adjacent to a brackish tidal marsh, where shellfish presently abound (Figures 2.1, 2.2, and 2.3). This site is unique in that it is the only known Mississippian period shell ring along the Atlantic coast, post-dating similar Late Archaic shell rings by nearly three millennia (Ashley et al. 2007:1).

According to local informants, in the 1960s looters removed human remains from the sand mound (Ashley and Rolland 2006:3). In 1973, state archaeologists visited the Grand site and excavated a one-meter square into the northern part of the shell ring (Ashley and Rolland 2006:2). This resulted in the site's placement on the *National Register of Historic Places* in 1975. In 1997, Michael Russo visited the site with a total station and produced a surficial topographic map of the ring complex (Figures 2.4 and

Figure 2.1 Reference Map of Florida and the Grand Site

2.5). The following year a systematic shovel test survey was conducted on the south end of Big Talbot Island (Ashley and Rolland 2006:2).

In the summer of 2006, I assisted Dr. Keith Ashley of the University of North Florida in the excavation of a 1x14 meter trench that cross-sectioned a portion of the southeastern arm of the ring (Figure 2.4). The trench was excavated as seven contiguous 1x2 meter units with vertical levels not exceeding 10 centimeters. Excavated material was sieved through ¼ inch mesh, and column samples were collected to be water screened through $^{1}/_{16}$ inch mesh. Seven $50cm^2$ shovel tests were dug into other areas of the shell ring and the interior plaza (Ashley et al. 2007).

The ring matrix consisted of densely packed shells, which created a favorable environment for preservation of vertebrate faunal material. Shell was the main constituent

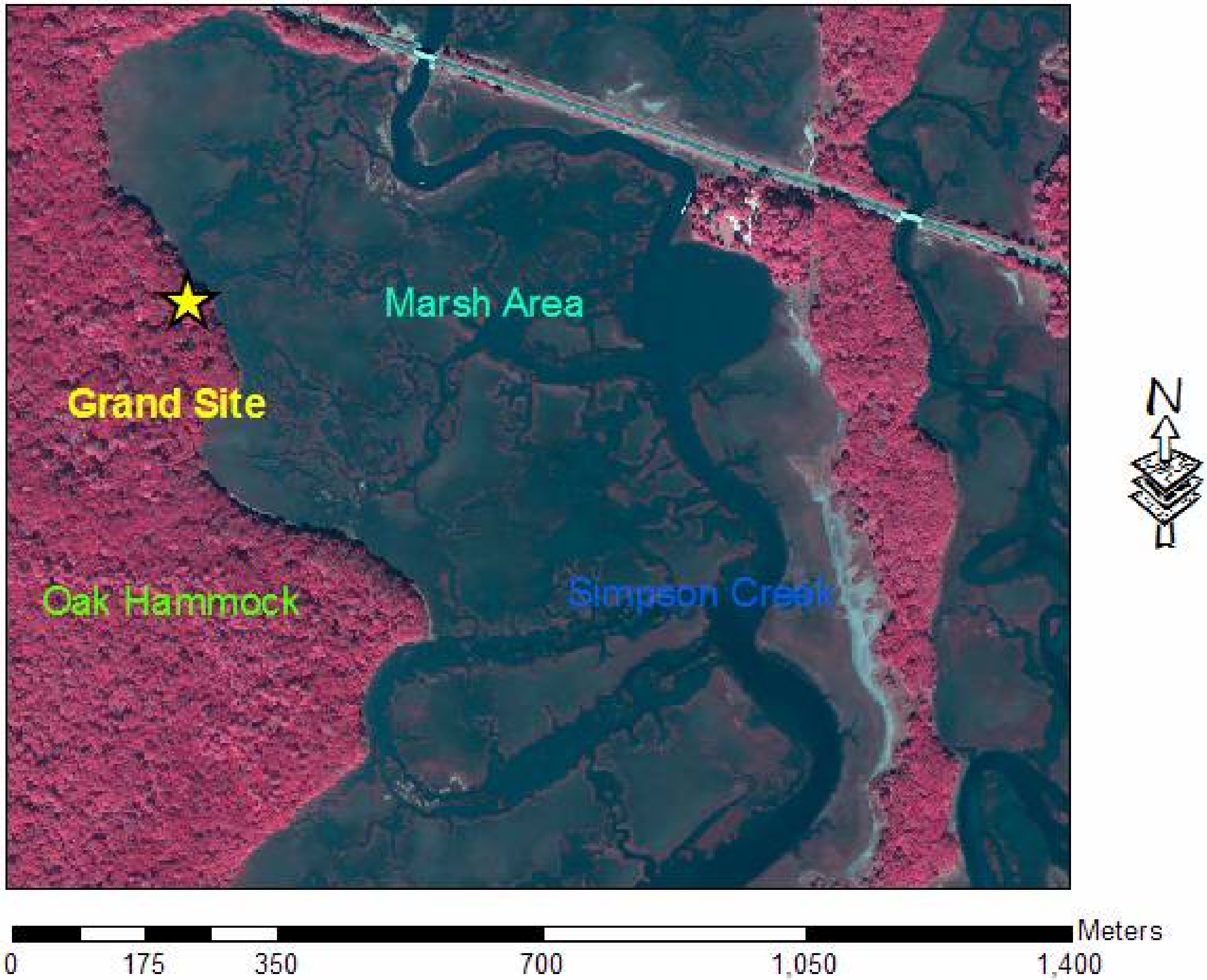

Figure 2.2 Infrared Orthoimage of the Grand Site

Figure 2.3 True Color Orthoimage of the Grand Site

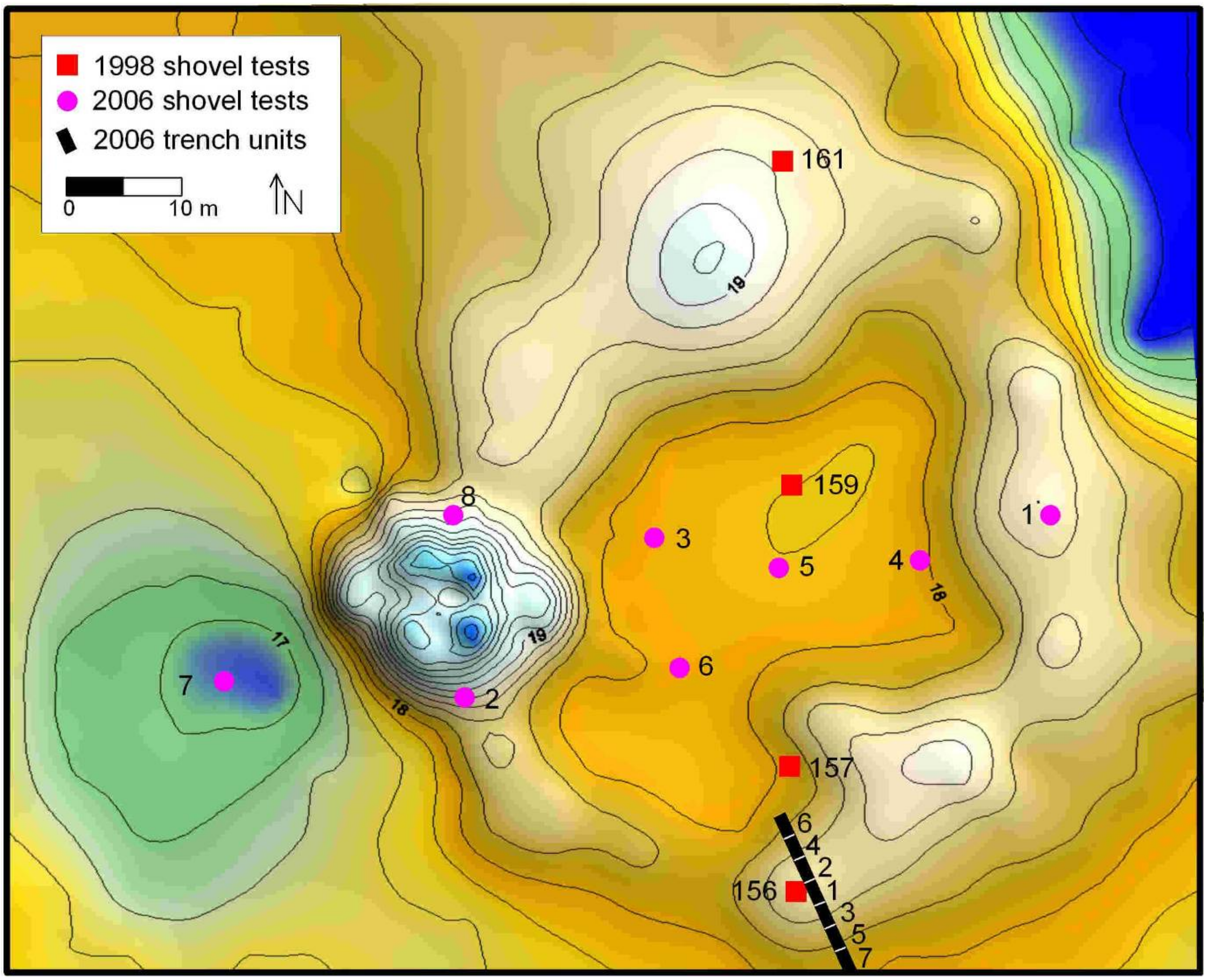

Figure 2.4 Topographic Map of the Grand Shell Ring (Nadir View)
Courtesy of Michael Russo

of the matrix, with little soil present. We recovered fish scales in numerous quantities, and it was not uncommon to find shells with their color and luster intact. Eastern oyster (*Crassostrea virginica*) was the predominant invertebrate in the matrix; northern quahog clams[1] (*Mercenaria mercenaria)* were the second most abundant invertebrate. Stout tagelus (*Tagelus plebeius)*, Atlantic ribbed-mussel (*Geukensia demissa)*, and other gastropods were also plentiful. Lenses of shell were observed within the ring stratigraphy,

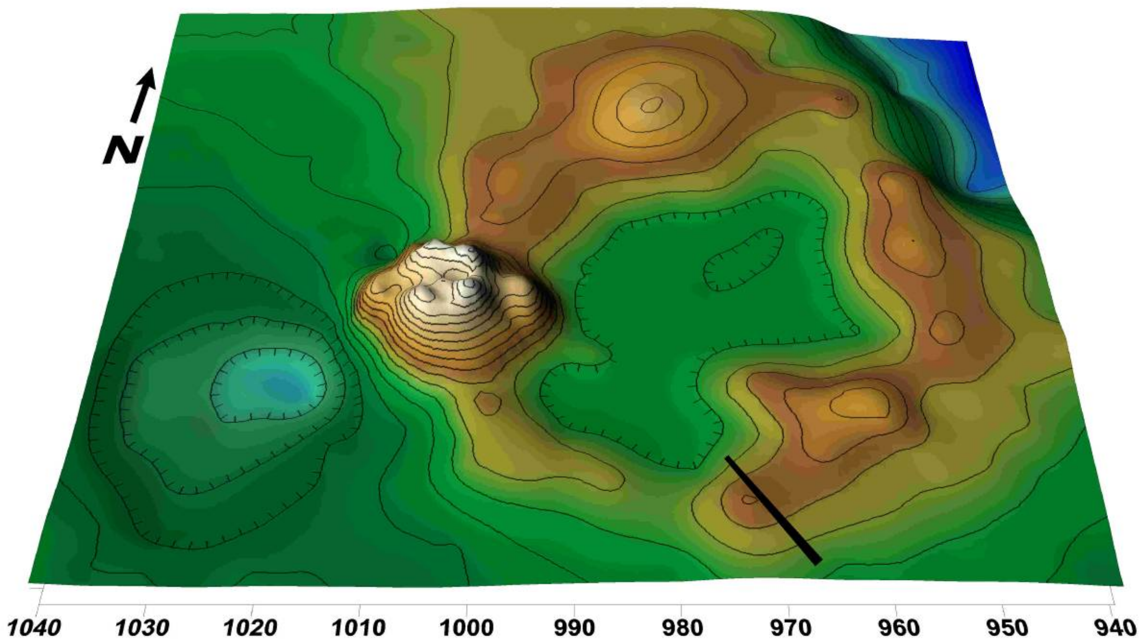

Figure 2.5 Topographic Map of the Grand Shell Ring (Oblique View)
Courtesy of Michael Russo
The sand burial mound is the highest point in the complex at approximately 3 meters tall, and was constructed on top of the western arm of the ring.

including lenses of densely concentrated quahog clam, Atlantic ribbed mussel, and stout tagelus. The inclusion of stout tagelus in the diet is interesting because this shellfish is found in colonies about one meter deep in the estuarine mud. This resource is typically extracted by digging into the side of the colony.

Excavation revealed a complex stratigraphy within the ring. Nearly 200 field specimen numbers were assigned, 21 areas were identified, and eight features were located (Ashley et al. 2007). I obtained clam samples from Features 1, 3, and 4, which were located within or underneath the ring. Features 1 and 4 were located in the northern portion of the trench, while Feature 3 was located in the southern portion of the trench. Like other St. Johns II sites, no evidence for maize was recovered from the Grand site. This group likely obtained the majority of their subsistence by hunting and gathering estuarine, marine, and terrestrial flora and fauna.

Table 2.1 Radiocarbon Assays from the Grand Site

Beta No.	Provenience	Material	Measured C14 Age (BP)	Conventional C14 Age (BP)	Calibrated 1 Sigma (AD)	Calibrated Intercept (AD)	Calibrated 2 Sigma (AD)
222530	ST 2, L-100, below sand mound	Oyster	1100±60	1450±60	900-1020	980	820-1060
227470	Trench 1, CS- 1, L-1	Oyster	960±60	1350±60	1000-1110	1040	940-1190
219850	Trench: U5, FEAT 3	Oyster	1000±60	1320±70	1020-1170	1060	960-1240
222531	Trench: U6, L-8	Clam	910±40	1290±40	1060-1170	1110	1030-1220
222529	ST 1, L-1, East side of ring	Clam	860±40	1270±40	1070-1190	1160	1040-1230
120267[a]	Ph. I ST	Clam	790±60	1190±60	1170-1285	1235	1065-1320

Note: After Ashley et al. 2007:76
[a]Beta Number 120267 was collected during shovel testing conducted in 1999; all others were obtained in 2006 during excavation at the site.

Two shovel tests were placed in the sand mound to determine whether the shell ring lay beneath it and to determine the chronology of construction. These tests yielded hematite impregnated sand, a human tooth, and several bone fragments that might have been human (these items were immediately reburied) (Ashley and Rolland 2006:5). The majority of the sand mound is located on top of the existing shell ring, although the northern end of the mound lies on top of a thin, intermittent layer of shell (Ashley and Rolland 2006:5).

Five radiocarbon assays indicate that the Grand site is a St. Johns II period site that was constructed between ca. A.D. 900 – 1250 (Table 2.1). The overwhelming majority of the ceramics recovered from the site are associated with the St. Johns period, complementing radiocarbon evidence for a St. Johns II occupation. Ring construction was not a uniform process – deposition took place over many years, as evidenced by radiocarbon dates and varying amounts and kinds of shells in different units at the same vertical level (Ashley and Rolland 2006).

Ceramics Recovered at the Grand Site

Many sites throughout the Florida-Georgia border area have produced a mixture of ceramics typical to both the St. Johns archaeological culture of Florida and the St. Marys archaeological culture (called Savannah in earlier studies) of Georgia. St. Johns ceramics are distinguished by a temper of sponge spicules, which gives the ceramics a chalky feel. Check stamping on these chalky wares marks the beginning of the St. Johns II period (Milanich 1994:262). St. Marys (or Savannah) ceramics are distinguished by sand tempered cord marked and plain wares (Russo et al. 1993:20). Plain sand tempered sherds are frequently found in significant quantities at both St. Johns and St. Marys sites, and therefore cannot be attributed to a particular cultural group. The presence of multiple ceramic types (St. Johns, St. Marys, and sand tempered wares) at different sites has led some researchers to believe that the Florida-Georgia border area may be a cultural transition zone between the St. Johns and St. Marys cultures, or that different cultural groups may have occupied the same area at different times (Russo et al. 1993:20).

This mixture of ceramic wares was not evident at the Grand site. St. Johns ceramics made up 77 percent of the ceramic assemblage by count, and 81 percent by weight (Ashley et al. 2007:ii). No St. Marys cord-marked ceramics were recovered, despite their recovery at other sites in the region. St. Johns (plain, check stamped, burnished, incised, and punctate), a St. Johns-like ceramic, and unidentified sand tempered wares were recovered in numerous quantities (the majority of St. Johns sherds were checked stamped, and few sherds were burnished) (Ashley et al. 2007). Few (n=24) Woodland sherds were recovered from the lower levels of the trench, including Deptford, charcoal tempered, Swift Creek, and Colorinda (Ashley et al. 2007; Rolland 2007). Papys Bayou and Little Manatee types were almost nonexistent in the assemblage. One Ocmulgee cord-marked sherd was recovered, as well as two San Pedro sherds. Ceramic analysis has demonstrated that most vessels were 20-28 cm in diameter, a much smaller size than the nearby St. Johns site, Shields Mound (8DU12), where most vessels ranged from 26-36 cm (Rolland 2007).

As previously stated, this ceramic assemblage firmly places the Grand site within the St. Johns II period. The overwhelming majority of ceramics were St. Johns, with few types associated with other cultures present in the area (such as St. Marys or Ocmulgee). Small to medium containers seem to have been the preferred vessel size (Rolland 2007), rather than larger utilitarian wares.

Other artifacts recovered from the site included eleven modified pieces of bone, shell tools, three shell beads, ferric oxide powder, a fossilized alligator scute, and several pieces of raw clay (Ashley and Rolland 2006:7). Use wear was observed on 68 clam and whelk shells, including scoops or containers and blunt-end hammer or cutting tools (Ashley et al. 2007:104, 106). Lithic material was rare and no projectile points, knives, or other stone tools were recovered (Ashley et al. 2007:104).

The St. Johns Culture

The St. Johns archaeological culture spans the Woodland, Mississippian, and Mission periods of northeast and central Florida. St. Johns people were located in northeast and central Florida along the St. Johns River, drainage, tributaries and adjacent coastal barrier island lagoons, and the central Florida Lake District (Milanich 1994:254). Stirling (1936 cited in Goggin 1998:15) originally divided Florida into four regions, Gulf Coast, Glades, Northern Highlands, and St Johns. Goggin (1998:15) further divided the St. Johns area into two separate regions: the Northern St. Johns region (hereafter referred to as "St. Johns"), "including only the coast and river valley north of Cape Canaveral," and the Melbourne region. The Melbourne region is now called the Indian River region and the archaeological culture is referred to as Malabar. Goggin (1998:15) further defines the St. Johns region as "(1) that part of the St Johns River valley below the outlet of Lake Harney, (2) parts of Okefenokee Swamp, and (3) the Atlantic Coast from the St. Marys River to the southern end of Mosquito Inlet." The division into St. Johns and Indian River regions is significant, because few Glades cultural influences are found north of the Indian River area (Goggin 1998). Variation of temporality within the St. Johns II period between the Northern and Indian River areas (see Ashley 2005) also supports this division. Russo, Cordell, and Ruhl (1993) have suggested that Northeast Florida and Southeast Georgia share many cultural characteristics and should therefore collectively be referred to as the St. Marys Region. This area “refers to the coastal area extending from the Satilla River, Georgia to below the mouth of the St. Johns River, Florida and is bisected at the state border by the St. Marys River” (Russo et al. 1993:4).

The St. Johns chronology was developed primarily by using predominant ceramic types as well as other cultural traits (Table 2.2). This chronology was created by Goggin (1998) based on stratigraphy, and has been only slightly modified since its creation in the 1950s (Miller 1998:xiv). Radiocarbon dates have given better precision to Goggin’s chronology, and date ranges have been determined for different cultural periods.
There are also some important distinctions between the Indian River area and the St. Johns area in northeast Florida (lower St. Johns River), particularly regarding the development and disappearance of the St. Johns people.

Milanich (1994) proposed that the St. Johns culture developed out of the local Archaic residents. Evidence in support of a local development of the St. Johns culture include continued trends in ceramic, bone, and shell production, similar lithic production, continued dependence on an aquatic resource base as well as continuity in settlement patterns (Ashley 2003:65). In northeast Florida however, some suggest that St. Johns II people may have migrated into the area, since there is little evidence for a St. Johns I occupation (Ashley 2002:170). In addition, the St. Johns II period in northeast Florida begins ca. A.D. 900 (Ashley et al. 2007:20), more than 150 years later than in the Indian River area (ca. A.D. 750). The St. Johns cultural group may have been ancestral to the group known in historical times as the Timucua Indians (Milanich 1994), who spoke the Timucuan language and occupied a large portion of northeast Florida and parts of Southern Georgia. In northeastern Florida, it appears that St. Johns II people abandoned the area ca. A.D. 1250, and may have been replaced by St. Marys II people from southeastern Georgia (Ashley 2002:172).

Table 2.2 St. Johns Regional Chronology

Period	**Dates**	**Distinguishing Characteristics**
St. Johns IIc	A.D. 1513-1565	St. Johns Check Stamped pottery; European artifacts in some middens and mounds. Burial mounds still present early. The St. Johns IIc people are the various Timucuan-speaking groups described in European documents of the early sixteenth century.
St. Johns IIb	A.D. 1050-1513	St. Johns Check Stamped pottery; some Fort Walton and Safety Harbor pottery and Southeastern Ceremonial Complex objects in mounds. Mississippian Influences.
St. Johns IIa	A.D. 750-1050	Appearance of St. Johns Check Stamped pottery in villages and mounds; large number of mounds and villages, reflecting larger populations; late Weeden Island pottery and copies in some mounds.
St. Johns Ib	A.D. 500-750	Weeden Island, Dunns Creek Red (early), and St. Johns pottery in mounds; village ceramics almost all plain St. Johns ware; Weeden Island influences; some pottery caches in mounds.
St. Johns Ia	A.D. 100-500	Village pottery nearly all plain St. Johns ware; Hopewellian-Yent complex objects in early mounds (pre-A.D. 300); some possible log tombs. Late Deptford and Swift Creek pottery traded and copies locally manufactured; Dunns Creek Red common. Weeden Island influences appear late.
St. Johns I	500 B.C. – A.D. 100	Village pottery all St. Johns ware, both plain and Incised; some Deptford pottery or copies present. Burial mounds appear for first time. All pottery coiled; some pottery punctuated or pinched; side lugs rare; at times mixed quartz sand and fiber temper.

Note: After Milanich 1994:247. Ashley (2005) argues that the St. Johns II period is more compressed in northeastern Florida, extending from ca. A.D. 900 to A.D. 1250.

St. Johns II Culture in Northeast Florida

The St. Johns II period corresponds with the Mississippian period in the broader southeast. In northeast Florida this period begins in A.D. 900 and ends around A.D. 1250 (Ashley et al. 2007:20), at which time it appears that St. Johns II people abandon the area and St. Marys people move in (Ashley et al. 2007:20, Ashley 2002:172). The St. Johns II period in northeast Florida is characterized by a slow progression of changes from the local St. Johns culture embellished with influences from Mississippian cultures to the north and west (Thunen and Ashley 1995:6). Exotic goods increased in numbers, colored sands were used to define burial areas, and burial mounds increased in volume and in burial population size (Thunen and Ashley 1995:6). Although St. Johns II people adopted some Mississippian traits, there are important distinctions. Some major Mississippian characteristics, such as agriculture, were not adopted in northeast Florida until much later. Ashley (2002:162) has argued that although St. Johns II people were engaged in interaction and exchange with the Mississippian world, they were fisher-hunter-gatherers who had a more communally oriented political economy than traditional Mississippian societies. Furthermore, it does not appear that St. Johns II people were engaging in craft specialization, nor is there evidence for elite control over craft items (Ashley 2002:166). Thunen and Ashley (1995:6) argued that the rarity of multiple mound complexes in northeast Florida might indicate a lack of structured social hierarchies as seen in other Mississippian groups.

The St. Johns II period demonstrated the largest populations and most extensive occupations of St. Johns people (Milanich 1994:257). St. Johns II people focused their subsistence strategy on aquatic resources, although terrestrial species were hunted and gathered as well (Ashley 2002, 2003; Milanich 1994; Russo et al. 1993). Faunal remains indicate that the St. Johns II people fished from the coasts and estuaries, employing mass capture techniques (such as nets, weirs, or seines) and did not practice open ocean or deep-water fishing (Ashley 2002:165, 2003:278; Ashley et al. 2007). Shellfish, particularly oyster, were gathered in mass quantities for consumption, resulting in numerous shell heaps throughout the region. Previous research on the seasonality of St.

Johns II sites has indicated year-round coastal occupations with a continued reliance on aquatic fauna (Ashley 2003; Quitmyer et al. 1997; Russo et al. 1993).

Historical documents indicate that maize was an important resource for the contact-era Timucuans. To date, there is no direct archaeological evidence for maize agriculture in northeastern Florida during the majority of the St. Johns II period (Ashley 2003:280). Ashley (2003:280) has argued that because domesticated plants were absent, wild plants may have been the main source of carbohydrates. However, shellfish provide carbohydrates as well, and may have been targeted for this reason (see Claassen 1986a). The lack of paleobotanical evidence for maize agriculture has been further corroborated by stable isotopic testing of four St. Johns II burials, which did not indicate any maize consumption (Hutchinson et al. 1998:403, 407, 2006:106, 110 cited in Ashley 2002:165). The earliest evidence for corn in northeastern Florida is from sixteenth century sites (Ashley 2003:280), well beyond the occupation period of the Grand site.

Summary

In this chapter, I have provided a brief description and history of the Grand site, paying particular attention to the shell ring. The Grand shell ring is unique in that it is currently the only known Mississippian period shell ring (Ashley et al. 2007:1). Occupants of the Grand site obtained their subsistence by hunting and gathering with a focus on estuarine and marine resources. Five radiocarbon dates along with the ceramics recovered at the site firmly date construction of the shell ring to the St. Johns II period (ca. A.D. 900-1250), which corresponds with the early Mississippian period in the broader Southeast. The majority of the ceramics assemblage at the Grand site is comprised of St. Johns ceramics (Ashley et al. 2007). Other artifacts were few in number, including shell tools and beads, modified pieces of bone, ferric oxide powder, a fossilized alligator scute, and several pieces of raw clay (Ashley and Rolland 2006:7). I have provided a brief discussion of the St. Johns archaeological culture as well as the St. Johns II culture in northeastern Florida. Similar to other northeastern St. Johns II sites, the Grand occupants obtained the majority of their subsistence from marine and estuarine resources, not from maize agriculture.

Notes

1. *Mercenaria mercenaria* (northern quahog clam) and *Mercenaria campechiensis* (southern quahog clam) look fairly similar and both exist in the Jacksonville area. The range of *M. mercenaria* is from the Gulf of St. Lawrence, Canada to Florida; *M. campechiensis* ranges from New Jersey to Florida (Abbott and Morris 1995:61-62). These two species are known to interbreed. *M. mercenaria* is distinguished from *M. campechiensis* by a section of smooth surface on the central exterior of the valve (M. campechiensis lacks this smooth section) (see Abbott and Morris 1995:61-62). All clams that were sampled in this study were identified as *M. mercenaria*, but other specimens in the assemblage may be *M. campechiensis* or a cross breed of the two.

CHAPTER 3

METHODOLOGY

Introduction

In the following chapter, I summarize the methodology utilized for this study, specifically including the recovery of the clams, the sample I chose, and the manner in which I cross-sectioned the clams. I discuss the modern comparative collection I employed for the study, as well as the isotopic analysis that confirms the comparability between the location of the modern collections and the Grand site. Next, I discuss the process of interpreting the clams, followed by a brief discussion of valves one should avoid when taking on incremental growth studies.

Recovery

All clams used in this sample were recovered through stratigraphically controlled excavation or shovel testing at the Grand site. In all, 4,200 whole or nearly whole northern quahog clam (*M. mercenaria*[1]) shells[2] were collected from the site. It is important to note that this number does not represent the minimum number of individuals (MNI) from the excavation. The MNI of quahog clams recovered during excavation was not determined. Clam shells collected as part of other samples (such as column samples) were not included in this study. In addition, not all of the excavated shells were collected. Many shells in the matrix were broken and deteriorated, and during the first few weeks of the excavation, only 30 whole clams were kept from each FS (FS 3-38, 41, 42). We later realized that more clams might be needed, and all whole or nearly whole shells were kept (except those taken as part of other samples).

It is important to state that not all of the collected shells are useable for this study. To be usable, the shell must have an intact margin (where the terminal growth layer is deposited). It must also be more than two years old, so that the terminal growth layer can be compared with previous years' growth. I did not determine how many valves would actually be useable for cross-sectioning. Following recovery, all clams were stored in sealed plastic bags in cardboard boxes.

The Sample

For my study, I counted and sorted all the shells into right and left valves (right = 2,133; left = 2,067). To obtain a valid sample, it is important that the same clam is not counted or used twice. There are two methods of sampling to ensure that this does not happen: (1) pairing left and right valves and using only one valve of each clam; and (2) using only one side (right or left) of the clams in the study. I elected to sample only the right valves, which were more numerous than left valves.

To determine whether clam exploitation varied between the features and the rest of the ring deposit, I divided the sample between general excavation levels and features. I selected a 5 percent sample of the right valves, from all general level field specimen collections. This number was rounded up to the nearest whole number. I was able to obtain a 5 percent sample from all but three FS numbers. It should be noted that a sample greater than 5 percent would likely be unattainable due to preservation problems and difficulty reading some of the clams. The general level sample totaled 138 valves.

I elected to take a larger sample (20 percent) of the right valves from the features within and beneath the ring. Clams recovered from the features were far less numerous than from the rest of the ring. Features represent closed deposits that were presumably created over a much shorter period, and may be significantly different from the general levels. The sample from the features totaled 53 clams. Quitmyer and Jones (1997: 837) argued that sample numbers greater than 30 are generally agreed to be acceptable.

I examined all the right valves from every FS and selected those with the best margins, the best preservation, and a relatively large size. Prior to cross-sectioning the valves, I marked them with their FS number, an arbitrary clam number (within the FS), and a letter representing sides of the clam (e.g. 52-3-A). I used the letter A to indicate posterior side of the valve, and the letter B was to indicate the anterior side of the valve. I did this to facilitate quick and easy matching of the shell pieces once they were cross-sectioned. If the clam was broken into more than two parts during the cross sectioning, the letters C and D were also used.

Cross-Sectioning the Clams

Clams were cross-sectioned radially along the greatest growth axis, which lies off-center towards the posterior margin of the shell. I could not cut all clams along the greatest growth axis, however, due to deteriorated or chipped margins. Instead, these clams were cross-sectioned on the greatest part of the growth axis that provided an intact margin.

To cross-section the clams I followed the methods used in the archaeomalacological study at King's Bay, Georgia (Quitmyer et al. 1985a and 1985b[3]) with a few minor deviations. All clams were cut with a wet tile saw equipped with a diamond blade. During cross-sectioning, I found that it was easier to cut the clam from the posterior margin to the umbo (instead of from the umbo to the margin, as done in the King's Bay study). As I neared the end of my cut, the saw often ground up the edge of the shell and broke off large chunks. By starting the cross-section at the posterior margin, I was able to get a clean cut on the margin, which allowed me to read the terminal growth layer. The grinding and chipping occurred at the umbo, which was far less detrimental for determining the growth phase[4].

After I cross-sectioned the clams, I allowed them to dry and then returned them to storage bags. (New bags were created for each FS for cross-sectioned clams so that they would not be stored with the clams that were not cross-sectioned.) I then returned these bags to cardboard boxes.

The Modern Comparative Collection

As discussed in Chapter 1, clam growth phases are initiated by seasonal changes in temperatures, and are variable both within and between regions. Therefore, it is essential to have a local, modern comparative collection of the species of interest for incremental growth studies. Quitmyer et al. (1985a) gathered living quahog clams at

King's Bay Naval Base, Georgia once a month for one year (except in June). Quitmyer et al. (1997) published the results of a second year of collection at King's Bay. I used their published data (1985 and 1997) on these comparative collections (instead of collecting my own) because the King's Bay Naval Base is less than 25 miles away from the Grand site. Climatic differences between the two locations should not be significant enough to cause substantial variation in shell growth periods.

To confirm that climatic differences between King's Bay and the Grand site are negligible and that the clam collections are comparable, I conducted stable isotopic analysis on three clams recovered from the Grand site. I then compared the results of this analysis to the isotopic analysis of a clam from King's Bay.

The temperature fluctuations demonstrated by oxygen isotopic analyses should correspond with specific growth increments in the clams (at specific times of the year). Samples from the opaque increment should demonstrate cooler temperatures, and samples from the translucent increment should demonstrate warmer temperatures.

Quahog clam shells form from daily deposition of calcium carbonate ($CaCO_3$) (Quitmyer et al. 1985:61). During this process, oxygen isotopes (^{18}O and ^{16}O) from seawater are incorporated into the shell (Quitmyer et al. 1997:831). The oxygen isotopic composition of molluskan shell carbonate is at or near equilibrium with the oxygen isotopic composition of seawater (Quitmyer et al. 1997). Changes in molluskan oxygen isotopic ratios closely track the annual temperature cycle, and it is thus possible to approximate the range of temperatures in which the clam deposited shell (Quitmyer et al. 1997).

I assigned each clam a terminal growth phase according to the six-part division used by Quitmyer et al. (1985) for later comparison with isotopic results. Using a dental drill, I removed discrete samples of approximately 1g of carbonate powder. I removed the samples by drilling consecutive grooves parallel to shell growth increments. I removed the samples in ontogenetic order over at least one and a half years of growth, including both opaque and translucent increments. I soaked all carbonate samples in a 30% solution of hydrogen peroxide (H_2O_2) for half an hour to remove any organic contaminants. I then removed a final sample of 200-500µ from the original samples, which I then flushed with pure helium in vacuo, followed by injection of orthophosphoric acid. The samples were analyzed by a Finnigan Mat Delta Plus XP Stable Ratio Mass Spectrometer. I calibrated the results of the analysis and reported them in VPDB standard.

As expected, all three clams demonstrated a correlation between growth phase and temperature (Figure 3.1). The translucent increment occurred during warm weather, and the opaque increment occurred during the cool weather. This is the same pattern found in the King's Bay clam by Quitmyer et al. (1997) (Figure 3.2). Because the drill I sampled with was large, I was not able to get very precise samples, and the results represent some averaging within growth increments. Although my samples were not as precise as the samples taken from the King's Bay clam, they indicate that the patterns of clam growth are similar at King's Bay and at the Grand site. These results confirm that climatic differences between the two locations are negligible and that the modern comparative collection from King's Bay is an appropriate analog to study clam seasonality at the Grand site.

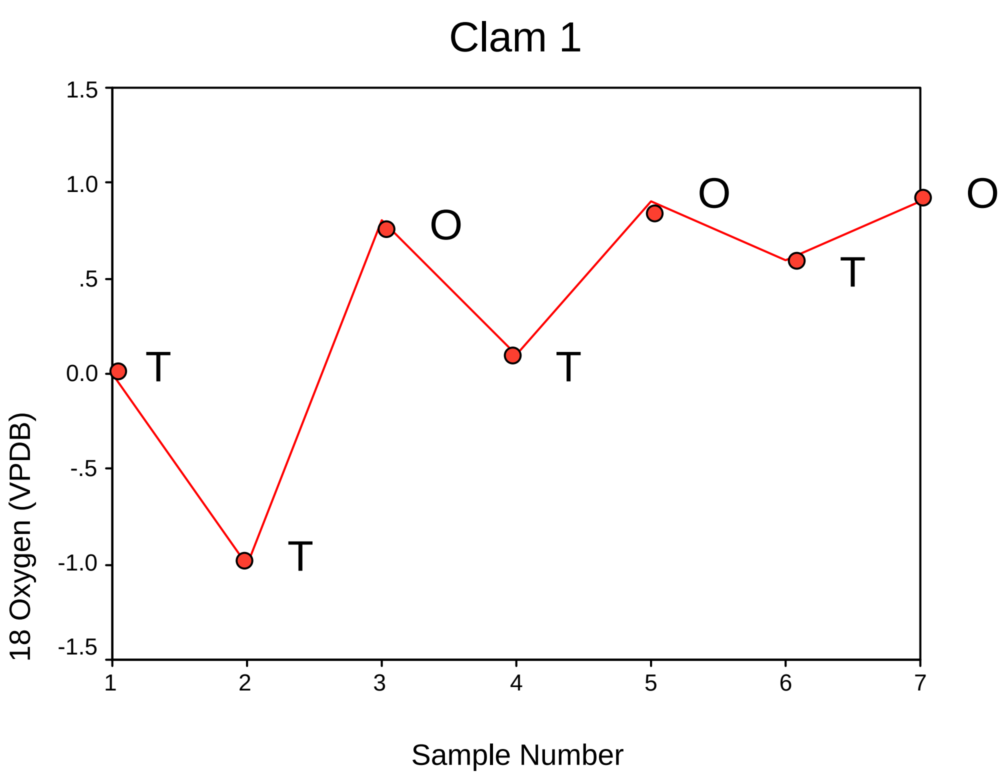

Figure 3.1 Distribution of $\delta^{18}O$ values for Clam 1
Negative numbers indicate warmer temperatures; positive numbers indicate cooler temperatures. The samples are labeled T for translucent, and O for opaque.

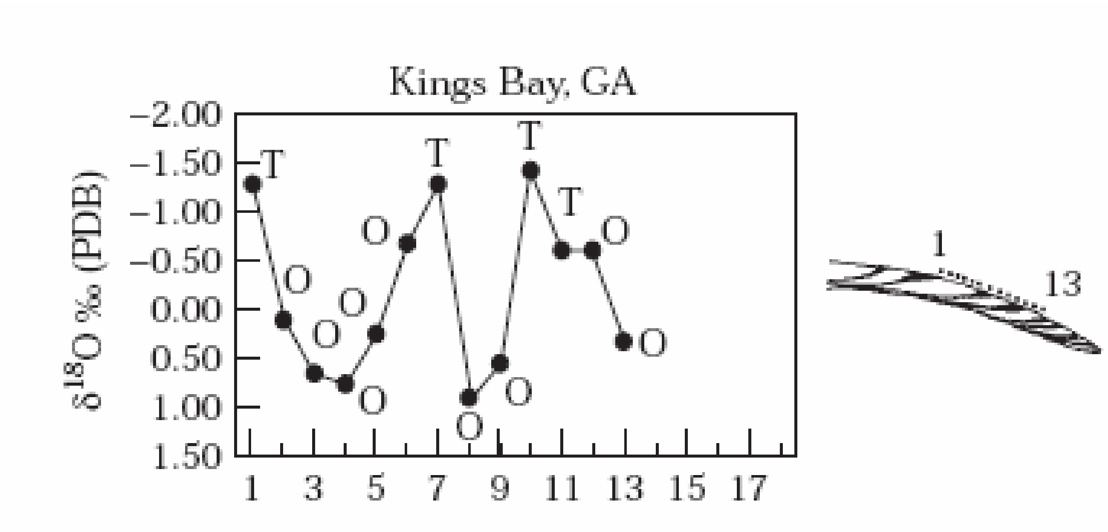

Figure 3.2 Distribution of $\delta^{18}O$ values of a Modern Clam from King's Bay (Quitmyer et al. 1997:834)
This graph shows the distribution of $\delta^{18}O$ values from the modern clam from King's Bay, Georgia. In this graph, the values have been reversed so that warmer temperatures (lower $\delta^{18}O$ values) are on top, and cooler temperatures (lower $\delta^{18}O$ values) are on the bottom.

Interpreting Clam Seasonality

Quitmyer et al. (1985a) separated shell growth into two growth increments: (1) translucent or slow, and (2) opaque or fast. They further divided these increments into three growth phases based on the amount of the growth increment that was deposited: (1) growth increment forming on marginal edge, (2) growth increment half-complete, and (3) growth increment complete (Figure 3.3). (By comparing the marginal growth to the previous year's growth, it is possible to determine the terminal growth phase.) I used these same divisions for my study.

I soaked the cross-sectioned clams in water to enhance color differences between layers, and examined them under a 5X lens to determine season of death. I examined clams that were particularly difficult to interpret under a 10X lens or microscope. I also determined the age for the valves. This is done by counting the number of complete annual cycles. When viewed in cross-section, one can count the age by simply counting the dark line that forms following a completed translucent band (Claassen 1998:153).

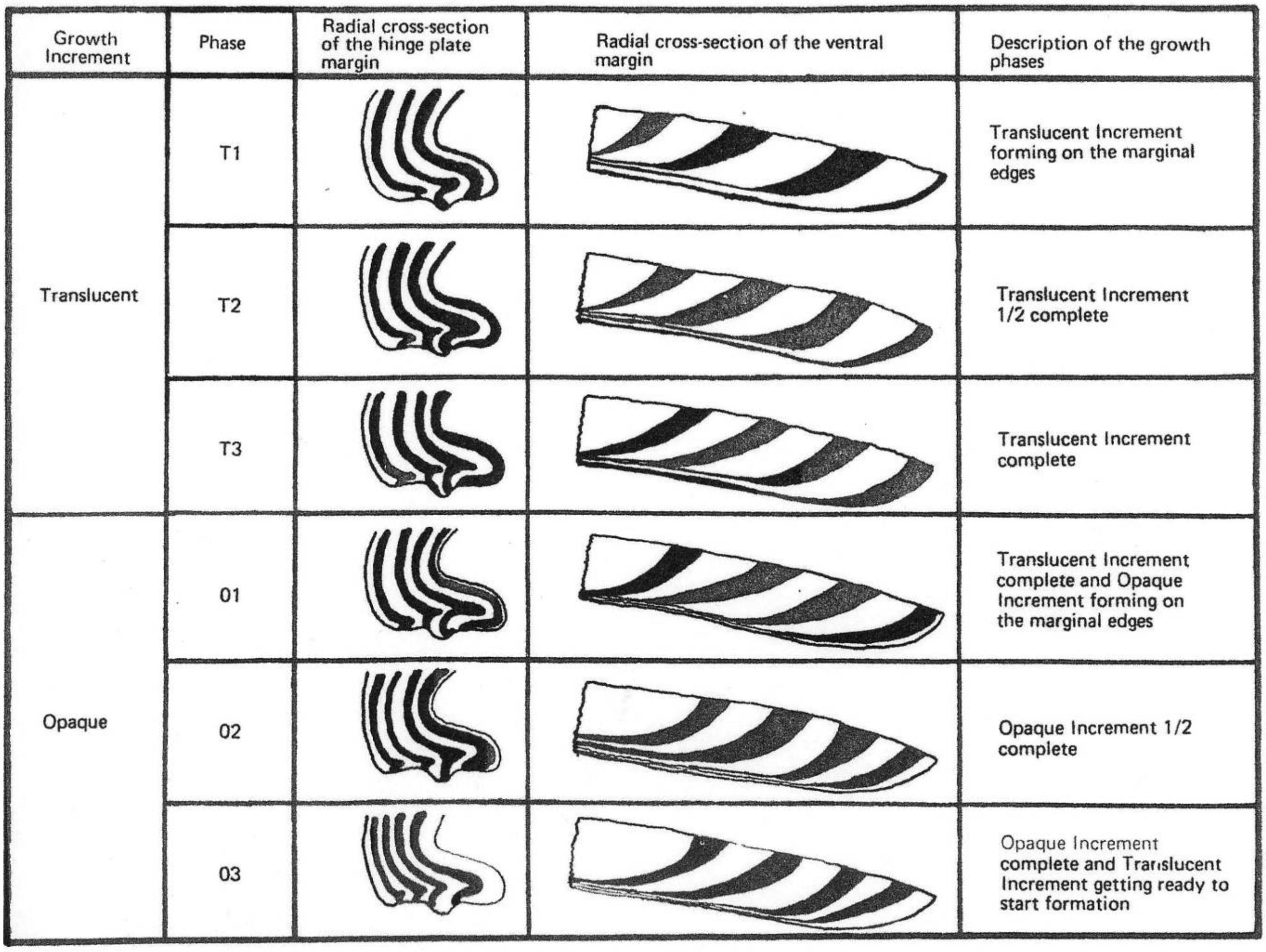

Figure 3.3 Growth Increments and Phases of Quahog Clams
(Quitmyer et al. 1985:31)

I cross-sectioned slightly more than 300 clams for this study; however, I could determine the terminal growth phase for only 188 of these clams (approximately 63 percent). Interpretation of terminal growth phase was complicated by several factors including senescence[5], small size, poor preservation, chips or breaks along the margin, purple coloration, young age (not enough years of growth to make a good comparison) and faint growth lines. When I could not interpret the terminal growth, I noted that the clam was unreadable and substituted another clam from the same FS. I could not determine the terminal growth phase for any of the clams in FS 73, 84, and 111 (from the general excavation levels), therefore they are not represented in the results.

Valves to Avoid in Incremental Growth Studies

Despite intentionally selecting valves with intact margins, many were still unreadable due to several problems. When selecting valves for incremental growth studies, one should avoid certain valves when possible. Careful examination of the valves prior to cross-sectioning can decrease the number of shells that are necessary to obtain the desired sample size.

Senescent clams are problematic because the growth lines become very close together and are often indistinguishable. Thin, horizontal lines or breaks are visible on the outside of the shell that mark one year's growth. It is important to note that the growth lines for some years may not be visible on the external shell, but they can be useful in estimating the age or condition (senescence) of the clam. If these lines are very close together at the marginal end of the valve, the clam was probably senescent and interpretation will be difficult. One can also use these horizontal lines to ensure that clams less than two years old are not sampled. I have previously discussed that clams less than two years old are not suitable for incremental growth studies. Growth over at least two years is necessary to compare the terminal growth to growth from the previous year in order to determine its season of death. For this reason, it may be preferable to exclude very small clams from the study.

One should also avoid clams that retain their purple color where possible. These shells were extremely difficult to interpret because the color often obscured growth increments (particularly the translucent increments). Due to the excellent preservation at the Grand site, several valves retained this coloration and were very difficult to interpret. On the other end of the spectrum, deteriorated or poorly preserved valves were also difficult to interpret; I recommend avoiding these valves if possible.

Summary

In this chapter, I have laid out the precise methodology I employed to determine clam seasonality. I obtained the clam sample through stratigraphic excavation and shovel testing. In all, 4,200 whole or nearly whole clam valves were collected for this study. I sampled only the right valves (n=2,133) to ensure that each clam was counted only once in the study. I divided the sample into general excavation levels and features to determine whether there were any differences between the two deposits. I took a 5 percent sample from the general excavation levels, and a 20% sample from the features.

I cross-sectioned the clams along the greatest growth axis according to the methodology provided by Quitmyer et al. (1985a and 1985b). I have also used the published data on the modern comparative collections of Quitmyer et al. (1985a and 1997). They obtained these collections from the Kings Bay Naval Base, less than 25 miles from the Grand site. To confirm the comparability of the modern comparative collection and the archaeological collection from the Grand site, I conducted stable isotopic analysis of three shells from the Grand site. Comparison of the $\delta^{18}O$ values of the archaeological collection and the modern collection confirm that the two samples have similar temperature cycles, and are therefore comparable.

I could interpret only approximately 63 percent of the cross-sectioned valves. To obtain the desired sample size, I cross-sectioned just over 300 clams. Senescent clams were very difficult to interpret and when possible one should avoid these in incremental growth studies. Other clams that one should avoid include small clams (less than two years old) and clams that retain their purple coloration.

Notes

1. As mentioned in Chapter 2, some of the clams used for this study may actually be *M. campechiensis* or a cross breed of *M. campechiensis* and *M. mercenaria*. However, all of the sampled clams were determined to be *M. mercenaria*.

2. Used here, “shells” is shorthand. I consider a shell to be one valve, not two articulated valves (which would form a whole shell).

3. Quitmyer et al. 1985a and 1985b are based on the same study at Kings Bay, Georgia. 1985a represents a chapter in the site report, and 1985b represents an article published in *Southeastern Archaeology*.

4. In hard clams, growth increments can be seen in the umbo as well as in the margin. However, there is a delay in the deposition of the most recent growth increment in the umbo, whereas in the margin the deposition is immediate. This means that the margin provides a more accurate and recent record of terminal growth than the umbo.

5. Senescence was the most common factor that precluded interpretation of season of death. Senescence refers to the phase of slow growth and general decline that occurs towards the end of a bivalve’s life cycle. When a clam is in the senescent phase of its life, translucent (slow) growth is often larger than opaque (fast) growth, and growth rings are very close together. This causes substantial difficulty in determining the terminal growth phase.

CHAPTER 4

RESULTS

Introduction

In this chapter, I provide a brief overview of the interpretations and the comparative collections I used in the study. I discuss the division of the sample into two parts: general excavation levels and the features. I then provide the results for the general levels, followed by the results for the features.

Overview

To interpret clam seasonality, I used the modern comparative collections obtained by Quitmyer et al. (1985a and 1985b,) and Quitmyer et al. (1997) from Kings Bay, Georgia. Table 4.1 shows the frequency and percentage of the growth phases of the one-year modern collection, and Figure 4.1 illustrates the percentage of growth phases per season. Figure 4.2 displays the distribution of growth phases in the two-year collection[1] of modern clams. Note that some growth phases occur in several seasons. This means that a single clam cannot be confidently assigned to a particular season. For example, a clam in the T3 growth phase could be found during any season of the year. To make inferences about season(s) of harvest, a statistically significant number of valves must be examined to show a range of phases which are then compared to the range of a modern collection.

I explored the seasonality of clams at the Grand ring in two ways: (1) trends in clams from the general excavation levels of the ring deposit, and (2) trends in clams from the features. The distribution of terminal growth phases was similar throughout the excavation levels and features; however, some differences were discernible.

Table 4.1 Distribution of Growth Phases in Modern Clams

Season	Sample	O1	O2	O3	T1	T2	T3
Summer	12	n=0 0%	n=0 0%	n=0 0%	n=0 0%	n=8 66.7%	n=4 33.3%
Fall	15	n=2 13.3%	n=0 0%	n=0 0%	n=0 0%	n=0 0%	n=13 86.7%
Winter	15	n=8 53.3%	n=1 6.7%	n=1, 6.7%	n=0 0%	n=0 0%	n=5 33.3%
Spring	27	n=6 22.2%	n=10 37.0%	n=7 25.9%	n=3 11.1%	n=0 0%	n=1 3.7%

Note: After Quitmyer et al. 1985b

T1 = onset of translucent growth
T2 = translucent growth half complete
T3 = completion of translucent growth

O1 = onset of opaque growth
O2 = opaque growth half complete
O3 = completion of opaque growth

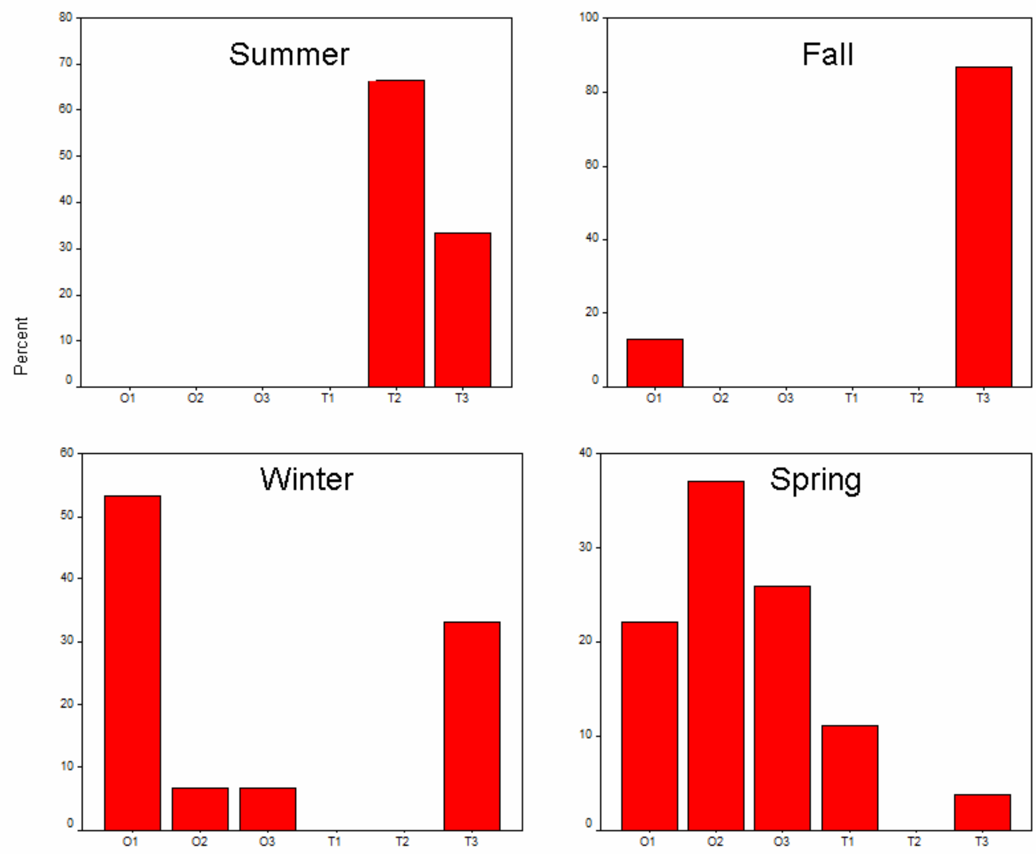

Figure 4.1 Growth Phases of Modern Clams at King's Bay Collected for One Year (After Quitmyer et al. 1985b:32). The frequencies of clams in each season were used to interpret seasons of death for clams at the Grand site.

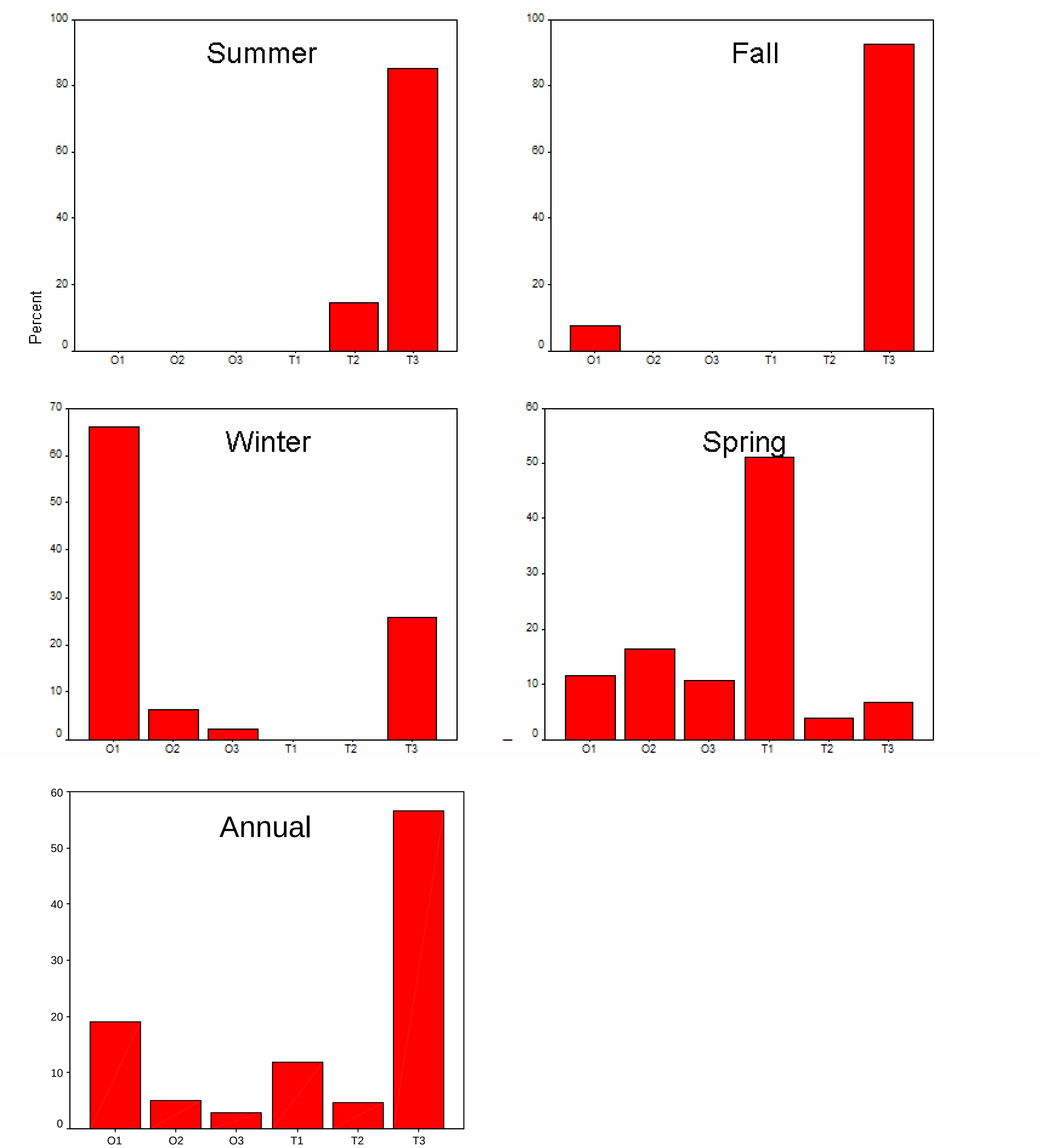

Figure 4.2 Growth Phases of Modern Clams at Kings Bay Collected for Two Years (Quitmyer et al. 1997:833). This figure shows the frequencies of clams by season and annually. This collection includes the clams shown in Figure 4.1 as well as clams that were collected over the following year.

Results from the General Excavation Levels

The sample from the general excavation levels consisted of 135 clams. Concentrations of clams are evidenced both vertically and horizontally (Tables 4.3 and 4.4). Vertically, there are dense clusters of clams in levels 7-9; horizontally, there are dense clusters of clams in test units 1 and 2 (at the center of the trench). Units 1, 2, and 3 also seemed to contain higher percentages of vertebrate faunal remains when compared to other units.

The general levels revealed clams in all phases of growth (Figure 4.3). Clams in the opaque growth phase were most common, comprising 84.4 percent (n= 114) of the sample. The translucent growth phase comprised only 15.6 percent (n=21) of the sample. The distribution of clams is as follows (descending order): O2, O1, O3, T1, T3, and T2. The most common growth phase (O2) comprised 39.3 percent of the general levels sample; the second most common growth phase (O1) comprised 25.2 percent of the general levels sample. This distribution indicated a primarily spring deposit, with collection in the winter as well. Winter collection probably occurred more frequently towards the latter half of winter.

Though the clams in the translucent increment were few, their presence was nonetheless informative. Clams in the T1 phase (n=10; 7.4 percent) represented the most common translucent growth phase. The T1 growth phase marks the beginning of heat stress in clams. The modern collection demonstrated that T1 occurs only in the spring, thus providing further evidence of a spring deposit. As discussed previously, clams in the T3 stage can be found in any season. However, with the strong indications of a spring and winter collection it is likely that the T3 clams (n=7; 5.2 percent) in the deposit were collected at this time as well. Very few clams in the T2 growth phase (n=4; 3.0 percent) were recovered. This may indicate collecting in either the spring or summer. Based on the seasonality of the rest of the clams, it is unlikely that summer collecting played a major role in the subsistence pattern.

Table 4.2 Vertical Distribution of Right Valves in General Excavation Levels

Level	Number of Right Valves	Percentage
2	24	1.2
3	54	2.7
4	49	2.5
5	98	4.9
6	127	6.4
7	307	15.5
8	391	19.7
9	525	26.4
10	100	5
11	63	3.2
12	57	2.9
13	36	1.8
14	41	2.1
15[a]	113	5.7
Totals	**1985**	**100**

Note: Shaded cells indicate high concentrations of whole clams.
[a]Level 15 represents clams recovered under features and at any levels below 14.

Table 4.3 Horizontal Distribution of Right Valves in General Excavation Levels

Test Unit	Number of Right Valves	Percentage
7	140	7.1
5	253	12.7
3	200	10.1
1	483	24.3
2	591	29.8
4	214	10.8
6	104	5.2
Totals	**1985**	**100**

Note: Shaded cells indicate high concentrations of whole clams. Excavation units were numbered from the center outward with even numbers extending to the north of unit 1 and odd numbers extending toward the south.

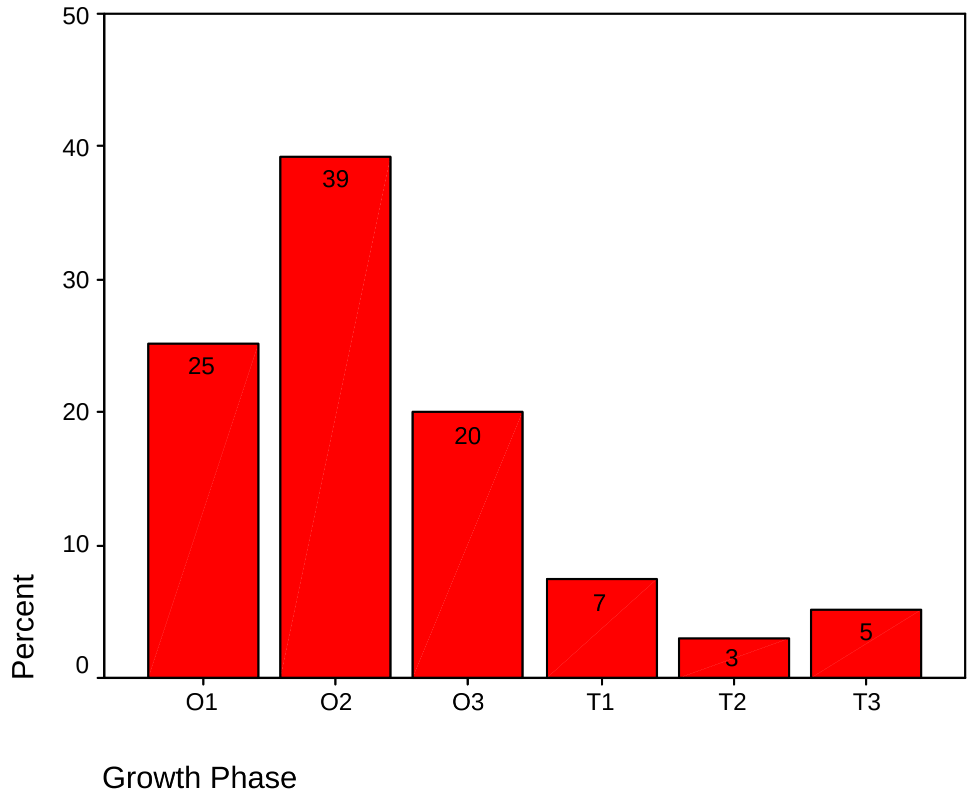

Figure 4.3 Distribution of Growth Phases in the General Excavation Levels

Clams in the opaque growth phases were found at nearly all levels of excavation, whereas clams in the translucent phase tended to be found sporadically in fewer levels and away from the surface (Figure 4.4). Clams in the translucent phase were not encountered until the fourth level of excavation, but even at lower levels translucent clams were uncommon in comparison to opaque clams. This indicated that the general trend was to target clams in the opaque growth phases during the spring and winter. In sum, the general excavation levels demonstrated Grand inhabitants collected quahog clams most frequently throughout the spring and in the latter half of winter.

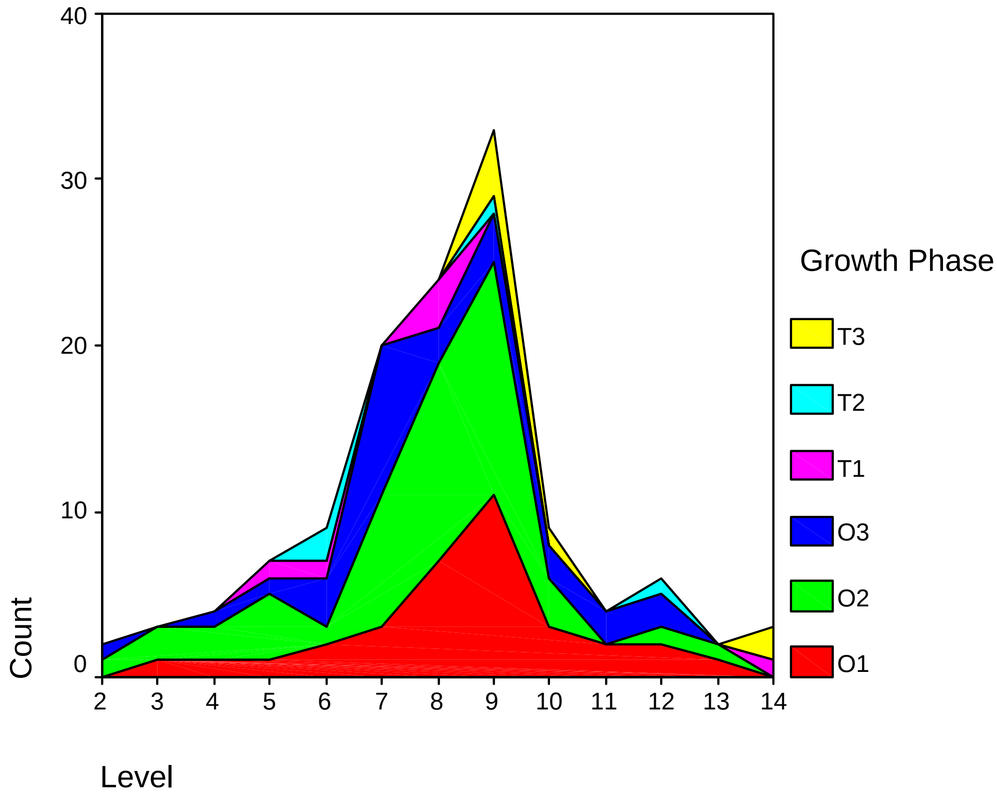

Figure 4.4 Distribution of Growth Phases in the General Levels
Levels 7, 8, and 9 contained of the highest number of clams, and therefore have higher peaks for all phases of growth.

Results from the Features

The sample from the features consisted of 53 valves. The sample from Feature 1 contained 46 valves and was explored through stratigraphic excavation in the general levels as well as shovel testing. Feature 3 contained a sample of four clams, and Feature 4 contained a sample of three clams. The distribution of clams in the features is as follows (descending order): O1 and O2 were most common; O3, T1, and T3 were all represented equally (Figure 4.5). T2 was not represented at all. Feature 1 contained far more clams than the other two features, and was analyzed as a separate entity (Figure 4.6).

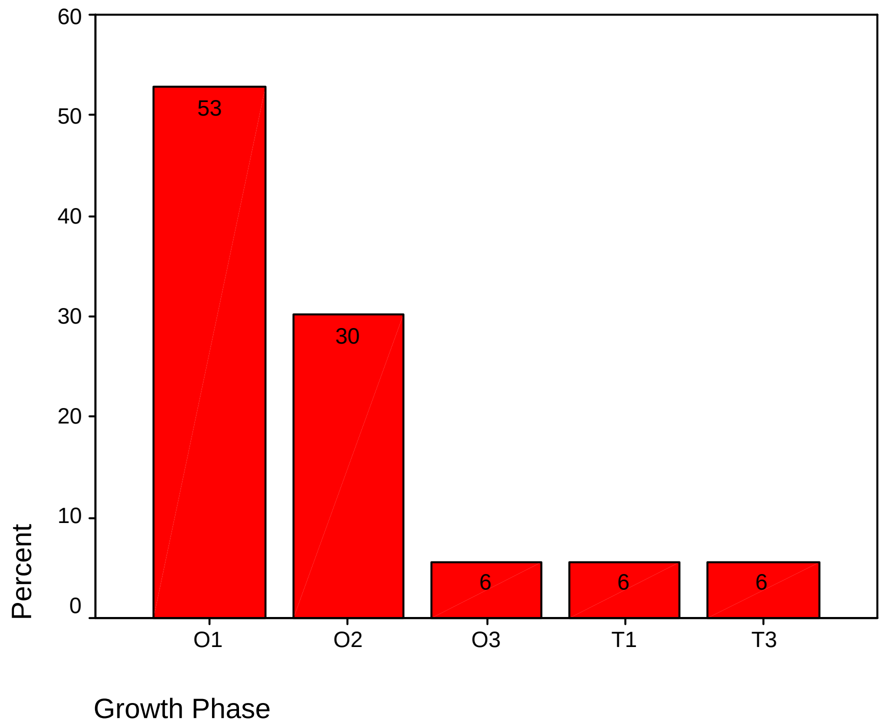

Figure 4.5 Distribution of Growth Phases in the Features

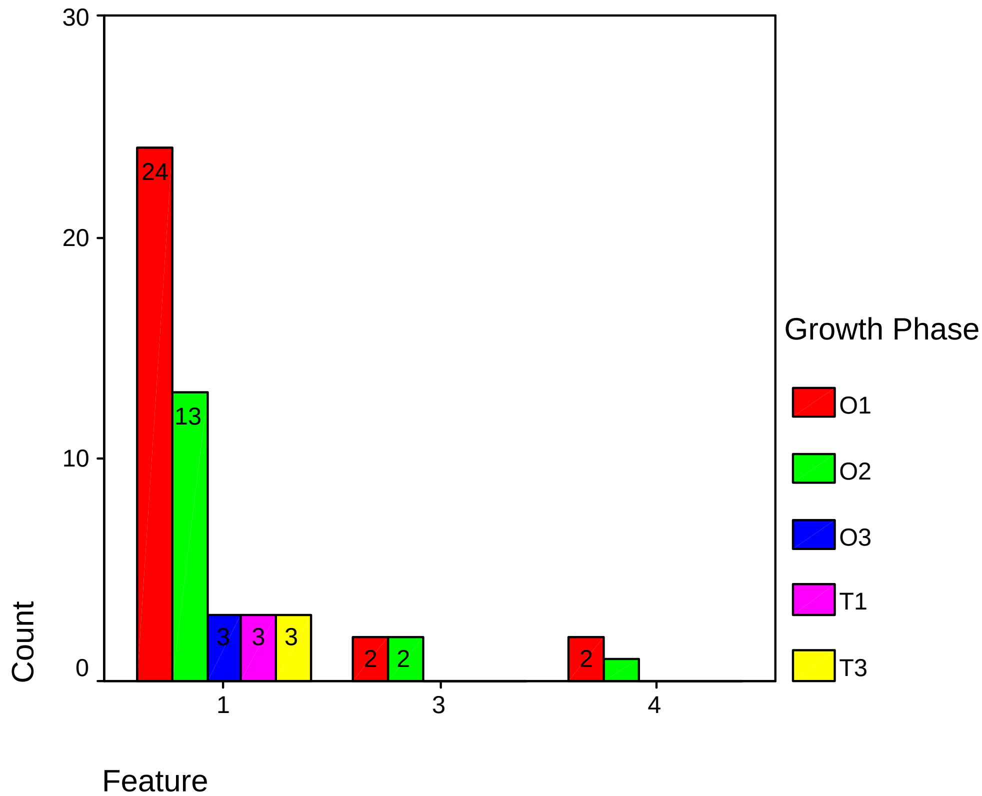

Figure 4.6 Distribution of Growth Phases in Each Feature

Feature 1 was a steep-sided pit located beneath the shell ring in unit 2, and was the largest feature encountered during excavation. (Ashley et al. 2007:49). This feature contained primarily St. Johns II ceramics, along with one charcoal tempered and one sand tempered sherd (Ashley et al. 2007). Feature 1 contained clams in all growth phases except T2 (Figure 4.7). The distribution of clams in Feature 1 is as follows (descending order): O1, O2, and an equal representation of O3, T1, and T3. Slightly more than half (52.2 percent, n=24) of the clams in Feature 1 were in the O1 growth phase and 28.3 percent (n=13) of the clams were in the O2 growth phase. It would appear that these clams were collected throughout the winter and spring. Summer or fall collection was not evident in this feature.

Features 3 and 4 contained clams in the growth phases O1 and O2 only. Although these clams may belong to winter and spring collections, there are simply too few clams to be confident about when they were gathered.

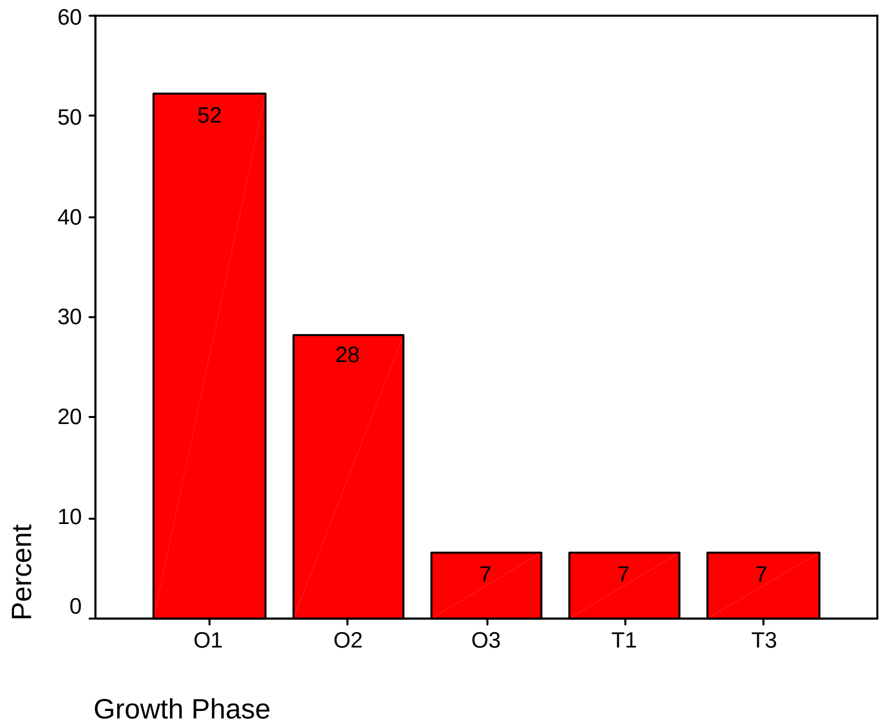

Figure 4.7 Distribution of Growth Phases in Feature 1

Clam Ages

Clams in the sample were young, ranging from 2 years old to 10 years old (Table 4.4), with most clams around 3-5 years old (Figure 4.8). It should be noted, however, that when I was cross-sectioning the clams I intentionally avoided very small clams, as well as some clams that appeared to be senescent. This practice likely selected against very young clams and very old clams as well. I counted the ages for the clams that I could

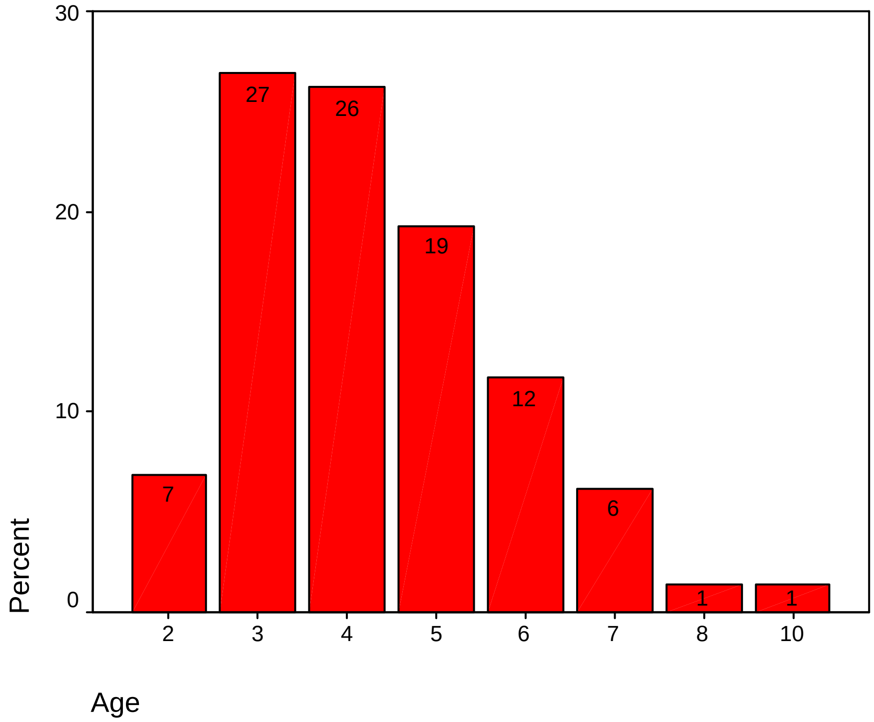

Figure 4.8 Clam Ages by Percentage

Table 4.4 Clam Ages by Count

Age	**Number of Clams**
2	10
3	39
4	38
5	28
6	17
7	9
8	2
9	0
10	2

interpret season of death, with a few additions (from within the same FS) to replace clams for which I could not determine age. Some of the clams in the sample were broken apart during cross-sectioning, and I could not determine their age. While these clams are rather young, there are a multitude of natural and environmental pressures exerted on clam populations, besides human predation. These include a variety of natural predators, such as fish, birds, starfish, and other mollusks (Claassen 1998). The overall reproductive success of clam populations is also a factor in clam demographic profiles. Therefore, the relatively young age of the majority of the clams cannot be solely attributed to human predation.

Summary

Clams in the O2 and O1 growth phases were most common in both the general excavation levels and the features (Table 4.5). O2 was most common in the general levels, whereas O1 was most common in Features 1 and 4. Feature 3 has an equal representation of O1 and O2 growth phases. Clams in the O3 growth phase were much more common in the general levels than they were in the features. In general, clams in the translucent growth increment were few, but were more common in the general levels than they were in the features. Clams in the T1 growth phase were the most common of the translucent increment, which occurs only during the spring. Clams in the T2 growth

Table 4.5 Distribution of Growth Phases in the Grand Shell Ring

Context	**Sample**	**O1**	**O2**	**O3**	**T1**	**T2**	**T3**
All	188	n=62 33%	n=69 36.7%	n=30 16%	n=13 6.9%	n=4 2.1%	n=10 5.3%
General Levels	135	n=34 25.2%	n=53 39.3%	n=27 20%	n=10 7.4%	n=4 3%	n=7 5.2%
All Features	53	n=28 52.8%	n=16 30.2%	n=3 5.7%	n=3 5.7%	n=0 0%	n=3 5.7%
Feature 1	46	n=24 52.2%	n=13 28.3%	n=3 6.5%	n=3 6.5%	n=0 0%	n=3 6.5%

phase were the least common and found only in the general levels. T2 clams were most likely collected during the spring, although T2 clams were also found in the summer in the modern comparative collection. Clams in the T3 growth phase were found in similar amounts in the general excavation levels and features.

In sum, the people who constructed the Grand shell ring collected quahog clams primarily during the spring and winter. Both the general levels and Feature 1 indicated collection of clams throughout the spring. The general levels deposit indicated that occupants collected winter clams more frequently towards the latter half of the season, whereas the deposit in Feature 1 indicated that collection occurred throughout the winter.

When Feature 1 was deposited, clams were collected throughout the winter and spring. In the general levels deposit, clams were collected in the *latter half of winter,* with an emphasis on spring collection. This may represent a slight change in the timing of quahog clam exploitation, or Feature 1 may represent an atypical collection event(s). Summer and fall collection are not apparent in either the general levels or Feature 1.

Notes

1. The two-year collection of modern clams (Quitmyer et al. 1997) includes clams collected from the one-year sample (Quitmyer et al. 1985a and 1985b).

2. One clam was located underneath Feature 1. This clam was included with the rest of the sample from Feature 1.

CHAPTER 5

INTERPRETATIONS

Introduction

In chapter 5, I present the interpretations of the seasonality study. I discuss St. Johns period sites as well as other Southeastern sites that yielded seasonal patterns of collections, and provide several explanations for the seasonal collection of quahog clams. I then explore four explanatory models for the seasonal collection pattern evident at the Grand site. These include: (1) Nutrition and Biomass, (2) Food Availability, (3) Feasts and Aggregations, and (4) Limited Deposition During the summer and fall. Finally, I provide a discussion of the patterns of collection at other St. Johns sites in northeast and central Florida.

Quahog Clams and Seasonal Collection

In 1986, Claassen synthesized the results of shellfish seasonality studies at 94 sites in the southeast United States. Two St. Johns sites (both St. Johns II) were included in her discussion: the Fletcher site (8SJ57) and the Palm Coast Midden (8FL15). At the Fletcher site coquina were the only species examined. Miller (1980 cited in Claassen 1986a:28) reported that coquina were harvested in October, but Claassen (1986a:28) argued that his graph actually demonstrated collection between October and January. The Palm Coast Midden yielded similar results (Claassen 1986a:28). Claassen (1986a:29-30) concluded that "Regardless of the time period or the level of cultural development in the southeastern United States….Atlantic marine shellfish were collected principally late fall to spring. Minor amounts of summer collecting did occur in Georgia…. The exceptions are few."

More recent work has shown otherwise. In 1997, Quitmyer, Jones, and Arnold synthesized the results of clam seasonality studies at 52 sites in the southeast United States. They found a variety of exploitation patterns, ranging from a single season to year-round. At the Timucuan Historic and Ecological Preserve, for example, several St. Johns II sites demonstrated year-round collection of quahog clams, and oysters were taken during the summer and fall. Other sites throughout Florida also demonstrated summer or year-round shellfish collection. These studies demonstrate that the fall to spring collection pattern discussed by Claassen is by no means a hard and fast rule, and cannot be used as the sole explanation for the winter and spring pattern of exploitation at the Grand shell ring.

As previously discussed, red tides, paralytic shellfish poisoning (PSP), and diarrhetic shellfish poisoning (DSP) were probably not a substantial threat to prehistoric populations. Several sites in Florida demonstrated clam exploitation in the summer and fall, providing further evidence that red tides, PSP, and DSP were either not present or not threatening enough to deter collection. Spoilage due to summer and fall heat did not seem to deter clam collection during this time either. Other factors influencing the selection for spring and winter collections (and aversion during summer and fall) must be explored to understand the quahog clam collection pattern at the Grand Shell Ring.

Seasons of Site Use

It is not valid to base inferences of site seasonality on one resource alone because people do not always collect resources throughout the year, even if they are available year-round. This means that the absence of seasonal evidence (of clams) is not necessarily evidence for the absence of people. The results of the vertebrate faunal analysis conducted by Dr. Rochelle Marrinan are thus imperative for understanding the patterns of quahog exploitation at the Grand site (see Ashley et al. 2007:113-131). Faunal analysis indicated that subsistence practices focused primarily on the surrounding salt marsh and tidal creeks, with secondary attention to brackish water or fresh water that may be indicative of ponds or river mouths (Ashley et al. 2007:124). The presence of migratory birds and a variety of fish species recovered from the deposit indicated that every season of the year was represented. However, the duration of occupation throughout the year is unknown (Ashley et al. 2007:133).

Occupants collected quahog clams exclusively during the spring and winter. Although people deposited vertebrate fauna into the Grand shell ring during the summer and fall, they did not exploit quahog clams at this time. Clams are available throughout the year; therefore, the absence of quahog clams in the diet for half of the year must represent a dietary *choice*. I discuss several potential explanations for this pattern below.

Explanatory Models for Seasonal Quahog Collection

Model 1: Seasonal Exploitation Tracked Nutrition and Biomass

During the summer and fall, quahog clams spawn and come under heat stress. According to Quitmyer (1985:29), harvesting during this period places the clam population at risk of local extinction, and early European colonies legislated conservation. Smith and Wishnie (2000:515), however, demonstrated that (faunal) conservation behaviors are rare in subsistence-based societies, and are typically not responsible for food avoidance. Furthermore, Claassen (1986b) has provided a strong case that prehistoric people would be unlikely to deplete shellfish resources significantly; even commercial exploitation has not drastically reduced shellfish populations. Hence, it seems unlikely that prehistoric populations avoided collecting shellfish during the summer and fall in order to ensure shellfish reproduction.

Immediately prior to spawning, most shellfish undergo an increase in meat weight (Waselkov 1987:110). This may be due to seasonal allocation of clam resources to reproductive organs (see Peterson and Fegley 1986). In clams, this increase occurs during the spring. The spring emphasis and winter collection of clams seen at the Grand site may be the result of purposefully targeting clams at times when their biomass was greatest (especially prior to spawning) and the nutritional levels were high.

In addition to lowering biomass, spawning reduces the nutritional value of clams as well; glycogen and caloric value decrease at this time (Quitmyer 1985:29). This means that it would be most beneficial to gather clams when they are not spawning or in heat stress, which is exactly what we see at the Grand site. In addition, some people have argued that shellfish are less palatable during spawning (Waselkov 1987:110).

The seasonal exploitation at the Grand site appears to track these rises and falls in biomass and nutrition. Clams were exploited primarily during the spring, when biomass and nutrition were highest, avoided during the summer and fall when biomass and nutrition were low (due to spawning and heat stress), and collected in the winter when biomass and nutrition were relatively high. The occupants at the Grand site may have selected clams in the winter and spring for their high biomass and possibly their nutritional value.

Model 2: Seasonal Exploitation was Dictated by Food Availability

It is possible that occupants gathered clams during the winter and spring because other preferred resources were unavailable. In other words, clams may have been used as a seasonal supplement in the diet when other foods could not be obtained. The overwhelming majority of the vertebrate diet was obtained from fish (Ashley et al. 2007), many of which are available throughout the year. To determine whether there were seasonal differences in the availability of important fish, I examined the seasonal data on fish at the Grand site provided by Ashley et al. (2007:123 and 134). Nine species of fish contributed more than 1 percent of the total biomass, and collectively amounted to nearly half of the vertebrate biomass for the site (45.66 percent) (Table 6.8 in Ashley et al. 2007:123). I compared the seasonal availability of these nine fish to the patterns of quahog clam collection at the Grand site.

The nine selected fish species contributed 45.66 percent of the total vertebrate biomass at the Grand site. Table 5.1 shows the availability of these select fish. Four of the fish species were available year-round and represented 16.8 percent of the total biomass. The other five species were available seasonally and totaled 28.87 percent. Six out of nine species were available throughout the winter, (these fish composed 22.46 percent of the total biomass); one was available middle though late winter and one was available only in late winter. During the spring, all fish were available (45.66 percent of the biomass); one was available in late spring only. All were available in the summer as well (45.66 percent of the biomass); one was available only in late summer. During the fall, eight out of nine fish were available (these fish represented 43.89 percent of the total biomass); two were available only in early fall.

Table 5.1 Availability of Select Fish at the Grand Site

Taxa	Percent	Winter	Spring	Summer	Fall	Seasons
Ariidae[a]	11.15	None	All	All	All	Spring-fall
Ariopsis felis	3.27	None	All	All	All	Spring-fall
Bagre marinus	2.86	None	All	All	All	Spring-fall
Mugil sp.	3.81	All	All	All	All	Year- round
Caranx sp.	5.92	None	Late	All	Early	Late spring-early fall
Archosargus probatocephalus	3.9	Mid-Late	All	Late	Early	Mid-winter-spring, Aug, and Sept
Cynoscion sp.	2.97	All	All	All	All	Year-round
Pogonias cromis	4.42	All	All	All	All	Year-round
Sciaenops ocellatus	1.77	Late	All	All	None	Late winter-summer
Pleuronectiformes[b]	5.59	All	All	All	All	Year-round

Note: Compiled from Ashley et al. 2007
[a]The Ariidae family includes both species of sea catfish: *Ariopsis felis* and *Bagre marinus*.
[b]The *Pleuronectiformes* family includes flounder.

In short, all selected fish were available during the summer, and almost all were available during the fall, meaning that plenty of fish were available during the seasons shellfish were not collected. Only six out of the nine selected fish (22.46 percent of the total biomass) were available during the winter, which may have created a need for winter consumption of quahog clams. During the spring, however, all selected fish were available. Nearly half of the total vertebrate biomass (45.66 percent) was available at this time, and supplementing fish in the diet (with clams) would be unnecessary.

Based on the seasonal availability of the selected fish, clams may be an important supplement in the winter, but they do not appear to be a necessary dietary supplement in the spring. This is contrary to what we would expect if occupants used clams primarily to supplement fish. If site occupants collected clams to replace fish, this would occur when fish were unavailable or less readily available, and would not collect clams when fish were plentiful. Throughout the general levels, spring collection was emphasized, a time at which all nine selected fish (46.55 percent of the total vertebrate biomass) were available. This leads me to conclude that occupants did not collect clams primarily as a replacement for unavailable fish species.

Wild plant foods were almost certainly an important part of the diet, and it is possible that when they were unavailable in adequate quantities people supplemented their diet with clams. Claassen (1986a:34) has argued that shellfish eaten during the fall and winter were targeted for their carbohydrate value, which is highest during this time. Paleobotanical evidence is not currently available for the Grand site, and can neither support nor refute the speculation that clams were sought when plant foods were unavailable.

As stated above, fish were the primary food item for people at the Grand site. It does not appear that clams were collected during the winter and spring as a substitute for fish. Most of the selected fish were available during the winter, and all were available during the spring. It is possible that clams were collected to replace plant foods that were unavailable during the winter and spring, but to date paleobotanical evidence is unavailable.

Model 3: Clams were Gathered for Feasts and/or Aggregations

It is possible that occupants gathered clams seasonally in preparation for feasts and/or aggregations during the winter and spring. According to Ashley et al. (2007:ii), the site may have served as the ceremonial center of the dispersed St. Johns II population in the area. The Grand Shell Ring is composed primarily of subsistence refuse (Ashley et al. 2007). Aggregations at the site would have added large amounts of refuse to the ring, including quahog clams.

Foods that can be gathered and processed in mass quantities would be ideal for providing food for large numbers of people (see Jackson and Scott 2002:46). Hayden (2001:38) also argued that typical, everyday foods (which can be acquired without much deviation from daily life) are often used to feed the many participants of feasts in situations where social solidarity is the goal. The clams, oysters, and fish recovered from the Grand site would certainly meet these requirements. Feasts designed to create social solidarity would also be less likely to display elite goods and status differences in food consumption, which is what we see at the Grand site. If St. Johns II people were a communally based society as Ashley (2002) has suggested, this is exactly the type of feasting we would expect to find.

A few large deposits of unconsolidated and jumbled whole oyster shells were located (Ashley et al. 2007:i), as well as multiple areas of unconsolidated, jumbled, and clean tagelus and clams shells. Several articulated clams were also found in the ring, possibly indicating large amounts of prepared food where shells that could not be easily opened were simply discarded. Russo (2004:43) has argued that this type of deposit is indicative of rapid deposition, which may represent a feasting event. However, much of the ring was composed of dark gray to black soil with densely packed shell (Ashley et al. 2007:i), which is more suggestive of a daily refuse deposit.

Jackson and Scott (1995) have outlined criteria for determining feasting behavior based on faunal remains. They based these criteria on inland assemblages that primarily consisted of mammalian remains; applying these criteria to coastal assemblages that contain large amounts of fish and relatively fewer mammals has proven difficult (Ashley et al. 2007:135). According to Jackson and Scott's (1995) criteria for feasting, the Grand faunal assemblage does not indicate feasting events. However, feasting assemblages would look substantially different in the coastal zone, and models for detecting coastal feasting assemblages are currently lacking,

Artifactual evidence at the Grand site does not indicate ritual feasting. Ritual items or exotic goods were not present in the Grand ring. Excavation uncovered few items of personal adornment (e.g., shell and bone beads) and few tools; ceramic sherds were the most common artifact at the Grand ring. Vicki Rolland has compared the ceramics at the Grand site with the nearby Shields Mound (8DU12), which was also occupied during the St. Johns II period (A.D. 900-1250). The Shields Mound contained both quotidian refuse and a deposit indicative of feasting (Ashley et al. 2007:100). Ceramic analysis demonstrated that most vessels at the Grand site were 20-30 cm in diameter, a much smaller size than the nearby Shields Mound (Rolland 2007). The Grand site contained vessels of all sizes, but small and medium vessels (less than 20 cm in diameter) were frequent; only four vessels were considered large (50-60 cm), compared to 33 from the Shields site (Ashley et al. 2007:102).

Blitz (1993:85) argued that the variety of food processing activities is decreased during feasting events in comparison to every day food processing, which results in a small range of vessel sizes (at feasts). At the Grand site, most vessels were small, and the range of vessel size appears to be smaller than at Shields Mound. Blitz (1993:85) also argued that the large amounts of food consumed at feasts would necessitate large cooking vessels that would likely be represented in the deposit. This is not the case at the Grand site – most vessels are small. While the size range of ceramic vessels is small, the Grand ring lacks large vessels that are typical at feasting sites.

The spring emphasis evident in the Grand site may be the result of limited collection in preparation for feasting or during aggregations at the site. Although quahog clams would probably be included in feasts, it is unlikely that they were used solely for feasting events. Quahog clams are typically a plentiful constituent in St. Johns II middens, and were a year-round food source at other St. Johns II sites (see Russo et al. 1993). Clearly, St. Johns people did not use clams solely for feasting, but feasting events or aggregations might explain the spring emphasis and limited seasonal collection evident at the site. Perhaps numerous people aggregated at the site during the winter and spring for seasonal feasts, ceremonies, or funerals in the sand burial mound. It appears that some portions of the Grand deposit were the result of feasting, but the majority of the deposit appears to have accumulated from quotidian refuse disposal.

Model 4: Limited Deposition Occurred during Summer and Fall

If aggregations occurred during the winter and spring, it is possible that fewer people used the site during the summer and fall. A small resident population may have remained at the site year-round who deposited refuse into the ring throughout the year. This would explain why fauna indicating all seasons of the year was recovered at the site. Perhaps this was a resident population who dealt with funeral preparations related to the sand burial mound. These people may or may not have consumed clams throughout the year.

Although this model is possible, it seems to be the least plausible. Vertebrate fauna was deposited throughout the year, even though clams were exploited only during the winter and spring. Oysters were gathered primarily in the winter, although they were gathered throughout the year (Ashley et al. 2007). Oysters and clams are found in rather different locations (oysters are found on bars in large aggregations whereas clams are found singly buried within the substrate) so it is not entirely surprising that they demonstrated different collection patterns. This indicates that people consumed other types of shellfish throughout the year, making unlikely that the lack of clams during the summer and fall was a result of few people living at the site.

Quahog Clams at Other St. Johns Sites

Russo et al. (1993) carried out an extensive study of quahog seasonality at the Timucuan Ecological and Historic Preserve, located in northeast Florida. This study was the result of a resource management project that examined occupation of the area from the Preceramic Late Archaic through the Mission period. Although the Grand site lies within the boundaries of the Timucuan Preserve, it was not examined as part of the study. Russo et al. (1993) evaluated quahog seasonality at several Archaic, St. Johns, and Savannah period sites. The five St. Johns period sites are of particular interest for this research (Table 5.2). They found a spring emphasis of clam collection at several of these sites, as well as year-round, winter-summer, spring, and winter collections.

Seasonality studies of quahog clams were carried out at several St. Johns period sites in Central Florida as well (Table 5.3). Two St. Johns I period sites indicated year-round clam gathering, and one indicated winter collection (Russo et al. 1989, Quitmyer et al. 1990). Three St. Johns II period sites demonstrated three different patterns of consumption: year-round, winter-spring, and summer-fall (Quitmyer et al 1995). Unlike the Grand site, spring emphasis was not evident at any of these sites. It would appear that there may be more variability in seasonal clam collection in Central Florida, but more studies must be undertaken.

Table 5.2 Quahog Seasonality of St. Johns II Sites in the Timucuan Preserve

Site Name	**Number**	**Grid Coordinates**	**# of Clams**	**Seasons Exploited**
Cedar Point North	TIMU17 #1 Za56	500N/25W	25	Year-Round
Cedar Point North	TIMU17 #2 4-Za69	513N/76E/4	43	Spring-Summer
Cedar Point North	TIMU17 #3 5-Za70	513N/76E/5	34	Spring-Summer
Cedar Point North	TIMU17 #4 6-Za71	513N/76E/6	49	Winter- Summer; Spring Emphasis
Cedar Point North	TIMU17 #4 7-Za78	513N/76E/7	15	Winter-Summer; Spring Emphasis
Cedar Point North	TIMU17 #5 Za55	440N/65W	22	Spring
Cedar Point North	TIMU17 #5 2-Za66	440N/66W	17	Spring
Cedar Point North	TIMU17 #5 3-Za67	440N/66W	24	Spring
Cedar Point North	TIMU17 #6 Za60	400N/65E	29	Winter
Cedar Point	TIMU28 Za54	30N/170E	19	Winter
Dolphin Island	TIMU154 Za101	Surface	12	Spring
Jones	TIMU168 Za139	EU1/LV2	46	Winter-Summer; Spring Emphasis
Jones	TIMU168 Za141	EU1/LV3	17	Winter-Summer; Spring Emphasis
Piney Point	8NA31	Feat 1/6	29	Winter

Note: Compiled from Russo et al. 1993

Until more clam seasonality studies are conducted in the immediate area, it is impossible to determine whether the Grand site represents a typical seasonal schedule for clam consumption or whether it represents something more unusual. These types of studies could also shed further light on the issue of feasting at the Grand site. Once more clam seasonality studies are conducted at St. Johns period sites a clearer picture of regional differentiation and/or similarity can be developed.

Table 5.3 Quahog Seasonality of St. Johns I and II Sites in Central Florida

Site Name	**Site #**	**Period**	**# of Clams**	**Season**	**Reference**
Honeymoon Hill	8BR162	St. Johns I	30	Winter	Quitmyer et al. 1990
Edgewater – Mound D	8VO115	St. Johns IA-IB	299	Year-round	Russo et al. 1989
Edgewater – Mound B	8VO1705	St. Johns IA-IB	307	Year-round	Russo et al. 1989
Seminole Rest – Snyder's Mound	8VO124	St. Johns II	383	Year-round	Quitmyer 1995
Seminole Rest – Fiddle Crab Mound	8VO124	St. Johns II	247	Winter – Spring	Quitmyer 1995
Seminole Rest – Mound II	8VO124	St. Johns II	32	Summer – Autumn	Quitmyer 1995

Summary

I have explored several explanations for the seasonal pattern of quahog collection, including models based on nutritional value and biomass, dietary supplements, feasting foods and seasonal aggregations, and dispersals resulting in differential deposition throughout the year. At present, the best explanation is that clam exploitation tracked seasonal fluctuations in biomass and nutrition, although other factors likely influenced the subsistence pattern as well.

Grand occupants collected clams exclusively when they were experiencing fast growth – during the winter and spring. Clam consumption occurred during times when clams had high biomass and were most nutritious. It is likely that St. Johns II people were aware of seasonal changes in biomass of clams, and followed a seasonal schedule to optimize their diet. It does not appear that occupants primarily used clams as a seasonal substitute for fish, since many fish were available during the seasons of clam collection. Although three out of the nine selected fish were unavailable during the winter, all were available during the spring, when clam collection was emphasized. Based on the comparison of clam collection and fish seasonality, nearly half of the vertebrate biomass was available during the spring, thus obviating a *need* to collect clams due to a lack of fish. It is possible that clams supplemented plant foods that were unavailable during this time, but the lack of paleobotanical evidence precludes testing this hypothesis.

Clams may have been an important menu item for feasts held during the winter and spring. Clams, oysters, and fish could have provided large amounts of foods with minimal procurement and processing costs. These are the most common faunal remains in the shell ring and provided a substantial amount of food. Excavation at the Grand site revealed mixed evidence both for and against feasting. Based on clam seasonality alone, I cannot determine that feasting occurred at the Grand shell ring; but the unusual ring shape, associated sand burial mound, shell orientation and condition, the large quantities of food (that were simply procured and processed), and the spring emphasis on clam collection may hint at ceremonial activity at the site. It is quite possible that the Grand shell ring represents an amalgamation of both daily refuse and feasting deposits. Russo and Heide (2003:34) argue that shell rings are places of both habitation and ceremony, with much of the ring resulting from feasting events. This would explain why some areas of the Grand excavation appear to be the result of feasting, yet the majority of the deposit appears to be the result of daily refuse discard.

During the summer and fall, it is possible that a limited resident population remained at the Grand site and deposited refuse into the ring. This would explain why fauna from all seasons of the year were recovered, but clams killed during these times were absent. Few clams might have been gathered by this population during the summer and fall or perhaps not at all. Although this model is possible, it is not well supported by the current evidence. It seems unlikely that the absence of clams during the summer and fall was due to an absence of people, particularly when one considers that oysters and vertebrate fauna from all seasons of the year were found within the deposit.

One thing is clear from other clam seasonality studies of St. Johns II people –clam exploitation peaked during the spring at several sites. This may indicate that spring was the preferred time to collect clams because of their nutritional value and high biomass (prior to spawning). I believe that this is the primary cause for the seasonal pattern of winter and spring collection of clams at the Grand site. Clams were collected when they had the most meat and when they were the most nutritious. A comparative study of the seasonality of clams in the outlying middens might provide information on whether clam exploitation during the construction of the shell ring was markedly different.

CHAPTER 6

CONCLUSIONS

Introduction

In this final chapter, I provide a review of the initial hypotheses, the sample, the results for both the general excavation levels and the features, and the explanatory models proposed in Chapter 5. I provide concluding remarks, and then I discuss future directions for research at the Grand site.

Discussion and Concluding Remarks

This study sought to determine the season(s) in which northern quahog clams were collected and to develop an understanding of when the site was occupied. In Chapter 1, I laid out three hypotheses that I could test with this study. They are as follows. (1)Year-round exploitation of quahog clams occurred at the site, indicating year-round occupation and deposition. (2) Specific seasonal usage of quahog clams occurred at the site, despite longer periods of deposition (indicated by the faunal remains of other seasonal species). (3) Limited site usage and deposition occurred only during a specific season(s) at the site, indicated by limited seasonal evidence of both quahog clams and other seasonal fauna. This study has clearly demonstrated that hypothesis 2 is correct – clams were gathered during specific seasons of the year, even though all seasons of the year were represented in the vertebrate faunal assemblage.

I cross-sectioned just over three hundred valves to obtain the desired sample size of 188 valves. I divided the sample into two sections, the general excavation levels and the features. This division allowed me to examine the differences between the different types of deposits. I cross sectioned a sample of 5 percent (rounded up to the nearest whole number) of the general levels, and a sample of 20 percent (rounded up to the nearest whole number) of the features. To determine whether the 5 percent sample was adequate I reduced the sample size of Feature 1 from 20 percent to 5 percent and compared the frequencies. The 5 percent sample achieved an adequate representation of Feature 1; therefore, the 20 percent sample could have been reduced to a 5 percent sample without obvious detriment.

The general excavation levels totaled 135 clams and demonstrated all phases of growth. This deposit indicated that Grand occupants collected quahog clams primarily during the spring, with collection in the latter half of winter as well. Summer or fall collection was not evident. Feature 1 was the only feature for which clams seasonality could be interpreted. In other features clams were either nonexistent or too few in number to interpret confidently. The Feature 1 sample totaled 46 clams. It demonstrated a slightly different seasonal schedule from the general levels. Feature 1 demonstrated winter through spring collection, instead of late winter-spring collection. No summer or fall collection was evident in Feature 1. Feature 1 may represent a slightly different pattern of clam collection prior to ring construction, or it may represent an atypical collection event(s). Like the general excavation levels, Feature 1 yielded primarily St. Johns II ceramics. Vertebrate faunal analysis of feature 1 is forthcoming. A comparison of the vertebrate faunal assemblage in Feature 1 with that of the general excavation levels may indicate similarities or differences between the two deposits.

I have explored several explanations for the seasonal collection pattern at the Grand shell ring. The first possible explanation was that clam collection tracked nutritional and biomass changes in quahogs. In northeast Florida, clams spawn and go into heat stress during the summer and fall. At this time, clams decrease in nutrition and biomass (Quitmyer 1985:29), and are said to be less palatable at this time (Waselkov 1987:110). During this time, clams were avoided at the Grand site. In the winter and spring, biomass and nutrition are increasing, especially in the spring just prior to spawning. Clam exploitation at the Grand site occurred almost exclusively during the winter and spring, when biomass and nutrition were at their highest. It appears that occupants purposefully selected clams at times when they had the highest biomass and were most beneficial. As discussed previously, the current evidence seems to support this model best.

Another possible reason for seasonal exploitation was that clams were collected when other foods were unavailable or scarce. Vertebrate faunal analysis demonstrated that fish were the principal food item at the Grand ring (Ashley et al. 2007). Nine species of fish (that each contributed more than 1 percent of the total vertebrate biomass) were examined for seasonal availability. In total, these nine species represented nearly half of the total vertebrate biomass. It appears that a few of these fish were unavailable during the winter, but all nine fish were available at some point in the spring. At the Grand site, occupants exploited clams in the winter, when fewer fish were available, but exploited clams most frequently during the spring, when all of the selected fish were available. This indicates that occupants did not gather clams primarily to supplement fish in the diet. Paleobotanical evidence is not yet available at the Grand site, and it is possible that clams supplemented important wild plant foods. Domesticated plants have not been recovered from any St. Johns II contexts in northeast Florida (Ashley 2003:280), and are therefore not expected to be part of the diet at the Grand site.

It is possible that clams were gathered for late winter and/or spring feasts and/or aggregations. Some aspects of the Grand deposit indicated feasting, such as the small range of vessel sizes, areas of loose, clean, and jumbled shells, articulated clams, and large amounts of food capable of feeding large numbers. Other aspects of the deposit do not indicate feasting, such as smaller vessels instead of larger ones, lack of elite goods, year-round deposition, and the dark gray soil with densely packed shell that characterized the majority of the deposit. It is likely that the Grand site represents an amalgamation of quotidian refuse disposal and feasting deposits. Russo and Heide (2003) argued that shell rings represent the results of both feasting and daily refuse disposal, and the Grand site seems to support this interpretation. This would explain the inconsistency of evidence regarding feasting, indicating that while some areas may have been the result of feasts, the majority of the shell ring appears to have accumulated as the result of quotidian refuse disposal. The associated sand burial mound suggests some sort of ceremonial function for the site. Feasts may have been related to interments in the sand burial mound, or may have had entirely different meanings and associations.

While it is possible that aggregations occurred in the late winter and spring, and that a significantly smaller population remained for the rest of the year, this seems somewhat unlikely. Faunal remains were deposited into the ring throughout the year, and oysters were collected year-round. It seems more likely that occupants did not consume clams during the summer and fall, despite occupation at the site. Clams were spawning and/or in heat stress during the summer and fall, and consequently had a lower biomass and nutritional value. This further supports the notion that occupants simply avoided clams during this time.

Future Directions

This study revealed that occupants consumed clams primarily during the latter half of winter and throughout the spring, and provided insight into the cause of this resource scheduling. It should be noted that the 2006 excavation trench represents only a small portion of the shell ring at the Grand site. Different areas of the ring may yield different construction techniques, faunal remains, artifacts, dates of deposition, and clam seasonality. Russo (2004) has used social space theory to argue that high status individuals would have occupied the center portion of the ring (looking across to the opening). According to Russo, this location often contains higher quantities of animal remains (demonstrating an ability to gather and/or store food) and may contain a higher percentage of elite goods (Russo 2004). This area at the Grand site has yet to be excavated, and may yield significantly different artifacts and faunal remains. Future excavations should be mindful of these possible variations within the ring and should seek to develop an understanding of ring conformity or variability.

Future excavations should also consider the surrounding areas of midden and refuse disposal. Comparing the shell ring to typical mounded or sheet middens may help to illuminate issues of function, particularly whether the vessel sizes, subsistence practices, and resource scheduling seen at the Grand site were typical of the immediate area. By understanding what the typical St. Johns II site looks like (in the immediate surrounding area), it may be possible to develop a better understanding of whether the Grand ring functioned as a ceremonial location, a quotidian deposit of refuse, or some blending of the two. Thompson (2007) stated that shell rings likely took on different meanings and functions throughout time. It is quite possible that the shell ring at the Grand site took on different meanings and functions over the ~350 years it was constructed.

Seasonality studies have the ability to play an important role in northeastern Floridian archaeology. Northeastern Florida was a border region between the St. Johns and St. Marys archaeological cultures. It is possible that these groups represent different ethnic groups. While the ceramics of these cultures were distinct, the ubiquity of sand tempered plain wares obfuscates identifying the associated culture. Seasonality and resource scheduling may have been a cultural marker that was specific to the group. By developing an understanding of the seasonal patterns and resource scheduling typical of clearly identified groups (e.g., St. Johns, St. Marys), archaeologists may be able to unravel the complex issues of identity in northeast Florida. Studies of clams, oysters, fish, and migratory birds all offer important information on not only site seasonality and usage but seasonal food scheduling as well. Future studies should seek to add to the growing body of seasonality data in Florida as well as in southeastern North America.

Summary

In this chapter, I have recapitulated the three hypotheses laid out in Chapter 1. This study has clearly demonstrated that occupants gathered clams during specific seasons of the year, despite year-round deposition at the site. The general excavation levels demonstrated that Grand occupants gathered quahog clams primarily during the spring, but during the latter half of the winter as well. Feature 1, on the other hand, did not demonstrate a spring emphasis but revealed equal collection throughout the winter and spring. Feature 1 demonstrates a slightly different exploitation pattern than that of the general excavation levels. Vertebrate faunal analysis of Feature 1 is forthcoming, and may demonstrate other irregularities in seasonal exploitation.

I have summarized the different explanations for the seasonal collection pattern of clams at the Grand shell ring, including seasonal collection based on biomass and nutrition, scarcity of other resources, gathering for feasts or aggregations at the site, and seasonal dispersals. I have concluded that current evidence best supports that model that clam exploitation tracked changes in biomass and nutrition. Clams had the highest biomass and nutrition in the spring, the time when clam collection was emphasized in the majority of the Grand deposit. Other St. Johns II sites in the area also demonstrated a spring emphasis and/or winter collection, hinting at a regional pattern clam collection. Until more seasonality studies are conducted in the area, nuanced regional comparisons cannot be made.

Future work at the Grand site should seek to evaluate other areas of the ring, as the 2006 excavation trench represents only a small portion of the Grand ring. These excavations may reveal new information about subsistence and seasonality. Future excavation should also examine the area surrounding the shell ring to elucidate differences and similarities between the differing deposits.

Finally, seasonality studies present archaeologists with a new way to explore identity and social customs of resource scheduling. By comparing the resource schedules of clearly identified groups, we may begin to see differences not only in ceramic typologies but in subsistence strategies as well. Studies of seasonal fauna offer important information on multiple topics of interest, including site seasonality, subsistence, and seasonal food scheduling. Future studies should seek to add to the growing body of seasonality data, and thus enhance our knowledge of prehistoric people and their culture.

APPENDIX A

Table A.1 Growth Phases for Clams in the General Levels and Features

FS	Clam #	Growth Phase	Growth Phase Code	Test Unit	Level	Feature	Area
4	1	O3	3	2	2		
5	2	O2	2	2	3		
6	1	O2	2	3	3		
7	1	O2	2	1	2		
8	1	O1	1	1	3		
10	1	O2	2	2	4		
11	1	O2	2	3	4		
11	2	O3	3	3	4		
14	3	O1	1	1	4		
16	4	O2	2	5	5		
17	1	O2	2	3	5		
19	1	O2	2	2	5		
20	2	O1	1	1	5		A
21	1	O2	2	1	5		B
22	1	T1	4	1	5		C
22	2	O3	3	1	5		
26	4	T1	4	5	6		
26	6	T2	5	5	6		
27	2	O3	3	3	6		
29	1	O2	2	4	6		
30	1	O3	3	2	6		
31	1	O1	1	2	6		E
32	3	T2	5	2	6		
33	1	O1	1	1	6		C
34	1	O3	3	1	6		B
38	1	O3	3	4	7		
39	1	O3	3	2	7		
39	2	O2	2	2	7		
39	3	O3	3	2	7		
39	4	O3	3	2	7		
40	2	O1	1	2	7		F
41	1	O2	2	7	7		
42	2	O2	2	5	7		
44	1	O2	2	3	7		
44	3	O3	3	3	7		
44	5	O3	3	3	7		
44	6	O3	3	3	7		
46	1	O3	3	1	7		C
46	2	O3	3	1	7		C
46	4	O2	2	1	7		C
47	1	O2	2	1	7		B
47	2	O2	2	1	7		B
47	3	O1	1	1	7		B
47	4	O1	1	1	7		B
48	2	O2	2	1	7		A

Table A.1 Continued

FS	Clam #	Growth Phase	Growth Phase Code	Test Unit	Level	Feature	Area
50	1	O2	2	4	8		
51	1	O2	2	4	8		
51	2	O2	2	4	8		
52	2	O2	2	2	8		
52	3	O2	1	2	8		
52	5	O1	2	2	8		
53	1	O2	2	2	8		I
53	3	O2	2	2	8		I
54	1	O2	2	2	8		J
54	2	O2	2	2	8		J
54	4	O1	1	2	8		J
54	6	O2	2	2	8		J
55	1	O2	2	2	8		K
55	2	O1	1	2	8		K
56	1	O2	2	7	9		
56	2	O3	3	7	9		
56	3	O2	2	7	9		
59	1	O1	1	5	8		
59	4	O1	1	5	8		
59	5	O1	1	5	8		
59	6	O1	1	5	8		
63	1	T3	6	7	9		
63	2	T3	6	7	9		
63	3	O2	2	7	9		
65	1	O2	2	5	9		
65	2	O2	2	5	9		
65	3	O1	1	5	9		
67	1	T1	4	1	8		C
67	2	O3	3	1	8		C
67	3	O3	3	1	8		C
68	1	O2	2	1	8		B
68	2	T1	4	1	8		B
68	5	T1	4	1	8		B
69	3	O1	1	6	9		
70	1	O2	2	4	9		
71	3	O1	1	4	9		O
72	1	O3	3	4	9		C
73	1	.	.	4	9		
74	1	T2	5	2	9		C
75	3	O2	2	2	9		I
75	4	O2	2	2	9		I
76	1	O1	1	2	9		J
76	2	O1	1	2	9		J
76	6	O1	1	2	9		J
77	2	O1	1	2	9		K
78	2	O2	2	2	9	1	

Table A.1 Continued

FS	Clam #	Growth Phase	Growth Phase Code	Test Unit	Level	Feature	Area
78	3	O1	1	2	9	1	
78	4	O1	1	2	9	1	
78	5	T1	4	2	9	1	
78	6	O1	1	2	9	1	
78	8	O3	3	2	9	1	
78	9	O1	1	2	9	1	
78	11	T3	6	2	9	1	
78	12	O2	2	2	9	1	
78	15	O2	2	2	9	1	
78	16	O1	1	2	9	1	
79	1	O1	1	2	9		SUBSOIL
80	1	O3	3	3	9		
80	2	O2	2	3	9		
80	3	O1	1	3	9		
81	1	O1	1	3	9		P
82	1	O2	2	3	9		SUBSOIL
83	1	O1	1	1	9		
83	3	O2	2	1	9		
83	4	O2	2	1	9		
83	5	O2	2	1	9		
83	6	O2	2	1	9		
83	8	T3	6	1	9		
83	9	T3	6	1	9		
84	1	.	.	1	9		SUBSOIL
85	1	O3	3	6	10		
86	1	O2	2	4	10		
87	1	O1	1	7	10		
87	2	O2	2	7	10		
90	1	O2	2	5	10		
90	2	T3	6	5	10		
92	1	O1	1	3	10		Q
94	1	O3	3	3	10		
95	1	O1	1	1	10		
96	1	O3	3	6	11		
97	2	O3	3	4	11		
98	1	O1	1	4	11		
100	1	O1	1	5	11		S
106	3	O3	3	6	12		
107	1	T2	5	6	12		SUBSOIL
108	2	O2	2	4	12		NORTH
108	3	O1	1	4	12		NORTH
109	1	O1	1	4	12		T
111	1	.	.	5	12		
112	1	O3	3	5	12		S
115	1	O2	2	6	13		U
117	2	O2	2	5	13	3	

Table A.1 Continued

FS	Clam #	Growth Phase	Growth Phase Code	Test Unit	Level	Feature	Area
117	3	O2	2	5	13	3	
117	4	O1	1	5	13	3	
117	5	O1	1	5	13	3	
118	1	O1	1	4	13		U
120	1	O2	2	4	13	4	
121	2	T3	6	6	14		U
121	3	T1	4	6	14		U
122	3	T3	6	4	14		U E WALL
123	2	O1	1	4		4	
123	3	O1	1	4		4	
127	2	O2	2	4			BELOW U
127	4	O2	2	4			
134	2	O1	1	2		1	
134	3	O2	2	2		1	
134	4	O1	1	2		1	
134	5	O1	1	2		1	
134	7	O1	1	2		1	
134	8	O1	1	2		1	
134	13	O1	1	2		1	
134	14	O1	1	2		1	
134	20	O2	2	2		1	
134	21	O1	1	2		1	
134	30	O1	1	2		1	
134	31	T3	6	2		1	
134	22	T3	6	2		1	
134	24	O2	2	2		1	
134	25	O3	3	2		1	
138	1	O1	1	2		1	
138	4	O2	2	2		1	
138	5	O1	1	2		1	
138	6	O1	1	2		1	
139	1	O2	2	2		-1	
144	1	T1	4				ST 1
144	2	T1	4				ST 1
144	4	O3	3				ST 1
144	5	T1	4				ST 1
145	1	O2	2				ST 1
145	3	T1	4				ST 1
146	4	O2	2				ST 1
154	1	O3	3			1	ST 2
154	2	T1	4			1	ST 2
154	3	O1	1			1	ST 2
154	5	O1	1			1	ST 2
154	6	O1	1			1	ST 2
154	9	O1	1			1	ST 2

Table A.1 Continued

FS	Clam #	Growth Phase	Growth Phase Code	Test Unit	Level	Feature	Area
154	11	O2	2			1	ST 2
154	12	O2	2			1	ST 2
154	13	T1	4			1	ST 2
154	15	O2	2			1	ST 2
154	16	O2	2			1	ST 2
154	18	O2	2			1	ST 2
154	19	O1	1			1	ST 2
154	20	O1	1			1	ST 2
154	21	O1	1			1	ST 2

APPENDIX B

Table B.1 Growth Phases for Clams in the General Levels

FS	Clam #	Growth Phase	Growth Phase Code	Test Unit	Level	Area
4	1	O3	3	2	2	
5	2	O2	2	2	3	
6	1	O2	2	3	3	
7	1	O2	2	1	2	
8	1	O1	1	1	3	
10	1	O2	2	2	4	
11	1	O2	2	3	4	
11	2	O3	3	3	4	
14	3	O1	1	1	4	
16	4	O2	2	5	5	
17	1	O2	2	3	5	
19	1	O2	2	2	5	
20	2	O1	1	1	5	A
21	1	O2	2	1	5	B
22	1	T1	4	1	5	C
22	2	O3	3	1	5	
26	4	T1	4	5	6	
26	6	T2	5	5	6	
27	2	O3	3	3	6	
29	1	O2	2	4	6	
30	1	O3	3	2	6	
31	1	O1	1	2	6	E
32	3	T2	5	2	6	
33	1	O1	1	1	6	C
34	1	O3	3	1	6	B
38	1	O3	3	4	7	
39	1	O3	3	2	7	
39	2	O2	2	2	7	
39	3	O3	3	2	7	
39	4	O3	3	2	7	
40	2	O1	1	2	7	F
41	1	O2	2	7	7	
42	2	O2	2	5	7	
44	1	O2	2	3	7	
44	3	O3	3	3	7	
44	5	O3	3	3	7	
44	6	O3	3	3	7	
46	1	O3	3	1	7	C
46	2	O3	3	1	7	C
46	4	O2	2	1	7	C
47	1	O2	2	1	7	B
47	2	O2	2	1	7	B
47	3	O1	1	1	7	B
47	4	O1	1	1	7	B

Table B.1 Continued

FS	Clam #	Growth Phase	Growth Phase Code	Test Unit	Level	Area
48	2	O2	2	1	7	A
50	1	O2	2	4	8	
51	1	O2	2	4	8	
51	2	O2	2	4	8	
52	2	O2	2	2	8	
52	3	O2	1	2	8	
52	5	O1	2	2	8	
53	1	O2	2	2	8	I
53	3	O2	2	2	8	I
54	1	O2	2	2	8	J
54	2	O2	2	2	8	J
54	4	O1	1	2	8	J
54	6	O2	2	2	8	J
55	1	O2	2	2	8	K
55	2	O1	1	2	8	K
56	1	O2	2	7	9	
56	2	O3	3	7	9	
56	3	O2	2	7	9	
59	1	O1	1	5	8	
59	4	O1	1	5	8	
59	5	O1	1	5	8	
59	6	O1	1	5	8	
63	1	T3	6	7	9	
63	2	T3	6	7	9	
63	3	O2	2	7	9	
65	1	O2	2	5	9	
65	2	O2	2	5	9	
65	3	O1	1	5	9	
67	1	T1	4	1	8	C
67	2	O3	3	1	8	C
67	3	O3	3	1	8	C
68	1	O2	2	1	8	B
68	2	T1	4	1	8	B
68	5	T1	4	1	8	B
69	3	O1	1	6	9	
70	1	O2	2	4	9	
71	3	O1	1	4	9	O
72	1	O3	3	4	9	C
73	1	.	.	4	9	
74	1	T2	5	2	9	C
75	3	O2	2	2	9	I
75	4	O2	2	2	9	I
76	1	O1	1	2	9	J
76	2	O1	1	2	9	J
76	6	O1	1	2	9	J
77	2	O1	1	2	9	K

Table B.1 Continued

FS	Clam #	Growth Phase	Growth Phase Code	Test Unit	Level	Area
79	1	O1	1	2	9	SUBSOIL
80	1	O3	3	3	9	
80	2	O2	2	3	9	
80	3	O1	1	3	9	
81	1	O1	1	3	9	P
82	1	O2	2	3	9	SUBSOIL
83	1	O1	1	1	9	
83	3	O2	2	1	9	
83	4	O2	2	1	9	
83	5	O2	2	1	9	
83	6	O2	2	1	9	
83	8	T3	6	1	9	
83	9	T3	6	1	9	
84	1	.	.	1	9	SUBSOIL
85	1	O3	3	6	10	
86	1	O2	2	4	10	
87	1	O1	1	7	10	
87	2	O2	2	7	10	
90	1	O2	2	5	10	
90	2	T3	6	5	10	
92	1	O1	1	3	10	Q
94	1	O3	3	3	10	
95	1	O1	1	1	10	
96	1	O3	3	6	11	
97	2	O3	3	4	11	
98	1	O1	1	4	11	
100	1	O1	1	5	11	S
106	3	O3	3	6	12	
107	1	T2	5	6	12	SUBSOIL
108	2	O2	2	4	12	NORTH
108	3	O1	1	4	12	NORTH
109	1	O1	1	4	12	T
111	1	.		5	12	
112	1	O3	3	5	12	S
115	1	O2	2	6	13	U
118	1	O1	1	4	13	U
121	2	T3	6	6	14	U
121	3	T1	4	6	14	U
122	3	T3	6	4	14	U E WALL BELOW
127	2	O2	2	4		U
127	4	O2	2	4		
144	1	T1	4			ST 1
144	2	T1	4			ST 1
144	4	O3	3			ST 1
144	5	T1	4			ST 1

Table B.1 Continued

FS	Clam #	Growth Phase	Growth Phase Code	Test Unit	Level	Area
145	1	O2	2			ST 1
145	3	T1	4			ST 1
146	4	O2	2			ST 1

APPENDIX C

Table C.1 Growth Phases for Clams in the Features

FS	Clam #	Growth Phase	Growth Phase Code	Test Unit	Level	Feature	Area
78	2	O2	2	2	9	1	
78	3	O1	1	2	9	1	
78	4	O1	1	2	9	1	
78	5	T1	4	2	9	1	
78	6	O1	1	2	9	1	
78	8	O3	3	2	9	1	
78	9	O1	1	2	9	1	
78	11	T3	6	2	9	1	
78	12	O2	2	2	9	1	
78	15	O2	2	2	9	1	
78	16	O1	1	2	9	1	
117	2	O2	2	5	13	3	
117	3	O2	2	5	13	3	
117	4	O1	1	5	13	3	
117	5	O1	1	5	13	3	
120	1	O2	2	4	13	4	
123	2	O1	1	4		4	
123	3	O1	1	4		4	
134	2	O1	1	2		1	
134	3	O2	2	2		1	
134	4	O1	1	2		1	
134	5	O1	1	2		1	
134	7	O1	1	2		1	
134	8	O1	1	2		1	
134	13	O1	1	2		1	
134	14	O1	1	2		1	
134	20	O2	2	2		1	
134	21	O1	1	2		1	
134	30	O1	1	2		1	
134	31	T3	6	2		1	
134	22	T3	6	2		1	
134	24	O2	2	2		1	
134	25	O3	3	2		1	
138	1	O1	1	2		1	
138	4	O2	2	2		1	
138	5	O1	1	2		1	
138	6	O1	1	2		1	
139	1	O2	2	2		-1	
154	1	O3	3			1	ST 2
154	2	T1	4			1	ST 2
154	3	O1	1			1	ST 2
154	5	O1	1			1	ST 2
154	6	O1	1			1	ST 2

Table C.1 Continued

FS	Clam #	Growth Phase	Growth Phase Code	Test Unit	Level	Feature	Area
154	9	O1	1			1	ST 2
154	11	O2	2			1	ST 2
154	12	O2	2			1	ST 2
154	13	T1	4			1	ST 2
154	15	O2	2			1	ST 2
154	16	O2	2			1	ST 2
154	18	O2	2			1	ST 2
154	19	O1	1			1	ST 2
154	20	O1	1			1	ST 2
154	21	O1	1			1	ST 2

APPENDIX D

Table D.1 Ages for clams in the General Levels

FS	Clam #	Age	Test Unit	Level	Feature	Area
4	1	6	2	2		
5	2	4	2	3		
6	1	4	3	3		
7	1	5	1	2		
8	1	5	1	3		
10	1	4	2	4		
11	1	6	3	4		
11	2	2	3	4		
14	3	3	1	4		
16	4	3	5	5		
17	1	.	3	5		
19	1	4	2	5		
20	2	.	1	5		A
21	1	.	1	5		B
22	1	.	1	5		C
22	2	6	1	5		
26	4	4	5	6		
26	6	4	5	6		
27	2	3	3	6		
29	1	4	4	6		
30	1	5	2	6		
31	1	3	2	6		E
32	3	6	2	6		
33	1	4	1	6		C
34	1	5	1	6		B
38	1	3	4	7		
39	1	4	2	7		
39	2	.	2	7		
39	3	7	2	7		
39	4	.	2	7		
40	2	.	2	7		F
41	1	4	7	7		
42	2	7	5	7		
44	1	4	3	7		
44	3	4	3	7		
44	5	6	3	7		
44	6	2	3	7		
46	1	6	1	7		C
46	2	5	1	7		C
46	4	4	1	7		C
47	1	.	1	7		B

*Denotes where I have substituted a clam that was not included in the seasonality study.

Table D.1 Continued

FS	Clam #	Age	Test Unit	Level	Feature	Area
47	2	6	1	7		B
47	3	4	1	7		B
47	4	5	1	7		B
48	2	3	1	7		A
50	1	4	4	8		
51	1	.	4	8		
51	2	.	4	8		
52	2	6	2	8		
52	3	.	2	8		
52	5	3	2	8		
53	1	.	2	8		I
53	3	4	2	8		I
54	1	.	2	8		J
54	2	4	2	8		J
54	3*	2	2	8		J
54	4	.	2	8		J
54	6	3	2	8		J
55	1	3	2	8		K
55	2	3	2	8		K
56	1	.	7	9		
56	2	3	7	9		
56	3	4	7	9		
59	1	.	5	8		
59	4	2	5	8		
59	5	.	5	8		
59	6	.	5	8		
63	1	6	7	9		
63	2	.	7	9		
63	3	3	7	9		
63	5*	10	7	9		
65	1	4	5	9		
65	2	3	5	9		
65	3	5	5	9		
67	1	.	1	8		C
67	2	.	1	8		C
67	3	3	1	8		C
68	1	5	1	8		B
68	2	.	1	8		B
68	5	.	1	8		B
69	3	3	6	9		
70	1	3	4	9		
71	3	5	4	9		O
72	1	6	4	9		C
73	1	.	4	9		
73	2*	8	4	9		
74	1	5	2	9		C
75	1*	2	2	9		I

Table D.1 Continued

FS	Clam #	Age	Test Unit	Level	Feature	Area
75	3	.	2	9		I
75	4	2	2	9		I
76	1	7	2	9		J
76	2	.	2	9		J
76	6	4	2	9		J
77	2	3	2	9		K
79	1	5	2	9		SUBSOIL
80	1	3	3	9		
80	2	3	3	9		
80	3	.	3	9		
80	4*	3	3	9		
81	1	5	3	9		P
82	1	3	3	9		SUBSOIL
83	1	3	1	9		
83	3	.	1	9		
83	4	4	1	9		
83	5	4	1	9		
83	6	3	1	9		
83	8	.	1	9		
83	9	.	1	9		
84	1	.	1	9		SUBSOIL
85	1	3	6	10		
86	1	.	4	10		
87	1	3	7	10		
87	2	3	7	10		
90	1	.	5	10		
90	2	.	5	10		
92	1	4	3	10		Q
94	1	2	3	10		
95	1	.	1	10		
96	1	7	6	11		
97	2	.	4	11		
97	4*	3	4	11		
98	1	5	4	11		
100	1	4	5	11		S
106	3	5	6	12		
107	1	5	6	12		SUBSOIL
108	2	5	4	12		NORTH
108	3	3	4	12		NORTH
109	1	2	4	12		T
111	1	.	5	12		
112	1	5	5	12		S
115	1	5	6	13		U
118	1	.	4	13		U
121	2	.	6	14		U
121	3	.	6	14		U
121	4*	6	6	14		U

Table D.1 Continued

FS	Clam #	Age	Test Unit	Level	Feature	Area
122	3	.	4	14		U E WALL
127	1*	6	4			BELOW U
127	2	.	4			BELOW U
127	4	5	4			BELOW U
144	1	3				ST 1
144	2	5				ST 1
144	4	.				ST 1
144	5	2				ST 1
144	6*	8				ST 1
145	1	5				ST 1
145	3	4				ST 1
146	1*	5				ST 1
146	4	.				ST 1

APPENDIX E

Table E.1 Ages for clams in the Features

FS	Clam #	Age	Test Unit	Level	Feature	Area
78	2	.	2	9	1	
78	3	.	2	9	1	
78	4	3	2	9	1	
78	5	5	2	9	1	
78	6	3	2	9	1	
78	8	.	2	9	1	
78	9	.	2	9	1	
78	11	.	2	9	1	
78	12	.	2	9	1	
78	15	.	2	9	1	
78	16	.	2	9	1	
117	1*	7	5	13	3	
117	2	4	5	13	3	
117	3	.	5	13	3	
117	4	6	5	13	3	
117	5	4	5	13	3	
120	1	10	4	13	4	
123	2	.	4		4	
123	3	5	4		4	
123	4*	4	4		4	
134	2	4	2		1	
134	3	5	2		1	
134	4	3	2		1	
134	5	3	2		1	
134	7	5	2		1	
134	8	3	2		1	
134	13	3	2		1	
134	14	4	2		1	
134	20	4	2		1	
134	21	4	2		1	
134	30	.	2		1	
134	31	3	2		1	
134	22	.	2		1	
134	24	3	2		1	
134	25	4	2		1	
138	1	6	2		1	
138	2*	4	2		1	
138	4	.	2		1	
138	5	4	2		1	
138	6	7	2		1	
139	1	4	2		-1	
154	1	7			1	ST 2

*Denotes where I have substituted a clam that was not included in the seasonality study.

Table E.1 Continued

FS	Clam #	Age	Test Unit	Level	Feature	Area
154	2	6			1	ST 2
154	3	6			1	ST 2
154	5	.			1	ST 2
154	6	3			1	ST 2
154	8*	6			1	ST 2
154	9	4			1	ST 2
154	11	2			1	ST 2
154	12	4			1	ST 2
154	13	7			1	ST 2
154	15	.			1	ST 2
154	16	5			1	ST 2
154	18	.			1	ST 2
154	19	5			1	ST 2
154	20	.			1	ST 2
154	21	3			1	ST 2
154	22*	7			1	ST 2

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BIOGRAPHICAL SKETCH

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Education

University of Central Florida	Anthropology	BA, 2004
Florida State University	Anthropology	MS, 2008

Appointments:

2008, Spring	Lab Instructor for Introduction to Archaeological Science. Dr. William Parkinson.
	Collections Manager, Department of Anthropology
2007, Fall	Teaching Assistant for Fundamentals of Archaeology. Dr. Rochelle Marrinan.
	Collections Manager, Department of Anthropology.
2007, Spring	Lab Technician. Southeastern Archeological Center.
2006, Fall	Lab Technician. Southeastern Archeological Center.
2006, Spring	Lab Technician. Southeastern Archeological Center.
2005, Fall	Departmental Assistant.

Synergistic Activities

Presentations at conferences:

I have presented papers at meetings such as the Society for American Archaeology (SAA), Southeastern Archaeological Conference (SEAC), Panhandle Archaeological Society of Tallahassee (PAST) – the local branch of the Florida Anthropological Society (FAS), and at Mission San Luis in Tallahassee, Florida.

Public Outreach:

In collaboration with Anthropology and Classics graduate students, I assisted in the creation and execution of several mock archaeological excavations and labs at local elementary and middle schools. These were designed to give students hands on experience with artifacts and excavation, and foster an interest in local archaeology.

In cooperation with Yesteryear Village I created several educational displays on Florida prehistory and history for public events, as well as answered questions and provided information regarding displays, buildings, and Florida prehistory and history. I also participated in the restoration of several historic buildings at Yesteryear Village.

Field Research

I have experience in field research with professional archaeologists and students in England, Spain, and Florida.

Grants

John W. Griffin Student Grant – Florida Archaeological Council

Graduate Advisors

Glen Doran (Florida State University)
Rochelle Marrinan (Florida State University)
William Parkinson (Florida State University)
Michael Russo (Southeastern Archeological Center)