Foraging Variability in the Prehistoric Caribbean: Multiple Foraging Optima, Resource Use, and Anthropogenic Impacts on Carriacou, Grenada

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Abstract

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This research assesses the zooarchaeological evidence for variable foraging strategies at two matched Caribbean sites, Sabazan and Grand Bay, on the Grenadine Island of Carriacou during the Late Ceramic Age, ca. AD 400 – 1400. Using human behavioral ecology and foraging theory, I investigate whether foraging adaptations differ between sites in a context where the culture, environmental structure, and settlement history of the study locals correspond strongly to each other. This parity of comparison permits me to evaluate whether multiple, optimally adaptive foraging solutions (multiple foraging optima) may exist under the same set of cultural, ecological, and chronological constraints. In addition, I consider the potential for disparate foraging optima to differentially influence the course of future adaptations at each site and resulting human impacts on the environment by examining long-term patterns of resource use and evidence for anthropogenic exploitation depression.

Results indicate strong correspondences between the sites in taxonomic composition, major prey species and habitats targeted, the introduction of continental mammals, and intensified exploitation of molluscan resources over time. At both sites, resource use appears to have been sustainable over a millennium of occupation. Significant zooarchaeological differences between sites were also identified, namely the presence of a well-developed pelagic tuna fishery at Sabazan and a comparatively greater emphasis on inshore/shallow water fishing at Grand Bay. Rather than support the existence of multiple foraging optima, however, these disparities in resource use are better attributed to modest differences in local environmental structure. These findings underscore the way in which seemingly minor foraging constraints may shape behavioral adaptations and the importance of incorporating such considerations into analytic models. Moreover, they illustrate that the ecological effects of human foraging in the past are variable and cannot be universally assumed to have been detrimental, even for small island ecosystems. It is hoped that by integrating into an explicit foraging theory framework the methods currently employed in Caribbean archaeology to understand resource exploitation and insular adaptation, this research will increase the predictive and explanatory power of such studies and open up additional avenues of research.

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DEDICATION

For Matilda

And for Lisa

I have no doubt at all the Devil grins,

As seas of ink I spatter.

Ye gods, forgive my "analytic" sins—

The other kind don't matter.

- With license, Robert Service

Chapter 1

INTRODUCTION

A group of islands lying between two great continents and separating two of the world's zoological regions must perforce be of interest….

\- James Bond

The long-term cultural and ecological effects of human subsistence activities on islands are historically particular and depend on the adaptive strategies employed by islanders. These adaptations themselves are dependent on a complex interplay of constraining environmental factors, cultural behavior, technology, and time. It is obvious that different sets of constraints will lead to different subsistence outcomes. However, theoretical principles derived from behavioural ecology and foraging theory (Krebs and Davies 1991; Smith 1991; Stephens and Krebs 1986) also predict that multiple, adaptive foraging strategies may exist even where constraints are identical across foraging groups (Smith and Winterhalder 1992:58-59). Because of this, the initial same set of historically particular circumstances may potentially result in differential ecological impacts. This possibility has considerable implications for understanding the complexities of human-environmental interactions, foraging behavior, and for current conservation biology efforts (Lyman and Cannon 2004; Wolverton and Lyman 2012). It suggests the human ecological footprint is dynamically constructed in ways which we do not yet fully comprehend, but must begin to consider so that archaeological reconstructions of human impacts may better articulate with modern environmental issues. Applications of behavioral ecology that make comparative use of contemporaneous, culturally-similar prehistoric sites may begin to address the topic of multiple adaptive foraging strategies in a given context. While zooarchaeologists routinely pursue comparative explorations of prehistoric resource exploitation (e.g., Carder et al. 2007, Carder and Crock 2012; Carlson and Steadman 2009; Wing 2001; Wing and Wing 2001), to my knowledge this specific issue not been pursued by archaeologists within an explicit foraging theory framework.

In this work, I investigate the possibility of multiple foraging solutions in ecologically similar settings by conducting a paired site comparison of zooarchaeological assemblages from two prehistoric sites (ca. AD 400 – 1250/1400), Grand Bay and Sabazan, on the island of Carriacou in the Lesser Antilles archipelago of the Caribbean. The faunal remains from these two sites are analyzed using a foraging theory framework to reconstruct human resource exploitation strategies over time and determine the variability in human response to the same changing environmental and cultural influences. An aspect of evolutionary ecology, foraging theory has been widely employed in zooarchaeological studies to detect prehistoric resource depression and the effects of human predation on fauna (Allen 2012; Broughton 1994, 1997; Broughton et al. 2010; Butler 2001; Byers and Broughton 2004; Campbell and Butler 2010; Grayson and Delpech 1998; Keegan 1992; Langejans et al. 2012; Lupo 2007; Nagaoka 2000, 2002a, 2002b). The principal expectation in these studies is that human subsistence patterns will conform to the predictions of optimization, even in the face of changing resource structure, whether this is culturally or environmentally initiated (Cannon 2001a; Kaplan and Hill 1992; Stephens and Krebs 1986). Because archaeological applications of foraging theory typically address assemblages from single sites, however, only a single adaptive (optimal) solution, averaging the actions of a group of foragers, is ever under consideration for any one time. Archaeologists have yet to consider the possibility that multiple adaptive solutions may exist in any given setting and, significantly, that the solution which arises in this context may determine both the course of future adaptations and the nature of human impacts on that setting. The central objective of this research is to evaluate whether, as predicted by human behavioral ecology, multiple foraging adaptations exist for a given context that may be detected in the archaeological record, and where this may be shown, to determine the long term environmental consequences.

Empirical investigation of this issue requires sites matched in chronology and culture and located in extremely similar environments, such that observed differences in subsistence or ecological trajectories may be attributed to human behavior rather than extrinsic factors such as local resource availability. In this study, I conducted paired analyses using the vertebrate and invertebrate faunal assemblages from the Grand Bay and Sabazan sites which meet these criteria. The equivalence of these two sites allows foraging constraints to be held constant across sets of foragers, offering a valuable opportunity to address the issue of variable optima.

It is hoped that this research will advance foraging theory applications in archaeology by applying novel approaches for understanding past human adaptations. This study integrates resource exploitation models currently employed in Caribbean zooarchaeology with explicit foraging theory principles and predictions. In doing so, I seek to enhance the explanatory power of existing Caribbean models by linking their interpretive frameworks to an ultimate causal mechanism: the evolutionary adaptedness of human foraging behavior. Lastly, this work presents the first comprehensive reporting of all results from archaeological excavation conducted by the author at Sabazan. Together with findings from the Grand Bay site, this research enhances archaeological knowledge for the southern Caribbean, an area where limited prehistoric investigation has occurred.

The dissertation is organized into two major components. The first section (Chapters 2 – 4) presents the archaeological and theoretical background for this study. In Chapter 2, I discuss foraging theory and develop the set of zooarchaeological predictions and indicators used in this research. Chapter 3 reviews the archaeology, culture history and environmental setting of the study region. Chapter 4 introduces the study locales, Sabazan and Grand Bay, discusses their archaeology, and establishes the basis for an equitable comparison between the two sites. The second component of this work (Chapters 5 – 9) presents the methodology, analytic results, and overall research findings. Chapter 5 concerns the methods employed in this study and introduces the zooarchaeological datasets. In Chapter 6, the data are tested against the proposed research question: are multiple foraging optima detectable between Sabazan and Grand Bay? Chapter 7 explores evidence for negative impacts on the population of a heavily exploited prey species at the archaeological sites in this study. The following chapter interprets the results of analysis and considers various explanations for the observed archaeofaunal patterning at both sites. In the final chapter, Chapter 9, I summarize the research findings and offer some final thoughts.

Chapter 2

THEORETICAL CONTEXT: FORAGING THEORY AND OPTIMALITY IN THE ZOOARCHAEOLOGICAL RECORD

"I weep for you," the Walrus said:
"I deeply sympathize."
With sobs and tears he sorted out
Those of the largest size.

- Lewis Carroll, *Through the Looking Glass*

2.1 Research Agenda: Optimality and Theoretical Orientation

This research investigates the comparative optimality of foraging strategies employed by two prehistoric forager groups faced with the same set of constraints. It draws on the subset of behavioral ecology and evolutionary ecological thought known as optimal foraging theory (OFT) as an interpretive framework and is underlain by the neo-Darwinian assumption that individuals seek to maximize their fitness through their behavior. Natural selection is expected to favor behavioral strategies that best enhance an individual’s fitness. In a foraging context, this manifests as an attempt to optimize the energy, or some other, return obtained from prey with respect to the costs incurred by pursuit, processing and transport (Kaplan and Hill 1992; Smith 1991; Stephens and Krebs 1986). The logic of optimization thus involves a cost-benefit analysis for each prey item. This allows prey to be ranked for exploitation according to the net benefits provided, a value which is termed the return rate. This fitness-maximizing approach represents an optimal, not perfect, strategy because it is drawn from a set of feasible existing strategies constrained by the context and circumstances faced by the individual in question (Kaplan and Hill 1992; Lupo 2007). Since individuals or classes of individuals will differ in their constraints—factors such as social status, physical environment, individual capabilities—it follows that they will differ in optima. It is also the case, however, that individuals may exhibit different, but equally optimal, behaviors when presented with the same set of constraints (Smith and Winterhalder 1992).

In this dissertation I examine this latter scenario: is it possible to detect multiple foraging optima (MFO) in an archaeological setting with all else being equal? "All else" refers to the foragers' context and constraints which are broadly encapsulated by culture, environment, and temporal position. These three major variables must be held constant across analytic groups for a valid comparison to be made between multiple foraging behavioral strategies. Here, I will treat intrinsic constraints, those that are innate to the individual based on physical or cognitive faculties, as randomly distributed across subject populations through time, precluding the need for experimental control. In this way, observed differences in the foraging strategies of two groups may be attributed to different optima where the landscape, technological disparities, social differences, and so on cannot account for the phenomenon.

Implementation of this investigative agenda requires two contemporaneous archaeological sites of equivalent function, situated in extremely similar environments, with populations of similar size and of the same cultural identity. The late Saladoid-Troumassoid (ca. AD 400 – 1500) village sites of Sabazan and Grand Bay on the Caribbean island of Carriacou, in the southern Lesser Antilles, fulfill these criteria. The zooarchaeological assemblages from these two sites are used to explore the question of multiple foraging optima. In this chapter, I present the theoretical framework employed by this dissertation.

2.2 Foraging Theory Models

In conducting this study, I build on a strong research tradition of comparative analysis in Caribbean zooarchaeology (Carder et al. 2007; Carlson and Steadman 2009; Grouard 2002; Keegan et al. 2003; Newsom and Wing 2004; Steadman and Jones 2006; Wing 2001; Wing and Wing 1995). This line of scholarship has greatly enhanced our understanding of the ways in which cultural forces and environmental variation have influenced the foraging strategies of pre-Columbian peoples. Moreover, current interpretive models employed in the Caribbean, pioneered by researchers such as Elizabeth Wing (e.g., Newsom and Wing 2004; Wing 2001, 2008; Wing and Reitz 1982; Wing and Wing 1995, 2001), have proven highly effective for generating insight into zooarchaeological patterning and demonstrating anthropogenic environmental impacts. My research expands on this work by employing an explicit foraging theory framework to interpret results from vertebrate and invertebrate analyses.

The application of foraging theory has been limited within Caribbean archaeology. This is likely due to several factors. The long dominance of culture historical approaches to the record, no doubt, plays a role (e.g., Rouse 1986, 1989, 1992; see also discussions in Curet 2004; Fitzpatrick 2004; Siegel 2013). Also relevant are the absence of large, obviously high ranking terrestrial taxa in the West Indies—in addition, large marine mammals like the Caribbean monk seal and manatee are rare in sites (Newsom and Wing 2004)—and the dietary importance of tropical fish, for which a straightforward assessment of relative return rate is complicated by life history factors and mass capture techniques to be discussed later.

Foraging theory has been used widely by archaeologists elsewhere to understand change, or stability, in the zooarchaeological record and in particular to detect resource depression in antiquity (e.g., Allen 2012; Broughton 1994, 1997, 2002; Butler 2001; Butler and Campbell 2004; Byers and Broughton 2004; Codding et al. 2010a, 2010b; Grayson and Delpech 1998; Grimstead 2010, 2012; Keegan 1992; Nagaoka 2000, 2002a, 2002b, 2005; see also papers in Broughton and Cannon 2010). The strength of foraging theory derives in part from the fact that its prey and patch choice models may be used to generate testable hypotheses about the cause(s) of zooarchaeological variation over time.

There are three components to foraging theory models: constraints, decisions or goals, and currency (Kaplan and Hill 1992; Stephens and Krebs 1986; Lupo 2007). Constraints refer to those intrinsic and extrinsic strictures previously discussed, e.g., individual physiology, habitat variation, etc. The decision component addresses the foraging task under consideration, for example, which prey to pursue, when and where to forage, and thus dictates model selection. The currency provides a means by which to evaluate the benefits and costs of that decision and its fitness payoff relative to other potential behavioral strategies. Energy, measured as kilocalories, is often used as the currency in OFT models. Where this cannot be measured, the body size of an organism, excluding the most massive of organisms, frequently serves as a proxy for its energetic value (Broughton 1994, 1997, 1999; Broughton et al. 2011; Cannon 2000; Grayson and Cannon 1999; Griffiths 1975, 1980; Smith 1991; but see Bird et al. 2009, 2012). It should be noted, however, that ethnographic studies have demonstrated that foragers frequently value certain other payoffs above that of simple calories. Hence, in some instances, the appropriate currency might be fat, nutrient content, or the signaling of particular qualities expected to garner economic, political, or social benefits that ultimately enhance reproductive success (Bliege Bird and Bird 1997; Bliege Bird and Smith 2005; Lupo 2007; Lupo and Schmitt 2005; Smith 2004). In this research, energetic value is used as the currency unless specific indicators exist to suggest another more appropriate measure.

It should be noted that while foraging theory and behavioral ecology have been employed to elucidate the relationship between domestic plant and animal use and the foraging of wild resources (Gremillion 2006; Tucker 2006; Winterhalder and Goland 1997; Winterhalder and Kennett 2006; Winterhalder and Lu 1997), the considerations dealt with in such studies are not incorporated into this research. The cultural context of this study indicates that Carriacou's prehistoric inhabitants likely engaged in a mixed foraging-horticultural/agricultural economy, but as discussed in later chapters, the level and intensity of the latter activity is wholly unknown. Until further investigation can provide salient details regarding specific cultigens, farming strategies, and the possible management or husbandry of animals, modeling of their impact on foraging behaviour is a speculative endeavour. As such, this research focuses strictly on foraging activities, applying standard prey and patch choice models, discussed below, to the known zooarchaeological record.

2.2.1 Prey Choice Model

The simple prey choice, or diet breadth, model was developed to predict what taxa would be included in a forager's diet, dependent on the assumption that individuals will maximize the long-term net rate of energy acquisition during foraging (Kaplan and Hill 1992; Lupo 2007; MacArthur and Pianka 1966; Smith 1991; Stephens and Krebs 1986).

The prey choice model assumes that prey are encountered sequentially and randomly in proportion to their environmental abundance, known as the fine-grained or simultaneous search assumption. Upon encounter with a potential prey item, foragers must make a decision to continue the search or to handle the prey. Handling involves pursuit, processing, and transport of prey items and so incurs costs to the forager that impact the overall energetic return (return rate) of the prey. In addition, the choice to handle includes opportunity costs brought on by the forfeit of time that might have been devoted to other activities. Handling costs and search time are mutually exclusive. That is, search time is not deducted from the energetic value of the prey in calculating the return rate, but is instead shared by all prey items in the diet. From the perspective of a forager, resources may thus be comparatively ordered with the highest ranking prey item delivering the highest return rate.

Based on the assumption of net energy rate maximization, it follows that the highest ranking resource should always be taken on encounter. Lower return prey will be added sequentially to the diet in rank order until the addition of the next-ranked resource delivers a lower overall rate of return than could be obtained by continuing to search and handle higher ranked resources. The optimal diet comprises this set of higher ranked resources, and the number of taxa contained therein constitutes forager diet breadth. Prey in the optimal diet should always be exploited, while those outside of the set should always be disregarded. Since the ranking of a resource is based on its return rate, calculated as net energy divided by handling time, anything that impacts this equation, such as seasonal variation in the weight of prey or new processing technologies, will change the return rate, potentially affecting relative rank and ultimately whether the resource is exploited. Additionally, the decision whether or not to include a resource in the diet depends not on its rank, but on encounter rates with higher ranking prey. If encounter rates with taxa in the optimal set decrease, overall return rate per unit of search time will decline and additional lower ranking resources will be added to the diet. This process is termed diet breadth expansion.

2.2.2 Patch Choice Model

Resource distribution in the environment is often clumped or patchy. When foragers can be expected to devote a greater proportion of time seeking resources within particular environmental patches, the fine-grained search assumption is violated and search time can no longer be distributed across all exploited resources, thus complicating prey choice rankings. In such a scenario, foragers instead decide where to devote their time and how much of it to allocate before moving on. The patch choice model addresses this type of environmental variability and is employed to understand which patches a particular forager will exploit and for how long (Charnov 1976; Kaplan and Hill 1992; Lupo 2007; MacArthur and Pianka 1966; Smith 1991).

Like the prey choice model, the patch choice model assumes foragers attempt to maximize overall return rate. Costs to the forager consist of travel time between patches and resource handling. Patches are ranked sequentially according to average return rate based on an energy gain function which varies in its slope, from a constant return rate through to one of diminishing returns, depending on the nature of the exploited resource. Foragers will incorporate additional patches sequentially into the diet until the point at which adding a lower ranked patch diminishes overall mean return per unit of time, including travel time.

The marginal value theorem (MVT) (Charnov 1976) predicts when foragers will decamp for another patch for cases where patch exploitation is characterized by an energy gain function of eventual declining rates, i.e., cases where resources may be depleted over time (see Stephens and Krebs 1986:26). The MVT predicts that foragers will continue to exploit a patch until the average return rate per unit of time falls below that for the next-ranked patch including the cost of travel. Thus, the rate at which patch resources deplete and the density of patches on the landscape will determine how long a forager remains in a given patch. This is the optimal residence time.

Several important implications arise from the MVT. All patches in the optimal set should be exploited until they yield the same return rate. Since mean return rate for all patches determines optimal residence time in a given patch, an increase or decrease in patch productivity will reduce or lengthen patch residence time, respectively. Additionally, residence time will be affected if travel costs alter due to, for instance, technological gains or a change in patch density. Forager return rates will be maximized by spending more time in a patch as travel costs increase.

In practical terms, the patch choice model can be difficult to apply in anthropological and archaeological settings because it requires that the energy gain functions for of all environmental patches be known (Lupo 2007). However, selective application to just a few patches when combined with the prey choice model, can allow for useful comparisons and a better understanding of overall foraging strategies and ecological phenomena such as anthropogenic resource depression (West 2009; Smith 1991).

2.3 Foraging Theory and Resource Depression

In the relatively short time since humanly caused environmental impacts began to be addressed systematically in the archaeological record, appreciation for the temporal depth and seeming pervasiveness of such phenomena has grown rapidly (e.g., Braje et al. 2012; Erlandson and Rick 2010; Fitzpatrick and Keegan 2007; Grayson 2001; Mannino and Thomas 2002; Rick and Erlandson 2008; Turvey 2009). Anthropogenic resource depression, in particular, has been well documented in a number of temporally and geographically variable archaeological contexts (e.g., Broughton 1994, 1997, 1999; Broughton et al. 2010; Butler 2001; Byers and Broughton 2004; Grayson and Delpech 1998; Morrison and Hunt 2007; Nagaoka 2000, 2002a, 2002b, 2005, 2006; Wolverton et al. 2012; Wolverton et al. 2008; Whitaker 2010). Because resource depression is an anticipated potential finding for Sabazan and Grand Bay's archaeofauna, I review its theoretical underpinnings and archaeological indicators in this section. The Caribbean record for environmental impacts arising from human predation pressure is reviewed in Chapter 3.

2.3.1 Theoretical Grounds for Anthropogenic Exploitation Depression

Resource depression refers to the phenomenon of declining encounter rates with a prey taxon and is signaled by a decrease in its relative abundance on the landscape. Resource depression may take several forms and arise from several causes. For example, behavioral depression occurs when encounter rates drop because a species has left the area due to the recognized threat of predation (Whitaker 2010; Wolverton et al. 2012). By far of most interest to archaeologists is anthropogenic exploitation depression, where prey numbers decrease because human predation exceeds the level at which the target taxon can sustain its population.

Prey and patch choice models describe the process by which human foraging behavior may lead to exploitation depression. Foraging theory predicts that high ranking prey/patches will be exploited first. Exploitation of these resources will continue as long as they remain in the optimal set even if foraging pressure depletes their abundance on the landscape. As they become scarcer, encounter rates and associated returns will drop and foragers are expected to respond by incorporating lower ranking prey or patches into the diet, increasing the number of prey or patches used, and/or intensifying their use (Lupo 2007). This process is termed diet breadth expansion, and is one of the several indicators archaeologists look for when assessing the evidence for anthropogenic exploitation depression in the zooarchaeological record.

2.3.2 Zooarchaeological Indicators of Exploitation Depression

An apparent decline in the abundance of highly ranked prey in an area may be driven by a number of factors. Habitat destruction, disease, environmental changes, and even the methods used to quantify or recover zooarchaeological remains can lead to scenarios where the relative abundance of a taxon in the archaeological record appears to fall. To mitigate equifinality and identify resource depression specifically, archaeologists rely on several indicators in combination. These are:

1. *A decrease in the abundance of high ranked prey and a concomitant increase in lower ranked prey abundance* (but see Cannon 2000). The relative contribution of high versus low ranked taxa to the diet may be assessed through abundance indices (Bayham 1979, 1982; Broughton 1994, 1997, 1999; Cannon 2000; Ugan and Bright 2001). In archaeological

contexts, a quantitative demonstration of prey rank can be difficult to establish. Body size is frequently used as a proxy, therefore, with larger prey ranking more highly, at least to the point where added size incurs disproportionate costs, e.g., as with whale hunting (Griffiths 1975; Kaplan and Hill 1992).

Caution is warranted, however, where mass capture techniques may have been used to procure small, seemingly low ranked prey. Technology or equipment that allows smaller prey to be captured in aggregate, such as nets for the harvest of small schooling fish, can elevate the rank of these taxa relative to larger prey because it reduces handling costs (Cannon 2000; Grayson and Cannon 1999; Jones 2004a, 2006; Kaplan and Hill 1992; Madsen and Schmitt 1998). In this case, an increase in smaller prey does not signal declining encounter rates with larger, high ranked prey, but an increase in the return rate and relative rank of the smaller prey item. Ugan (2005) has cautioned that such cases may be limited, however, arguing that processing costs for most small animals are so high that mass capture does not sufficiently elevate rank to move small prey into the optimal set. In light of ethnoarchaeological data for low net energetic yield of mass captured prey, Lupo and Schmitt (2005) suggest that foraging techniques, such as communal net hunting, may, in fact, be pursued for non-consumptive benefits.

2. *An increase in diet breadth as indicated by one or more zooarchaeological measures including taxonomic richness and diversity and evenness indicators* (Grayson et al. 2001; Nagaoka 2001; Jones 2004b). This will be archaeologically visible as the addition of new prey or patches to the diet. In addition, increasing reliance on previously underutilized prey and patches may be evident (see indicator 6 below).

3. *A change in the age profile of high ranked prey that reflects human impact on population structure.* Typically, this will be visible archaeologically as a decrease in the mean age of prey because with increased predation pressure individuals are less likely to survive to older ages. An increase in the number of immature individuals from the highest ranking taxa, therefore, would be expected in faunal assemblages. Depending on species life history and ecology, however, an increase in mean age is also possible (Broughton 2002; Claassen 1998; Giovas et al. 2010; Mannino and Thomas 2002). Age may be assessed by dental eruption and fusion of skeletal elements (Reitz and Wing 2008), growth increments of fish otoliths (Debrot et al. 2006; Simons 1986) and molluscan shell (Cannon and Burchell 2009), or morphological characteristics of shells (e.g., lip flaring in strombid conchs, number of varices for some gastropod shells) (Giovas et al. 2010; Mannino and Thomas 2001, 2002; Stager and Chen 1996).

4. *A change in the mean size of highly ranked prey*. The average size of overexploited taxa is expected to decrease for several reasons. First, body size and age are generally correlated, particularly for species of indeterminate growth, thus fewer older individuals in an assemblage over time also means fewer larger individuals. Second, foraging theory in combination with the body-size proxy predicts that larger individuals might be preferentially targeted by hunters (Fenberg and Roy 2007). To the extent that this happens, larger individuals decline in number. As this occurs, smaller individuals should increasingly contribute to the diet. Third, human predation essentially constitutes a form of selection. If larger individuals within a taxon are consistently removed from the breeding population,

phenotypically smaller individuals may come to predominate over time (Fenberg and Roy 2007; Law and Stokes 2005). This effect has been demonstrated in modern field and controlled experiments with fish (Hilborne and Minte-Vera 2008; Reznick et al. 1990, 1997, 2002; Templeton and Shriner 2004; see also Jørgensen et al. 2007 with respect to global fisheries impacts), but whether localized human exploitation on a preindustrial scale is sufficient to produce such effects is unclear.

For vertebrates from archaeological and paleontological contexts size is often estimated from the application of allometric formulas to the measurement of a specific skeletal part. For molluscan taxa, a simple measurement of the shell is generally used (Claassen 1998; Reitz and Wing 2008). As with age, there are a number of instances where the 'decreasing size' rule of thumb may be violated. Life history, behavior, and ecology of the taxon in question must be considered when making predictions about the directionality of size change resulting from resource depression (Claassen 1998; Giovas et al. 2010; Leach and Davidson 2001; Thakar 2011). Removal of predators or competitors of a species, for instance, may positively influence the shell size of nerite snails (Underwood 1976; see also Giovas et al. 2013).

5. *Evidence for foraging increasingly farther afield*. The patch choice model predicts that as productivity declines in high ranking patches, foragers will add new patches to the optimal set. All else being equal, more distant patches will tend to rank lower because of increased travel costs. As diet or the number of patches in use expands, more distant patches will be incorporated into the optimal set. Central place foraging models predict that the farther from

home a forager is, the more heavily processed prey items will be in order to mitigate the cost of transporting heavy loads (Binford 1978; Bird and Bliege Bird 1997; Bird et al. 2002; Broughton 1995; Cannon 2000, 2003; Nagaoka 2005). This may be detected archaeologically through assessment of skeletal part representations showing bias in a site assemblage against the less meaty, lower utility parts. These skeletal portions are more likely to be butchered and left at the point of acquisition rather than transported long-distance. Faunal assemblages at the home base, therefore, will be skewed toward elements associated with more fat and tissue.

These predictions, of course, rest on the assumption that transport methods remain unchanged over the course of the study period. Technology that enhances access to resource patches can reduce travel costs, in turn raising return rates and prompting the exploitation of new taxa or the increased harvest of existing prey (e.g., see extensive discussions regarding canoes, dog sleds, and snowmobiles in Smith 1991). Whitaker and Byrd (2012) argue, for instance, that the dramatic increase in abalone exploitation on the Monterey Peninsula of central California after 950 BP can be attributed, in part, to a shift to logistical foraging from boats. Offshore diving provided access to larger individuals located in the previously inaccessible sub-tidal patch, elevating the rank of red abalone to the point of inclusion in the diet. Care must be taken, therefore, to ensure changes in utility indices are not artifacts of technological innovation in transportation.

6. *Evidence for more intensive use of existing taxa.* This is a corollary to indicator 5. As foraging costs rise, it may make more sense in terms of rate maximization for foragers to more heavily process the remains of exploited prey. This may be evident in the

archaeological record through indicators of intense butchering such as scrape marks and smashing and boiling of bones for marrow and grease extraction (Binford 1981; Broughton 1995; Lech et al. 2011; Nagaoka 2005; Wolverton et al. 2008).

Species richness, evenness, and relative abundance (i.e., indicators 1 and 2), reflect the OFT postulated relationship between high and low ranked prey and predicted expansion of the optimal diet set as high ranked prey/patches decline on the landscape. Mean age and size of prey, evidence for more distant foraging, and indicators of increasing transport costs (i.e., indictors 3 – 6) represent additional lines of evidence necessary to support an anthropogenic cause for exploitation depression (Broughton 2002; Cannon 2000, 2003; Grayson and Cannon 1999; Morrison and Hunt 2007; Nagaoka 2005). Where these are absent, it may not be possible to discern human predation from other mechanisms that may bring about a reduction in the number of high ranked prey on the landscape. Alternative causes, including environmental change or the introduction of exotic species, must also be ruled out to demonstrate anthropogenic exploitation depression.

2.4 Multiple Optima and Archaeological Implications

Anthropogenic resource depression illustrates the potential for human foraging activities to initiate a cascade of changes to ecological structure and communities. As the landscape transforms over time due to forager-prey interactions, the optimal strategy employed by foragers to exploit that landscape will be continuously redefined. An optimal strategy is defined as "that member of the feasible set that contributes the greatest fitness to an organism, *given the other* *traits that the organism possesses and given that each of these is optimal in the same context*" (emphasis in original, Smith and Winterhalder 1992:52). Smith and Winterhalder (1992) acknowledge that multiple optimal behavioral strategies may exist for a given problem even within the same natural or cultural environment because of differences in intrinsic constraints between individuals and classes of individuals. They go further, however, and suggest that even when operating under the same set of constraints—that is when all conditions are equal—foragers may exhibit multiple foraging optima when the evolutionary stable strategy for a population includes two or more strategies (Smith and Winterhalder 1992:58-59).

Smith and Winterhalder's (1992) discussion pertains to individual agents within the same population but may be logically extended to classes of agents or subpopulations within the same larger population, such as the two prehistoric village sites considered in this research. It follows that if multiple adaptive strategies exist in a given foraging context, and if these determine the course of future foraging adaptations (as implied by the empirical research discussed here and in the following chapter), then multiple optima may give rise to divergent long term environmental impacts.

All else remaining equal, multiple foraging optima may potentially be detected where there exist significant zooarchaeological differences between archaeological sites located in identical or virtually identical environmental settings. Three such scenarios are possible. In the first, the zooarchaeological records of the two sites differ from each other, suggesting different exploitation strategies, but at neither site is change evident over time (i.e., different but equally sustainable foraging strategies are evident). In the second, one site exhibits evidence for changing resource exploitation over time while the other does not (i.e., foraging strategies again differ from each other, with one being sustainable and the other not). Finally, in the third scenario, both sites exhibit evidence for changing resource exploitation over time but the nature of these changes differs between sites (i.e., different foraging strategies with differing environmental impacts are evident). In each of these scenarios, there exist disparities between the optimal foraging strategies employed at the sites that will require a causal explanation. Where it can be certain that these differences are not due to minor environmental or cultural variations, the existence of two foraging optima is indicated.

2.5 Proposed Research: Summary

In this dissertation, I examine the potential for multiple foraging optima at the paired prehistoric sites of Sabazan and Grand Bay on the Lesser Antillean island of Carriacou. This research is placed within a foraging theory context grounded in neo-Darwinian principles and employs optimization models as an interpretive framework. Assuming strict comparability of sites, to be discussed in the following chapter, differences in resource exploitation evident between Sabazan and Grand Bay may be interpreted as support for the existence of separate, but equally adaptive foraging strategies. Where foraging differences are absent, the hypothesis is not supported. I employ the standard zooarchaeological measures and indicators discussed in this chapter to characterize faunal assemblages and make quantitative comparisons between sites. Temporal patterning in resource exploitation at Sabazan and Grand Bay, whether matched or divergent, will rely on prey and patch choice models for interpretation and for an understanding of ultimate causality in terms of evolutionarily adaptive behavior.

Chapter 3

THE WEST INDIES AND WINDWARD ISLANDS:
ARCHAEOLOGICAL BACKGROUND

The fair breeze blew, the white foam flew,
The furrow followed free;
We were the first that ever burst
Into that silent sea.

- Samuel T. Coleridge, *The Rime of the Ancient Mariner*

3.1 Geographic Overview

The islands of the West Indies stretch more than 4000 km, forming a chain that separates the Caribbean Sea from the Atlantic Ocean. Bordered by the Gulf of Mexico and the American continents on three sides and the Atlantic Ocean on the fourth, the islands can be divided into three major archipelagos: the Greater Antilles, which include the largest islands, Cuba, Hispaniola, Jamaica, and Puerto Rico; the Bahamian Archipelago; and the Lesser Antilles, a double arc of small islands that mark the eastern most periphery of the Caribbean (Figure 3.1). The Lesser Antilles are further divided into the Leeward Islands to the north and Windward

Islands to the south. The study island, Carriacou, belongs to the nation of Grenada and lies within the Windward Island group.

It is worth noting here that the terms “West Indies” and “Caribbean” are not synonymous although they are often used interchangeably. Depending on the context, different sets of islands are grouped under these terms. For example, Trinidad and Tobago, situated off the Venezuelan coast are typically included in the geopolitical Caribbean, but not the biogeographic Caribbean since they share a closer biotic affinity with South America (Hedges 1996, 2001). Similarly, the Bahamas, while part of the West Indies and a member of the Caribbean Commonwealth community, are not geographically part of the Caribbean because they are not bounded by the Caribbean Sea. In this work, “West Indies” and “Caribbean” are used interchangeably to refer broadly to a region of islands beginning with the Bahamas in the north and extending south to the Aruba, Bonaire, and Curaçao (ABC) archipelago, the Los Roques archipelago, Isla de Margarita, Trinidad, Tobago, and other smaller islands. Off-shore Central American islands are excluded.

By this definition, the West Indies constitute a vast region that parallels all of Central America and portions of North and South America, from roughly 27° to 10° latitude. It represents some 234,000 km^2 of land area, of which Cuba alone represents nearly 50 percent (Keegan 1994). The dominant feature of this region is water—the Caribbean Sea, Atlantic Ocean, Gulf of Mexico, and Straits of Florida—which has profoundly shaped the biotic and cultural nature of the islands. Most of the islands are small, under 500 km^2, and although nearly all are tropical, they are characterized by diverse geology, climate, vegetation, and fauna.

3.2 Archaeological Background

3.2.1 Caribbean Prehistory Overview

Sometime around 6000 BC, the first migrants into the West Indies crossed by watercraft from South America to Trinidad (Boomert 2000). Subsequent migrations brought in colonizers from Central America to Cuba and Hispaniola in the Greater Antilles around 4000 – 5000 BC (Keegan 1994; Wilson 2007). People moved into the Lesser Antilles perhaps as early as 3000 BC, but it appears that not all islands within these chains were initially occupied (Fitzpatrick et al. 2010; Fitzpatrick and Giovas 2011). Emerging research suggests that many islands were bypassed or unknown at the time. The once prevailing narrative of sequential island colonization with population replacement by successive waves of continental migration (Rouse 1992) has given way to a more multidimensional reconstruction (see papers in Keegan et al. 2013). The peopling of the West Indies was accomplished in a series of multiple, complex, and punctuated events. The cultures that Columbus encountered in his voyages to the West Indies arose from a dynamic process of interaction between existing island groups and new migrants, augmented by ongoing contact with the continent (Hofman et al. 2010, 2011; Wilson 2007).

The last major Caribbean migration originated in South America around 2500 years ago and initiates a period in West Indian prehistory known as the Ceramic Age (ca. 500 BC – AD 1500). This name derives from the fact that ceramics, known to have appeared earlier (Keegan 2006; Rodríguez Ramos et al. 2008; Ulloa Hung 2005), now become ubiquitous. The period is also marked by extensive horticulture/agriculture and by the anthropogenic introduction of continental biota (for reviews see Giovas et al. 2012; Newsom and Wing 2004; Wing 2008). Ceramic Age populations have received the majority of scholarly attention in Caribbean archaeology as sites from this period are more abundant and widespread than those of earlier cultural periods (Keegan 1994, 2000).

Early Ceramic Age peoples (ca. 500 BC – AD 500) are termed Saladoid after their distinctive pottery (Petersen et al. 2004; Roe 1989; Rouse 1989), a name derived from the type site of Saladero, Venezuela (Rouse and Cruxent 1963). Saladoid pottery is relatively homogenous across its range in the Caribbean, but over time differentiates into regional expressions characterized by various ceramic series and sub-series (Petersen et al. 2004; Rouse 1986, 1992). In addition to foraging for wild resources, Ceramic Age people cultivated crops like manioc (*Manihot escuelenta*), sweet potato (*Ipomoea batatas*) and maize (*Zea mays*), as indicated by macro- and microbotanical remains, the location of sites near arable land, and the presence of artifacts related to horticulture, such as grater boards and ceramic griddles (Berman and Pearsall 2008; deFrance and Newsom 2005; Lane et al. 2008; Mickelburgh and Pagán-Jiménez 2012; Newsom 2008; Newsom and Pearsall 2003; Newsom and Wing 2004; Watters and Rouse 1989). Both marine and terrestrial fauna contributed to the diet as evidenced by abundant vertebrate and invertebrate remains from the midden deposits of Ceramic Age sites and by stable isotope ratios in human bone (deFrance et al. 1996; Keegan and DeNiro 1988; Krigbaum et al. 2013; Newsom and Wing 2004; Stokes 2005).

Saladoid peoples are assumed to have been relatively egalitarian, tribal-based communities. Excavations at sites such as Golden Rock on St. Eustatius reveal that they lived in independent, multifamily houses within large villages occupied for centuries or more (Versteeg and Schinkel 1992; see also Siegel 1992 and 1996). Burials are located within a central village plaza, but lack any specific orientation. Iconography of ceramics and personal ornamentation reflect their origins in, and continuing connections to, the South American mainland (Keegan 2000, 2009).

3.2.2 Culture History of the Windward Islands

The Lesser Antilles are divided into the Leeward Islands to the north and Windward Islands to the south (Figure 3.1). The groups are named for their lee or windward placement relative to the position of European colonial ships sailing from the Canary Islands on northeasterly trade winds. The passage between Dominica and Guadeloupe is often taken to mark the boundary between the two archipelagos.

Despite the proximity of Trinidad, which was settled as early as 6000 BC, conclusive evidence for the occupation of the Windward Islands does not appear until the Ceramic Age (Keegan 1994, 2000). While a preceding Archaic occupation is well established for the Greater Antilles and northern Lesser Antilles (Davis 1993; Keegan 1994; Hofman and Hoogland 2003; Rouse 1992; Wilson 2007), the only definitive evidence for a pre-Ceramic presence between the Guadeloupe Passage and Trinidad and Tobago comes from the Heywoods site on Barbados, ca. 160 km east of the main arc of the Windward Islands proper. Here, new radiocarbon dates verify Archaic occupation between 3300 – 2000 BC (Fitzpatrick, personal communication 2013; Fitzpatrick 2011; see also Drewett 2006).

The archaeological record of the Windward Islands becomes more robust during the Ceramic Age, particularly with the widespread increase of ceramics in the record. This ubiquitous artifact provides the basis for Rouse's (1986, 1992) influential cultural chronological framework for the prehistoric Caribbean still used by anglophone archaeologists and recently revised and synthesized by Petersen et al. (2004). Table 3.1 outlines the broad scheme of Windward Islands culture history, including key changes in ceramic artifact styles. For additional details beyond the scope of this dissertation, the reader is referred to the work of Petersen et al. (2004).

Although the precise mainland origin of the Saladoid cultural complex is debated, northeastern South America, often specifically the Orinoco basin, is identified as the source for the earliest ceramic-bearing horticulturalists who moved into the Caribbean after ca. 500 BC (Wilson 2007). From 500 – 400 BC up until AD 300 – 400 early Ceramic Age assemblages, termed Early Cedrosan Saladoid (ECS), are relatively undifferentiated, found from Puerto Rico through the Lesser Antilles (Allaire 2003). Ceramics are characterized by disproportionate amounts of undecorated plainware with a smaller component of typically thin, decorated wares exhibiting the hallmarks of white-on-red painting (WOR) and zoned incised crosshatching (ZIC) (Table 3.1).

In the Windward Islands, ECS sites are comparatively rare, occurring at Fond Brûlé on Martinique (Haviser 1997; Wilson 2007) and Pearls, Grenada (Haviser 1997; Keegan 1991). The early dates from the former site have been questioned (Callaghan 2013), while the latter is poorly dated and heavily looted. Most of the occupation at Pearls may, in fact, belong to a later period. Assuming the lack of early Ceramic Age sites in the Windwards is not a product of sampling bias due to patchy archaeological investigation of islands or weakly-developed radiocarbon chronologies (Cooper 2010; Cooper and Thomas 2011; Fitzpatrick 2006; Fitzpatrick and Giovas 2011), this patterning suggests the possibility that much of the area was selectively bypassed during Saladoid colonization as it proceeded northward (Wilson 2007). Alternatively, migration routes may have begun with a jump from South America to Puerto Rico, where the earliest Saladoid sites are found, and worked their way southward from there (Callaghan 2001; Fitzpatrick 2013; Fitzpatrick et al. 2010).

After about AD 400, ECS assemblages begin to take on regional distinctions. In the southern Lesser Antilles, Cedrosan Saladoid incorporates certain stylistic attributes that suggest interaction between island communities and the continent and nearby Trinidad and Tobabgo, either through trade, reciprocal exchange, or kinship relations (Table 3.1) (Boomert 2013; Petersen et al. 2004; Rouse 1992). The number of settlements in the Windwards increases during this period with Trinidadian Barrancoid influence evident in sites from all major islands between Guadeloupe and Grenada as well as Barbados (Haviser 1997; Petersen et al. 2004).

Beginning around AD 500 – 600 Cedrosan Saladoid assemblages in the Windwards are replaced by those of the Troumassoid, representing *in situ* cultural evolution of Lesser Antillean populations rather than population replacement by outside groups. The Troumassoid period is subdivided into the Troumassan Troumassoid (ca. AD 500/600 – 1000/1200) and the Suazan Troumassoid (AD 1000 – 1500), formerly classified as the Suazoid series (Rouse 1992). Troumassan pottery, which is widespread in the Windward Islands, is typified by decorated wares with polychrome painting, including Caliviny Polychrome (Bullen and Bullen 1972) which is distinctive of this period (Table 3.1). An increase in the number and size of sites suggests population growth during the Troumassan Troumassoid (Haviser 1991). Interaction with the continent and neighboring islands is strong for the Windward Islands during this period, and, with respect to exotic objects and iconography, expands to include the Greater Antilles and Leeward Islands after AD 600 (Hofman et al. 2011). The exchange of goods and people is documented by exotic ceramic and lapidary objects (Fitzpatrick et al. 2009a; Hofman et al. 2007, 2008; see also papers in Hofman and van Duijvenbode 2011), faunal translocations (Giovas et al. 2012; Newsom and Wing 2004; Olson and Pregill 1982; Serrand 2001; Williams and Steadman

2001) and the presence of non-local individuals in cemetery populations (Hoogland et al. 2010; Laffoon 2012).

While these developments were taking place in the Windward Islands, to the north, the Greater Antilles, Virgin Islands, and northern Lesser Antilles continued to follow their own cultural trajectories marked by ongoing and accelerating regionalization. After the Saladoid and early Troumassoid periods, the archaeological characteristics of the northern and southern Lesser Antilles become increasingly divergent. In the Greater Antilles, the period from ca. AD 600 to 1000 encompasses the socio-political developments that led to the complex, chiefly societies known as the Taíno that were encountered by the Spanish on Hispaniola and Puerto Rico in the late fifteenth and early sixteenth centuries. These developments include changes in mortuary practices and community organization, the evolution of ceremonial space, and developing site hierarchies (Curet 2005; Curet and Oliver 1998; Siegel 1996, 1999; Wilson 2007). The appearance in the Windward Islands of ritual objects and iconography associated with these developments in the north suggests the influence and transmission of associated socio-religious practices from the Greater Antilles and northern Lesser Antilles to the southern Lesser Antilles at this time (Hofman et al. 2007, 2008, 2011).

The Suazan Troumassoid, the final major cultural chronological period of the Windward Islands, is marked by a decline in the quality of ceramic workmanship with assemblages largely comprising utilitarian wares with simple forms, often with scratched surface treatments, finger indented rims, and distinctive human-faced adornos (Table 3.1). Suazan assemblages are widely distributed throughout the Windward islands, Guadeloupe, Barbados (Drewett 1993), and Tobago. Sauzan site distribution tends to favor arid coastal locations proximate to mangrove habitats with rich shellfish resources (Keegan 2000).

Researchers have looked at sites from the late prehistoric period for archaeological correlates of the ethnohistorically identified Island Carib Indians who supposedly invaded the Lesser Antilles just prior to the arrival of Columbus, i.e., ca. AD 1200 – 1500. At one time, Suazan assemblages were argued to be intrusive to the region and possibly representative of such an incursion (Bullen and Bullen 1970, 1972, 1976; see also Davis and Goodwin 1990). Boomert (1987, 2000) and others (Allaire 1984, 1997; Petersen et al. 2004), however, have argued effectively for cultural continuity between the Troumassan and Suazan periods. The question of Island Carib origins and its archaeological indicators still persists. It has been suggested that Cayo ceramics, which appear on a number of Windward Islands in the centuries just prior to and after European contact and have been linked to the Koriabo complex of the Guianas, might belong to the Caribs (Boomert 1986, 1995, 2000, 2011). The correlation between these archaeological and ethnohistoric groups is imperfect, however. At present, there is no consensus about precisely who the Island Caribs were and whether they can be identified in the archaeological record. Given the many questions surrounding the validity of European accounts about the Island Caribs (Allaire 1997, 2013; Davis and Goodwin 1990; Keegan 1996; Roux 2011), historical linguistic reconstructions (Cooper 1997), as well as the problems inherent in cultural historical interpretations of change in the material record, it seems unlikely that this issue will be resolved any time soon.

Despite the question of Carib identity, it is clear that the arrival of Columbus and the Spanish to the West Indies at the end of the fifteenth century profoundly altered the trajectory of West Indian history. Wilson (1997:29) has remarked that the meeting of the Spanish and Caribbean indigenous populations was "an "encounter" of peoples the way a train wreck is an encounter. The results were catastrophic." Within two decades, the peoples of the Greater Antilles and surrounding islands were almost completely exterminated by introduced diseases, Spanish aggression, and enslavement. The brunt of first contact was borne by the northern Caribbean. European colonization of the Lesser Antilles, particularly the Windward Islands, did not truly begin until the seventeenth century giving indigenous populations there time to adapt and organize resistance (Gonzalez 1997; Joseph 1997). Barbados, however, had apparently been abandoned or depopulated sometime around Columbus's arrival in the Caribbean and was uninhabited when the British settled the island in the 1620s.

The culture historical sequence reviewed here provides a framework for contextualizing Carriacou's archaeological record and the island's place in the larger pre-Columbian history of the West Indies. Along with its geographic and environmental characteristics to be discussed in the following pages, these data offer details salient toward understanding foraging strategies at Sabazan and Grand Bay and their ecological impact. The Caribbean zooarchaeological record for resource exploitation and anthropogenic environmental impacts provides additional context for interpreting archaeofaunal patterning on Carriacou. The remainder of this chapter is, therefore, devoted to reviewing prehistoric human-environment interactions and foraging patterns for the Caribbean in general and Lesser Antilles in particular.

3.3 Pre-Columbian Human-Environment Interactions

Ceramic Age foragers in the Caribbean relied heavily on marine environments for resources, especially in the Lesser Antilles where islands are generally smaller and settlements tended to be located on or near the coast. As measured by the minimum number of individuals, marine vertebrates and invertebrates typically constitute upwards of 70% of the zooarchaeological record of most Lesser Antillean sites (Newsom and Wing 2004). While exceptions exist, in these places variability in resource use between sites tends to be a function of local environmental variability, with the most preferred habitats being those that were most accessible and/or closest to a site (Carder and Crock 2012; Grouard 2002; Newsom and Wing 2004; Nokkert 1999; Scudder 1991; Wing and Reitz 1982; Wing and Wing 1995). Important for its theoretical implications, this patterning provides a basis for ranking major habitats and their resources against each other for relative foraging returns.

An example of this correspondence between resource exploitation and availability can be found at the post-Saladoid components of the Silver Sands and Chancery Lane sites on Barbados. The two sites exhibit nearly identical levels of exploitation of shore, shallow inshore, coral reef, pelagic, and terrestrial habitats that is in keeping with their similar location (both are on the southern coast of the island) and their comparable proximity to these resource patches (Drewett 2000; Newsom and Wing 2004). Similarly, on St. Martin the Saladoid site of Anse des Pères, which is situated on a flat coastal plain by the sea, contains abundant remains of marine taxa such as fish and sea turtles (Nokkert 1999). In contrast to Anse des Pères, the Saladoid-era Hope Estate site, also on St. Martin, shows an emphasis on terrestrial species which Nokkert (1999) attributed to the inland location of this site and the surrounding hilly terrain that may have impeded access to the sea. In a zooarchaeological survey of seven sites on Guadeloupe, Grouard (2002) found that those located on low-lying limestone terrain near shallow, protected waters had greater representation of proximate coral reef and littoral resources, whereas sites located by steep, volcanic drop-offs had a much more significant representation of taxa from nearby deep water channels and rocky substrate habitats.

3.3.1 Exploitation of Introduced Terrestrial Taxa

Although marine resources were important during the Ceramic Age, certain terrestrial resources were sufficiently significant that Saladoid people retained these as part of their subsistence regime as they moved into the West Indies. A number of plant and animal species were introduced from the mainland into the Caribbean during this period. The translocation of economically important plants began prior to the Ceramic Age (Newsom 2008), but it at this time that evidence for plant introductions becomes more robust. Manioc (*M. esculenta*), corn (*Z. mays*), peanuts (*Arachis hypogaea*), various trees such as achiote (*Bixa orellana*), soursop (*Annona* sp.) and papaya (*Carica papaya*) are among the botanical taxa introduced prehistorically to the West Indies from the continental Neotropics (Mickleburgh and Pagán-Jiménez 2012; Newsom and Pearsall 2003; Newsom and Wing 2004).

With a depauperate native terrestrial fauna in the Lesser Antilles, the presence of exotic continental animals in archaeological sites is relatively easily detected. The scarcity of larger bodied terrestrial vertebrate prey may partially explain why Ceramic Age settlers chose to introduce a number of animals into the Caribbean. In the Lesser Antilles, there are no Holocene records for native terrestrial mammals other than rice rats and bats. The remains of agouti (*Dasyprocta* sp.), opossum (*Didelphis* cf. *marsupialis*), dog (*Canis familiaris*) (Grouard 2001, 2004), and more rarely guinea pig (*Cavia porcellus*), armadillo (*Dasypus novemcinctus*), and peccary (*Tayassu/Pecari* sp.) have been recovered from archaeological sites scattered throughout the Lesser Antilles, and in some cases the Greater Antilles, during both the Saladoid and post-Saladoid (Fandrich 1991; Giovas et al. 2012; LeFebvre and deFrance in review; Narganes Storde 1985, 2005; Stahl 2009; Versteeg 1989; Wing 1968; 1999, 2001; Wing and Reitz 1982). All but the first two of these species are relatively rare in the islands (see Giovas et al. 2012 for a recent review of geographic distributions), but even agouti and opossum were never particularly abundant, except perhaps at Pearls, Grenada (Newsom and Wing 2004; Wing 2008). The green iguana (*Iguana iguana*), native to South and Central America, but now found distributed throughout the Lesser Antilles and Virgin Islands, has alternately been considered both a prehistoric and modern translocation or a natural dispersal into the West Indies (Stahl 2009). A number of other Caribbean introductions are suspected for various lizards, snakes, birds, and possibly a tortoise, but are inconclusive due to, among other issues, problems with reconstructing anthropogenically altered species distributions from fragmented, sparse remains and geographically limited records (Olson and Maiz Lopez 2008; Ricklefs and Bermingham 2008; Stahl 2009; Williams and Steadman 2001).

In addition to the introduction of novel taxa to the Caribbean, evidence exists for inter-island transport of native species. The Puerto Rican hutia (*Isolobon portoricensis*), for instance, which is native to Hispaniola, was transported to Puerto Rico and the Virgin Islands where it may have been managed as a captive resource (Flemming and McPhee 1999; Wilkins 2001). The extinct flightless rail (*Nesotrochis debooyi*) originates from Puerto Rico, but is found in midden deposits from archaeological sites in the Virgin Islands indicating human translocation of this species (Olson 1974; Olson and Maiz Lopez 2008).

Wing (Wing 2008; Wing and Wing 1995) has noted that distributions for introduced animals generally conform to the island biogeographic principle of declining numbers with growing distance from source, in this case South America. Interestingly, guinea pig does not correspond to this pattern. Its distribution in the Caribbean is concentrated more heavily in the Greater Antilles and nearby northern islands (i.e., Hispaniola, Puerto Rico, Vieques, the Virgin Islands and Antigua), and its presence in the Lesser Antilles south of Antigua is confirmed only for Carriacou (Giovas et al. 2012).

With the exception of dogs, which typically occur in burial contexts suggesting a socio-symbolic role for these animals (Grouard 2002; Lippold 1991; Newsom and Wing 2004; Wing 1993, 2008), the remains of introduced animals are generally found disarticulated in middens, indicating their exploitation for food. Captive management is assumed for the domestic guinea pig in the prehistoric Caribbean and has been suggested for the agouti on the basis of such practices in contemporary Latin America (Vietmeyer 1991; Wing 2008). Generally low relative abundances for introduced taxa in archaeological contexts, however, imply that they never made more than a modest dietary contribution. The centuries-long persistence (or continual reintroduction) of these taxa in archaeological contexts hints that cultural roles may at times have extended beyond basic subsistence. Elsewhere, symbolic functions related to ritual or displays of status mediated consumption by elites have been documented for introduced taxa (Sandweiss and Wing 1997; Kirch and O'Day 2003). In the West Indies, such roles have yet to be conclusively established (see discussion in Curet and Pestle 2010; deFrance 2010; LeFebvre and deFance in review). Even so, potential symbolic functions for certain taxa will need to be taken into account when assessing the relative rank of species.

3.3.2 Anthropogenic Environmental Impacts

The record for human-environment interactions in the Ceramic Age Caribbean shows clear evidence for anthropogenic environmental impacts in the form of disrupted ecology, landscape alteration, and species extinctions (Fitzpatrick and Keegan 2007; Keegan et al. 2003; Pregill et al. 1994; Steadman et al. 1984, 2005; Stahl 2009; Steadman and Stokes 2002). It seems reasonable to posit that introduced animals may have impacted West Indian ecology through predation and competitive displacement of indigenous species, although I am unaware of any investigations examining this issue. This process has been documented prehistorically for many other island regions worldwide (Amorosi et al. 1997; Carlson and Keegan 2004; Erlandson et al. 2004; Grayson 2001; Vigne 1992). The combined effect of invasive biota and habitat alteration initiated by land clearance and agricultural practices likely contributed, at least in part, to the extinction of many endemic Caribbean bird and rodent species (Reis and Steadman 1999; Olson 1974, 1978; Olson and Maíz López 2008; Turvey et al. 2006, 2007; Williams and Steadman 2001) and an undescribed Bahamian tortoise (*Geochelone* sp.) (Carlson 1999; Carlson and Keegan 2004).

In deeper antiquity, human overhunting has been suggested as a possible cause for the extinction of West Indian ground sloths on Cuba, Hispaniola, and Puerto Rico, whose last occurrence overlaps with human occupation on some islands (MacPhee et al. 2007; Steadman et al. 2005; Veloz Maggiolo and Vega 1982) and does not appear related to any overarching climate change. Forces detrimental to some native species may have favored others, however, through the creation of commensal opportunities or by the removal of predators and competitors. Wing (1995, 2008), for instance, has argued that endemic rice rats (Oryzomyini) increased through time at sites like Hope Estate on St. Martin, Kelbey's Ridge on Saba, and Hichman's Shell Heap (GE-6), Nevis, because human activities fostered ecotone habitats in which these rodents flourished.

Anthropogenic impacts are not limited to the terrestrial environment. Trends for species decline and changing composition over time have been observed in the zooarchaeological record for fish, molluscs, and land crabs. Keegan et al. (2003), for example, tracked the presence and abundance of gastropod, bivalve, echinoderm, and coral taxa at two Ceramic Age sites from Paradise Park, Jamaica to reconstruct changes in the local bay environment. Based on the preferred habitats of species abundant at the sites, they demonstrated that the bay shifted over time from a freely circulating, high salinity seagrass habitat, to one of low circulation, lower salinity, and muddier substrates associated with mangroves. These changes were brought about by a complex interplay of human overfishing, alterations in sea level and rainfall patterns, and erosion from agricultural land clearance, and were responsible for the observed decline in queen conch (*Eustrombus* (*Lobatus*) *gigas,* formerly *Strombus gigas* [Petuch and Roberts 2007; Landau et al. 2008]) and extirpation of West Indian top snail (*Cittarium pica*).

In their comprehensive synthesis of pre-Columbian indigenous use of biological resources in the West Indies, Newsom and Wing (2004) identify several trends in the Lesser Antillean zooarchaeological record that are consistent with intensifying human predation pressure on local biota. These include a change in taxonomic composition and abundance of prey from a particular habitat, a change in environmental patches exploited, and a diminution of size and/or age of certain prey.

For instance, Wing and others (Newsom and Wing 2004; Wing 2001; Wing and Wing 1995, 2001) have demonstrated that the average weight of reef fish and the size distribution of reef taxa such as parrotfish (Scaridae) and snappers (Lutjanidae) decreased through time at Caribbean sites such as Maisabel, Puerto Rico; Tutu, St. Thomas; Hope Estate, St. Martin; Kelbey's Ridge, Saba; and Indian Castle, Nevis. These changes suggest that fishing pressure became sufficiently intense that targeted prey did not have the opportunity to attain larger sizes before being harvested, a process termed growth overfishing (Wing and Wing 2001). At these sites and elsewhere, the contribution of reef fish to the total estimated aquatic vertebrate biomass declines from early to late deposits, while the mean trophic level of reef fish also drops over time. Finally, offshore and pelagic taxa, such as Scrombridae, increase in later deposits. These patterns reflect a shift in fishing focus by humans, known as "fishing down marine food webs", in which people turn from carnivorous reef fish, to reef herbivores, and finally to harder-to-obtain pelagic species as each becomes overfished (Hardt 2009; Newsom and Wing 2004; Pauly et al. 1998, 2000; Reitz 2004; Steadman and Jones 2006; Wing 2001; Wing and Wing 2001).

These patterns should be familiar as the theoretically-predicted outcomes of resource depression discussed in the preceding chapter: diet breadth expansion, prey and patch switching, and changes in the age and/or size structure of prey populations. In the remainder of this chapter I review in greater detail the zooarchaeological evidence for each of these patterns, focusing on the Lesser Antilles.

3.3.3 Changing Prey and Habitat Exploitation: Prey and Patch Switching

Studies of changing taxonomic abundances in Lesser Antillean zooarchaeological assemblages have generally focused on the marine environment, particularly fish assemblages where species richness is often high. When coupled with trophic level and/or biomass of taxa, researchers have used the relative contributions of fish species at a site to characterize the ecological communities in which they are found and determine if and how humans influenced these over time (Blick 2007, 2012; LeFebvre 2005, 2007; Newsom and Wing 2004; Reitz 2004; Reitz et al. 2009; Quitmyer and Reitz 2006; Wing 2001; Wing and Wing 2001). Derived from fisheries biology (Pauly et al. 1998, 2000), mean trophic level analysis is based on the feeding guild and food web position of a fish species and its associated biomass. The scale assigns a numeric rank to taxa, with the lowest value given to primary producers and the highest to top piscivores such as snappers (Lutjanidae) and tuna (Scombridae). This, in turn, is used in combination with the relative biomass contributions of taxa to assess to assess the mean trophic level of a catch.

Within the context of changing taxonomic composition, certain directional trends are frequently observed for Caribbean zooarchaeological assemblages. Over time there is often a shift in the relative contribution of coral reef species from a given trophic level. Large-bodied carnivorous fish such as groupers (Serranidae: subfamily Epinephelinae) and snappers tend to be replaced by smaller, ecologically more numerous herbivores and/or omnivores such as parrotfish (Scaridae), surgeonfish (Acanthuridae), and wrasses (Labridae). Such trophic-level shifts were observed, for instance, in a study of the fish assemblages from five West Indian sites by Wing and Wing (2001). The authors found that the mean trophic level of reef fishes declined through time, indicating a decreased contribution of these fishes to the total estimated aquatic biomass.

Similar prey switching is seen among invertebrates. The replacement of gecarcinid land crabs (e.g., *Cardisoma guanhumi*) by marine molluscs, especially the West Indian top snail (*C. pica*), in midden remains over time is a well-recognized phenomenon in the prehistoric Caribbean. Land crabs are common in early Saladoid deposits, but much less so in the late occupation phases of sites. In fact this pattern, the so-called “crab-shell dichotomy”, is so pronounced in those places where it occurs that when first encountered by Froelich Rainey in the 1930s, he attributed it to the replacement of a “Crab Culture” by an in-migrating “Shell Culture” (Rainey 1940). Once much-debated (Carbone 1980; Davis 1988; deFrance and Newsom 2005; Goodwin 1980; Jones 1980; Rodriguez Ramos 2005), it is now recognized that that this subsistence change, like that involving trophic–level shifts or the incorporation of previously unexploited taxa into the diet, represents diet breadth expansion due to the local overexploitation by humans of one resource (crabs) and a consequent dietary shift to another (Keegan 1989; Wing 2001).

In addition to changes in the taxonomic abundance of species within a particular habitat, Caribbean researchers have documented shifts in resource exploitation that occurred across habitat patches. In these cases, foragers came to rely increasingly on taxa from environments which previously contributed minimally to diet, or not at all. In the later, post-Saladoid component of the Heywoods site on Barbados, for instance, there is an increased contribution to diet of offshore or pelagic fishes such as tuna, horse-eye jack (*Caranx latus*), and flyingfish (Exocoetidae) (Newsom and Wing 2004). These species may be caught either seasonally when some taxa venture closer to shore or by traveling into open waters beyond the reef to fish (LeFebvre 2005, 2007; Newsom and Wing 2004). In either case, sea worthy craft and maritime knowledge are crucial to this enterprise.

In some places, the relative representation of terrestrial species in the diet rose because of increasing rice rat exploitation. This trend is recorded for the period spanning 500 BC to AD 700 at the Hope Estate site on St. Martin, for example (Grouard 2004). Rice rats also increase over time at Kelbey's Ridge, Saba, and Hichman's Shell Heap, Nevis (Wing 2008). Despite evidence for increasing terrestrial exploitation in some instances, it is generally the case that reef taxa dominated most Ceramic Age zooarchaeological assemblages in the Lesser Antilles. It is only their relative dominance that changes over time.

It is important to note that not all variation in taxonomic composition and relative abundance arises from human predation pressure. Such shifts may also result from environmental changes, the introduction of new fishing technology or processing methods, changes in the division of labour (e.g., children assigned to collect shellfish), dietary preference, or taphonomic bias (Bird and Bliege Bird 1997; Jones and Quinn 2009; Reitz et al. 2009; Wing and Wing 2001). Thus, although often used as an indicator of intense predation pressure, dietary shifts alone are insufficient to establish adverse human impacts. Investigators often look to the size and/or age structure of prey populations to provide additional support for anthropogenic exploitation depression.

3.3.4 Size Change in Prey Species

As discussed in Chapter 2, there are several reasons why mounting human predation pressure may produce a decline in the mean body size of a species. Assuming foragers conform to theoretical expectations, preference for larger individuals means selective removal of these individuals in a population resulting in a declining mean size—and age for taxa that grow throughout life. Size diminution in fauna over time has been documented in fish, mammal, and invertebrate assemblages from a number of Lesser Antillean sites, and has been used to infer intensifying foraging practices.

Change in average body size is typically established by assessing the relative ratio of adult to juvenile members of a species in a zooarchaeological assemblage or by measurements of select skeletal/exoskeletal/shell parts which can be predictably correlated with the biomass or live weight of a taxon (Reitz and Wing 2008). Size changes over time are apparent when the size distribution and its mean for a given sample differ in a statistically significant way from one period to the next.

For instance, in the same five island study discussed above in which Wing and Wing (2001) identified a decrease in mean trophic level, the authors also detected a decline in the estimated average weight of reef fish and the size distribution of individual obligate reef taxa (e.g., Scaridae, Acanthuridae, Lutjanidae, Serranidae). Similar size declines and/or increase in the relative abundance of juvenile (i.e., smaller) individuals are observed over time for fish assemblages across the Caribbean during the Ceramic Age (Blick 2007, 2012; Grouard 2004; Newsom and Wing 2004), and are taken to be indicative of growth overfishing.

Among mammals, Grouard (2004) has shown that the endemic rice rat (Oryzomyini) at the Saladoid site of Hope Estate on St. Martin, became smaller in the later occupation phase. Native rice rats are now extinct, but were commonly found as food remains within midden deposits of Lesser Antillean archaeological sites. They were heavily exploited at the Hope Estate site where Grouard (2004) found that the mean length of rice rat mandibular alveolar length decreased from older to younger deposits. At the same time, she found that the degree of dental wear exhibited by rice rat molars decreased, indicating increased representation of younger individuals in the assemblage (assuming no changes in rice rat diet). Grouard suggested that the observed patterning was indicative of increasing predation pressure by humans.

Studies of invertebrate size change are not as numerous as those for fish, but size decline has been documented for invertebrates and include cases for queen conch (Stage and Chen 1996; see also Antczak et al. 2008), West Indian top snail (Blick 2007), and coquina clams (*Donax denticulatus*) (Serrand 2008), as well as those for land crabs (Gecarcinidae). Based on measurements of mandibles, land crabs have been shown to become smaller over time at sites on Nevis and Saint Martin, and possibly also Puerto Rico (de France 1988; Newsom and Wing 2004; Nokkert 1999). Size decline in gecarcinids is tied to the crab-shell dichotomy. As land crabs are replaced in later deposits by molluscs, they also become smaller, once again suggesting intensifying exploitation by humans as the cause.

3.4 Ceramic Age Anthropogenic Impacts: A Second Look

In recent years, discussion has emerged about the apparent ubiquity of prehistoric anthropogenic impacts and our ability to detect these (e.g., Baisre 2010 and "Forum" responses in the *Journal of Island and Coastal Archaeology* 5:1). Critiques center on the difficulty of teasing apart cause and consequence in complex systems operating over centuries or millennia, an over-reliance on broad, unicausal explanations (i.e., climate vs. humans), and the fallacy of extrapolating locally-demonstrated impacts into region-wide resource depression (Baisre 2010; Reitz et al. 2009). Emerging research indicates that anthropogenic impacts on island ecosystems are variable and cannot be assumed to have been universally detrimental (e.g., Carder and Crock 2012; Carder et al. 2007; Giovas et al. 2010, 2013; Whyte et al. 2005). As shown for a number of sites in the Caribbean and elsewhere, change in the zooarchaeological record may arise from multiple human-behavioral causes unrelated to direct predation pressure by humans.

Long-term stability of exploited resources has also been documented prehistorically in the West Indies and other regions (Butler and Campbell 2004; Campbell and Butler 2010; Giovas et al. 2010, 2013; Grouard 2001). Carder and colleagues (Carder and Crock 2012; Carder et al. 2007), for instance, saw none of the above discussed changes in fish size, abundance, or community structure in prehistoric Anguilla's zooarchaeological record. Through application of an abundance biomass comparison model used in contemporary fisheries studies, they were able to demonstrate that prehistoric fishing on the island was sustainable over a millennium. Such studies serve as cautionary note that resource depression and related impacts should not be taken for granted as inevitable outcomes of Saladoid or post-Saladoid foraging strategies, and reaffirm the importance of employing multiple lines of evidence and eliminating alternative causal mechanisms.

Figure 3.1 Map of the Caribbean showing the location of the study island Carriacou. (Map courtesy of S.M. Fitzpatrick)

Overview of Windward Islands Culture History

Calendar Date	Cultural Chronological Period	Island Colonization and Occupation	Sociocultural Developments	Ceramic and Artifact Characteristics
Pre-500 BC	Archaic (Pre-Ceramic)	No reliable evidence for Windward Islands occupation. Occupation of surrounding islands of Trinidad, Tobago, Barbados, and northern Leeward Islands.	N/A	N/A
500/400 BC – AD 300/400	Early Saladoid / Cedrosan Saladoid	Colonization of northern Caribbean islands. Very limited settlement in Windwards.	Migration from South America into Caribbean. Archaeological characteristics relatively undifferentiated from Puerto Rico to northern Lesser Antilles.	Ceramic decoration: white-on-red painting (WOR), zoned incised crosshatching (ZIC), curvilinear, linear; anthropomorphic and zoomorphic adornos. Vessel form with thin walls; bell, boat or kidney-shaped with d-shaped handles; lipped griddles. Religious praphrenalia: incense burners, inhalers, carved stone pendants, three-pointer çemis of clay, stone, and shell .
AD 400 – 500/600	Late Saladoid / Cedrosan Saladoid with Barrancoid influences	Settlement expansion into Windward Islands. Carriacou settled.	Colonization of smaller Windward islands. Increse in number of settlements and development of interaction networks with South America and neighboring islands.	Saladoid (as above) with addition of Barrancoid traits: zoned painting; curvilinear incisions; thickened, triangular or flanged rims; red painting and buff-coloured polishing; hollow-backed adornos.
AD 500/600 – 1000/1200	Troumassan Troumassoid	Increase in number of sites and site expansion suggest population growth.	Increased regionalization across Caribbean. Intensification of island interaction in Windwards; continental contact. Trade of ceramics, lapidary objects; South American faunal translocations. Non-local individuals in cemeteries. Large increase in site size and number.	Ceramic decoration: red, white, and black polychrome painting some with curvilinear incisions. Caliviny Polychrome is distinctive of period: characterized by red and black painted scrolls on a buff surface. Cylindrical potstands, jars, and effigy bowls are common. First appearance of griddles with legs.
AD 1000 – 1500	Suazan Troumassoid	Abandonment of some sites; depopulation? Occupation at Sabazan and Grand Bay end.	Widespread occupation of Windwards. Some site abandonment at end of period. Late appearance of Cayo complex ceramics in Windwards: South American influence, new migration, or incursion by Island Caribs? European contact follows in 17th and 18th centuries.	Decline in ceramic quality, thicker, cruder. Simple forms, utilitarian wares emphasized, scratched surfaces common. Finger-indented and inwardly thickened rims. Vessels with legged, pedestal, or annular bases. Griddles with triangular rims and legs. Small amount of fine ceramics: polished surfaces, parallel lines, circles, or scrolls of linear incisions; red paint, or linear and zoned painting. Laterally flattened human head adornos with distinctive pierced, flaring ears.

Table 3.1 Developments in Windward Island culture history during the Ceramic Age.

Chapter 4

CARRIACOU'S NATURAL AND CULTURAL ENVIRONMENT

How inappropriate to call this planet Earth when it is quite clearly Ocean.

- Arthur C. Clarke

4.1 Carriacou: Research Context

4.1.1 Historic, Geographic, and Climatic Overview

The island of Carriacou is one of three islands constituting the tri-island nation of Grenada. Carriacou is situated approximately 190 km north of Venezuela within the Grenadine group of the Windward Islands (Figures 3.1 and 4.1). The island is a former British colony, but the earliest European settlers to the island in the 1700s were French. The Spanish held the island early in post-contact history but never settled it. Even today, many of the island's place names reflect this French influence. Through the 18th, 19th, and into the 20th century, plantation estates formed the basis of an agrarian economy engaged in the production of cotton, sugar, and lime juice. Traditional boat building for transportation and fishing was, and remains, an important activity on Carriacou. Subsistence horticulture continues to be practiced by many of the islands 5000 or so residents.

The largest and most southerly of the Grenadines, Carriacou is roughly 32 km^2 and is divided down its length by a ridge that rises to an elevation of 290 m. The climate is tropical with annual average temperatures of around 30 ºC. The island sits within the trade wind belt, but the comparatively low relief limits orographic rainfall despite moisture carried by the prevailing easterly winds. Carriacou receives ca. 1000 – 1700 mm of rainfall annually but evapo-transpiration rates typically exceed rainfall (Beard 1949; Government of Grenada Plan and Policy for a System of National Parks and Protected Areas 1988). Consequently, the landscape is relatively dry except during the height of the summer-fall rainy season (Figures 4.2 A and B). There are no permanent streams or rivers on the island, although springs collect in natural basins along with rainwater during the wettest months (Bullen and Bullen 1972; Sutty 1991a). Modern residents rely heavily on rainwater harvesting to meet their water needs (National Rainwater Harvesting Programme for Grenada 2006). Inadequate water supplies are known to have been a chronic problem historically and remain an issue today. During the colonial period, measures taken by islanders to collect water and direct its usage include digging irrigation ditches to channel rainwater from the hills down to agricultural fields, the construction of substantial stone lined wells and cisterns, and even, during a particularly bad drought in the 1890s, the importation of water for human consumption from Grenada (Government of Grenada Plan and Policy for a System of National Parks and Protected Areas 1988). It seems reasonable to surmise from this that water limitations may have been a challenge for prehistoric inhabitants as well.

Summer and fall constitute the active hurricane season in the region. Since 1877, the nation of Grenada has been hit by more than a dozen tropical storms and five hurricanes, all a category 3 or weaker on the Saffir-Simpson scale. In July 2005, Carriacou sustained a direct hit from Hurricane Emily, a category 1 storm. A more powerful storm, Ivan, made landfall on the island of Grenada the year prior causing modest environmental damage on nearby Carriacou.

Carriacou’s terrain is sharply hilly with a geological makeup of mixed igneous and sedimentary origins. The Grand Bay formation, composed of Miocene-age fossiliferous limestone, makes up the eastern third of the island, while volcanic substrate forms the remaining two-thirds (Donovan et al. 2003; Jackson et al. 2008; Pickerill et al. 2001, 2002). The region is volcanically and tectonically active, the Lesser Antilles having been created primarily through subduction of the North American plate under the Caribbean plate. Three active stratovolcanoes are found in the immediate vicinity of Carriacou: Mount Saint Catherine on Grenada (last eruption ca. 1000 years ago); Soufrière on the north end of Saint Vincent (last eruption 1979); and the submarine Kick’em Jenny (last eruption 2001). Kick’em Jenny, about 20 km south of Carriacou, is the nearest volcano. There is some speculation that volcanism may have influenced colonization and settlement patterns in the region, specifically by deterring earlier occupation of the Windward Islands (Callaghan 2010; Fitzpatrick 2012). No known evidence exists for regional eruptions having impacted any sites on Carriacou after they were settled, however.

4.1.2 Marine and Terrestrial Environments

I follow Newsom and Wing’s (2004) habitat classification scheme recognizing five major habitat types on Carriacou: terrestrial, rocky intertidal/littoral, shallow and inshore waters, coral reef, and pelagic. For Carriacou, each of these larger habitat patches encompasses a number of smaller, more restricted environments. I review these habitat patches below with reference to the environmental makeup of Carriacou and, in particular, the two study sites of Sabazan and Grand Bay on the eastern (Atlantic) coast of the island (Figure 4.1).

Terrestrial Habitat

Several systems have been used to describe West Indian terrestrial biotic communities (e.g., Holdridge 1947, 1967; Beard 1949). Here, I follow the global system of ecoregions described by Oslon et al. (2001:933) where ecoregions are defined as "relatively large units of land containing a distinct assemblage of natural communities and species, with boundaries that approximate the original extent of natural communities prior to major land-use change." I make use of specific ecoregion descriptions available at www.worldlife.org/biomes based on Olson et al. (2001). According to this system, most of the island is, or at least once would have been, classified as tropical dry forest. Mangrove habitats are additionally recognized, but have been assigned to the shallow and inshore water habitat patch discussed below.

The tropical/subtropical dry forest ecoregion occurs at low to middle elevations on a number of islands throughout the Lesser Antillean archipelago. The original forest formations of this ecoregion include littoral woodland, thorn woodland, deciduous woodland, and semi-evergreen woodland. Carriacou's dry forest exhibits a mix of thorny and deciduous tree species, the latter of which shed their leaves in the dry season to conserve water. Beard (1949) specifically recorded *Bursera simaruba*, *Brosimum alicastrum*, *Pisonia fragrans*, *Ficus lentiginosa* (*F. citrifolia*), and *Lonchocarpus latifolius* among Carriacou's forest flora, along with several other less common species. However, he noted that most of the island's woodland was disturbed, secondary growth, with the *original* formation most likely having been semi-evergreen forest (Beard 1949:147; my emphasis) (Figure 4.3). During the 18th and 19th centuries, the island was heavily deforested by plantation agriculture, livestock grazing, and ship building activities, leaving behind a significantly disturbed ecosystem (Richardson 1975; Wells 1902).

Deforestation and erosion persist as problems today exacerbated by the "let go" practice of releasing livestock, such as sheep and goats, to forage for themselves during the dry season (Government of Grenada Plan and Policy for a System of National Parks and Protected Areas 1988). Only a small fraction of relatively undisturbed dry forest exists today, but was presumably more widespread prior to the systematic land clearance associated with the colonial estate plantation system. Following the collapse of Carriacou's agrarian export economy in the 20th century, much of this land has been "reclaimed". Patches of secondary growth with *Vachellia macracantha, Cordia macrostachya, Croton* spp. and introduced *Acacia nilotica* can be found on former pasture and cultivated lands (Beard 1949) (Figure 4.4).

Along the coast, vegetation is scrubby with species such as manchineel trees (*Hippomane mancinella*), prickly pear (*Opuntia* sp.), and sea grape (*Coccoloba uvifera*) dispersed with an open understory and grassy clearings presumably maintained by grazing introduced livestock (Figure 4.5). Many of the Windward Islands' low elevation and coastal areas can be described as xeric scrub with trees and shrubs such as *Pisonia fragrans* and *Chrysophyllum argenteum,* along with the cacti *Opuntia dilenii* and *Pilosocereus royeni*. Vegetation in this zone is adapted to arid conditions and low fertility soils. Although currently limited, such habitat may have been more extensive along low-lying coastal tracts on Carriacou in prehistory.

Fauna encountered in terrestrial environments include ground lizards (*Ameiva* sp.), iguanas (*Iguana* sp.), and various bird species of which tropical mockingbirds (*Mimus gilvus*), small doves and pigeons (e.g., *Zenaida auriculata, Patagioenas squamosa*), and Carib grackles (*Quiscalus lugubris*) are common (Figures 4.5B and 4.6). At least one species of snake is found on Carriacou today based on my own observation of a live individual in the forest at the Sabazan site. Bats are the only native mammals remaining on Carriacou, but free-roaming introduced livestock and introduced opossums (*Didelphis marsupialis*) are encountered throughout the island (Figure 4.5A). Agoutis (*Dasyprocta* sp.) were introduced prehistorically, but do not occur on the island at present. Land crabs, *Cardisoma guaunhumi* and *Gecarcinus lateralis*, may be found in relatively low-lying areas usually within a few hundred meters of the coast; *G. ruricola* may be found farther inland and at somewhat higher elevations (Bright and Hogue 1972). Examples of some of Carriacou's terrestrial fauna are shown in Figure 4.6.

Rocky Intertidal/Littoral Habitat

The rocky intertidal/littoral environmental patch is restricted to hard substrates within the narrow band between high and low tide lines along the coast. The maximum tidal range, based on measurement data from the main town of Hillsborough, is under 0.6 m (www.tide-forecast.com). Rocky intertidal habiat includes wave-washed rocky outcrops and shelves, beach rock, and tidal pools. Substrates may be of either volcanic rock or limestone. Rocky intertidal areas are present in the vicinity of both Sabazan and Grand Bay and are distributed at intervals around Carriacou's coastline, especially along headlands that fall steeply into the sea (Figure 4.7).

Faunal resources available here are mostly mollusc species and other invertebrates such as the sally lightfoot crab (*Grapsus grapsus)*. Major molluscan species include nerites (*Nerita* spp.), the West Indian top snail (*C. pica*), several species of chiton (Chitonoidae), and periwinkles (Littorinidae) (Figure 4.8). Depending on physiology and behavior, some of these species are only available for exploitation at certain times of the day when the falling tide makes them accessible. Their exploitation may thus require a degree of planning. Slow moving or immobile species like chiton and nerites are relatively easy to acquire once located, but collecting sufficient quantities of smaller shellfish to constitute a meal is time consuming. However, since their harvest does not require any specialized skill or technology, they may be foraged by anyone, including small children and the elderly.

Shallow and Inshore Water Habitat

Shallow and inshore waters are defined here as those surrounding (but excluding) the reef and extending from the landward side of the reef to the shore. Much of this area falls into what is known as the back reef (sometimes called the reef flat), the zone situated between the shore and the barrier reefs that flank the coastline. This nearshore area is typically less than 10 m in depth (MarSIS map data, Baldwin 2012) and encompasses several distinct habitat types: sand flats, seagrass beds, and patch reefs. Patch reefs are grouped with other reef formations discussed below. In addition to sand flats and seagrass areas, within the shallow/inshore water habitat patch I include coastal mangrove forests and the sandy intertidal zone. I chose to include the sandy intertidal zone because the fauna that would have been exploited from this area are primarily infaunal, filter feeding species such as coquina clams (*Donax* sp.) which must re-establish submersion if washed out of their soft substrates. This distinguishes these taxa from economically important rocky intertidal species such as *Nerita* spp. which are generally exposed above the water and visible to foragers.

Seagrass beds perform critical ecological roles in marine environments that affect biotic systems far beyond the beds themselves. Among their many functions, seagrasses provide food, habitat, shelter, and a settlement medium for vertebrate and invertebrate species; they filter contaminants, recycle nutrients, oxygenate water, anchor sediments, and counter erosion (Dawes et al. 2004). Major grass species in the Caribbean include turtle grass (*Thalassia testudinum*) and manatee grass (*Syringodium filiforme*) (Barlow 1993). Much of the back reef surrounding the Sabazan and Grand Bay sites is composed of seagrass beds interspersed with sand flats (Figure 4.9). Fauna inhabiting these areas include invertebrate species such as queen conch and the West India sea egg (*Tripneustes ventricosus*) (Barlow 1993; Davis 2005; Ray and Stoner 1995). Bivalve taxa like the tiger lucine (*Codakia orbicularis*) and the gaudy asaphis (*Asaphis deflorata*) may be found in sand in shallow water.

Fish species found in this environmental patch include jacks (Carangidae), barracudas (Sphyraenidae), goatfishes (Mullidae), porgies (Sparidae), as well as juvenile representatives of reef taxa such as parrotfish (Scaridae) and wrasses (*Halichoeres* sp.). In addition, a number of adult fish species, such as wrasses and schooling carnivores like snappers (*Lutjanus* sp.) and grunts (*Haemulon* sp.), leave the reef at night to disperse over the back reef (Froese and Pauly 2013; Randall 1965, 1968; Smith 1997). The bigeye scad, *Selar crumenophthalmus,* is a small coastal pelagic fish that forms large schools and can be found in shallower waters (< 80 m) closer inshore where it may be caught by netting from skiffs or by beach seining (Froese and Pauly 2013; Roos et al. 2007; Roux and Conand 2000; Smith 1997). As its name implies, turtle grass provides significant grazing habitat for the green sea turtle (*Chelonia mydas*). Manatees inhabit shallow waters, but their remains are rare in Caribbean archaeological sites (Newsom and Wing 2004).

Mangrove shorelines serve as critical nursery areas for young fish such as juvenile barracuda. They stabilize and extend the shoreline, and provide habitat for a variety of shore birds, reptiles, and invertebrates, forming an ecological community referred to as mangal (Barlow 1993; Moore 2004a, 2004b). Fauna found within mangrove shorelines include species of egrets and herons, which may be seen roosting and fishing from mangrove prop roots and branches (Rafaelle et al. 1998), and the flat tree oyster (*Isongnomon alautus*) and mangrove oyster (*Crassostrea rhizophorae*) which grow on submerged roots. *Cardisoma guanhumi* additionally may be found toward the landward side of mangrove shorelines where burrows may access the water table without being submerged by the tide (Barlow 1993; Bright and Hogue 1972).

Mangrove shorelines throughout the West Indies have been significantly reduced due to a variety of anthropogenic impacts, especially coastal development. On Carriacou, three small remnants of mangrove remain, the largest and most ecologically significant of which is located on the southwest end of the island at Tyrrel Bay (Moore 2004a, 2004b) (Figure 4.9). These three mangrove systems are composed primarily of dominant stands of red mangrove (*Rhizophora mangle*) interspersed with black mangrove (*Avicennia germinans*), buttonwood (*Conocarpus erectus*), and scattered salt bush (*Batis maritima*) (Moore 2004a). The extent of mangal on prehistoric Carriacou is unknown.

Coral Reef Habitat

Coral reefs are one of the most ecologically complex and biodiverse ecosystems on earth. Reefs owe their structure to a number of organisms, but the most conspicuous of these are the stony or hard corals, Scleractinia (Smith 1997). Until relatively recently in the Caribbean, the dominant coral species and most significant reef builders were elkhorn (*Acropora palmata*) and staghorn (*Acropra cervicornis*) corals. In 2006, these taxa were placed on the IUCN Red List and today remain listed as critically endangered species, with losses of 80 – 98% of individuals across their range (http://www.iucnredlist.org). Their collapse is emblematic of the multiple adverse anthropogenic and natural impacts sustained by Caribbean reef taxa in the historic era (e.g., Hardt 2009; Jackson 1997; Jackson et al. 2001).

Carriacou’s reefs have not escaped these effects. The name ‘Carriacou’ is an indigenous word meaning “land of many reefs”, but today the ecological communities of the island’s reef systems are in poor condition due to poaching and overfishing (KIDO Ecological Research Station, Carriacou, personal communication, 2006; Mahon et al. 2002; Staskiewicz and Mahon 2007). Nevertheless, reef fishing remains a significant subsistence activity for Carriacou’s current inhabitants, and coral reef environments are demonstrated to have been an important resource for prehistoric islanders as well (Fitzpatrick et al. 2009b; LeFebvre 2005, 2007; Keegan et al. 2008).

In contrast to the larger island of Grenada roughly 26 km to the south, Carriacou has relatively extensive development of a large bank barrier reef complex, especially along the eastern (Atlantic) coast where more than 16 linear km of predominantly shallow to mixed depth fringing and barrier coral reefs track the coastline at varying distances from the shore (ReefBase map data, Tupper et al. 2013). Figure 4.10 illustrates the structure of Carriacou’s current reef system. It reveals a mix of barrier and fringing reefs concentrated on the northern, southeastern and eastern sides of the island. Patch reefs occur at the southern and northeastern tips, with one small patch system off the western (Caribbean) coast. Some 3 to 3.5 km east of Carriacou, extensive barrier and fringing reefs envelope the nearby island of Petite Martinique. Carriacou’s reefs occur in shallow and mixed depth waters (Figure 4.10B). Past the edge of the fringing and barrier reefs on the eastern side of Carriacou, water deepens beyond 20 – 40 m as the insular shelf falls away. The lack of extensive reefs systems on the western side of the island may relate in part to the sharply dropping bathymetry here, where, in some places, water depths surpass the

50 m depth growth threshold for shallow-water tropical corals within l.5 – 3 km from the shore, falling rapidly to several hundred meters thereafter (MarSIS map data, Baldwin 2012). The accessibility of reef habitats from each of the study sites is discussed in greater detail later in this chapter.

Prehistorically, coral reefs in the West Indies were economically important for the fisheries they supported. Major coral reef fish include herbivorous species such as parrotfish, (Scaridae) and surgeonfish (Acanthuridae) and ominivorous and carnivorous taxa such as grunts (Haemulidae), triggerfish (Balistidae), and wrasses (Labridae). Pisciverous reef fish occupying high trophic levels include groupers (Serranidae: Epiniphelinae) and snappers (Lutjanidae) (Froese and Pauly 2013). Groupers and snappers, in particular, are aggressive fish that will readily take a hook and line (Wing and Wing 2001).

Pelagic Habitat

Pelagic is a term with varying meaning, often used informally to refer to the open ocean. The pelagic zone specifically refers to an area within the water column extending from the surface down to the zone of water near to or immediately at the sea floor (termed demersal and benthic zones, respectively). The pelagic zone includes both neritic waters, those above the continental shelf, and oceanic waters beyond the shelf edge (Smith 1997). Pelagic habitat is, therefore, defined based on a vertical zonation of sea water. Because the sea floor and surface intersect, however, pelagic habitat must also be horizontally delimited. Here I follow the example of Newsom and Wing (2004) in excluding shallow, inshore waters from pelagic habitat as these may be significantly influenced by the ecology of the sea bottom. For Carriacou, deeper pelagic waters are those illustrated in dark blue, seaward of the reef edge as indicated in Figure 4.10 B and C (ReefBase map data, Tupper et al. 2013). Under this definition, the distance of pelagic waters from shore varies around the island depending on location. On the eastern side of Carriacou most of the immediate pelagic area beyond the reef is between 20 and 35 meters deep with a sandy, hard, or mixed live bottom (MarSIS map data, Baldwin 2012).

Pelagic taxa include various species of tuna (Scombridae), flyingfish (Exocoetidae), herrings (Clupeidae), needlefish (Belonidae), and the rough scad (*Trachurus lathami*). Although cetaceans such as dolphins and humpback whales were once common in Caribbean waters, based on the paucity of their remains in archaeological sites, they do not appear to have been exploited. Or, if they were, they were butchered on the shore and skeletal remains left behind (Newsom and Wing 2004:213).

For pre-industrial fisheries, the exploitation of pelagic habitats is technologically and culturally significant. Removed from the relative protection of the coast, strong waves, high winds, and currents can take hold of small vessels on the open water. Additional technical knowledge, skill, and sea-worthy craft are required to successfully exploit pelagic waters, particularly when engaging in trolling for larger fish such as tuna. Specific data on maritime conditions in the pelagic waters around each site are not known. However, the predominant current in the region is the powerful Caribbean Current which sweeps up the coast of the Brazil, travels northwest along the South American coast, and then funnels through the passages between the mainland, Trinidad, and the Windward Islands to enter the Caribbean Sea (Gyory et al. 2001-2013). Due to a bottle-neck effect, currents between passages are strong, some three to four times stronger than those lying to the west of the islands, and can be difficult to navigate (Callaghan 2013). Data regarding wind direction and speed come from the weather station closest to Carriacou, located approximately 8 km north in Clifton Harbour on the eastern side of Union Island (Carriacou lacks a weather station) (www.windfinder.com). Monthly wind statistics based on 2012 data indicate predominately easterly winds in the winter and spring months followed by a shift to northeasterlies in the summer and fall. Winds are strongest in the winter, averaging 31 km/h (17 kts), and weaker in the summer and fall, averaging 22 km/h (12 kts).

4.2 Archaeological Research on Carriacou

4.2.1 Previous Research

Until recently, limited archaeological inquiry had been conducted on Carriacou. Fewkes (1914) performed an early investigation in the beginning of the last century, followed in the 1970s by Bullen and Bullen (1972) who surveyed several sites, including Sabazan and Grand Bay, collecting surface sherds and other artifacts. Bullen and Bullen's excavation of a foot thick "slice" of Sabazan's coastal profile provided a single radiocarbon date on charcoal of 940 ± 100 BP (RL-29; 2-sigma calibration: AD 900 – 1270) (Bullen and Bullen 1972:14-17) (Table 4.1). Sutty (1991b) followed in 1990, conducting informal surveys and documenting the presence of various ceramic types and other artifacts. At Sabazan, a small-scale informal excavation undertaken by a Canadian junior college study abroad program in 1975 uncovered the burial of child. All materials were apparently returned to the trench following exhumation. In the interim, however, tourists unassociated with the program reportedly looted some of the finds (Greg Hill, personal communication 2009).

In 2003, the first extensive and ongoing archaeological investigation of Carriacou began with the launch of the Carriacou Archaeological Field Project (CAFP) directed by Scott Fitzpatrick (formerly at North Carolina State University, now at the University of Oregon), Quetta Kaye (Secretary, International Association for Caribbean Archaeology), and Michiel Kappers (QLC BV, Ltd, The Netherlands). Prompted by threats to Carriacou's archaeology from looting, erosion and development, CAFP comprehensively surveyed the island in 2003 (Fitzpatrick et al. 2006; Kaye 2003; Kaye et al. 2005). At this time twelve locations with evidence for prehistoric occupation, including Sabazan and Grand Bay, were documented around the coast (Figure 4.1) (Fitzpatrick et al. 2007a; Kaye et al. 2004, 2005). Another Late Ceramic Age site was recorded at Point Bay in 2011 (Kaye et al. 2011). CAFP began excavation of Grand Bay in 2004 (Kaye et al. 2004). In 2005, I undertook site reconnaissance and column sampling at Sabazan and established the potential for successful subsurface investigation of this site. In 2007, I began the first systematic excavation of Sabazan through CAFP with a small crew of students (Fitzpatrick et al. 2007a). Five field seasons of excavation have been conducted at Grand Bay between 2004 and 2011, and two field seasons of excavation at Sabazan in 2007 and 2008.

Both Grand Bay and Sabazan are archaeologically rich midden sites which span approximately a millennium of occupation. Research at these two locations has generated a number of insights into the prehistory of Carriacou and of the Grenadine Islands. The following archaeological review is based on published (Fitzpatrick and Giovas 2011; Fitzpatrick et al. 2004, 2006, 2007a, 2007b, 2008, 2009a, 2009b, 2010; Kaye et al. 2004, 2005, 2007, 2009, 2011; Giovas 2009; Giovas et al. 2012; LeFebvre 2005, 2007) and unpublished data and summarizes the radiometric chronology and archaeological findings to date as they bear on the island's prehistory. Specific, methodological details of excavation and faunal analysis will be discussed for each site in the following chapter.

4.2.2 Radiometric Chronology

A suite of 40 radiocarbon and two thermoluminescence dates (Fitzpatrick et al. 2004, 2006, 2009a, 2009b, 2010; Fitzpatrick and Giovas 2011) has been obtained by the project for Grand Bay and Sabazan (Figure 4.11, Table 4.1). Additional chronological control over island occupation is provided by a single ^{14}C date for Sabazan obtained by Bullen and Bullen (1972; RL-29), for the Harvey Vale Site (AA-62284) on the southwest end of Carriacou, and for a burial at the Point Bay site (UCIAMS-111933) about 2 km north of Grand Bay. Unless otherwise indicated, all radiocarbon dates reported in this dissertation are presented as calendar dates calibrated to 2-sigma using CALIB 6.0 (Stuiver et al. 2009). Dates on marine shell are calibrated using a global marine reservoir correction (MARINE09, Stuiver et al. 2009) without ΔR since local reservoir effects have not been determined.

Based on the collective radiometric determinations, Carriacou appears to have been first occupied during the late or terminal Saladoid, around ca. AD 400. No evidence for a pre-Ceramic Age presence on Carriacou has been uncovered despite extensive survey of the island. The late Saladoid settlement dates suggest that the island was bypassed during the initial Ceramic Age colonization of the Antilles. Carriacou was inhabited continuously for at least a millennium, with the latest dates in the radiometric series coming from Sabazan where occupation ends around AD 1280 – 1400, and from a burial F177 at Grand Bay dated to AD 1410 – 1450 (Figure 4.11, Table 4.1). Burial F177, however, is intrusive into the uppermost midden deposits at Grand Bay, which date no later than AD 1250, and may represent reuse of the site after abandonment (Scott Fitzpatrick, personal communication 2012). It is unknown whether any sites on the island post-date AD 1450 or extend into the period of European contact and settlement in the 17th and 18th centuries. The French friar Jean Baptiste du Tertre (1667: 41-42) visited the iland in 1656, reporting on its natural features, but did not mention any indigenous inhabitants.

The radiocarbon chronology for Grand Bay spans AD 380 – 1450. For Sabazan, radiocarbon dates span AD 400 – 1400. A single post-1950 date was obtained from charcoal from the uppermost midden layer of Trench 2 (Layer 2, Level 1) at Sabazan, but this is likely due to the introduction of modern charcoal from the surface as a result of the activities of livestock or humans in the vicinity. For both sites, all calibrated dates appear in stratigraphic order and are consistent with the ceramic typology-based cultural historical sequence reviewed in Chapter 3. Sabazan and Grand Bay have tightly corresponding chronologies with regard to initial settlement and duration of occupation, and the two sites can be considered contemporaneous.

4.3 The Study Sites: Sabazan and Grand Bay

Sabazan and Grand Bay are located on the east, or windward, coast of Carriacou within embayments of the Atlantic Ocean that are flanked by coral reefs. The two sites are situated approximately 1.5 km overland from each other and are separated by a moderately steep headland. Similar geography and geology underpin the comparable structure of the environment surrounding the two sites, although there are some differences which are discussed below. The material records of Sabazan and Grand Bays show many correspondences, and for both sites the cultural sequences conform to the late Saladoid, Troumassan Troumassoid, and Suazan Troumassoid periods.

4.3.1 Sabazan

The Sabazan site sits on Sabazan (Little Breteche) Bay, partly sheltered by the headland that separates it from the Grand Bay site (Figure 4.1). The site area is covered primarily by disturbed dry forest of thorny and deciduous trees with pipe organ (*Pilosocereus* sp.) cactus, and is located at the bottom of a narrow valley between headlands that rise inland (Figures 4.3 and 4.4). The site grades down to meet the beach in the southwest, but follows the rising landform to the northeast to create a wave-cut shelf that reaches 3 – 4 m high and exposes site stratigraphy in profile. There are no perennial streams in the vicinity of the site; however, there is an ephemeral stream and pond nearby that temporarily fills with runoff water during the rainy season. This drainage channel was apparently damned or canaled historically at a location farther inland from the site, but based on the remains of this structure, the small dam has long since failed or been removed. A historic, ca. 19th century cemetery and deep, stone-faced well are located at the northern end of the site at the base of a hill overlooking the site and bay. On the hill's summit, but located off-site, are the stone-walled ruins of buildings and a series of cisterns or storage wells. The historic structures at Sabazan represent the remains of a larger plantation with one of the most elaborate estate houses on Carriacou. Based on historic documents the estate was probably established in the late 18th or early 19th century (Government of Grenada Plan and Policy for a System of National Parks and Protected Areas 1988). Records of the Grenada Land Registry indicate that in 1772, a French cotton plantar John (or Jean) Sabazan obtained a mortgage for a plantation on Carriacou (Seymour and Haggerty 2010), and presumably it is this man for whom the estate and area are named.

Terrestrial fauna around the site include lizards (e.g., *Ameiva* sp. and *Iguana iguana*), tree snails (Orthalicidae), and gecarcinid land crabs, which are abundant in the open forest fringing the shoreline (Figure 4.6). Historically introduced goats, pigs, sheep, donkeys, and cattle roam freely. Several marine habitats are readily accessible from the site. Intertidal molluscs such as chiton (Chitonidae), nerites (*Nerita* spp.), and periwinkles (Littorinidae) can be found on rocky outcrops and beach rock along the shore in the intertidal zone (Figure 4.8). Beyond this is a small area of shallow inshore waters with sea grass flats that extends to fringing and barrier reefs lying less than 250 m from the shore (Figures 4.9 and 4.10). Open pelagic waters are comparatively close to shore at Sabazan, about a half kilometer distant from the coast, and are accessible to water craft able to navigate past the reef edge.

The Sabazan archaeological site has been identified as a large prehistoric village based on its size and deep, extensive midden deposits, as well as the presence of domestic features and burials. Surface scatters of pottery, shell, and bone extend up to 65 m back from the beach and are visible as a thick midden layer within the ca. 110 m long wave-cut coastal profile (Figure 4.12A). The original size of the site is difficult to assess. At present, based on the distribution of surface artifacts, the site is around 3000-4000 m^2. However, a substantial portion of the deposits along the coastal profile has been lost to erosive action by the sea. This process, driven by modern sea-level rise, storm action, and human activities, is ongoing. There is no estimate for rates of deposit loss, but at Grand Bay this same process has claimed up to one meter of ground a year, largely the result of sand mining by locals (Fitzpatrick et al. 2006). A similar erosion rate may hold for more exposed portions of Sabazan, although rates may not have been as high in the past. Ceramic sherds litter the surface for some 20 m along the headland that extends east from the current site center, indicating that archaeological deposits once stretched into the present-day location of the bay but have since been washed away. Sherds and other midden remains are commonly found eroded onto the beach and tumbling in the surf. Based on the extent of surface artifact scatters and a conservative approximation of the former shoreline I estimate the Sabazan site once covered at least ca. 5000-6000 m^2 in area.

The coastal profile reveals dense midden deposits of up to 1 – 1.5 m thick (Figure 4.12B). Midden layers are capped by humic topsoil, although this has succumbed to lateral erosion in the southwestern area of the site, and are underlain by yellow, clay-rich subsoil. Strata are generally thick and the boundaries between layers transition gradually rather than abruptly, except in the case of pit/post and hearth features which are delineated by sharply contrasting sediments. Within the midden, clusters of bone and shell are sometimes apparent. This is consistent with a deposit in which diverse remains have been more or less homogenized, but discrete dumping events, or subsequent cultural disturbances, can still be detected.

During the 2005 reconnaissance project, I collected archaeological material from a 1 m wide column section of the northeastern profile that appeared to span the full occupation sequence of the site. Charcoal, artifacts, and faunal remains collected from this location were used to establish site chronology and provide baseline zooarchaeological data. Figure 4.13 illustrates this sequence in profile and shows the lowermost cultural deposits identified at the site (Layer 15), which provide the basal dates of AD 400 – 550 (AA-67535) and AD 410 – 560 (AA-67536) (Table 4.1). Two field seasons of excavation followed the column sampling. In 2007, three 1 × 1 m units were opened up in an area 40 – 50 m distant from the coast within mixed scrub and forest cover (Figure 4.14). The following season, one of these units (Trench 1) was expanded to a 2 × 1 m block to increase horizontal coverage of the site. The excavation area was selected based on the presence of artifact surface scatters throughout the vicinity. The location of specific units was guided by the necessity of working around tree and cactus cover that could not feasibly be cleared during the short field season. Unit orientations, therefore, do not follow a standard grid, but are slightly offset from each other (Figure 4.15).

Culturally sterile subsoil has been reached only in the northern-most excavation block, Trench 1 (Square 1), where basal deposits date between AD 910 and AD 1160. To the east, in Trenches 2 and 3, archaeological deposits continue beyond maximum excavated depths (115 cm and 90 cm below the surface, respectively). The lowermost strata reached here date to AD 900 – 1010 for Trench 2 (Square 1) and AD 710 – 880 for Trench 3 (Square 1). The earliest dates overall for the site, AD 400 – 550 and AD 410 – 560, come from charcoal recovered from the aforementioned basal cultural deposit (Layer 15) exposed along the coastal profile. Site stratigraphy and associated ^{14}C dates for Sabazan are presented in Table 4.2.

Although Sabazan was first settled during the Late Saladoid, it appears that occupation intensified after AD 700 during the Troumassan Troumassoid period. The pattern of shallower and younger deposits as one moves back from the shore suggests expansion of the site inland during later habitation, possibly due to population increase. Intensified occupation for Sabazan is also indicated by rapid deposition in post-AD 800 layers where deposits of up to a meter accumulated within possibly as little as a century or two. The uppermost levels of Trenches 1 and 2 (Stratum 2) are particularly dense with faunal remains, notably fish bone and mollusc shell. In contrast, the lower levels in Trench 2 tended to yield the majority of beads, worked turtle bone, and formal artifacts discovered in the course of excavation. Along with various small features (e.g., ash lenses, small postholes), these data point to changing functions for this area over time or at least a change in the types of materials discarded here.

The small-scale of excavation limited the discovery of significant features in the test units. A number of layered ash lenses, were encountered in Trenches 1 and 2. However, their diffuse, unstructured nature suggests these probably represent fire pit cleaning and dumping events rather than the hearths themselves. Along the site's coastal profile, however, several larger, well-structured features were identified, including two pit/post features 55 – 70 cm across and 60 – 70 cm deep (Figure 4.12B), a hearth, and a human burial located on a stretch of the northeastern wave-cut bank. The burial of a single individual was found eroding out of the coastal profile in the 2005 season. Unfortunately, due to its location high in the profile with access excluded by the rising tide, the burial could not be recovered. It was described *in situ* before being eventually claimed by erosion. The individual, tentatively identified as a female, lay in a flexed position on her left side in a north-south orientation (Kraan n.d.). In four seasons of site visits and excavation that I conducted at Sabazan, isolated human remains were found amongst eroded surface scatters on several occasions, indicating the presence of additional burials at the site. This is consistent with reports of burial encounters by past site visitors (see section 4.2.1) and by members of the Carriacou Archaeological Field Project in 2011.

Sabazan's artifact assemblage is dominated by ceramic sherds as is typical for West Indian Ceramic Age sites. In order to characterize the ceramic assemblage, Mary Hill Harris (Harris n.d.) of the Museum of Archaeology and Anthropology, University of Cambridge, conducted a small-scale analysis focused on one test unit (Trench 1, Square 1) where ceramic remains were most dense and in which sterile subsoil had been reached. Harris analyzed seven ceramic samples from this unit (a total of 1083 sherds), representing four separate stratigraphic contexts spanning AD 1040 – 1400 (Harris n.d.). She also analyzed a small suite (n = 60) of sherds from the column sample taken from the coastal profile, which incorporates the full occupation sequence. Since the test unit samples do not capture the oldest deposits and the samples from the basal deposits of the coastal profile are small, the earliest occupation phase is represented in this analysis by just a few sherds. These are sufficient, however, to give some indication of the most common types present at this time. Findings for the upper portion of the cultural sequence may be extrapolated to the other two trenches through correlation of strata.

Harris documented that across all samples, most sherds were of either a scratched/brushed ware (40 – 60% of the samples) or a light brown slipped ware (20 – 40% of the samples). Less frequent was a red-slipped ware, or sherds with brown slipping on one side and red-slipping on the other. Ware types did not show any trends over time and sherds were of similar medium thickness (7 – 12 mm) in most contexts. Decorated sherds are not common overall ($\leq$10%). Decorated types present in Stratum 2 include Caliviny Polychrome (including black on white), finger-indented, fine-line incision, single-line grooving, and possible white-on-red (WOR) pottery.

The same decorative types recorded for Stratum 2 (Layer 2) are also found in Stratum 4 (Layer 3) with the addition of zoned red decoration and grooved and painted forms, including Caliviny Polychrome with grooving and probable St. Lucia Zoned Incised, a late Saladoid type. Ceramic decoration encountered in Stratum 5 (Layer 4) includes grooving, Caliviny Polychrome, possible WOR, and one grooved and modeled animal head lug consistent with Troumassoid slipped ware. Discernable forms are mostly open hemispherical bowls. Griddle fragments are not common overall, and such specimens are generally flat except for one footed griddle from

Stratum 4. A single spindle whorl and an unusual frog-faced body stamp were also recovered in the course of excavation. Most vessel rims are plain and flattened or rounded.

Strata 4 and 5 include a small amount of Saladoid associated characteristics: triangularly-thickened rims, pelleted lugs, and a possible Palo Seco flanged rim. The lowest cultural stratum, the basal layer from the coastal profile column, contains Saladoid sherds with stylistic attributes that indicate a pre-AD 650 – 750 date, which is consistent with the ^{14}C dates from this context.

In sum, all contexts within the test unit (Trench 1, Square 1) contain Troumassoid ceramics. Stratum 2 shows a mix of early and late traits such as finger-indenting which is associated with the later Suazan Troumassoid. Finger-indenting is rare in Strata 4 and 5. Instead, these contexts tend to contain sherds with elements definitively associated with the later Saladoid, such as triangularly-thickened rims. In general, Sabazan's ceramic assemblage can be characterized stylistically as Troumassan and Suazan Troumassoid with some Saladoid, i.e. early Ceramic Age, elements in lower strata. Sherds from the oldest deposits indicate a late Saladoid date for site settlement. The associated dates for Strata 4 and 5 (AD 1020 – 1150) suggest that some Saladoid stylistic elements persists relatively late at Sabazan. This is consistent with findings at Grand Bay, suggesting late survival of Saladoid ceramic characteristics on Carriacou.

Most of the several dozen non-ceramic artifacts recovered at Sabazan are made from shell or bone. Small numbers of lithic-based artifacts are also present at the site. Non-ceramic artifacts include tools, such as stone and conch shell adzes, tool preforms manufactured from the lip of the queen conch, stone and shell beads and ornaments, coral abraders, and worked bone objects. A series of shell beads/ornaments/objects were made from cut and polished conch or from complete shells with the spire removed and a perforation cut into the opposite end, presumably for suspension as a pendant or possible use as a net weight. Artifacts of this latter type were typically made from *Oliva* shells, although one specimen was of reticulated cowrie-helmet (*Cypraecassis testiculus*) (Fig 4.16). The presence of beads in several stages of manufacture and the use of stone and shell available on the island suggest the lapidary industry was locally-based. A single, highly weathered stone adze and four lithic flakes (one with minor retouch) were encountered.

One fishhook fashioned from the shell of West Indian top snail was recovered from Trench 2 (Figure 4.17). Fishhooks are relatively rare in the West Indian prehistoric record, possibly because highly perishable materials were used for their manufacture, as exemplified by the recovery of wooden fishhooks from archaeological deposits in the Bahamas Archipelago (Berman et al. 2013; Keegan 1986; Newsom and Wing 2004:51). The discovery of a fishhook at Sabazan, similar to specimens discussed below from Grand Bay, indicates that site inhabitants were likely exploiting fish readily caught by hook and line, such as groupers and snappers.

Several unusual worked bone objects were also found at the site. The first set of these are made from the pleural bones of sea turtle (Cheloniidae) carapace. These objects are flat with bevelled, tapered edges that have been polished, either through use or manufacture. Two complete specimens have a distinctive "bow-tie" shape and presumably the remaining four partial specimens recovered also took this form (Fig. 4.18). The function of these objects is unknown, although they possibly served as weaving implements or net mesh gauges. A nearly identical turtle bone artifact was found in 2008 at the Grand Bay site and another has also been recovered from Anse des Pères, Saint Martin and the Golden Rock site on Saint Eustatius (Nokkert 1999:120-121). Wing (1991) reports similar finds from Barbados and Martinique, as does Nokkert (2002a) for the site of Hichman's (GE-5) on Nevis.

The second artifact type is a partial mandible belonging to a deer (probably red brocket deer, *Mazama americana*), dated by association to AD 890 – 990. The anterior body of the mandible and upper portion of the ramus have been removed, leaving only a spatula-shaped segment where the two parts meet. The bone is highly polished and carved on the buccal surface with a design reminiscent of a frog-leg motif with tiny perforations at the "knees", while three drilled holes appear on the lingual aspect (Figure 4.19). Since deer are not found in the Antilles, this artifact, the bone that provided the raw material, or possibly the live animal, must have originated from either South America or Trinidad where brocket deer are found. Its presence on Carriacou reflects the existence of interaction networks in the region. Its function, however, is unclear. It may have been some form of personal ornamentation since the three perforations on the back seem to suggest attachment points for suspension or fastening. On the other hand, the triangular arrangement of these, which is of socio-symbolic significant in the Caribbean, could indicate a ritual purpose (see discussion below regarding çemis).

4.3.2 Grand Bay

The Grand Bay site is located on the southern end of the broad bay from which it takes its name (Figure 4.1). At an estimated 6000 m^2, Grand Bay is larger than Sabazan, but like that site it sits atop a small bluff 2 – 4 m high with exposed, wave-washed archaeological deposits extending along the shore for more than 100 m (Figure 4.20). This coastal profile reveals the presence of numerous postholes, burials, and other features in addition to abundant faunal remains and artifacts in cultural deposits 1 – 1.5 m thick. Similar to Sabazan, erosion has claimed a substantial proportion of Grand Bay's deposits. Based on a series of measurements made since

2003, Fitzpatrick et al. (2006, 2007b) estimate that a meter per year of the profile is lost to encroachment of the sea (Figures 4.21 and 4.22). In recent years this rate has slowed somewhat, possibly due to a 2010 government ban on the mining of beach sand which was contributing to the undercutting of the coastal profile (Kaye et al. 2011).

Unlike its sister site, Grand Bay is directly exposed to the prevailing easterly trade winds and Atlantic Ocean. The site area is a mix of cactus scrub and manchineel stands with open clearings and a broad extent of relatively level terrain (Figure 4.5). Toward the western end of the site, the ground rises gently inland and dry forest with acacia (Mimosoideae) becomes thick. The headland separating Grand Bay from Sabazan lies just over half a kilometer to the south. Terrestrial fauna in the vicinity are the same as those encountered at Sabazan. Perennial streams are absent, but temporary channels and pools swell with rainwater during the wet season.

As at Sabazan, several marine environments are accessible from the site, although the scale of these differs at Grand Bay. Beach rock outcrops provide substrate for intertidal molluscs, such as nerites, that would have been easy to collect prehistorically (Figure 4.7B). Grand Bay is about four to five times broader than Sabazan Bay and this influences the structure of marine habitats in the vicinity. The area of mixed depth inshore waters is substantially greater than at the Sabazan site and is composed of large areas of seagrass beds and sand flats (Figure 4.9). Grand Bay's coral reefs, located roughly 1.5 – 2 km from the shore, are also significantly more distant (Figure 4.10A-C). Barrier reef covers the western extent of the bay, but fringing reef is limited to a small area at the northern end of the embayment 1.5 km distant. Assuming these conditions prevailed in the past, prehistoric foragers at Grand Bay would have had to travel at least 1 km farther than residents at Sabazan to reach open waters. Whitecaps breaking on the Grand Bay reef reveal that the reef crest is also shallower than its Sabazan counterpart.

A grid system on a north-south axis was established for the site at the beginning of the first season of excavation at Grand Bay in 2004. In the five field seasons since, six 5 × 5 m blocks, each comprising 25 1 × 1 m units, have been excavated in addition to numerous separate features (Figure 4.21). Subsoil has been reached in all trenches except 592. Cultural deposits are deep and comprise stratified midden layers of dark sediment rich in ceramics, bone, and shell remains, interrupted by more than 200 discrete features. Deposits across the site are underlain by yellow, clay-rich subsoil. Like Sabazan, strata are generally thick with the transitions between layer boundaries often more gradual than abrupt, but are clearly discernable in the coastal profile. Features include trash pits and postholes, hearths, and more than two dozen human interments. Large concentrations of relatively whole, mature and almost-mature queen conch shell may represent stockpiling for use in tool and ornament manufacture (Fitzpatrick et al. 2009b; O'Day and Keegan 2001). Fitzpatrick et al. (2010) argue for intensified occupation of Grand Bay during the Troumassan Troumassoid as the bulk of radiocarbon dates and artifactual material fall during this period (Figure 4.11, Table 4.1).

More than 60 possible postholes have been identified to date. Particularly notable are two large postholes/pits in the coastal profile and one in the western profile of Trench 446 (Figure 4.23) and a linear arrangement of four postholes, 60 – 100 cm in diameter, visible as dark staining against the subsoil in a surface-eroded area of the site (Figure 4.21). These features are interpreted as supports for two large, oval-shaped, multifamily houses (Fitzpatrick et al. 2007a, 2009b; Kaye et al. 2005). Similar evidence for such structures has been found at other archaeological sites in the West Indies such as Golden Rock on Saint Eustatius (Versteeg and Schinkel 1992).

Twenty-seven burials have been recorded at Grand Bay (Fitzpatrick et al. 2009b; Kaye et al. 2007; 2011). Most are single, primary burials with a range of mortuary treatments demonstrated. However, burial F0164 is an interment of a crouched, articulated individual with the isolated remains of two other persons, and burial F0190 contains the remains of an adult and child (Fitzpatrick et al. 2009b; Kaye et al. 2009; Osborne 2013). Individuals were generally buried in pits or pre-existing postholes within midden deposits sometimes used as interment fill. A formal cemetery has not been identified at Grand Bay, although a cluster of seven burials concentrated within a single trench was excavated during the 2011 field season (Kaye et al. 2011). A single burial may possibly be located within the floor of a house based on the burial's truncation of a large posthole (Kaye et al. 2007, Figure 3). Individuals are typically buried in a flexed position with a slight preference for a north-south orientation. Grave goods are not common, possibly because they were made of perishable materials that have not survived, but have been identified in two instances. One of these is burial F0180 which contained an adult male lying in a flexed position with four complete or nearly complete, large ceramic bowls resting around him (Kaye et al. 2011). The other (F0177) is an interment of a crouched individual above a hearth feature with possible grave goods in the form of an articulated turtle flipper and spindle whorl (Kaye et al. 2011). Most of the graves belong to adult individuals, with roughly equal proportions of males and females represented, where sex is identifiable. Pathologies observed for some of the skeletal remains are consistent with traumatic accidents or illness (Fitzpatrick et al. 2009b).

Because the scale of excavation at Grand Bay is considerably greater, the quantity of artifacts recovered here far exceeds that of Sabazan. Ceramics are the most abundant artifact type at Grand Bay. Harris has analyzed more than 32,000 sherds from the site, roughly a quarter of the ceramic assemblage (Fitzpatrick et al. 2009b, Kaye et al. 2011). As at Sabazan, scratched ware and a pale brown or red ware are the most common types. Sherds are on average 7 – 12 mm in thickness, but are typically thinner in the lower and basal deposits where some are no more than 2 – 3 mm (Fitzpatrick et al. 2009b, Kaye et al. 2011)—thinner ceramics are associated with the Saladoid. Decorative types include Caliviny polychrome, linked to the Troumassan Troumassoid, Saint Lucia zoned incised, and some WOR, the latter two associated with the Saladoid period. These types tend to be replaced by Suazan finger-indented ceramics in the upper strata (Fitzpatrick et al. 2009b). A single sherd of zoned incised crosshatching (ZIC), an early Saladoid type, was recovered in a basal stratum during the 2011 season at Grand Bay. The lowermost deposits also yielded Saladoid Palo Seco pottery (Kaye et al. 2011). Open or hemispherical bowls are the most common vessel forms. Also present are flat dishes, bell-shaped bowls, incense burners and ritual inhaling vessels for hallucinogenic *cohoba* snuff, a powdered preparation of the plant *Anadenanthera peregrina* or other botanical species (Kaye 2010). Numerous spindle whorls and several body stamps, used to impress painted designs upon the skin, have also been recovered. Less common are griddle sherds and adornos, modeled vessel handles with zoomorphic or anthropomorphic forms (Figure 4.24). Overall, Grand Bay's ceramic assemblage may be characterized as primarily Troumassan and Suazan Troumassoid in style, with Saladoid (i.e., early Ceramic Age) stylistic elements in the lowermost strata. These findings are consistent with the associated radiocarbon chronology and show general correspondences with the ceramic record from Sabazan.

In addition to the macroanalysis of ceramics, a sample of sherds from several of Carriacou's sites, including Grand Bay and Sabazan, was subjected to instrumental neutron activation analysis (INAA) and thin section petrography to characterize clay composition and temper. INAA results reveal the presence of two geochemical compositional groups which transcend ceramic type or period. For both Sabazan and Grand Bay, petrographic analysis indicates several exotic temper types with possible origins in Puerto Rico, Barbados, and an as yet undetermined source (Fitzpatrick et al. 2008; Pavia et al. 2013). A non-local origin is also is also suggested by luminescence dates for a ceramic inhaling bowl fragment found in a AD 1000 – 1200 context at Grand Bay. Inhaling bowls are ritual vessels used as receptacles for hallucinogenic powders. The luminescence dates for the Grand Bay bowl fragment along with two other unprovenienced museum specimens from Carriacou have a weighted average of ca. 400 ± 190 BC, several centuries before the earliest radiocarbon dates for the Grand Bay site (AD 380 – 670). These early dates suggest the vessels originated elsewhere, possibly Puerto Rico, based on stylistic affinities, and were curated over many centuries before being transported to Carriacou (Fitzpatrick et al. 2009a).

The non-ceramic artifact assemblage, like that of Sabazan, consists mostly of objects made of shell, but artifacts manufactured from stone are also present. The diversity of non-ceramic artifacts recovered from Grand Bay is greater than at Sabazan, as would be expected from the much larger scale of excavation at this site. In addition to shell and stone tools and tool performs, excavators recovered shaped and polished shell and stone beads, pierced *Oliva* pendants, two *C. pica* fishhooks (Figure 4.17), and a number of small unretouched flakes which may represent the teeth of grater boards used to process root-crops. The number of bone artifacts is small, but includes the find of an awl manufactured from the long bone of an unidentified bird.

In addition, excavation has yielded several ritual-related artifacts. Three vomit spatulas, one made from conch shell and two from turtle bone, have been found. These objects were probably used to induce purging in the course of ritual purification ceremonies (Kaye 2010). Additionally, excavators recovered one partial and two complete three-pointed stones, objects which served as manifestations of supernatural entities known as “çemis” or “zemis” (Oliver 2009) (Figure 4.25). These finds are significant as three-pointers tend to occur on islands to the north of Carriacou. Their presence here suggests integration into the general socio-religious belief system of the larger Caribbean (Fitzpatrick et al. 2009b; see also Hofman et al. 2007, 2008, 2010, 2011).

4.3.3 Summary and Introduction to the Faunal Assemblages

Sabazan and Grand Bay are village sites located in similar coastal environments with access to similar marine, intertidal and terrestrial resources. How closely current landform and environmental characteristics conform to those of the past is difficult to say. Vegetative cover has undoubtedly been altered considerably since initial European arrival, but it is probable that the basic terrain of the sites and also their surrounding reef systems, which take many centuries to develop, are similar to the way they would have appeared in the past. Access to fresh water was probably a consideration for prehistoric inhabitants at both locations as it continues to be in the modern era.

Corresponding ceramic assemblages and radiocarbon chronologies for Sabazan and Grand Bay indicate that the two sites are contemporaneous. Sabazan was occupied for perhaps a century longer, but this may simply be a sampling effect for Grand Bay where fewer dates have been obtained. Both sites were settled at the close of the Saladoid period and both show signs of intensified occupation in the following Troumassan Troumassoid period.

The occurrence at each village of conch adzes and lapidary objects in various stages of the reduction sequence points to the manufacture of these items on site and the existence of corresponding levels of technical expertise. In addition, the presence of comparable toolkits, particularly the recovery of a single fishhook from Sabazan and two from Grand Bay, suggests residents at Sabazan and Grand Bay likely employed comparable technologies in their daily foraging and subsistence activities. At both sites, evidence for interaction with the continent and/or other islands of the West Indies exists in the form of exotic ceramics and ritual or symbolic paraphernalia (e.g., worked cervid mandible, heirloom inhaling bowl).

The sites are not without their differences. What impact this may have had on foraging practices is one of the questions addressed by this dissertation. As previously discussed, the habitats available for exploitation in the general vicinity of Sabazan and Grand Bay are similar, but the relative scale and accessibility of some resource patches does differ between sites. For example, the inshore area for Grand Bay is significantly larger and the reef approximately four times more distant from the coast than at Sabazan. This may have meant that open pelagic waters were not as readily accessible or attractive to Grand Bay foragers. Different fish taxa are to be found at varying abundances across these habitats and this may have influenced the relative taxonomic composition of Sabazan and Grand Bay's faunal assemblages. Moreover, while data are absent, the possibility exists that differing maritime conditions in the pelagic waters beyond each site may have made one location relatively more suitable for fishing.

The local topography of the two sites is also an important consideration. Sabazan is located within a relatively narrow valley between two steep headlands. The low coastal land available for agriculture is only about a quarter kilometer across, although terracing of hillsides could have alleviated this constraint. Grand Bay, with its broader coastal lowland, possesses nearly twice as much agriculturally suitable terrain. Varying horticultural productivity between the two sites may have influenced foragers' relative dependence on wild resources and resultant predation pressure on local habitats.

The dense midden deposits at Sabazan and Grand Bay, with their abundant fish and molluscan remains, tend to suggest that inhabitants at both sites relied heavily on marine resources despite perceived environmental differences between locations. Introduced mammalian species are present in the faunal assemblages of both sites as well. Whether the relative abundance of taxa and the relative contribution of various habitats to subsistence differed between sites in a significant way will be explored in the following pages. Assessing the comparative optimality of foraging strategies at the sites, any temporal trends, and their cause(s) are the subject of the remaining chapters in this dissertation.

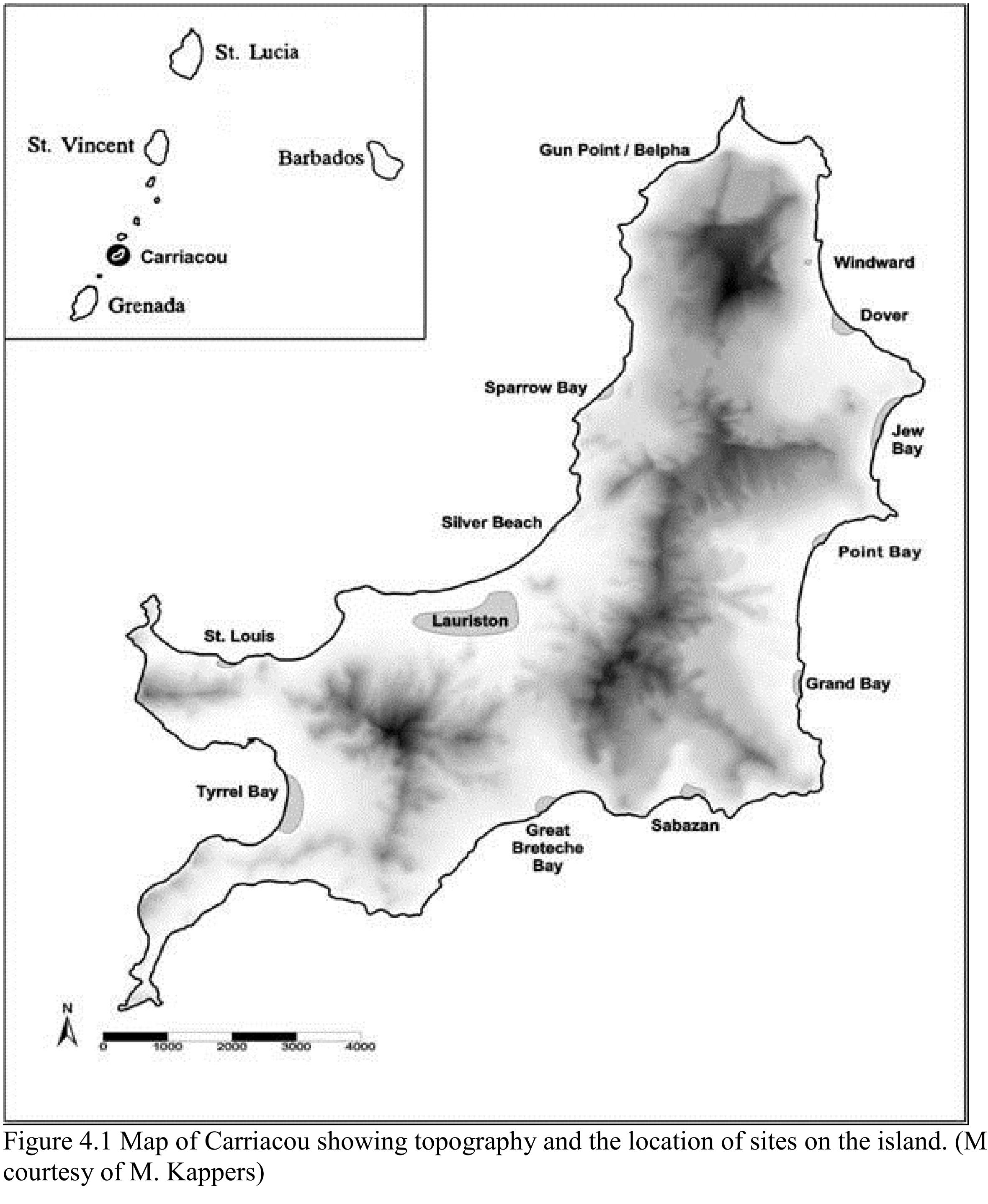

Figure 4.1 Map of Carriacou showing topography and the location of sites on the island. (Map courtesy of M. Kappers)

Figure 4.2 Contrasting lushness of vegetation in the Grenadine Islands during the A) dry season (island of Bequia) and the B) wet season (Carriacou). (Photographs by author)

Figure 4.3 Dry (disturbed) forest on Carriacou. The vegetation pictured is secondary growth typical of the island's present-day landscape. Arrow indicates approximate location of Sabazan excavation trenches. Note the historic tower on the hillside, near the center of the frame and just above the arrow. (Photograph by author)

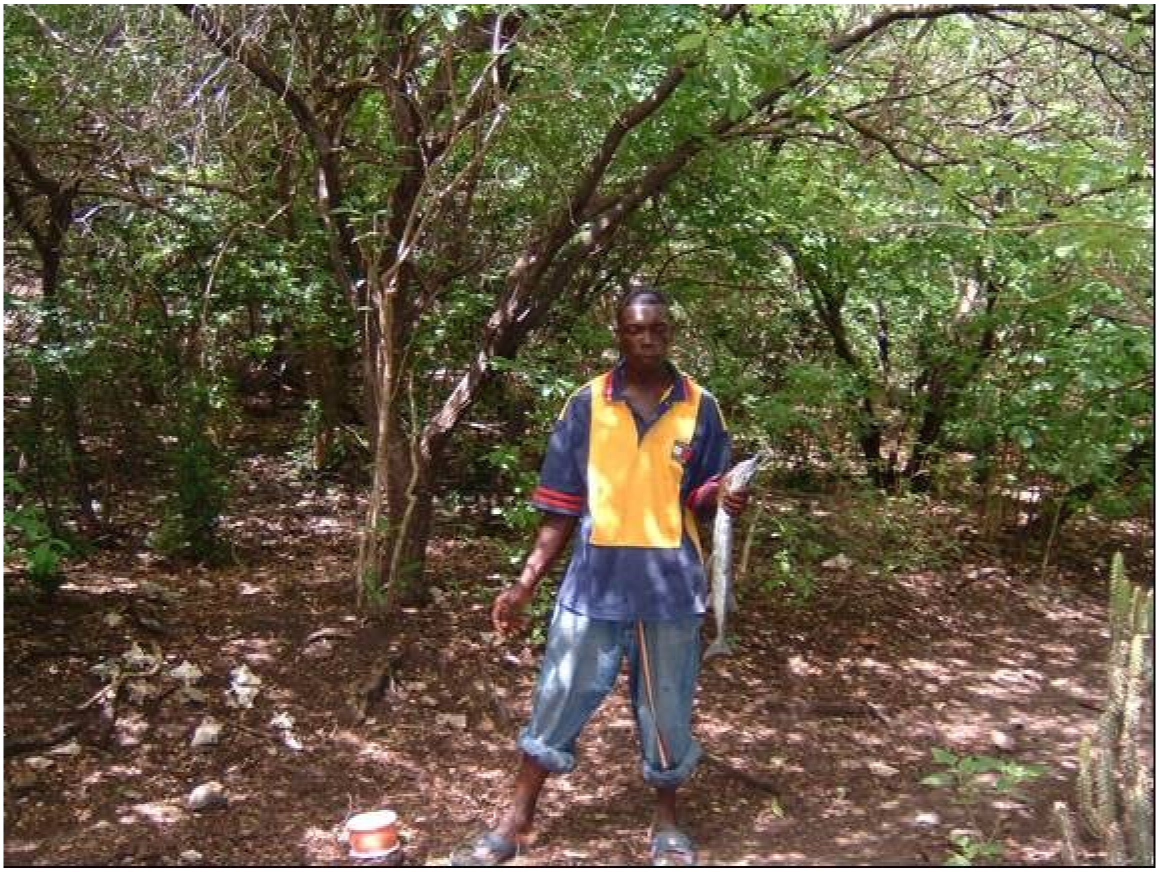

Figure 4.4 Thorny dry forest at the Sabazan site. Note pipe organ cactus (*Pilosocereus* sp.) in right foreground and exposed conch shells from midden deposits in left foreground. The man pictured has just returned from fishing at Sabazan Bay, having caught a needlefish (Belonidae) with a hand line. (Photograph by author)

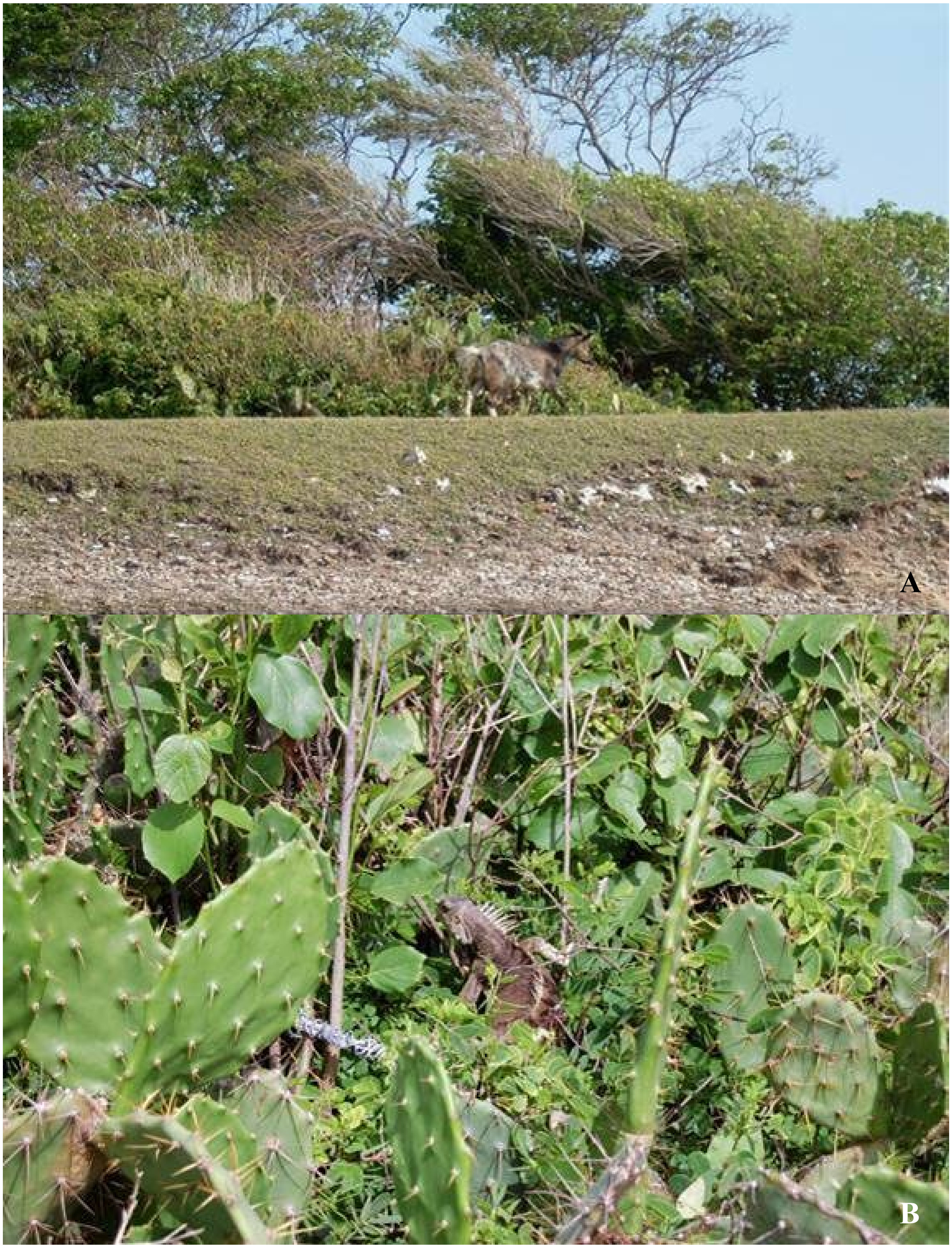

Figure 4.5 Examples of mixed coastal scrub and trees at the Grand Bay site. Above, A) windswept shrubs with prickly pear (*Opuntia* sp.), a grassy clearing in the foreground and manchineel trees (*Hippomane mancinella*) in the background. Note the freely roaming goat. Below, B) a close up view of scrub vegetation with prickly pear and an iguana (*Iguana iguana*). (Photographs by author)

Figure 4.6 Terrestrial fauna of Carriacou: A) the common opossum (*Didelphis marsupialis*); B) an agouti (*Dasyprocata* sp.), a prehistorically introduced mammal which no longer occurs on the island; C) ground lizard (*Ameiva* sp.); D) gecarcinid land crab (*Cardisoma guanhumi*); E) tree snail (*Orthalicus undatus*); and F) scaly naped pigeon (*Patagioenas squamosa*). (Photograph A by Juan Tello; photographs B-F by author)

Figure 4.7 Rocky intertidal habitat on Carriacou: A) exposed beach rock at the southern end of Sabazan Bay with rocky headland in the background; and B) the southern end of Grand Bay showing rocky headlands and tidal shelf of exposed bedrock. (Photographs by author)

Figure 4.8 Rocky intertidal fauna from Carriacou: A) zebra periwinkle (*Echinolittorina ziczac*); B) tessellated nerite (*Nerita tessellata*); C) West Indian chiton (*Chiton tuberculatus*) collected from the rocky intertidal zone around Sabazan by a local boy. (Photographs by author)

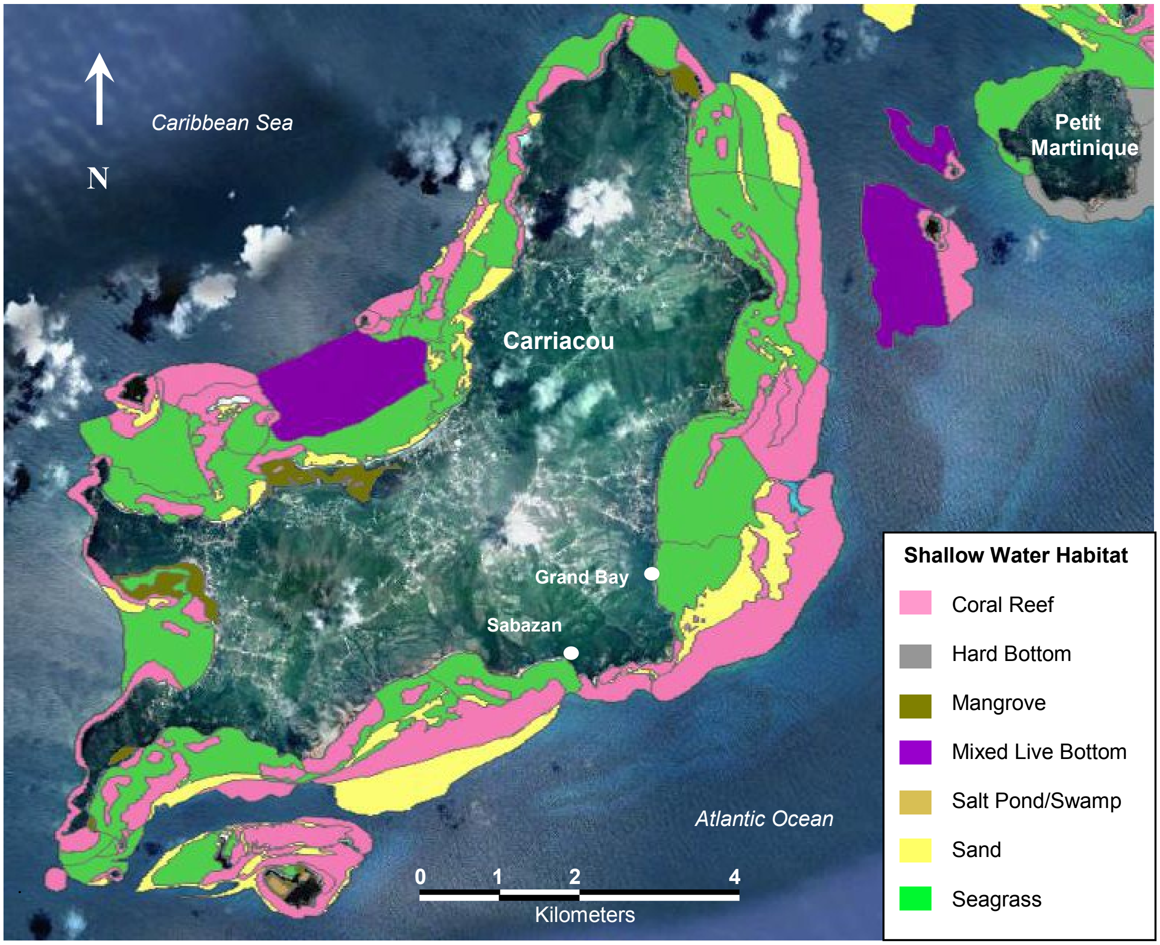

Figure 4.9 Distribution of shallow and inshore water habitat types around Carriacou. Habitat characterization based on MarSIS data (Baldwin 2012); satellite imagery from Google Earth.

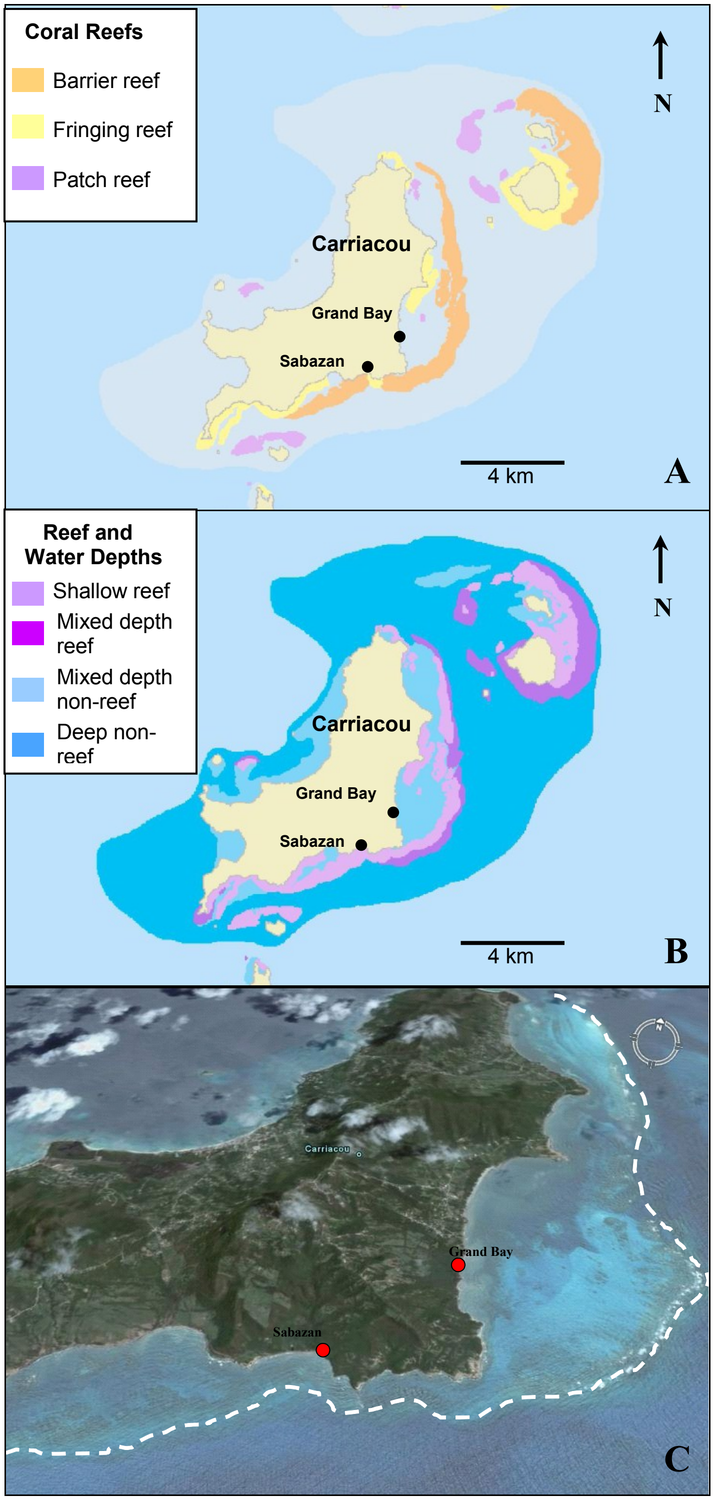

Figure 4.10 Carriacou reef systems: A) coral reefs types); B) coral reef and water depths; C) satellite image showing the outer-most extent (dashed line) of reefs off of the eastern coast of Carriacou. Maps A and B: scale 1:181,490; Tupper et al. 2013, reefbase.org. Map C: Google Earth.

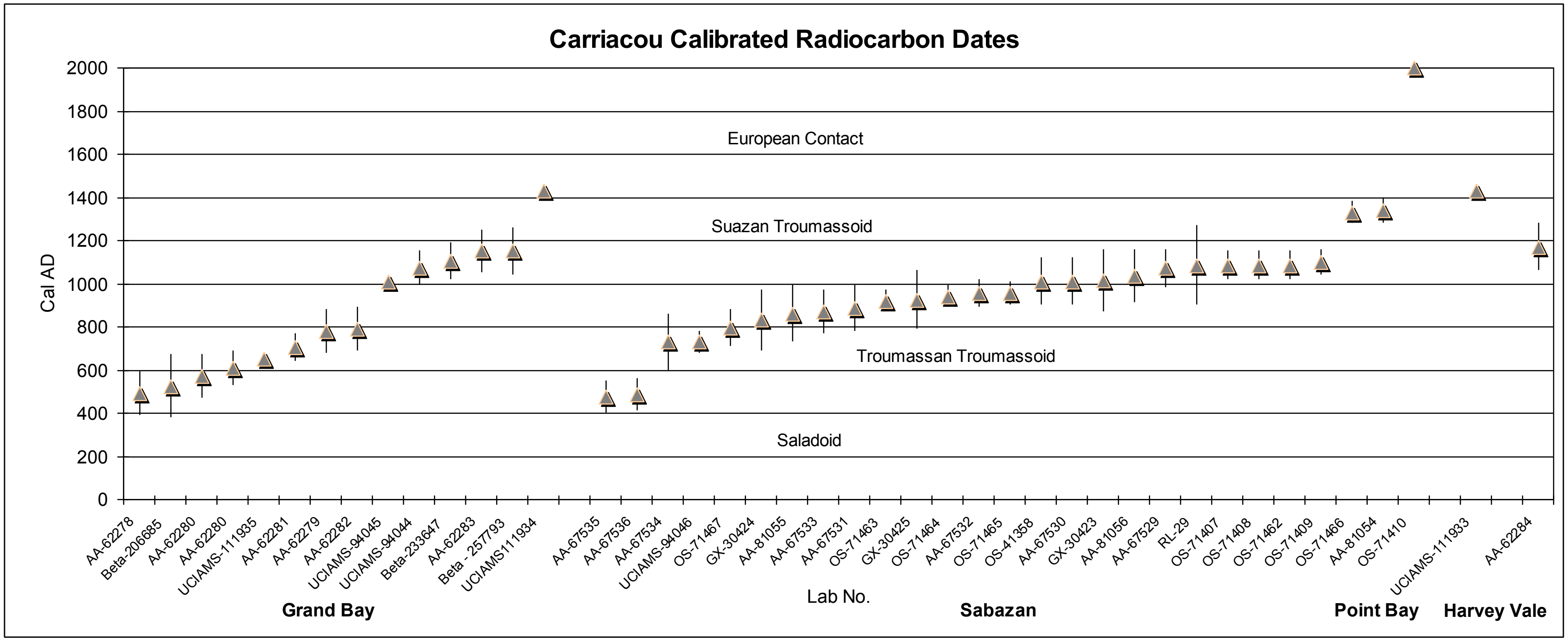

Figure 4.11 Chronological range of calibrated radiocarbon dates for the Sabazan, Grand Bay, Point Bay, and Harvey Vale sites on Carriacou.

Figure 4.12 Coastal profile of the Sabazan site: A) view of the coastal profile looking southwest; B) section of coastal profile showing dark stratified midden deposits and location of 2005 column sample prior to excavation (above stadia rod). Note pit/post feature intrusive into subsoil on the left and wave wash at base of bluff. (Photographs by author)

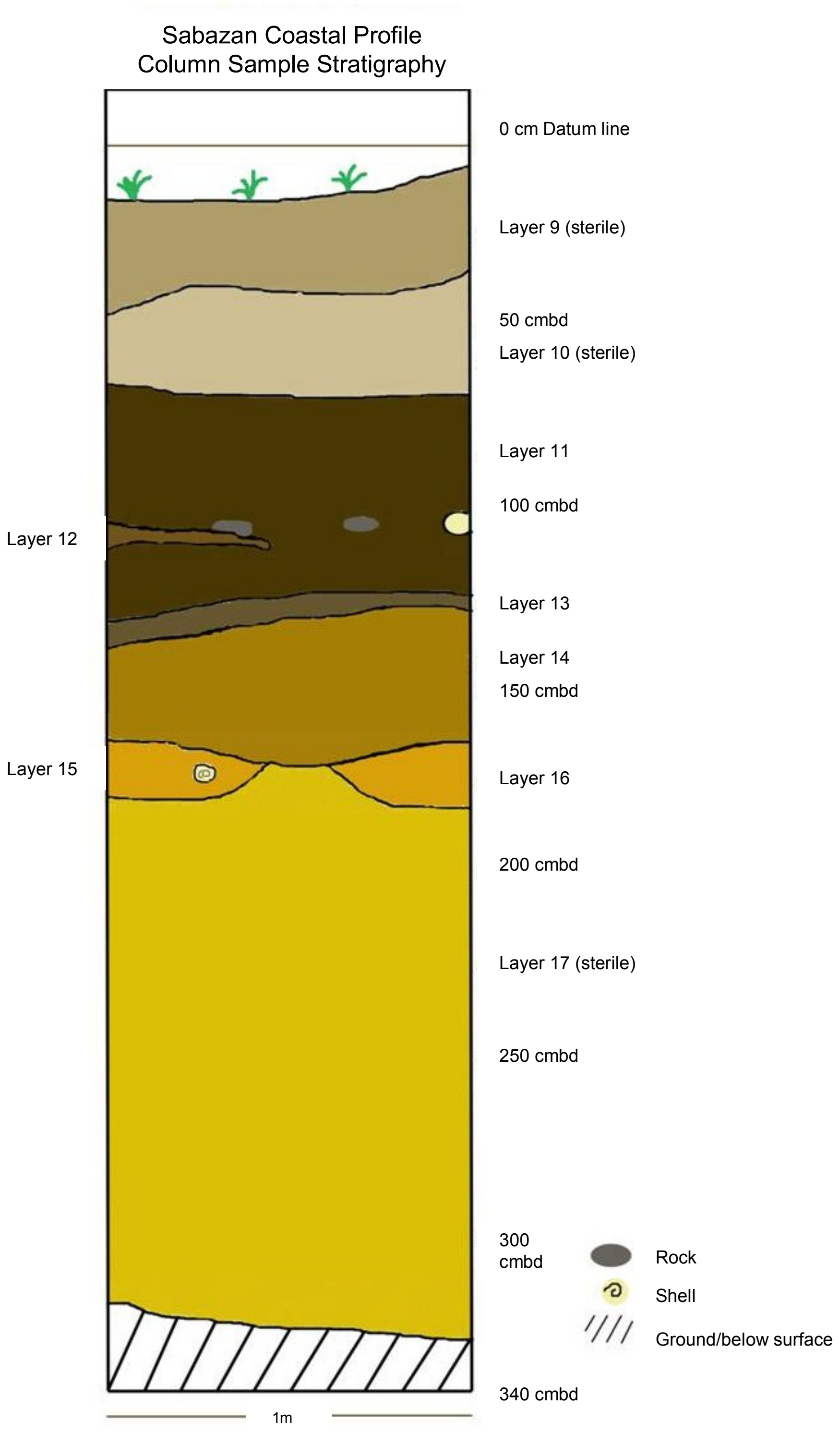

Figure 4.13 Profile drawing of 1 m column sample from Carriacou's wave-cut bank, excavated during the pilot research season in 2005. Radiocarbon dates for cultural layers appear in Table 4.1.

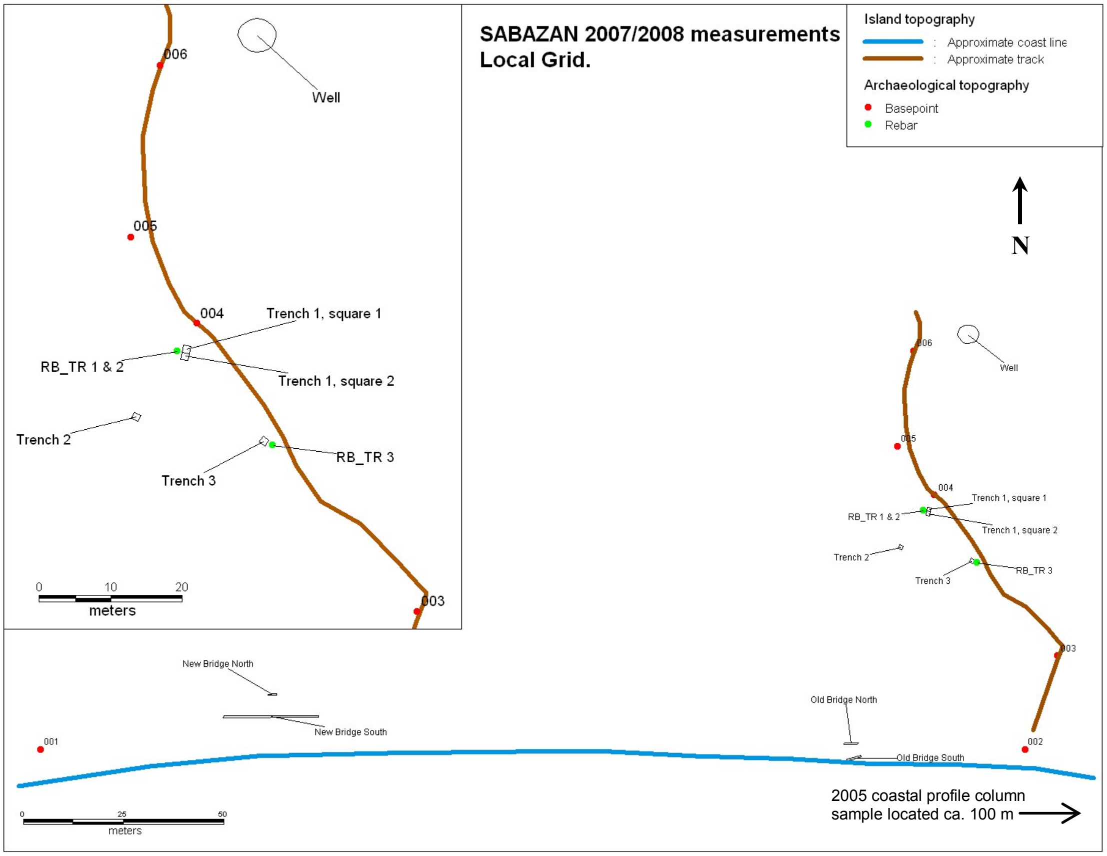

Figure 4.14 Map of Sabazan site and surrounding area with location and orientation of the three excavation trenches. (Map courtesy of M. Kappers)

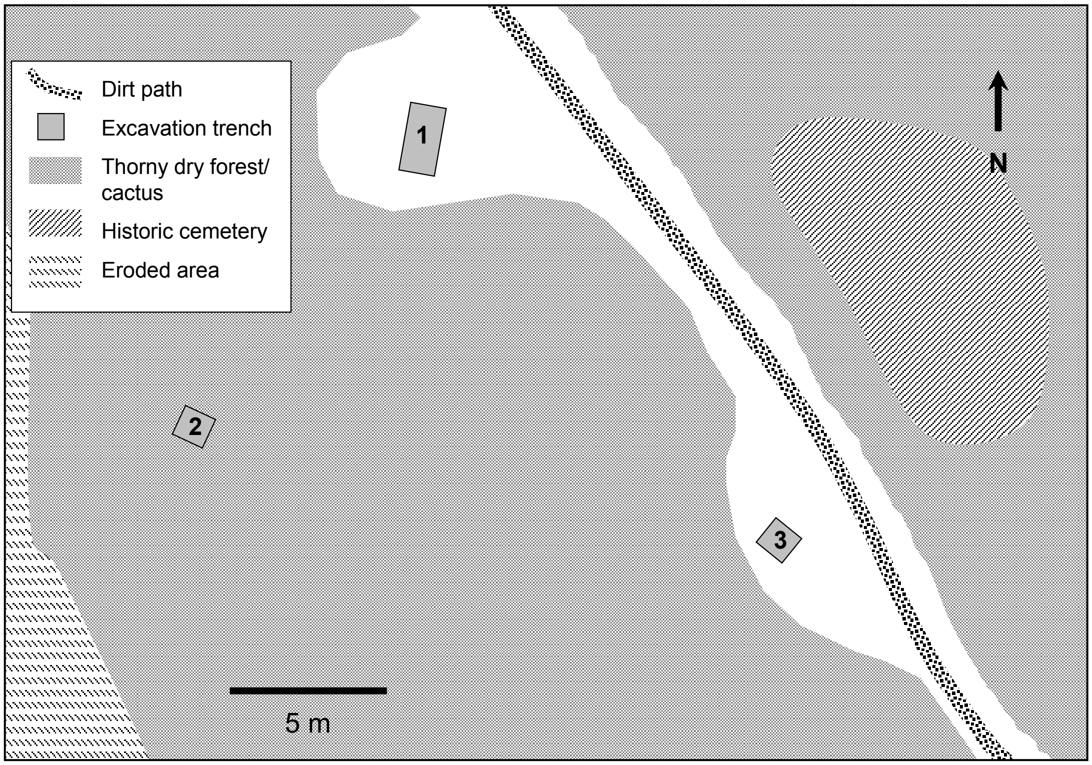

Figure 4.15 Map of excavation trenches 1, 2 and 3 at Sabazan with surrounding vegetative cover and historic features.

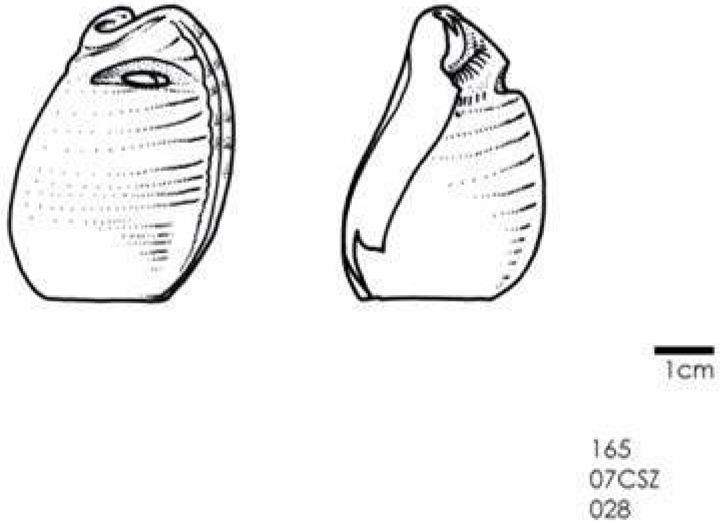

Figure 4.16 Pendant made from a reticulated cowrie-helmet (*Cypraecassis testiculus*) recovered from excavation at Sabazan. (Drafted by John Swogger)

Figure 4.17 Fishhooks made from *Cittarium pica* shell recovered from screened deposits; left from Sabazan, right from Grand Bay. A second specimen was also found at Grand Bay similar in size to the first. (Photograph by author)

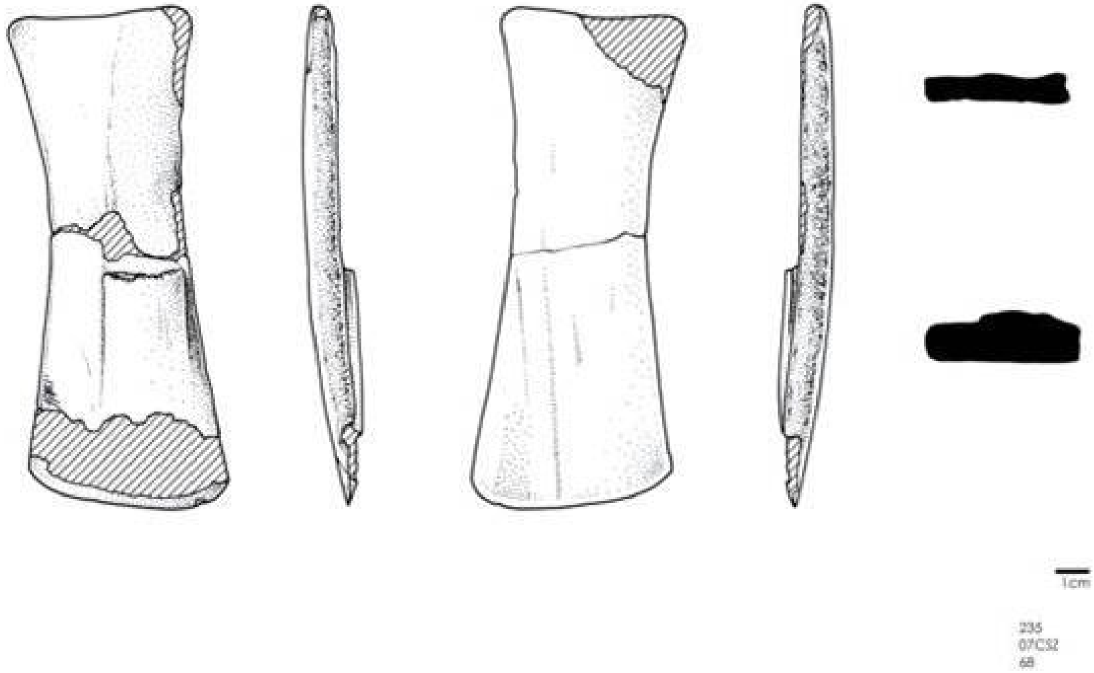

Figure 4.18 One of several similar artifacts of unknown function made from worked sea turtle bone that were recovered from excavation at Sabazan and Grand Bay. (Drafted by John Swogger)

Figure 4.19 An imported, carved and incised deer mandible from Sabazan. The specimen is probably red brocket deer (*Mazama americana*) which does not occur on Carriacou, but is native to South America and Trinidad. (Photographs by author)


Figure 4.20 Coastal profile at Grand Bay, looking north. (Photographs by author)

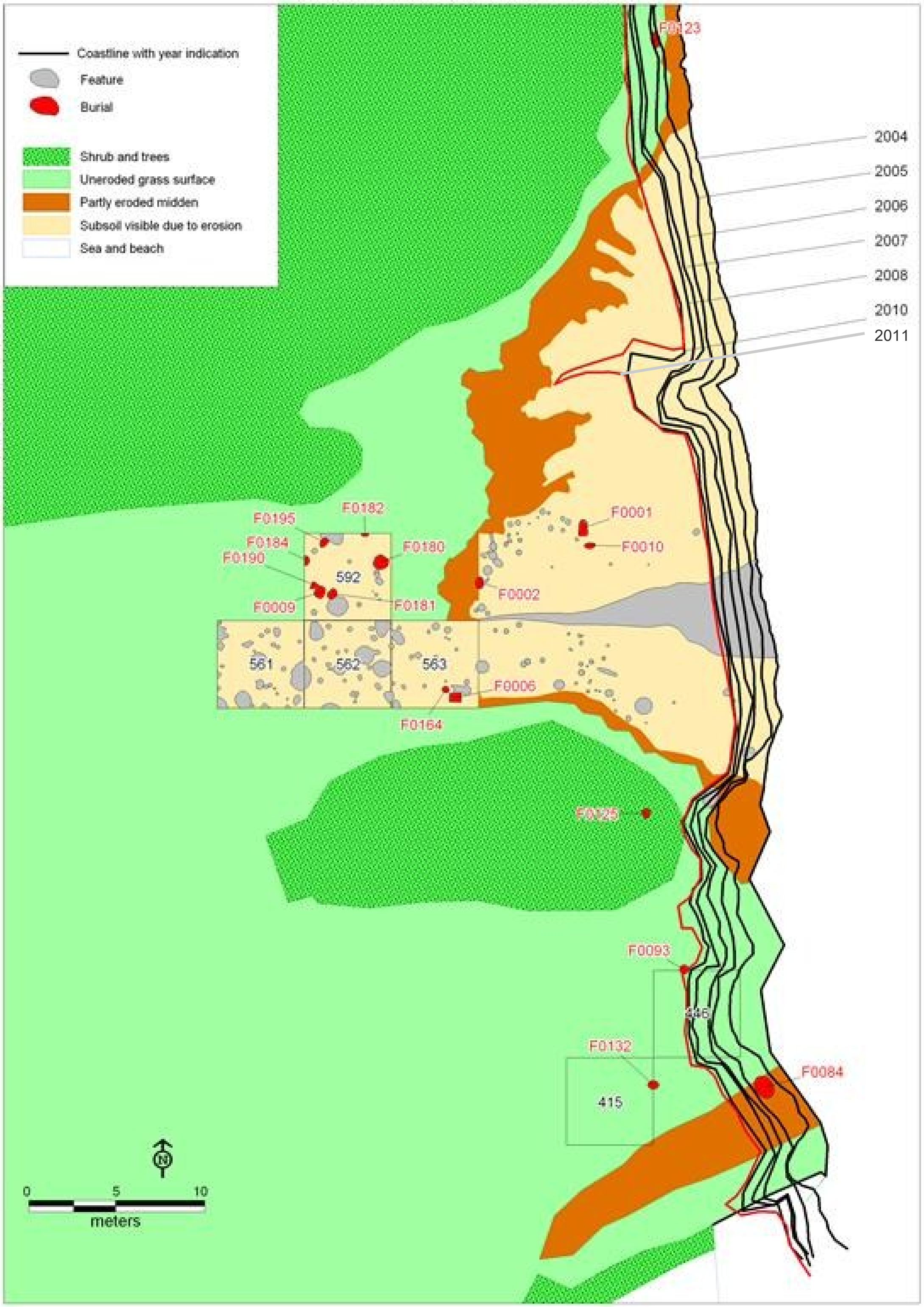

Figure 4.21 Map of Grand Bay showing location of excavated trenches 415, 446, 561, 562, 563, and 592, burials, and features. (Map courtesy of M. Kappers)

Figure 4.22 Progression of erosion along the coastal profile at Grand Bay from 1999 to 2006, view looking south. Note the leaning manchineel tree in the center/background for reference (Photographs courtesy S.M. Fitzpatrick).

Figure 4.23 A) Two large postholes/trashpits visible in the coastal profile of Grand Bay; B) a trash pit or possible posthole feature in the western profile of Trench 446. (Photographs courtesy of S.M. Fiztpatrick)

Figure 4.24 An adorno representative of the Suazan Troumassoid series, from Grand Bay Carriacou. (Photograph courtesy of Q. Kaye)

Figure 4.25 Two three-pointed stones representing çemis from Grand Bay, Carriacou. (Photograph courtesy of Q. Kaye)

Table 4.1 Radiocarbon and thermoluminescence dates for sites on Carriacou; cmbs = centimeters below surface. For Sabazan, depths were recorded as cm below datum and have been converted into cmbs. All radiocarbon dates calibrated using CALIB 6.0 (Stuiver et al. 2009). Planum refers to the sequential numbering of each excavated level.

^{14}C Dates For Archaeological Sites From Carriacou

Site	Lab No.	Type	species	Unit	Feature (Stratum)	Planum	cmbs	^{13}C/^{12}C ratio	Associated ^{14}C age	Cal. BC/AD (2σ)
Grand Bay	UCIAMS-94045	bone	*Cavia* maxilla	446:9	L002	4	---	-13.5	1020+20	AD 990-1030
Grand Bay	UCIAMS-94044	bone	*Tayassu* /*Pecari* mandible	415:23	L002	5	---	-22.2	990+20	AD 990-1150
Grand Bay	AA-62283	bone	human (child - R. fibula)	F006	---	---	---	-14.21	1062±44	AD 1050-1250
Grand Bay	Beta-206685	shell	*E. gigas* (juvenile)	N. profile	---	---	108	2.1	1870±70	AD 380-670
Grand Bay	Beta-233647	shell	*C. pica*	415	L002	---	---	1.8	1310±40	AD 1020-1190
Grand Bay	AA-62278	shell	*C. pica*	447	L007	---	145	2.53	1917±37	AD 390-590
Grand Bay	AA-62279	charcoal	---	447	L006	---	110	-25.13	1243±36	AD 680-880
Grand Bay	AA-62280	shell	*Venus* sp.	447	L006	---	127	3.39	1789±38	AD 530-690
Grand Bay	AA-62280	shell	*Venus* sp.	447	L006	---	127	3.36	1822±41	AD 470-670
Grand Bay	AA-62281	charcoal	---	447	L006	---	93	-23.96	1339±36	AD 640-770
Grand Bay	AA-62282	charcoal	---	F016 (Posthole)	---	---	---	-25.97	1227±36	AD 690-890
Grand Bay	Beta -257793	bone	human (adult - rib frag.)	563; F0164	---	---	---	-12.4	870±40	AD 1040-1260
Grand Bay	UCIAMS-111934	bone	human (midshaft, L. fibula)	F177	---	---	---	-10.27	69±15	AD 1410-1450
Grand Bay	UCIAMS-111935	bone	human (midshaft, fibula)	F180	---	---	---	-13.57	1565±15	AD 620-680
Sabazan	RL-29	charcoal	---	midden	---	---	~60-80	---	940±100	AD 900-1270
Sabazan	GX-30423	shell	*C. pica*	profile	VI	---	160	2.4	1400±60	AD 870-1160
Sabazan	GX-30424	shell	*E. gigas*	profile	X	---	200	0.2	1570±60	AD 690-970
Sabazan	GX-30425	shell	*C. pica*	profile	XI	---	230	2.5	1460±60	AD 790-1060
Sabazan	OS-41358	charcoal	---	profile	X	---	215	-23.94	1030±30	AD 900-1120
Sabazan	AA67529	charcoal		profile	Prof. Column 11	---	53-108	-25.6	988±42	AD 980-1160
Sabazan	AA67530	charcoal		profile	Prof. Column 11	---	53-108	-25.6	1,039±35	AD 900-1120
Sabazan	AA67531	charcoal		profile	Prof. Column 13	---	108-115	-24.6	1,133±38	AD 780-990
Sabazan	AA67532	charcoal		profile	Prof. Column 13	---	108-115	(-25)	1,073±38	AD 890-1020
Sabazan	AA67533	charcoal		profile	Prof. Column 14	---	115-154	(-25)	1,172±36	AD 770-970

Table 4.1 continued

^{14}C Dates For Archaeological Sites Carriacou Continued

Site	Lab No.	Type	species	Unit	Feature (Stratum)	Planum	cmbs	^{13}C/^{12}C ratio	Associated ^{14}C age	Cal. BC/AD (2σ)
Sabazan	AA67534	charcoal		profile	Prof. Column 14	---	115-154	-24.6	1,333±57	AD 600-860
Sabazan	UCIAMS-94046	bone	*Didelphis* sp. (cervical vert.)	profile	Prof. Column 14	---	115-154	-19.0	1265+20	AD 680-780
Sabazan	AA67535	charcoal		profile	Prof. Column 15	---	149-164	-24.8	1,588±36	AD 400-550
Sabazan	AA67536	charcoal		profile	Prof. Column 15	---	149-164	-25.8	1,584±36	AD 410-560
Sabazan	AA81054	charcoal		Tr 1: sq 1	2	2	3-13	-23.8	657±44	AD 1280-1400
Sabazan	OS-71407	charred seed		Tr 1: sq 1	4	6	30-34	-23.55	960±15	AD 1020-1150
Sabazan	OS-71408	charcoal		Tr 1: sq 1	5	9	43-53	-25.99	970±15	AD 1020-1150
Sabazan	AA81056	charred seed		Tr 1: sq 1	6	11	57-67	-25.5	994±45	AD 910-1160
Sabazan	OS-71409	charcoal		Tr 1: sq 1	6	12	73.5	-24.73	925±15	AD 1040-1160
Sabazan	OS-71410	charcoal		Tr 2: sq 1	2	2	2-11	-26.05	> modern	modern
Sabazan	OS-71462	charred seed		Tr 2: sq 1	3	4	19-29	-24.5	975±20	AD 1020-1150
Sabazan	AA81055	charcoal		Tr 2: sq 1	3A	6	40-50	-25.1	1,158±45	AD 730-990
Sabazan	OS-71463	charcoal		Tr 2: sq 1	3A	9	75.5	-23.62	1140±15	AD 870-970
Sabazan	OS-71464	charred seed		Tr 2: sq 1	8	12	89-91	-24.03	1100±20	AD 890-990
Sabazan	OS-71465	charcoal		Tr 2: sq 1	9	15	115	-24.04	1080±15	AD 900-1010
Sabazan	OS-71466	charcoal		Tr 3: sq 1	2	2	8-19	-24.77	680±15	AD 1280-1380
Sabazan	OS-71467	charcoal		Tr 3: sq 1	3A	10	84	-25.67	1220±20	AD 710-880
Point Bay	UCIAMS-111933	bone	human (distal end, R. ulna)	F001	---	---	---	-12.61	715±15	AD 1410-1450
Harvey Vale	AA-62284	bone	human (R. ulna)	---	---	---	---	-12.55	1027±46	AD 1060-1280

Thermoluminescence Dates For Archaeological Sites From Carriacou

Site	Lab No.	Type	Unit	cmbs	Equivalent dose(Gy)	Dose rate	Age (ka)	Calendar date
Grand Bay	UW1732	ceramic	profile	45	2.51 ± 0.20 (OSL) 2.89 ± 0.77 (TL)	3.1 ± 0.13	1.14 ± 0.10	AD 870 ± 101
Grand Bay	UW1733	ceramic	profile	45	2.27 ± 0.30 (OSL) 2.58 ± 0.47 (TL)	3.58 ± 0.21	.80 ± 0.09	AD 1142 ± 132

Table 4.2 Sabazan unit proveniences corresponding strata and associated radiocarbon dates. Planum refers to the sequential numbering of each excavated level.

Trench 1: Square 1						Trench 1: Square 2						Trench 2: Square 1						Trench 3: Square 1						Coastal Profile			
Layer	Level	Planum	Stratum	Lab No.	Calibrated ^{14}C Date	Layer	Level	Planum	Stratum	Lab No.	Calibrated ^{14}C Date	Layer	Level	Planum	Stratum	Lab No.	Calibrated ^{14}C Date	Layer	Level	Planum	Stratum	Lab No.	Calibrated ^{14}C Date	Stratum/ Layer	Depth cmbs	Lab No.	Calibrated ^{14}C Date
1	1	1	1	AA81054	AD 1275-1400	1	1	1	1			1	1	1	1			1	1	1	1			Layer 9	Sterile		
2	1	2	2			2	1	2	2			2	1	2	2	OS-71410	modern	2	1	2	2	OS-71466	AD 1280-1380	Layer 10	Sterile		
2	2	3	2			2	2	3	2			2	2	3	2			2	2	3	2			Layer 11	53-108	AA67529	AD 980-1160
2	3	4	2			2	3	4	2			3	1	4	3	OS-71462	AD 1015-1150	3	1	4	7					AA67530	AD 895-1120
2	4	5	2			3	1	5	4			3	2	5	3			3	2	5	7			Layer 12	83-90		
3	1	6	4	OS-71407	AD 1020-1150							3A	1	6	3A	AA81055	AD 730-990	3	3	6	7			Layer 13	108-115	AA67531	AD 780-990
3	2	8	4									3A	2	7	3A			4	1	7	3A					AA67532	AD 890-1020
4	1	9	5	OS-71408	AD 1020-1150							3A	3	8	3A			4	2	8	3A			Layer 14	115-154	AA67533	AD 770-970
4	2	10	5									3A	4	9	3A	OS-71463	AD 875-970	4	3	9	3A					AA67534	AD 600-860
5	1	11	6	AA81056	AD 905-1160							3A	5	10	3A			4	4	10	3A	OS-71467	AD 715-885			UCIAMS-94046	AD 675-780
5	2	12	6	OS-71409	AD 1040-1160							3A	6	11	3A									Layer 15	149-164	AA67535	AD 400-550
5	3	13	6		Sterile							4	1	12	8	OS-71464	AD 895-990	Feat F	1	1						AA67536	AD 410-560
5	4	14	6		Sterile							5	1	13	9									Layer 16	149-170		
5	5	15	6		Sterile							5	2	14	9									Layer 17	Sterile		
												5	3	15	9	OS-71465	AD 895-1015										
Feat A	1	7																									
												Feat B	1	1													
												Feat C	1	1													
												Feat D	1	1													
												Feat E	1	1													

Chapter 5

RESEARCH METHODS AND THE ZOOARCHAEOLOGICAL DATA

One fish

two fish

red fish

blue fish.

- Dr. Seuss

5.1 Methods Overview

As previously discussed, testing for differences in the optimal responses of Sabazan and Grand Bay foragers requires sites matched in chronology, culture, and environment. Parity of comparison extends to the methodologies employed in field recovery and analysis of faunal material. Since research at Grand Bay and Sabazan was conducted under the same umbrella project, the methods used at each site are broadly similar. In this chapter, I describe the analytic methods employed in this research and present the zooarchaeological data from the Sabazan and Grand Bay sites. For this study, I analyzed the Sabazan vertebrate and invertebrate assemblages and the Grand Bay invertebrate assemblage. Data for Grand Bay's vertebrate assemblage come from research conducted by Michelle LeFebvre (LeFebvre 2005, 2007).

5.2 Field Methods and Faunal Sampling

The Grand Bay and Sabazan sites differ in the scale of excavation, with a significantly larger volume excavated at Grand Bay over the course of its five excavation seasons compared to Sabazan's two excavation seasons and preceding column sampling work. For both sites, analyzed samples represent multiple spatial contexts from midden deposits dated to ca. AD 600 – 1400. With the exception of a small sample from Sabazan, the earliest settlement phase for Grand Bay and Sabazan (ca. AD 400 – 600) is not represented, as these layers had not been excavated at the time of analysis. All analyzed samples come from material wet-screened through 6.4 mm (1/4″) and 1.6 mm (1/16″) mesh.

5.2.1 Excavation and Faunal Sampling Regimen at Sabazan

At Sabazan, four 1 × 1 m test units (two of which are contiguous) and a single 1 m wide profile column sample have been excavated by hand-troweling, using natural stratigraphic layers subdivided into 10 cm levels where necessary. Crews have excavated nearly 4 m^3 of soil to date. All sediments were wet sieved through nested 6.4 mm and 1.6 mm mesh screens. Zooarchaeological remains were collected by bulk-provenience from the screens and returned to the lab at the Carriacou Historical Society Museum for cleaning and processing. Special finds and charcoal collected for dating were point-provenienced *in situ* in the test units, bagged, and sent to the lab for appropriate processing and conservation.

Faunal samples analyzed from Sabazan come from three contexts: Trench 1, Square 1; Trench 2, Square 1; and stratigraphic layers 11 and 14 of the profile column sample (Figures

4.13 and 4.15). Archaeological material from the disturbed, uppermost layer was excluded from analysis, as was material from significant features or areas of detectable disturbance, such as land crab burrows. Samples from three small, diffuse areas of ashy sediment only a few centimeters in horizontal and vertical extent (Features A, B, and C), were included in analysis as these were interpreted as ash dumping events and part of the typical midden rather than formal hearths. Specific samples analyzed and their associated provenience are given in Table 5.1

Subsampling for analysis was employed for both the 6.4 mm and 1.6 mm fraction of zooarchaeological material. For the 6.4 mm component, a 25% by weight subsample was taken to maintain a comparable sampling regimen with Grand Bay, where analytically appropriate samples come from a 50 × 50 cm portion (i.e., a quarter) of so-called "environmental squares" designated for wet-screening at that site. Due to the small amount of 6.4 mm fraction recovered from the profile column samples at Sabazan, however, these were analyzed in full, as were certain samples from Trench 2, Square 1. Details of original sample size and specific sample treatment for a given analyzed provenience are provided in Appendix A.

For analysis of the 1.6 mm fine fraction, a standardized 100 g subsampling regimen was established, with subsamples ranging between ~ 2% to 100% of the original full samples by weight. The same physical procedure was used for subsampling both the 6.4 mm and 1.6 mm fractions. To ensure representative subsamples, the contents of each sample were homogenized by gentle mixing in a basin. Sample material was removed using a plastic scoop and added to a separate container on a scale until the target subsample weight was reached.

5.2.2 Excavation and Faunal Sampling Regimen at Grand Bay

Excavation at Grand Bay was conducted by hand-troweling in arbitrary 10 cm levels termed plana, with stratigraphic designations assigned to each planum during excavation. Four 1 × 1 m units (Squares 7, 9, 17, and 19) from each of the six 5 × 5 m trenches were designated as "environmental squares" for the collection of zooarchaeological material. Sediments from a 50 × 50 cm portion, i.e., a quarter sample of the squares, were wet sieved through nested 6.4 mm and 1.6 mm mesh. All analyzed vertebrate and invertebrate samples come from the context of these 50 × 50 cm environmental columns (Fitzpatrick et al. 2009b; LeFebvre 2005). As at Sabazan, archaeological remains from screens were collected by bulk-provenience and returned to the lab at the Carriacou Historical Society Museum for cleaning and processing. Zooarchaeological material from the disturbed, uppermost level was excluded from analysis.

Table 5.2 provides the details for the zooarchaeological samples analyzed from Grand Bay. The analyzed vertebrate assemblage is relatively limited in chronological coverage, representing only the post-AD 1000 contexts where LeFebvre focused her analysis (LeFebvre 2005, 2007; Fitzpatrick et al. 2009b). Unfortunately, this means that vertebrate exploitation from Sabazan's earlier occupation period does not have an analytic counterpart from Grand Bay. However, the invertebrate samples from both sites cover comparable time ranges, ca. AD 600 – 1250.

Since the analyzed 6.4 mm fraction comes from the 50 × 50 cm environmental column, each test unit level was effectively subsampled at 25% within the field, and additional subsampling was not required here. For the 1.6 mm component, the same protocols used to generate a 100 g sample of Sabazan's fine fraction were used for the invertebrate analysis. The vertebrate component of the fine fraction was analyzed in full by LeFebvre (2005).

The excavation and sampling protocols used at Sabazan and Grand Bay ensure that samples are roughly comparable across sites in their relative contribution to the analyzed assemblages, with the possible exception of the 1.6 mm vertebrate component. At Grand Bay, the fine fraction vertebrate samples represent 25% of a 1 × 1 m context, whereas at Sabazan they represent a varying percentage of a 1 × 1 m context because of the standardized 100 g subsampling protocol. The impact of this difference on the final analysis is anticipated to be minimal as most of the Grand Bay 1.6 mm vertebrate samples analyzed were relatively small (LeFebvre, personal communication 2012).

5.2.3 Special Considerations

Special protocols were employed for certain zooarchaeological materials. At Sabazan and Grand Bay, large specimens of conch (Strombidae), primarily queen conch (*Eustrombus gigas*), were analyzed apart from the main assemblages because their large size and abundance restricted curation. They were quantified in the field, but not collected for further analysis. At Grand Bay, the shell apices were counted on site and used to derive estimates of the minimum number of individuals (MNI) for all excavated contexts (Table 5.3). At Sabazan, counts of apex and columella portions for shells > 50% complete were recorded. Smaller conch fragments were also retained in the screened material for later analysis. These combined data were used to calculate the number of identified specimens (NISP) and MNI for all excavated trenches (Table 5.4).

Special handling aside, I note that conch pose potential interpretive issues. Queen conch are one of the largest Caribbean gastropods and one of the most obvious and plentiful molluscs in the sites' assemblages. The large, heavy shell was used extensively in prehistoric artifact manufacture throughout the Caribbean. Mature *E. gigas* may weigh as much as much as 2 kg, but contain only 150 g of meat (O'Day and Keegan 2001). Because of this, modern commercial and subsistence fisheries typically process animals on the beach leaving shells behind. Conch fishermen on Carriacou and many other parts of the Caribbean today follow this practice (Figure 5.1) (Antczak et al. 2008; Stager and Chen 1996). Similarly selective transport may have been employed by prehistoric peoples (Stager and Chen 1996), as has been described elsewhere (Bird and Bliege Bird 1997; Bird et al. 2002; Rowland 1994). For these reasons, O'Day and Keegan (2001) suggest that where large conchs occur in Ceramic Age archaeological deposits, it likely reflects stockpiling of shell for use in tool and ornament manufacture. An area of mature queen conch concentration at Grand Bay has been tentatively identified as a stockpile, although it may also represent a location of shell processing for removal of meat (Figure 5.2). The two functions, however, are not mutually exclusive. These on-site conch heaps probably under-represent the quantity of conch exploited. For the methodological and analytic reasons outlined here, conchs are excluded from the majority of statistical tests in this research.

The 1.6 mm screen fraction produced a number of species useful as paleoenvironmental indictors, but not directly reflective of diet. These include the awl snails (Subulinidae), terrestrial gastropods typically measuring < 10 mm, and "ground pearls", the tests of scale insects (*Margarodes* sp.) that attach themselves to grass roots (Newsom and Wing 2004). The remains of these taxa were not quantified, but were retained for future analysis. Fragments of stony coral (Scleractinia) were also excluded from analysis.

Fish otoliths were included in LeFebvre's analysis at Grand Bay, but I omitted these from the Sabazan vertebrate analysis because the necessary comparative collections were not available. Relatively few (n ≈ 82) otoliths were recorded. A qualitative appraisal of species representation suggests that otolith analysis would contribute only minimally to the NISP of already well represented taxa, such as parrotfish (Scaridae) and grunts (Haemulidae), and would contribute even less so to MNI, for which other more plentiful elements determine counts. The exclusion of otoliths specimens from Sabazan's analysis probably has a negligible impact.

Finally, in the analysis of 1.6 mm vertebrate remains from Sabazan, I did not tally the number of unidentified fish specimens because these were prohibitively numerous to quantify and did not add meaningful data to the analysis. LeFebvre, however, did quantify this component of her fine fraction sample at Grand Bay. This methodological difference does not impact this study, except where otherwise noted below.

5.3 Taxonomic Identification and Qualitative Analysis

Faunal remains were transported back to the University of Washington and University of Florida for analysis. Taxonomic identification of the Grand Bay invertebrate and Sabazan vertebrate and invertebrate assemblages was made relying on published reference materials, personal comparative collections, and the modern reference collections of the Florida Museum of Natural History's Environmental Archaeology Department, the Vertebrate Palaeontology and Mammalogy Departments of the Royal Ontario Museum, and the McMaster University Fisheries Archaeology Research Centre.

Specimens were identified to the lowest taxonomic level possible with the exception of sea urchin, identified only to class, Echinoidea. For fish, an effort was made to identify all diagnostic bones rather than a pre-selected set of elements (e.g., Dye and Longnecker 2004; Leach 1986; See also discussion in Whyte et al. 2005). Fish elements identified and taxonomic assignations based on these are provided in Appendix B. Data recorded in my analysis include: taxon; specimen count; skeletal element and the part/landmark(s) present; where applicable, element side and juvenile/adult status; specimen weight; and evidence for burning, cut marks, wear, other modifications, and pathology. Identification of small specimens from the 1.6 mm fraction was made with the use of a hand lens and a microscope at magnifications from 10x to 64x. My identifications are consistent with criteria outlined by Driver (2011) and Wolverton (2012) for quality control in zooarchaeological analysis.

Taxonomic naming conventions for fish follow those of FishBase (Froese and Pauly 2013 2012, www.fishbase.org). Of particular note, is that recent molecular evidence groups parrotfish (formerly the family Scaridae) as a subfamily (Scarinae) of the wrasses (Labridae) (Westneat and Alfaro 2012; Westneat et al. 2005). In keeping with FishBase, however, the family-level designation of Scaridae is maintained for this research because the distinctiveness of parrotfish skeletal elements makes them relatively easy to distinguish in archaeological contexts, and because fishing practices may have been influenced by behavioural differences between the two taxa. Maintaining these separate families permits a finer-grained analysis.

For molluscs, ongoing reassessment of evolutionary relationships in the last decade has placed the phylogeny and taxonomy of many species, particularly gastropod taxa, in a state of flux. Consequently, species, genus, and family designations in many published identification guides are now out of date. Also problematic, the taxonomic (re-)assignments of recent studies can sometimes conflict (e.g., Landau et al. 2008; Petuch and Roberts 2007; Rosenberg 2009). For these reasons, I deferred to a single source for molluscan naming conventions, Malacolog (Rosenberg 2009, Version 4.1.1, The Academy of Natural Sciences of Drexel University).

Where taxonomic information is absent from Malacolog, the Integrated Taxonomic Information System (ITIS) (www.itis.gov) and other published sources were relied upon.

5.4 Taxonomic Quantification, Data Aggregation, and Analytic Chronology

Fauna were quantified using standard measures of NISP and MNI (Grayson 1984; Reitz and Wing 2008). Taxon MNI was calculated by stratigraphic layer and trench, analytically combining the 6.4 mm and 1.6 mm fractions and taking into account side, size, and age where appropriate. For the Grand Bay vertebrate fauna, I recalculated MNI to follow this convention using raw data provided by LeFebvre, who analytically combined all analyzed contexts for MNI calculation in her research. The vertebrate MNI counts presented in this study, therefore, are slightly higher than those of published sources (e.g., LeFebvre 2005, 2007) because they have not been condensed to the same degree by aggregation procedures. As previously discussed, strombid conch MNI was calculated based on counts of shell apices and/or collumellae, i.e., using pre-selection of a non-repeating element. For the remainder of the molluscan assemblage, however, MNI was quantified using a standard approach in combination with a shell-part scoring system for estimating the completeness of specimens described by Giovas (2009). For all taxa, I made an effort to refit specimens within a sample. Refit fragments were treated analytically as a single specimen.

At Sabazan, not all strata were continuous across excavation units. All stratigraphic contexts are well-dated, however, allowing different strata to be correlated across the site (Table 4.2). To increase sample size for comparative analyses, Sabazan's sample data were combined according to chronological periods based on clustering of dates in the radiocarbon sequence (Figure 4.11).

Site chronology is divided into Initial (ca. AD 400 – 550), Early (ca. AD 600 – 800/850), Middle (ca. AD 750/800 – 1000), Late (ca. AD 1000 – 1150), and Final (ca. AD 1250 – 1400) periods. The associated dates and archaeological contexts assigned to each of these periods are summarized in Table 5.5. This approach was taken because it uncoupled the zooarchaeological record from the ceramic/artifact record and allowed for finer-grained temporal categories than provided by conventional Caribbean culture chronological framework.

As previously stated, for the purpose of quanitification, Grand Bay samples were analytically combined across trenches according to stratum. It was not necessary to further aggregate samples because most designated strata extended across all analyzed contexts. Archaeological contexts, their associated radiocarbon dates, and the chronological framework employed for analysis, are given in Table 5.6. Grand Bay's analytic chronology corresponds roughly to Sabazan's and is used as a basis for zooarchaeological comparisons between the sites. Initial (ca. AD 400 – 650), Early (ca. AD 650 – 850/900), Middle (ca. AD 850 – 1000), and Late (ca. AD 1000 – 1250) periods are defined. Additionally, a "Final" period (ca. AD 1250 – 1450) is identified through a radiocarbon date (UCIAMS-111934) for burial Feature F177. However, this feature may represent intermittent use of the site for special activities following site abandonment since dated midden layers signifying occupation appear to terminate around AD 1250 (Fitzpatrick, personal communication 2012). There are no faunal samples from the Final period.

Two stratigraphic layers, L003 and L005, fall within the Middle period. Their chronological designation is based on interpolation between dated layers above and below. Because L003 is not continuous across all analyzed/excavated contexts, and because both it and L005 lack associated dates, their relationship—that is whether they are essentially coeval or not—is undetermined. Therefore, the faunal material from these two layers was not analytically combined. Rather, each was treated separately as a component of the Middle Period ranging from ca. AD 850 to AD 1000.

5.5 Sabazan and Grand Bay Zooarchaeological Assemblages

The Grand Bay and Sabazan zooarchaeological assemblages are sizeable, but quantified individuals are distributed over a large number of taxa and many taxa are represented by just one or a few individuals. In the remainder of this chapter, I review these assemblages, focusing on taxa of major importance. I consider taxonomic composition, abundance, richness and diversity measures, and temporal trends evident at each site. Trends in faunal exploitation are assessed using chi square tests of independence. For these tests, NISP and MNI counts for identifications made with a "cf." have been assigned to securely designated specimens of the same taxon. I also examine foraging strategies in terms of environmental patches exploited. Comparisons between the two sites and related statistical assessment are the subject of the following chapter. Statistical tests in this research were performed using R, SPSS software, and a chi-square Excel macro developed by Cannon (n.d., http://home.utah.edu/~u0577421/). Generally, comparisons within taxonomic class rely on NISP to maintain sample size, but for reasons discussed below, I employ MNI when multiple classes are being considered.

5.5.1 The Sabazan Assemblage: Overview

The full dataset for analyzed faunal material from Sabazan is presented in Table 5.7 (data by provenience and screen fraction are provided in Appendix C). The relative contribution of specimens to each taxonomic class is given by period based on identifications below the class level. Because fewer sample contexts were analyzed for the invertebrate material and for the 1.6 mm component (Table 5.1) a subset of the faunal assemblage, based on equitable sampling across vertebrate and invertebrate categories and screen size fraction, was used to create a dataset, referred to hereafter as the sub-assemblage, in which invertebrate and vertebrate relative abundance could be appropriately compared to each other (Table 5.8). In this dataset, the relative contribution (% NISP, % MNI) of each class to the sub-assemblage as whole is provided. Taxonomic identifications made at the level of class (e.g., indeterminate Aves) are given separately from identifications made below the class level, but are included as part of the sub-assemblage relative abundance. This allows for a determination of the degree to which certain faunal classes were identifiable. Indeterminate bony fish (Actinopterygii[1]) specimens, were the most numerous of the unidentifiable remains, and consisted mostly of fragmentary, typically non-diagnostic elements such as rays and caudal vertebrae. As discussed previously, for Sabazan, indeterminate Actinopterygii were quantified only for the 6.4 mm fraction because the abundance of such remains in the smaller screen component was prohibitive to count. This means that the real count for indeterminate Actinopterygii for Sabazan is much higher. LeFebvre did quantify the 1.6 mm component of unidentifiable bony fish and this is reflected in the much greater relative abundance of "indeterminate Actinopterygii" for Grand Bay.

For Sabazan, a total of 7581 specimens (including Echinoidea) were identified, representing approximately 67% of the total faunal material analyzed for all periods (> 11,300 specimens). An additional 2080 specimens were identified to the class level, increasing NISP to 9661, or roughly

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[1] Note that in this study I refer to bony fish using the more precise taxonomic classification of Actinopterygii, which specifically refers to ray-finned bony fish. I do this rather than employ the commonly used term Osteoichthyes to designate bony fish since this latter classification is paraphyletic. Lobe-finned bony fish, the Sarcopterygii, are not known for Caribbean waters although they are found in South American freshwater bodies.

85% of analyzed sample. For identifications made to the class level or below, the vertebrate assemblage totals 5784 specimens, representing a minimum of 462 individuals. The invertebrate assemblage consists of 3787 specimens, or a minimum of 376 individuals. Recall that due to differing sampling regimens, vertebrate assemblage counts are not directly comparable to those of invertebrates unless referring to the invertebrate-vertebrate sub-assemblage in Table 5.8. Examining this table reveals that based on NISP, invertebrate remains are more than twice as abundant (n = 3787) than vertebrate remains (n = 1710).

The sample from Sabazan's Early period is quite small (NISP = 161, MNI = 17). Inferences drawn from these data should, therefore, be treated with caution. Taxa recorded in the Early sample are likely common in the period, but their relative abundance and negative evidence for other taxa are probably not reliably indicated.

Species richness is presented in Table 5.9 (counts exclude strombid conchs). Because a number of taxonomic assignations overlap at the species and genus levels, e.g., *Nerita* sp. and *Nerita tessellata* are not discrete taxonomic categories, richness is calculated based on the number of lowest level, mutually exclusive taxonomic designations (Grayson 1991). Using this approach, for example, the *Nerita* example presented here yields one taxon. Taxonomic richness is low in the Early period (n = 24), more than triples in the Middle period (n = 75), and drops to intermediate levels for the Late (n = 50) and Final (n = 54) periods. Across all samples, vertebrate richness exceeds that of invertebrate richness by 11% to 68%. Sample size and richness by period are correlated for invertebrates (r = +0.955, $p = 0.045$), but not vertebrates (r = +0.886, $p = 0.114$).

Shannon-Weiner diversity (H') and evenness (E) were calculated for each period (Magurran 1988, 2004) (Table 5.10). H' increases with increasing taxonomic diversity, while E approaches

1.0 as relative abundances become more equitably distributed across taxa. Low diversity and evenness measures indicate assemblage dominance by one or a few taxa. Because anatomy and fragmentation rates vary across faunal class, especially for invertebrates and fish, I used MNI to calculate diversity and evenness (Reitz and Wing 2008: 249). Taxa were aggregated by family (except in the case of Echinoidea, Amphibia and Cirripedia) to circumvent conflicts between overlapping taxonomic designations and to control for varying identification protocols between analysts. This procedure reduced the number of taxonomic categories by 21% to 24%, depending on period. Since most families are represented by a single species/genus, and where this was not the case, conspecifics/congeners in the assemblage tended to be ecologically similar, calculation of diversity and evenness statistics at the family level should not unduly mask relevant variation. Importantly, this approach maintains a larger sample size for more robust comparisons. I use the same procedure for the Grand Bay assemblage, employing the same standardized taxonomic categories used for Sabazan. Hence, diversity and evenness measures between sites are directly comparable, although richness counts (Table 5.9) are not.

At Sabazan, total assemblage diversity is greatest in the Middle period and the Late period and relatively lower in the Early and Final periods. Evenness similarly appears to decline over time from a high in the Early period to intermediate levels in the Middle and Late periods and a low in the Final occupation phase (Table 5.10). Sequential pairwise *t*-tests of diversity (Magurran 1988) were used with a Benjamini–Hochberg correction for multiple pairwise comparisons to test these trends. The Benjamini–Hochberg correction adjusts the significance level (α) with each sequential pairwise comparison to control the false discovery risk associated with multiple *t*-tests and provides a better balance between the risk of false positives and false negatives than the standard Bonferroni correction typically employed in such testing (Waite and

Campbell 2006). These tests indicate that differences in total assemblage diversity are statistically significant only between the Early and Middle period (Table 5.11). Given the limited sampling of the Early period, the diversity and evenness indices may not be truly reflective of the archaeofaunal population at this time. From the Middle period onward, however, it is clear that overall assemblage diversity remains fairly constant.

Closer inspection of Table 5.10, however, reveals differing trends for the separate invertebrate and vertebrate components of the faunal assemblage. While the vertebrate assemblage does not appear to change much over time in diversity or evenness (excluding the Early period), the invertebrate assemblage shows a notable decline in both indices. These trends are supported by Benjamini-Hochberg corrected *t*-tests that show no differences in vertebrate diversity after the Middle period, but a statistically significant decrease in invertebrate diversity between the Middle, Late, and Final periods (Table 5.11). Apparently, when the assemblage is treated as a whole, stable vertebrate diversity masks a trend for declining invertebrate diversity, and by extrapolation declining invertebrate evenness. Separating the vertebrate from the invertebrate components makes it clear that at Sabazan invertebrate exploitation increasingly focused on just one or a few taxa as time progressed.

Sabazan: Bony and Cartilagenous Fish

Fish are the largest vertebrate class in the Sabazan assemblage, about 86% of vertebrate NISP and MNI, and rank second in relative abundance only to gastropods for the assemblage as a whole. All but a single ray (Myliobatidae) specimen belong to ray-finned bony fish, Actinopterygii[2]. The preservation bias against cartilaginous shark and ray skeletons (Chondrichthyes: Elasmobranchii) may contribute to their rarity in the assemblage, as indicated for other coastal sites, such as those in the Channel Islands of California (Rick et al. 2002).

Fish counts are distributed over 35 mutually exclusive taxa in 24 families (Figure 5.3). Two additional taxa were recognized, based on consistent, distinctive traits of the anterior vertebrae, but could not be assigned to a family. These were labelled Taxon B and C and are included in NISP and MNI quantifications, but excluded from statistical analyses requiring taxon specific ecological information, such as tests of habitat patches exploited. Specimens which could only be assigned to superfamily or a combination of families, e.g., Lutjanidae/Serranidae, were quantified by NISP and retained within the identified sample for the additional habitat patch information they might provide.

While the number of fish families is large, most contribute relatively few individuals to the fish assemblage. Table 5.12 ranks fish by overall relative abundance with important families, those typically constituting at least 5% or more of fish NISP or MNI, appearing in bold print. By NISP and MNI, tunas and mackerels (Scombridae), parrotfish (Scaridae), and jacks, pompanos and scads (Carangidae) are the most abundant taxa, collectively accounting for 50 – 60% of sample. Surgeonfish (Acanthuridae), herrings and shads (Clupeidae), groupers and sea basses (Serranidae) and grunts (Haemulidae) are consistently present throughout most of site occupation at more moderate levels, ca. 4 – 13% of NISP or MNI.

Pronounced changes in relative abundance across time are evident for some of these seven common fish families (Table 5.12). To determine whether these changes are statistically significant, I applied chi square tests to the fish assemblage, aggregating taxa at the family level and excluding specimens identified above this level (e.g., Labroidei). Because of the number of

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[2] A single shark tooth was also observed in one of the samples that was not part of the analyzed dataset.

taxonomic categories, missing values, and low expected frequencies, *p*-values associated with the chi square statistics are computed using Fisher's exact method or a Monte Carlo approximation of the true significance based on 200,000 replicates. This procedure was employed, as appropriate, for all statistical assessments throughout this study, combining counts of specimens with overlapping taxonomic designations and assigning cf. designations to secure taxon counts.

Results of the chi square tests reveal significant changes in fish relative frequencies from each period to the next, except for the transition from the Early to Middle period, the later of which likely arises from the small Early period sample size (Table 5.13). The adjusted residuals associated with these tests indicate which specific taxa are responsible for the disparity between periods. The adjusted residuals appear as columnar values between the two periods to which they pertain. They are standard normal deviates whose sign reflects the increase (+) or decrease (-) in abundance as one moves from left to right (i.e., from the older to younger sample) (Everitt 1977). The associated *p*-values indicate whether the change in taxon abundance is significant at the 0.05 significance level (α); significant changes appear in bold print. For example, the change in Acanthuridae from the Middle to Late period is associated with an adjusted residual of 3.789 and a *p*-value of <0.001, indicating a significant increase in surgeonfish through time. The significance values for the adjusted residuals are distinct from that of the chi-square test as a whole, which appears at the bottom of the table. Note that an additional comparison has been made between the Final and the Middle periods by repeating the Middle period column on the right end of the table. In this case, adjusted residuals should be read from right to left, i.e., in chronological order.

Table 5.13 shows that between the Middle and Late period, increases in parrotfish and surgeonfish are significant. The large decline in jacks and scads is also significant, but not that of herrings. The increase in tunas is on the cusp of statistical significance ($p = 0.0502$). Interestingly, the 1.5% decrease in damselfish (Pomacentridae) also registers as a significant change between periods. In the transition to the Final Period, significant changes are detected for jacks and scads, which increase, and halfbeaks and tunas, which both decline in relative abundance. The decline observed in parrotfish, Scaridae, is not significant.

A chi-square test between the Middle and Final periods indicates that directed incremental changes, which did not register as significant from one period to the next, constitute significant changes over the long term. Through the last 400 – 600 years of site occupation, grunts, flyingfish (Exocoetidae), groupers, and snappers increased by small, but significant amounts in their relative contribution to the fish assemblage. Butterflyfish (Chaetodondidae) and porcupinefish (Ostracidae) also make statistically significant increases, but are represented by just a few individuals in the assemblage as a whole. Their increase in the Final period, therefore, may not be all that meaningful. Final period tuna fishing is not statistically distinguishable from that of the Middle period.

These changes may be better understood by grouping fish according to principal habitat occupied, focusing on the latter half of site occupation where sample sizes are larger. Here I consider habitat representation in terms of NISP as well as MNI since later assemblage-wide assessments of environmental patch exploitation rely on MNI. Habitat patch analysis reveals that from the Middle period onward, coral reef fish become increasingly abundant, while inshore/shallow water taxa decline (Figure 5.4). These changes are statistically significant as measured by both NISP and MNI (Table 5.14) and may be specifically attributed to the previously detected significant increases in the coral reef taxa of parrotfish, snappers, surgeonfish, and grunts and the decrease in shallow water carangids, in particular, bigeye scads (*Selar crumenophthalmus*) and members of the genus *Caranx* (Table 5.7 and 5.13).

Pelagic fishing does not statistically differ between the Middle, Late, and Final periods. This is unexpected in light of the significant decrease in the NISP of pelagic tunas and halfbeaks (Hemiramphidae) between the Late and Final periods (Table 5.13). Apparently, the increases in flyingfish (Exoceotidae) between the Middle and Final period and in the pelagic rough scad (*Trachurus lathami*) between the Late and Final phases is sufficient to offset these declines. These data suggest that the degree of offshore fishing at Sabazan remains relatively constant over time, but a shift occurs in terms of pelagic taxa targeted.

Sabazan: Mammals

Mammals account for 6.5% of vertebrate assemblage NISP (Table 5.7). Forty-two individuals were recorded representing four taxa: opossum (*Didelphis* sp.), armadillo (*Dasypus* sp.), agouti (*Dasyprocta* sp.), and rice rat (family Cricetidae, tribe Oryzomyini). All taxa except rice rats are known introductions from South America. The translocated mammals were assigned only to genus for reasons discussed in Giovas et al. (2012). Based on morphometric analyses, Turvey has preliminarily identified the rice rats remains as *Zygodontomys* sp., a genus found in Central and South America and the islands of Trinidad and Tobago. It is not yet clear, however, whether the Sabazan specimens represent an unknown endemic insular species or a mainland introduction (Samuel Turvey, personal communication 2013).

Fragmentary skeletal remains were assigned either to medium mammal, corresponding to an animal ~ 0.5 to 6 kg and most likely representing opossums or agoutis, or to small mammal, which corresponds in size to rice rats, but could include other small mammalian taxa. Considering the small size of the Early period sample, mammals, particularly rice rats, are surprisingly well represented, hinting that they may have been relatively important during the early occupation of the site. Rice rats dwindle over time relative to the introduced opossum and agouti, which exhibit marked increases in the Late and Final periods (Figure 5.5). Armadillos are rare at the site (NISP = 2) and were excluded from statistical assessments.

Chi square tests confirm the statistical significance of the observed trends (Table 5.15). The dramatic fall in rice rat numbers between the Early and Middle period and the Middle and the Final period is significant. Agoutis increase significantly in the Middle period, but exhibit no significant changes thereafter. Meanwhile, opossums register significant increases from the Middle to Late period and from the Middle to Final period. Despite the growing importance placed on introduced species as a component of mammalian foraging at Sabazan, however, Tables 5.7 and 5.8 indicate that mammals as a group decline over time relative to other vertebrates and invertebrates.

Sabazan: Birds and Herpetofauna

Birds constitute a very small portion of the assemblage, less than 1% of vertebrate NISP (Tables 5.7 and 5.8). Most bird remains in the assemblage occur as long bone shafts lacking diagnostic articular ends, precluding lower-level identification. The few taxa identified, Columbidae (doves and rock pigeons; NISP = 7) and Laridae (gulls; NISP = 1), are common among Carriacou's modern avifuana. The low numbers of birds in the assemblage is typical for Ceramic Age faunal assemblages (Newsom and Wing 2004). In light of their minor importance, birds and the single amphibian specimen recorded in the assemblage will not be discussed in further detail.

Among vertebrates, reptiles are slightly more abundant than mammals (7.1% NISP) but account for about half the number of individuals (MNI = 20). High rates of fragmentation and a lack of diagnostic attributes on post-cranial material mean that, with the exception of two *Iguana* specimens (probably *Iguana iguana*), most reptile remains can only be assigned to a higher level taxon. Collectively, lizards (Lacertilia) are slightly more common than snakes (Serpentes), but neither are especially abundant (Figure 5.6, Table 5.7). Sea turtle (Cheloniidae) remains are relatively numerous (NISP = 368), but excessively fragmentary, inflating their relative contribution to the assemblage. As an alternative indicator of relative abundance, MNI counts are also problematic. Cheloniidae MNI in this study is primarily an artifact of aggregation procedures—the protocol of calculating the minimum number of individuals by stratum and trench—rather than the repetition of a given element in the assemblage.

Grouping snakes collectively and comparing their NISP-based abundance with that of iguanas and sea turtles reveals that there are no significant changes in taxonomic relative frequency between either the Middle and Late periods ($\chi^2 = 0.94$, Fisher's exact $p = 0.795$), the Late and Final periods ($\chi^2 = 0.05$, Fisher's exact $p = 1.0$), or Middle and Final periods ($\chi^2 = 1.92$, Fisher's exact $p = 0.335$). The Early sample was excluded from this statistical assessment because of its small size. The reptilian taxa targeted, thus, do not appear to vary over time at Sabazan. Exploitation of reptiles as a class, in relation to all other faunal classes, remains steady throughout site occupation at under 4% NISP (Table 5.8).

Sabazan Molluscs: Gastropods, Chitons, and Bivalves

Molluscs, comprising gastropods, chitons and bivalves, make up about 38% of invertebrate NISP, but constitute nearly 90% of the invertebrate assemblage as measured by MNI (Table 5.7). The minimum numbers of individuals is used to compare invertebrate taxa in this study to offset quantification disparities that arise from the wide variance in body plans and differing rates of fragmentation between invertebrate classes (Table 5.7). Molluscan MNI values exclude strombid conchs, which are discussed separately below. Snails (Gastropoda) dominate the invertebrate assemblage (69.9% MNI), followed by chitons (Polyplacophora) (11.4% MNI), and bivalves (Bivalvia) (8.5% MNI).

Gastropod species include marine and terrestrial snails, but the dietary significance of the latter is unclear (see discussion in Gutiérrez Zugasti 2011). The presence of land snails in the assemblage may arise from their having taken advantage of commensal opportunities presented by village middens in the past. The most important gastropods are two rocky intertidal taxa: the West Indian top snail, *Cittarium pica* and nerites of the genus *Nerita*, primarily *Nerita tessellata*. Both top snails and nerites constitute just over 40% each of the gastropod sample as measured by NISP *(*Figure 5.7). Other gastropods are rare by comparison. Fragmentation rates for top snails are high because the nacreous portion of the shell is prone to splitting and flaking. To control for this effect, nacre fragments were quantified separately from larger shell remains (Tables 5.7 and 5.8). High separate nacre counts (NISP = 211) in combination with low MNI values (n = 14) suggest that the relative contribution of *C. pica* to the assemblage is overestimated. Still, as a source of raw material for the manufacture of ornaments and tools, such as the fishhooks recovered from Grand Bay and Sabazan (Figure 4.17), top snails were probably important.

Chi square tests indicate statistically significant differences in taxonomic composition across all time periods (Table 5.16). Between the Early to Middle periods, this is due to a decrease in *C. pica*, despite exclusion of nacre specimens from the tests, and in the terrestrial snails *O. undatus* and *Pleurodonte* sp. The Early period sample is small, though, and conclusions should be drawn from these results with caution. Collectively, nerites increase significantly in the Middle period, driven by rising counts of *N. tessellata*, the tessellated nerite (Table 5.7). Between the Middle and Late period, another small rocky intertidal snail, *Supplanaxis nucleus*, increases. In the Final phase of site occupation, *O. undatus*, *Pleurodonte* sp. and *C. pica*, again register significant decreases in abundance, while nerites continue to increase significantly. Long-term comparisons between the Middle and Final periods generally confirm these trends, except in the case of *C. pica* exploitation, which remains statistically unchanged. This last chi square test also indicates a significant decrease in the spotted slipper snail, *Crepidula maculosa*, an epibiont with unclear dietary significance—it may have entered deposits hitchhiking on the shells of larger molluscs, although subsistence exploitation is equally possible.

In sum, land snails decrease in Sabazan's deposits over time, West Indian top snail exploitation remains relatively constant or perhaps decreases slightly, and nerites make strong and steady increases through most of time. By the end of site occupation, nerites account for more than 56% of the gastropod NISP, 83% of the identified gastropod individuals, and 63% of invertebrate MNI. Along with conch, they are the one of the most important taxa exploited at Sabazan.

Chiton remains are abundant in the invertebrate sample and are found in all periods, generally increasing through time (Figure 5.7). Collectively, they represent roughly a fifth to a quarter of the molluscan assemblage from the Middle period onward. Their contribution to assemblage NISP, however, is amplified by their anatomical structure, eight valves versus the one or two of gastropods and bivalves. By MNI, chitons account for a smaller proportion of identified molluscs, 10% to 15%, but remain among the top ranked taxa. Of the three species identified, statistically significant changes in relative abundance are apparent for two (Table 5.17). *Chiton tuberculatus* increases relative to *Acanthopleura granulata* between the Middle to Late period and remains the top ranking chiton species through to the end of site occupation.

Bivalves are present at Sabazan in low to moderate levels. Of nine distinct taxa identified, only mussels (Mytilidae), represented by *Brachidontes* sp. and possibly *Ischadium recurvum*, appear in any substantial numbers. Their relative abundance falls after the Middle period until, by the close of site occupation, it is on a par with other bivalves. Statistically significant differences in taxonomic composition over time were not detected, however (Early to Middle period: N/A; Middle to Late period: $\chi^2 = 9.44$, $p = 0.216$; Late to Final period: $\chi^2 = 2.76$, $p = 0.741$).

Sabazan: Strombid Conchs

As previously discussed, conchs (Strombidae) were quantified both in the field for larger specimens and in the lab as part of the analysis of screened material (Table 5.4). Unfortunately, this approach means that conch abundance cannot be directly compared to that of other molluscs. However the data do make clear that strombids, which includes both the larger queen conch, *E. gigas*, as well as smaller species, are abundant (MNI = 88) and were heavily exploited, especially after AD 1000. The density of conch remains is relatively high considering their size—queen conch can attain a maximum length of 35 cm (Rosenberg 2009)—in relation to the small volume of soil excavated, and the fact that conch specimens tend to be concentrated in the upper deposits of the site. Conch MNI is not quantified for the Early period because no apices were encountered, even though smaller shell fragments were recorded. Conchs increase considerably between the Middle and Late periods (+375%), and between the Late and Final periods (+163%), a dramatic increase that cannot be accounted for by sample size (Figure 5.10). This pattern matches field observations that conch shells were encountered more frequently in the uppermost levels of the excavation, but tapered off in lower deposits.

Sabazan: Sea Urchins, Crabs, and other Invertebrates

The remaining invertebrate sample consists of sea urchins (class Echinoidea), crabs (order Decapoda), and a single barnacle specimen which likely entered the assemblage as an epibiont and will not be considered further (Table 5.7). Echinoids were not identified beyond the class level, due to a lack of comparative material. Sea urchin tests are fragile, resulting in high specimen counts, about 33.5% of invertebrate NISP. The number of identified urchin specimens increases somewhat over time, but MNI counts, which are quite low, remain relatively flat at around 5% of the invertebrate assemblage for any given period. Overall, sea urchin exploitation does not appear to change and they are relatively unimportant at Sabazan.

The identifiable decapod remains come from marine and terrestrial crabs. Like urchins, decapods are heavily fragmented, accounting for the high rate of NISP (n = 1089) relative to MNI (n = 18) and the low rate of identification. Just 5% by NISP of the decapod assemblage is identified to family or below. Of those specimens, terrestrial crabs of the family Gecarcinidae, including the blue land crab, *Cardisoma guanhumi*, and members of the genus *Gecarcinus*, are the most abundant. These taxa are common at low elevations near the shore on Carriacou today. In light of the skewness of the sample toward indeterminate decapods, statistical tests for changing taxonomic composition were not performed. On a final note, there is no evidence to support a “dichotomy” of land crabs and top snails (this is discussed in greater detail in Chapter 9). As a percentage of invertebrate MNI, Gecarcinidae and *C. pica* relative abundances do not vary in opposition to each other over time, but instead both increase in the Middle period, then briefly stabilize or decline steadily through the remainder of the sequence.

Sabazan: Vertebrate and Invertebrate Comparisons

Interclass exploitation is compared over time for the vertebrate and invertebrate assemblages in Figures 5.11, 5.12, 5.13, and 5.14. Generally, similar temporal trends are recorded by both NISP and MNI for the vertebrate classes. Fish always represent at least two thirds of the assemblage by NISP or MNI, making them the dominant vertebrate class. They are most abundant in the Middle period, but thereafter exhibit declining relative frequencies. Mammal and reptile exploitation in the Early period is relatively high compared to later periods, but this may be due to the effects of small sample size. Otherwise, these two classes fluctuate at low to moderate levels of between about 2% to 10% of NISP or MNI. Reptile NISP, however, increases during the final half of the temporal sequence, but this increase is not mirrored in MNI. Birds and amphibians are very minor contributors to the assemblage, fluctuating at values under 2% of NISP or MNI.

For the invertebrate assemblage, NISP and MNI record somewhat different temporal trends depending on the class (Figure 5.13 and 5.14). As discussed earlier, for comparisons across invertebrate classes the use of minimum number of individuals is deemed more appropriate.

Based on MNI, the most striking trend evident is the 10% increase in gastropods from the Middle period to the Final period where they account for three-quarters of the identified invertebrate assemblage. At the same time, decapods decrease from 7.8% to 2.5% of MNI, and bivalves decline by nearly half, down to 6.6% of invertebrate MNI by the Final period. Other taxa fluctuate minimally over time, indicating fairly stable rates of exploitation relative to other invertebrates.

The relationship of vertebrate to invertebrate exploitation is illustrated in Figure 5.15 based on sub-assemblage MNI (Table 5.8). For the sub-assemblage, the invertebrate and Early period vertebrate components are the same as the full assemblage, but the remaining Middle, Late, and Final period vertebrate samples are a smaller sub-sample of their respective counterparts in the full dataset (Table 5.7). To ensure these sub-samples are representative of the full analyzed sample, data were aggregated by family and chi square tests were used to check for statistical differences based on MNI. None were detected between any of the periods allowing additional statistical tests based on the sub-assemblage to proceed (Middle period: $\chi^2 = 9.98$, $p = 1.0$; Late period: $\chi^2 = 12.71$, $p = 0.977$; Final period: $\chi^2 = 4.64$, $p = 1.0$).

The data indicate a clear trend for declining vertebrate exploitation and increasing invertebrate exploitation over time that is statistically significant between the Late and Final ($\chi^2 = 5.12$, $p = 0.024$) and Middle and Final periods ($\chi^2 = 14.91$, $p < 0.001$) (Figure 5.15). Figure 5.16 reveals that this trend is being driven by a 21% overall increase in gastropod individuals. By the end of occupation they constitute just over 57% of the assemblage. Chitons increase marginally over the same period. Mammals and decapods decrease over time, making minimal contributions to diet by the end of site occupation. Fish experience the largest decrease, declining 15% between the Middle and Final periods. After removing the single barnacle (Cirripedia), statistical comparisons indicate that the decrease in fish and increase in gastropods are significant between the Middle and Final periods ($\chi^2 = 21.69$, $p = 0.004$) (Table 5.18).

These changes were examined at a finer scale using family-level aggregations of taxa for chi square tests (Table 5.19). Rare families, those recorded just once in the sub-assemblage, are excluded. The most noteworthy change is the significant increase in nerites between the Middle and Final periods. Coquina clams (Donacidae) and planaxis snails also register a significant increase during this phase, while slipper snail frequencies fall significantly by the end of occupation. No fish family registers any statistically significant change in relative frequency, although the majority of the associated adjusted residuals for both the Late to Final and Middle to Final period comparisons tend to be negative (i.e., decreasing values). Since the class-level chi square comparisons (Table 5.18) indicate a significant decrease in fish as a whole, these data together suggest that the decline in fishing at Sabazan is spread out over almost all the fish taxa. Thus, the loss registered by any one family in relation to the entire assemblage is limited. By contrast, the increase in gastropods is attributable to specific taxa: nerites and planaxis snails. Nerites are by far the more important taxon.

Sabazan: Habitat Patches

To gain insight into how environmental patches were exploited by Sabazan's occupants through time, I reorganized the sub-assemblage data according to prey habitat type (Table 5.20). Fauna were assigned to one of five habitats: coral reef, inshore and shallow water, rocky intertidal, pelagic, and terrestrial. Taxa that could not be readily assigned to a single dominant habitat because identifications lacked specificity or because individuals could be found in multiple environments were excluded from analysis.

Figure 5.17 reveals that exploitation of rocky intertidal taxa climbs throughout site occupation, and that by the Final period nearly two-thirds of individuals in the assemblage come from this habitat. After the Middle period, prey exploitation in all other habitats declines. Statistical assessment indicates that these changes are significant across the span of the Middle period to the Final period for all habitat types except pelagic (Table 5.21). The increased exploitation of rocky intertidal taxa and declining use of inshore/shallow water habitats is consistent with statistically significant trends for an increase in the collection of nerites and planaxis snails and a decrease in jacks and scads. Despite earlier tests for Sabazan, which indicated fishing increasingly targeted coral reef species, chi square habitat comparisons show that exploitation of this habitat patch as a whole declined. Since coral reef habitat in this study is represented primarily by fish such as parrotfish, surgeonfish, groupers and grunts, this finding supports the previous assessment that overall fishing declines though time at Sabazan. Declining absolute abundances of fish (based on sub-assemblage MNI by period) do not correlate with sample size ($r = +0.957$, $p = 0.187$), indicating that lower fish numbers cannot be explained by sample size effects.

5.5.2 The Grand Bay Assemblage: Overview

Faunal assemblage data for Grand Bay are presented in Table 5.22 (invertebrate data by provenience and screen fraction are provided in Appendix D). The vertebrate material comes from the uppermost levels of the site and represents the last stage of midden deposition, ca. AD

1000 – 1250. These deposits correspond roughly to the Late period at Sabazan, dated to AD 1000 – 1150. The invertebrate assemblage spans the Early Period occupation, beginning ca. AD 650, through to the end of the Late period. Grand Bay's stratigraphic sequence from the Early to Late period corresponds roughly with Sabazan's Early, Middle, and Late periods, ca. AD 600 – 1150 (Tables 5.5 and 5.6). Following the same protocols employed at Sabazan, a sub-assemblage dataset was created for appropriate comparison of the invertebrate and vertebrate fauna from Grand Bay's Late period, based on Trench 446 stratum L002, since sampling between these two groups was uneven (Table 5.23).

For the invertebrate assemblage, approximately 66% of specimens could be identified (NISP = 4393), representing 951 individuals. An additional 442 specimens were identified only to class, and boost invertebrate MNI to 952. Lefebvre's (2005) vertebrate analysis identified 1415 specimens below class, roughly 30% of the analyzed sample (n = 4785). As stated earlier, the vertebrate MNI count (n = 125) presented here is slightly higher than that arrived at by LeFebvre (2005, 2007) because I recalculated MNI values to follow protocols used at Sabazan. An additional 3370 vertebrate specimens could only be assigned to the class level, of which > 99.5% are indeterminate fish remains. The elevated counts of indeterminate fish in the Grand Bay assemblage relative to Sabazan reflect LeFebvre's quantification of unidentifiable fish specimens from the 1.6 mm fraction of the sample, a task that I did not perform for Sabazan. LeFebvre did not quantify indeterminate vertebrate remains.

Taxonomic richness, diversity, and evenness were derived using the same protocols employed for Sabazan (Tables 5.09 and 5.10). Thirty-four mutually exclusive invertebrate taxa are recorded for the Early period, 25 for the Middle-L005 phase, 29 for the Middle-L003 phase, and 49 for the Late period. Thirty-four distinct vertebrate taxa are recorded in the Late period for a combined invertebrate-vertebrate richness of 83 taxa. Sample size (NISP) and richness are not correlated for invertebrates (r = +0.945, *p* = 0.055). Species and family richness is higher for invertebrates at Grand Bay compared to Sabazan, possibly because the samples are larger and come from a wider assortment of contexts. Many of the same taxa rank highly at both sites, however.

Diversity and evenness for the combined vertebrate and invertebrate samples in the Late period are somewhat lower than those of Sabazan for the same time period (Table 5.10). For the invertebrate assemblage, diversity and evenness are highest in the Early period, intermediate in the Middle-L005 phase, and at their lowest in the Middle-L003 phase. Indices rebound to intermediate levels in the Late period. Pairwise *t*-tests of diversity (Magurran 1988) with a Benjamini-Hochberg correction indicate that differences in total assemblage diversity are statistically significant between all period pairs tested, except for the Middle-L005 and Final period (Table 5.11). In general then, invertebrate diversity and evenness are lower at Grand Bay after the Early period, suggesting a focus on one or two more dominant taxa during the later half of occupation.

Grand Bay: Bony and Cartilagenous Fish

Most of the vertebrate assemblage (94.8% NISP or 82.5% MNI) is composed of fish remains, all of which, with the exception of two shark tooth specimens, belong to ray-finned bony fish (LeFebvre 2007). Twenty-five mutually exclusive taxa are distributed over 17 families, plus the sub-class Elasmobranchii (Figure 5.18, Table 5.3). Of these, herrings, parrotfish, surgeonfish, triggerfish, grunts, snappers, and jacks/scads each account for 5% or more of NISP or MNI

(Table 5.24). The remaining taxa each represent < 5% of the fish assemblage. Noticeable in its absence from the top ranking taxa are tunas/mackerels. In general, many of the same fish families are found at both Grand Bay and Sabazan, and the genera and species represented within these families are similar, although *Trachurus lathami* is not recorded among carangids at Grand Bay.

Because the analyzed vertebrate assemblage comes entirely from the Late period, temporal comparisons of taxonomic relative abundance are not possible for fish and other vertebrates. To determine how marine patches were foraged, I examined fishing by habitat type (Figure 5.19). Nearly 60% of the identifiable fish specimens belong to coral reef taxa, while pelagic fish account for about a third of the sample. Inshore/shallow water taxa representation is less than 10%. As at Sabazan (Figure 5.4), MNI quantifications enhance the relative representation of inshore/shallow water taxa. Statistical tests are employed later in the chapter to determine whether these patterns are significant.

Consistent with the data presented here, LeFebvre (2007) characterized the fish assemblage as emphasizing coral reef exploitation. For the Late period deposits, she argued that the relative abundance of coral reef fish is counter to expectations derived from common Caribbean zooarchaeological trends in which the early depletion of coral reef taxa is subsequently offset by increased fishing of pelagic and shallow water/inshore species. Additional vertebrate samples from earlier deposits are necessary to confirm this assessment, but it is worth noting that the same characterization may be made for the Sabazan fish assemblage. The NISP-based relative representation of each habitat type is virtually identical between the two sites for the Late Period but differs somewhat when based on MNI (Figures 5.4 and 5.19).

Grand Bay: Mammals

Mammals represent 2.4 % of the identified vertebrate assemblage (NISP = 109, MNI = 12) (Table 5.9). Introduced taxa—opossum, agouti, and a single specimen of capromyid rodent[3]—are present at low to moderate levels (Figure 5.20). Rice rat is the most abundant mammal, however, accounting for about one fifth of identified specimens and half the number of individuals. In addition, four specimens of domestic guinea pig (*Cavia porcellus*) and two of peccary, *Tayassu*/*Pecari* sp., were recovered from stratum L002 at Grand Bay, but are not part of the analyzed sample. These latter two taxa are native to South America but have been recorded sporadically from archaeological contexts in the biogeographic Caribbean, primarily in the Greater Antilles (Giovas et al. 2012; LeFebvre and deFrance in review).

Grand Bay: Birds and Herpetofauna

Birds form a very small component of Grand Bay's vertebrate assemblage, less than 1% of NISP. A single specimen was identified to Columbidae. The remainder of the sample could not be identified below class. Frogs/toads (Anura) are extremely rare (Table 5.22).

Reptile abundance is roughly comparable to that of mammals by numbers of specimens (2.5% NISP), but reptiles account for fewer individuals (MNI = 7) (Figure 5.21, Table 5.22). Taxa present are the same at those at Sabazan and include iguanas, snakes, and sea turtles. Sea turtle is the most abundant reptile by NISP, representing 73% of the reptile assemblage. Specimen fragmentation plays a role in these high counts however. Just three individuals are

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[3] Additional analysis of Grand Bay vertebrate fauna has put the identification of the capormyid specimen in question, requiring further confirmation (LeFebvre, personal communication 2013)

identified. As at Sabazan, this MNI value reflects aggregation protocols rather than repetition of diagnostic skeletal elements.

Grand Bay Molluscs: Gastropods, Chitons, and Bivalves

The majority of the invertebrate assemblage is composed of molluscs. Gastropods are the most abundant (72.1% MNI), followed by chitons (19.5% MNI), and bivalves (5.8% MNI). These counts do not include conchs which are discussed later.

Three gastropod taxa are relatively common as measured by either NISP or MNI: nerites, West Indian top snail, and slipper snail (Figure 5.22). Among the nerites, *N. tessellata* is the most plentiful, but *N. versicolor* is also abundant. *Nerita peloronta*, the largest nerite species in the region, is relatively rare in the sample. This distribution mirrors the relative abundance of these taxa in their natural environment, that of rocky intertidal shorelines (Axelsen 1968). Slipper snails are about four times more common in the Grand Bay gastropod assemblage than at Sabazan, and specimens tended to be larger based on qualitative observations made during analysis.

Treating nerites collectively and excluding West Indian top snail nacre counts, statistically significant changes are detected for many taxa across all periods in the chronological sequence by chi square tests (Table 5.25). Here, I focus on significant trends for major taxa. Nerites make dramatic, statistically significant increases in abundance in the L005 phase of the Middle period, and then again in the L003 phase, before declining in the Late period to levels that are statistically indistinguishable from the Middle-L005 period. *Cittarium pica* shows the reverse trend with a notable decline between the Middle-L005 and Middle-L003 phases, followed by a substantial increase in the subsequent Late period. Direct comparison between the Middle-L005 and Late period frequencies, however, indicates a small but significant decrease over this ca. 400 year period. Slipper snails decrease significantly in from the Early to Middle-L005 periods with no significant change in abundance thereafter. Lastly, although they are not among the top taxa, Grand Bay orthalicid and pleurodonte tree snails exhibit a significant increase in abundance toward the end of site occupation. Interestingly, this differs from the trend observed for Sabazan where terrestrial snails decline significantly over time.

Perusal of Table 5.25 reveals curious reversals of relative frequency trends during the Middle-L003 period for a number of taxa, including nerites and West Indian top snail. The L003 phase of the Middle period is based on samples from a discontinuous stratum (L003) drawn from an area near a large, ashy pit feature (F0179) in Trench 446. Elsewhere in the site, including the adjacent Trench 415, deposits from the Middle-L005 period are immediately overlain by Late period (L002) sediments. In these instances, a direct comparison between the Middle-L005 and Final periods (i.e., the far right column of Table 5.25) is more appropriate. Setting aside the Middle-L003 for the moment and focusing on the transitions between the Early and Middle-L005 and Middle-L005 and Late periods, several temporal trends are evident (Table 5.25). Nerite exploitation increases significantly in the Middle-L005 period and thereafter remains steady. West Indian top snail decreases across occupation, but this decline only registers as statistically significant between the Middle-L005 and Late periods. *Crepidula* numbers decline in the Middle-L005 phase and do not subsequently change. As well, no statistical change in Orthalicidae is recorded but Pleurodontidae increases significantly in the Late period.

With five species recorded, Grand Bay chiton richness is slightly higher that at Sabazan but the same two taxa, *C. tuberculatus* and *A. granulata,* dominate the assemblage (Figure 5.23).

From the Middle-L005 period onward, *C. tuberculatus* increases while *A. granulata* declines. Both trends are significant and echo patterning seen at Sabazan (Table 5.26).

Of the 12 distinct bivalve taxa identified at Grand Bay, most are comparatively rare, except the mussel (*Brachidontes* sp.), the gaudy asaphis (*Asaphis deflorata*) and the tiger lucine (C*odakia orbicularis*) (Figure 5.24). These species are found within sand in shallow water or, in the case of the mussel, attached to rocks and algae (Rehder 1981). A significant increase in mussels occurs between the Middle-L005 and Late periods. The gaudy asaphis declines between the L005 and L003 phases of the Middle period and also between the Middle-L005 and the Late periods (Table 5.27). Significant changes in abundance register for a few other bivalves, but can be disregarded since these taxa are rare.

Grand Bay: Strombid Conchs

A minimum of 2405 conch individuals were identified from specimens recorded in the field and from analysis of screened material (Table 5.3). Species level identifications were not made by the field crew at Grand Bay, but virtually all the specimens I observed at the site belong to *E. gigas*. Figure 5.25 indicates a sizeable increase in the MNI of conch species from all excavated contexts of Stratum L002 (Late period). In fact, 69.1% of all conch MNI come from this uppermost deposit. Although conchs are not integrated into the rest of the assemblage quantification, I attempted to estimate conch abundance relative to other taxa. To do this I took the conch MNI counts for the contexts that were analyzed for the rest of the invertebrate assemblage and divided this value by four to obtain an adjusted MNI that takes into account the 50 × 50 cm environmental square sampling approach used in excavation. The adjusted MNI was then added to the invertebrate MNI counts for each period to obtain an estimated relative abundance for conch (Figure 5.26). The results support an increase in conch exploitation over time, but suggest that this actually begins somewhat earlier in the Middle-L005 period, ca. AD 850-1000. Interestingly, the frequency reversal observed for several other gastropod taxa in the Middle-L003 period is also seen in conchs, which decline in relative abundance at this time. Excluding the L003 sample, conchs increase from about 2% of invertebrate MNI in the Early period to around 6% in the Middle-L005 period and remain at that level until the end of occupation.

Grand Bay: Sea Urchins, Crabs, and other Invertebrates

The remainder of Grand Bay's analyzed invertebrate assemblage is made up of sea urchins, decapods, and a single barnacle specimen. Although overall sample size is larger at Grand Bay, the number of echinoid specimens recovered is less than half that of Sabazan. Echinoid abundance generally increases over time as measured by NISP, but MNI for this fragmentary taxon is persistently low and it appears to be of minimal importance. The Grand Bay decapod assemblage is also comparatively smaller than Sabazan's. Most crab remains are not identifiable below order. Of those that are identifiable to a lower taxonomic level, terrestrial gecarcinid land crabs, as a group, account for most of the remains. The identified crab sample is too small to detect any clear, reliable trends, but, collectively, decapods show minor decreases in MNI over time. The significance of this pattern is pursued as part of the interclass comparisons in the following section.

Grand Bay: Vertebrate and Invertebrate Comparisons

Interclass exploitation is compared for the vertebrate and invertebrate assemblages on the basis of NISP and MNI in Figures 5.27, 5.28, 5.29, and 5.30. These data are based on the vertebrate and invertebrate assemblages presented in Table 5.22. Temporal comparisons are not possible for the vertebrate assemblage, but the relative levels of exploitation for all faunal classes at the site may still be examined. The Late period corresponds to stratum L002 and represents the uppermost deposit at Grand Bay and the end of occupation. Whether quantified by NISP or MNI, it is clear that there is a very heavy emphasis on fish relative to other vertebrates during this time (Figure 5.27). Contributions from mammals and reptiles are very low, and those from birds and amphibian are miniscule. The NISP-based data suggest a somewhat heavier emphasis on fish at Grand Bay compared to Sabazan. However, it must be recalled that indeterminate fish remains from the 1.6 mm screened fraction were not quantified for Sabazan while they were for Grand Bay. This may account for the difference. Since indeterminate fish remains do not contribute to the minimum number of individuals, MNI counts are not impacted by this analytic difference. By MNI, relative rankings of vertebrate faunal classes are identical to Sabazan and relative frequencies by MNI are extremely similar (Figures 5.12 and 5.28).

Looking at the MNI data for the invertebrate assemblage, a notable increase in gastropods over time is evident (Figure 5.30). Chitons fluctuate through the sequence while bivalve and decapod relative abundances fall. Sea urchin and barnacle contribution to the assemblage is negligible. The trends for gastropods, bivalves and crabs are similar to those seen for these classes/orders at Sabazan.

Vertebrate-invertebrate comparisons for Grand Bay rely on the MNI-based sub-assemblage data from Table 5.23. I applied chi square tests at the family level to ensure that the sub-assemblage did not differ significantly from the full vertebrate and invertebrate assemblages in taxonomic composition and abundance. No statistical differences between sub- and full assemblages were detected, allowing the sub-samples for Late period vertebrates and invertebrates to be combined into a single assemblage for interclass comparisons (vertebrates: $\chi^2 = 3.76$, Fisher's exact $p = 1.000$; invertebrates: $\chi^2 = 31.53$, Monte Carlo $p = 0.435$). Figures 5.31 and 5.32 show how MNI is distributed across classes in the Late period. As at Sabazan, invertebrates account for about two-thirds of the sample. Constituting nearly half the assemblage, gastropods are the most well represented class, followed closely by fish. Chitons are present in moderate levels and are clearly more plentiful at Grand Bay than at Sabazan. Mammals are a minor class. All other taxonomic groups account for about 1% or less of assemblage MNI.

Chi square tests for changes in the relative abundance of invertebrate classes suggest gastropod increase at Grand Bay is probably significant over the span of Early to Late occupation, ca. AD 650 – 1250 (Table 5.28)[4]. Tests also reveal that bivalves and decapods decrease significantly by the end of site occupation.

Grand Bay: Habitat Comparisons

Following the same procedures used for Sabazan, I aggregated Grand Bay's Late period vertebrate and invertebrate taxa according to habitat patch using the vertebrate-invertebrate comparative sub-assemblage data from Table 5.23 (Table 5.29). As revealed in Figure 5.33,

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[4] The adjusted residual associated with gastropods becomes significant ($\alpha = 0.05$) with just one less gastropod individual in the Early period sample, i.e. MNI = 67 instead of 68 ($z = 2.005$, $p = 0.045$).

slightly more than half the taxa exploited at Grand Bay come from the littoral and rocky intertidal habitat patch. Coral reef species rank second, followed closely by those from inshore and shallow water environments. Terrestrial and pelagic taxa make a small sample contribution of about 10% combined. Notably, at Grand Bay, coral reefs rank ahead of inshore and shallow water patches, in inverse order to that seen at Sabazan. Overall, the relative frequencies and rank orders of environmental patches suggest that rocky intertidal habitats and coral reefs were somewhat more heavily emphasized at Grand Bay during the Late period. Inshore/shallow water, terrestrial, and pelagic habitats were not quite as important as at Sabazan. The sample size of Sabazan's MNI-based sub-assemblage is relatively small (MNI = 101), however, so further assessment, including statistical analysis, is necessary to determine whether meaningful differences exist between the faunal exploitation patterns recorded for Grand Bay and Sabazan. This is the subject of the following chapter.

5.6 Summary of Zooarchaeological Findings

Zooarchaeological data for Sabazan span the Early to the Final periods, or ca. AD 600 – 1400. The Early period sample is small, however, and cannot support robust interpretations. In reviewing the major zooarchaeological trends for Sabazan, I focus on the period after ca. AD 800, that is, from the Middle Period onward.

Fish and marine gastropods are the most important taxa at Sabazan, reflecting a focus on the marine environment that is typical of Lesser Antillean assemblages. Exploitation of these two classes changes over time. Driven primarily by increases in nerites, especially *N. tessellata*, gastropod collection increases through site occupation while overall fish numbers decline. These changes are reflected in a changing reliance on different habitats, specifically a shift toward rocky intertidal patches and away from coral reefs and inshore and shallow water environments. Rocky littoral habitats are increasingly exploited for nerites beginning around AD 800 and intensifying after AD 1000. West Indian top snails contribute to this trend early on, but their exploitation subsequently declines after ca. AD 1000. Chitons are a moderate, but consistent component of rocky intertidal foraging across time.

Between ca. AD 800 – 1400, fishing of coral reef and shallow water inshore habitats collectively declines. Pelagic fishing remains steady across site occupation, but there is a shift after AD 1000 toward increased exploitation of flyingfish and the rough scad, *T. lathami*, while halfbeaks disappear from the assemblage. Tunas fluctuate somewhat over time, but always remain an important, top ranking fish taxon. Herring contribution to the pelagic fishery remains relatively constant through all periods. At the same time that the overall fish catch is declining, fishing by Sabazan's inhabitants increasingly targets major coral reef taxa such as parrotfish, surgeonfish, snappers, grunts, and groupers, at the expense of inshore and shallow water species like jacks (*Caranx* sp.) and the bigeye scad. Other shallow water taxa such as sea urchins and marine turtles appear to have been exploited at fairly consistent levels, with little change in relative abundance. Sea turtle use may be underestimated if animals were processed on the beach and meat returned to the site, leaving behind the carcass.

Use of terrestrial resources also decreases over time, driven by changes in the abundance of specific taxa rather than any one faunal class as a whole. This is illustrated by the land snails *O. undatus* and *Pleurodonte* aff. *perplexa* which decrease after AD 1000 at the same time that overall gastropods increase at the site. Mammals and reptiles are a consistent component of the terrestrially-based diet at Sabazan, and, collectively, their contribution to the assemblage is relatively unchanged over time. Between AD 800 – 1000 rice rats decline in abundance supplanted by the introduced commensal species opossum and agouti. Iguanas are the only other large terrestrial vertebrate exploited at Sabazan. Their use may have increased somewhat after AD 1000, although a larger sample size is needed to confirm this. Land crab dietary contribution is difficult to evaluate because of specimen fragmentation, but on the whole, they seem to be of relatively minor dietary importance on a par with bivalves.

Lastly, the data suggest increasing strombid conch collection beginning around AD 1000. Conch counts have been excluded from the overall assemblage due to methodological issues previously discussed. The inclusion of this gastropod within assemblage quantification could potentially alter the observed foraging trends discussed above. Conchs are shallow, inshore water species generally found in and around sea grass beds and sand flats (Davis 2005; Ray and Stoner 1995). If the trend for increased conch exploitation in the Late and Final periods is genuine, this might minimize or even reverse the decline in shallow water/inshore habitat foraging observed for the main assemblage. Additional research is needed to investigate this possibility.

Unfortunately, Grand Bay's vertebrate assemblage can only be explored as a "snapshot" in time because data are available for the Late period only. The invertebrate assemblage, however, comes from deposits spanning the Early period through to the end of the Late period, or ca. AD 650 to AD 1250. As at Sabazan, the marine environment is the focus of faunal resource exploitation, with gastropods and fish the most important taxonomic classes during the Late period, ca. AD 1000 – 1250. Chiton, which are about twice as abundant at Grand Bay than Sabazan, figure prominently along with nerites in the exploitation of rocky intertidal habitats. This environmental patch is the most well represented in the Grand Bay assemblage, followed by coral reefs and shallow water/inshore habitats. Representation of pelagic and terrestrial habitats is about equal, but neither is strong.

Relative to other environmental patches, the coral reef component of Grand Bay's faunal assemblage is almost a third again as large as Sabazan's. This strong representation is due to the fact that three of the top five fish by NISP or MNI are coral reef taxa: parrotfish, surgeonfish, grunts, and/or triggerfish. Interestingly, triggerfish are relatively uncommon at Sabazan. Shallow water and inshore environments rank just below coral reef habitats in terms of relative exploitation. Jacks, bigeye scads and sea turtles account for most of the identified specimens from this habitat patch. As at Sabazan, sea turtle remains suffer from high rates of fragmentation and possible transport issues that complicate a straightforward assessment of turtle relative abundance. Also similar to Sabazan, conchs at Grand Bay exhibit evidence for intensifying exploitation over time, beginning around AD 850 – 1000. Here, again, exclusion of conchs in assemblage quantification might mask a relatively higher level of inshore/shallow water habitat use.

The pelagic fishery at Grand Bay is largely focused on herrings/shads, with moderate contributions from flyingfish and tunas. Tunas are not exploited at Grand Bay in the high levels seen at Sabazan, where they are a top ranking taxon from ca. AD 800 onward. The pelagic rough scad, *T. lathami*, and halfbeak (Hemiramphidae), which occur at Sabazan, are not recorded for Grand Bay.

The terrestrial patch is the poorest represented habitat at Grand Bay. Among terrestrial mammals, rice rats outnumber opossums and agoutis. Terrestrial reptiles include snakes and lizards, including specimens of iguana, but are not particularly abundant. Birds are rare.

The invertebrate assemblage reflects escalating levels of rocky intertidal exploitation with increases in nerites, especially *N. tessellata* and *N. versicolor*, and in chitons, particularly *C. tuberculatus*, driving this trend after AD 850. *Cittarium pica* contributes to this pattern with a significant increase in abundance after AD 1000 in the Late period. Bivalves as a class decline over time. Among bivalves, the exploitation of infaunal taxa shifts toward the collection of mussels belonging to the genus to *Brachidontes.* This change occurs gradually, registering as significant after AD 1000. Interestingly, while land snails decrease over time at Sabazan, at Grand Bay they fluctuate or increase in abundance. Sea urchin relative abundance fluctuates slightly over time, but never accounts for more than about 2% of invertebrate MNI. This contrasts with the somewhat greater importance Sabazan foragers placed on this inshore/shallow water taxon. Lastly, crabs, which account for 5.5% of the assemblage during the Early period, begin declining after AD 850 and continue to do so for the remainder of site occupation, hovering at 1% of MNI by the close of the Late period.

Several similarities are evident in the foraging patterns of Sabazan and Grand Bay. The most obvious of these is the primary importance of fish and gastropods to diet at each site. Parrotfish, jacks/scads, and surgeonfish, and were central to both fisheries—these taxa are typically the most heavily exploited during any period. Also notable is the escalating exploitation of rocky intertidal molluscs over time, driven largely by increased collection of the tessellated nerite. Residents at both sites also appear to have intensified conch collection beginning around AD 850, but especially after AD 1000. In many ways, these similarities in foraging are ones that are broadly shared by many sites in the Lesser Antilles. It is clear that a number of differences also exist between Sabazan and Grand Bay. The nature and extent of these correspondences between the zooarchaeological records of the two sites is the subject of the next chapter.

Figure 5.1 Field school student Hazel Lozano stands next to one of several modern conch shell (*Eustrombus gigas*) heaps on Windward beach, Carriacou. (Photograph by author)

Figure 5.2 Concentration of queen conch shells in Trench 415 at Grand Bay representing possible evidence for conch shell stockpiling. (Photograph courtesy of S.M. Fitzpatrick)

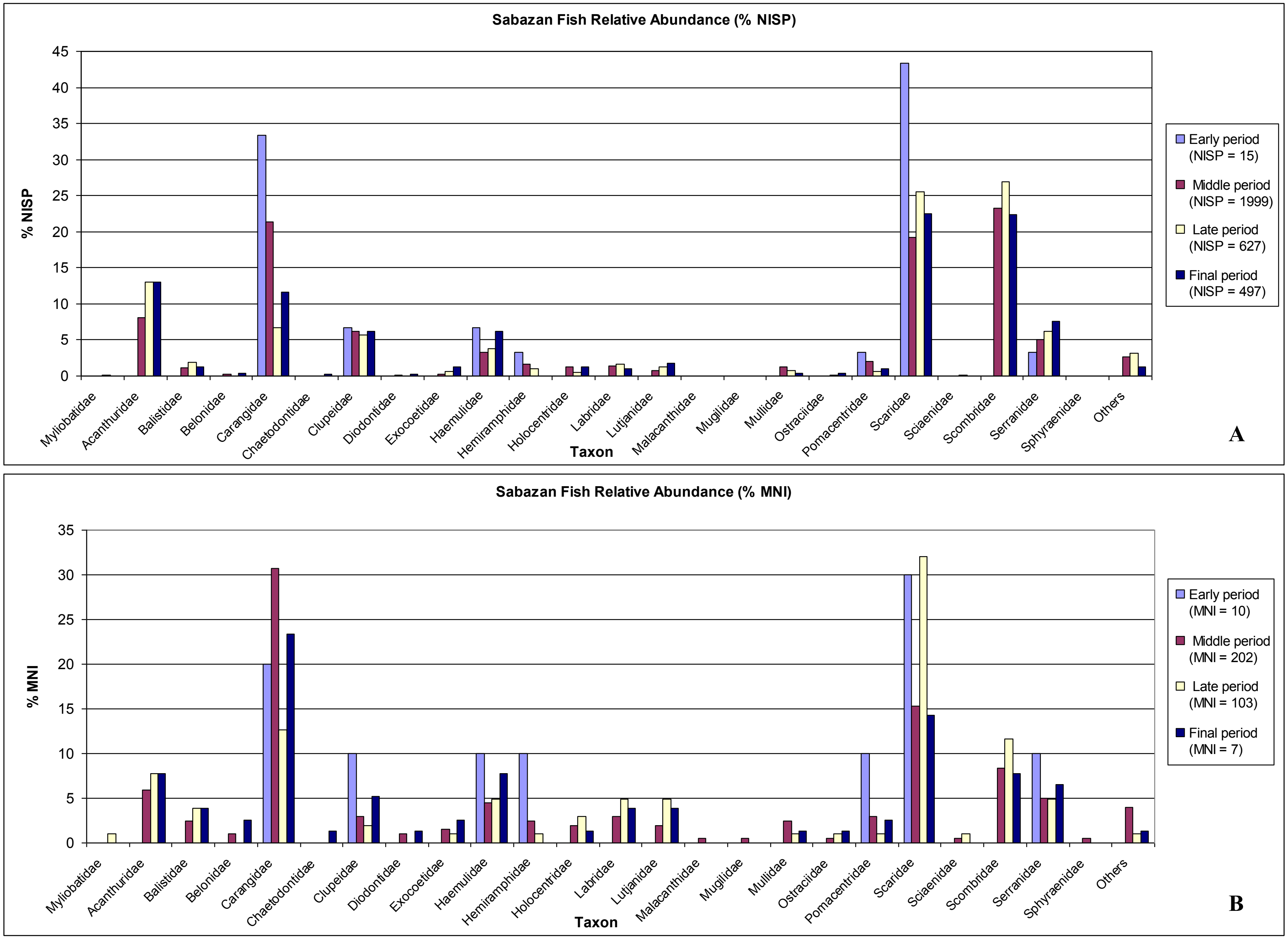


Figure 5.3 Fish taxa and relative abundance for Sabazan by A) % NISP and B) % MNI.

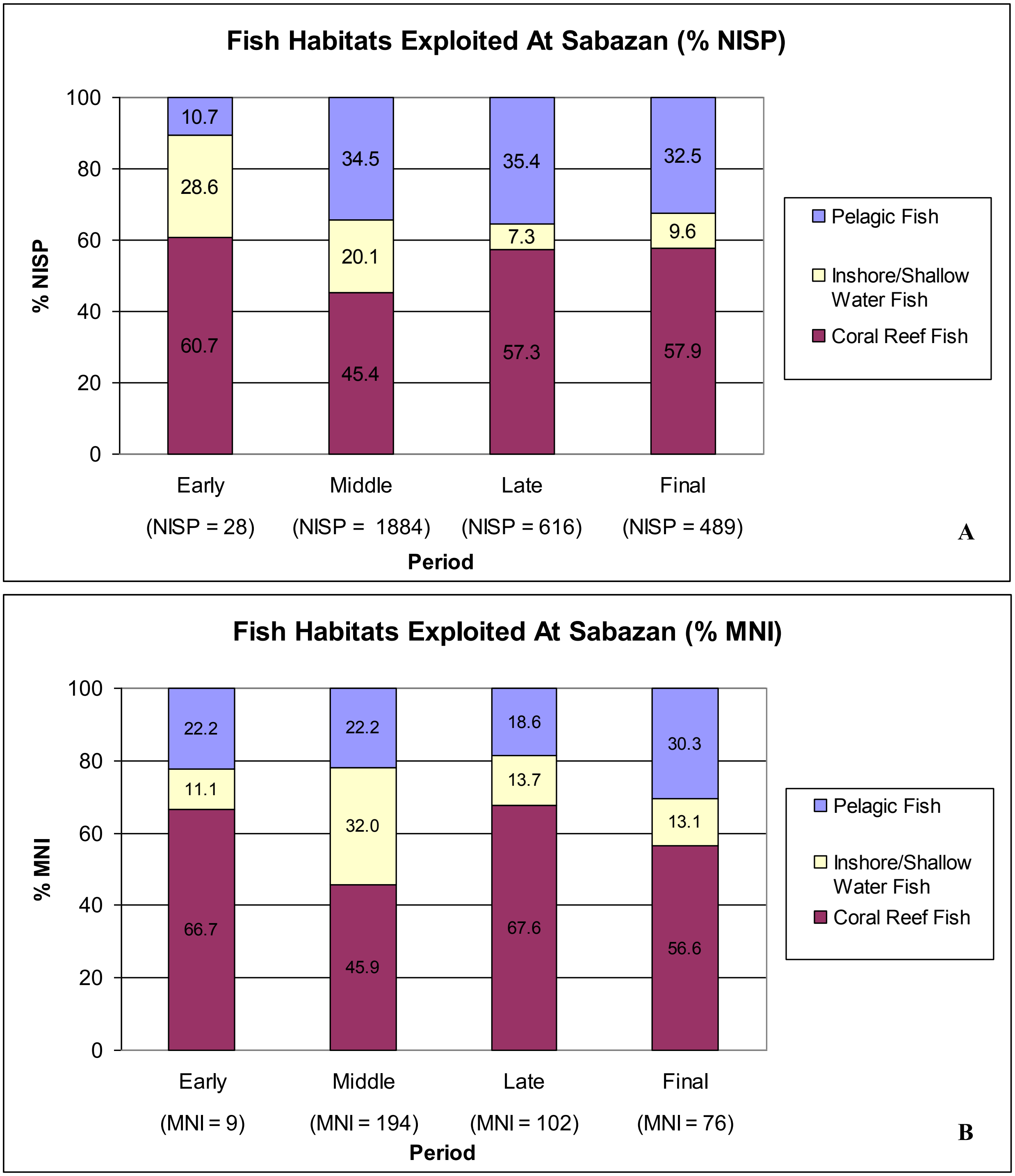


Figure 5.4 Changing focus on fish habitats exploited at Sabazan over time based on A) % NISP and B) % MNI.

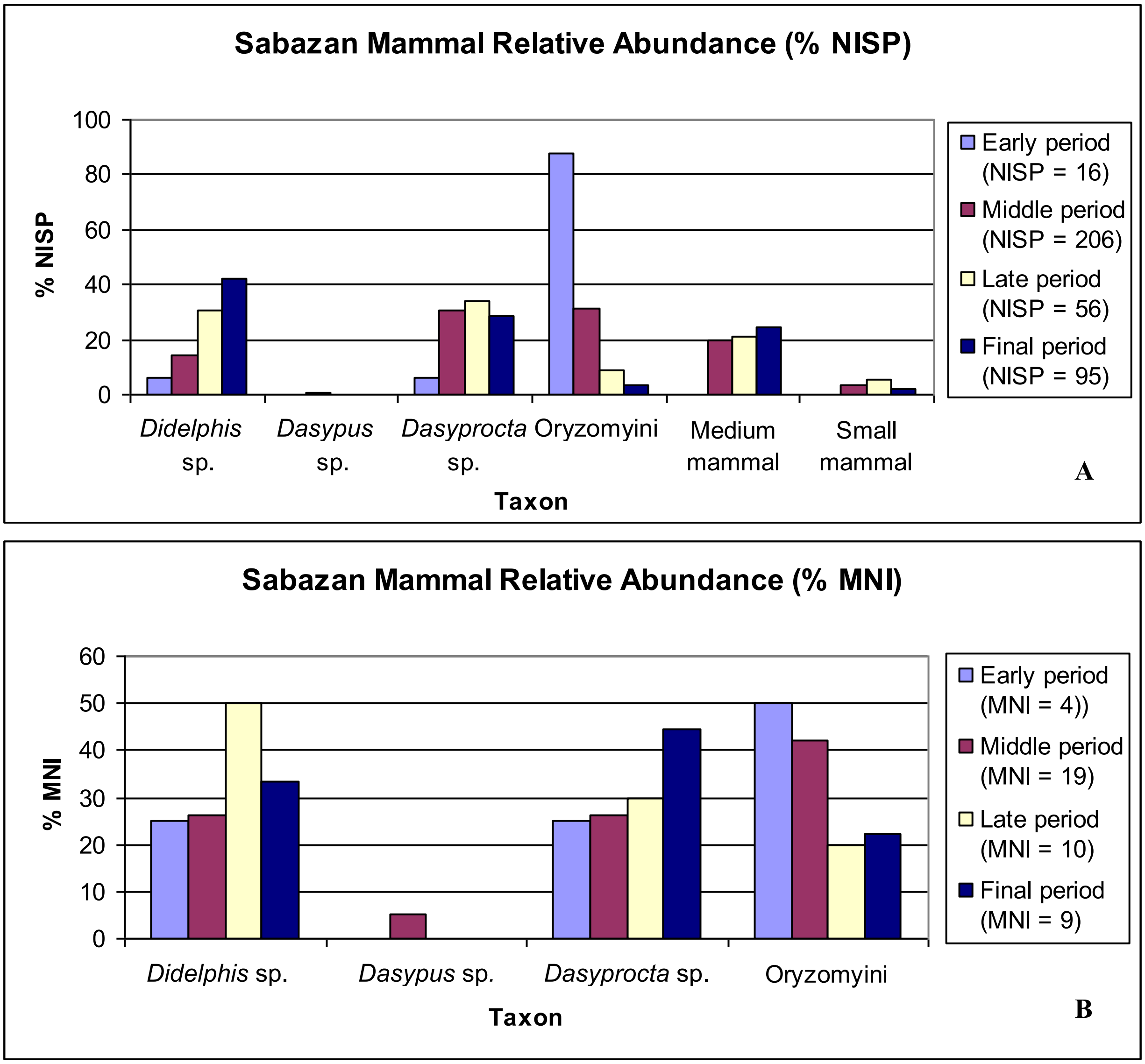


Figure 5.5 Mammal taxa and relative abundance for Sabazan by A) % NISP and B) % MNI.

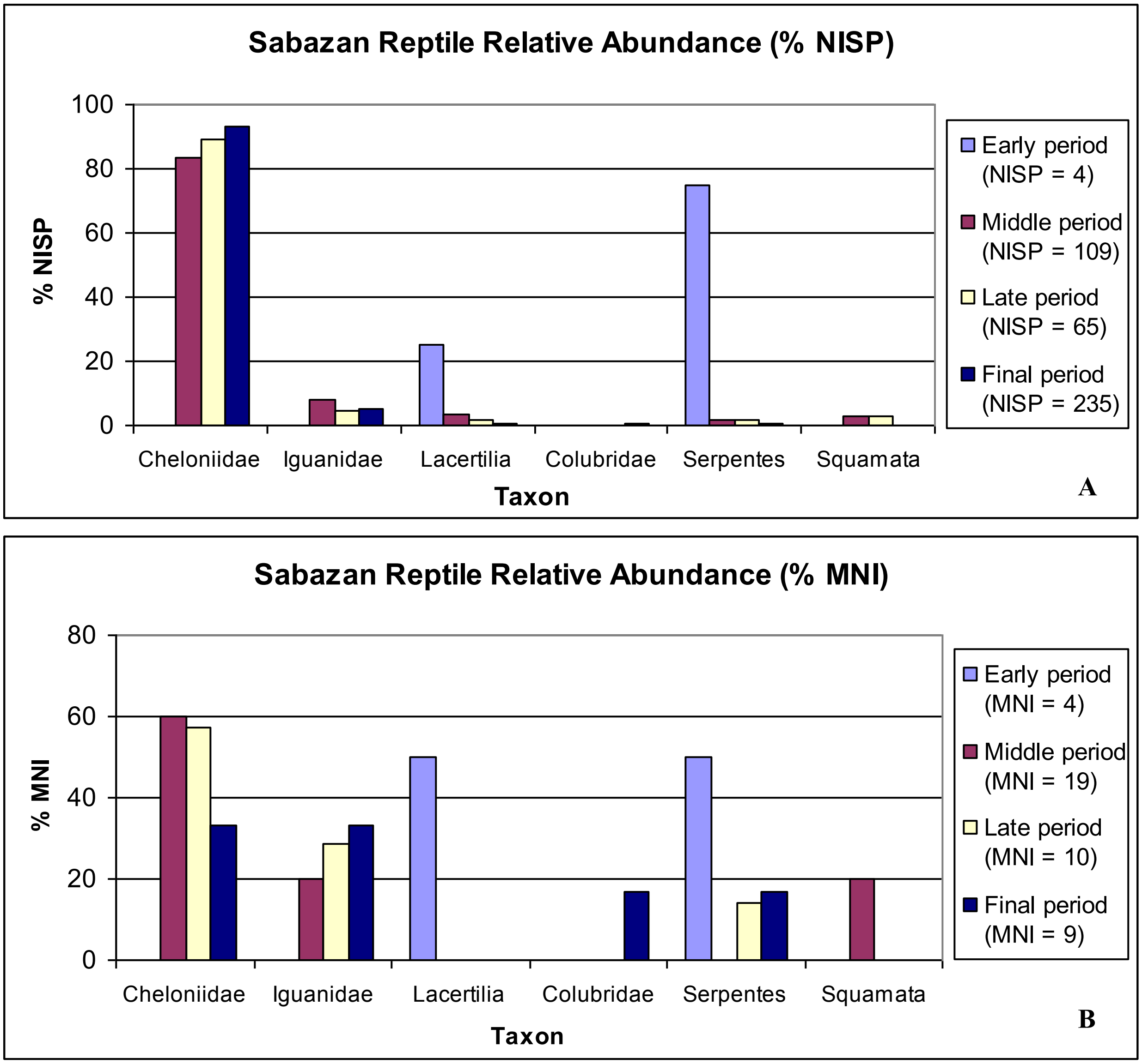


Figure 5.6 Reptile taxa and relative abundance for Sabazan by A) % NISP and B) % MNI.

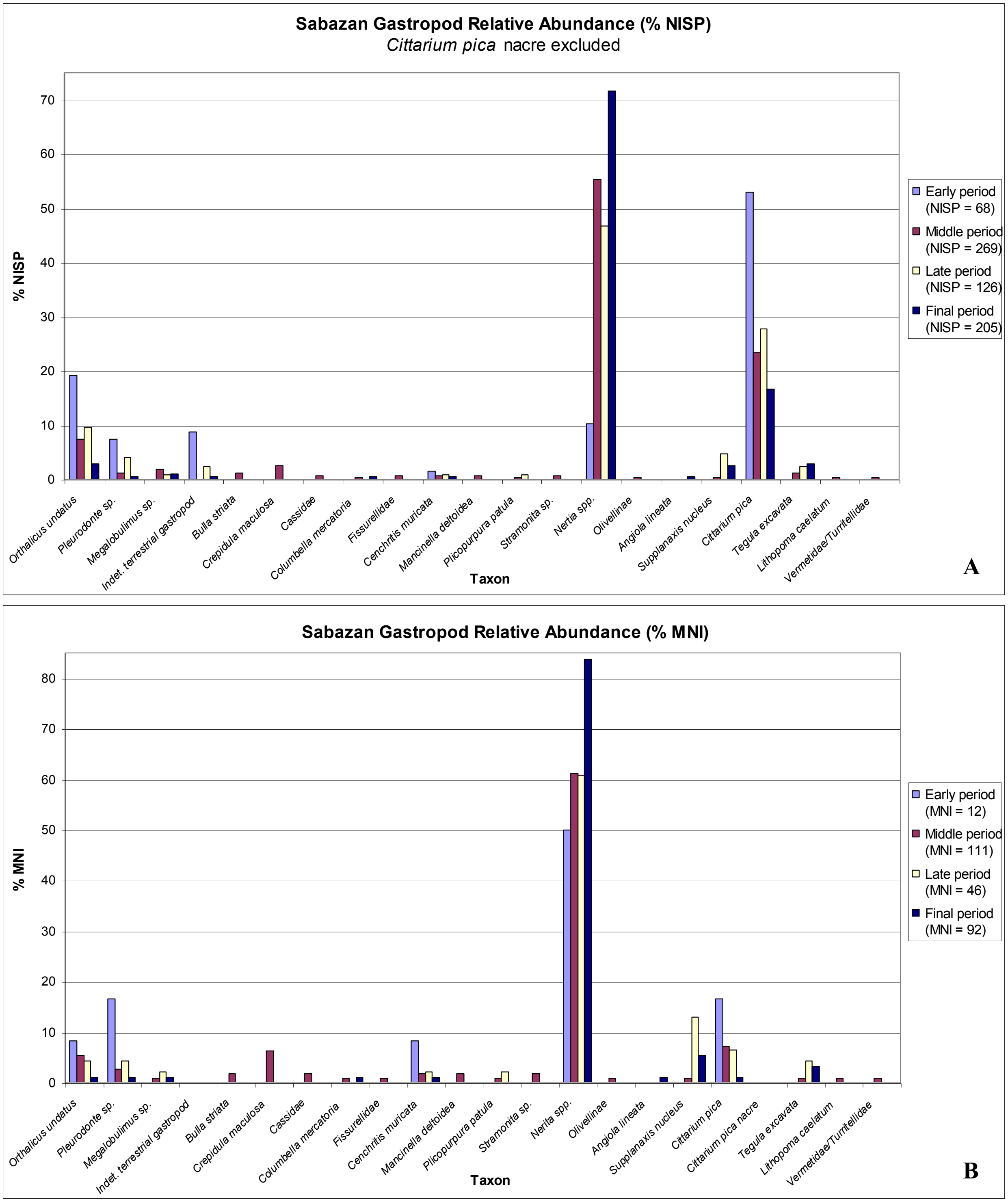


Figure 5.7 Gastropod taxa and relative abundance for Sabazan by A) % NISP and B) % MNI.

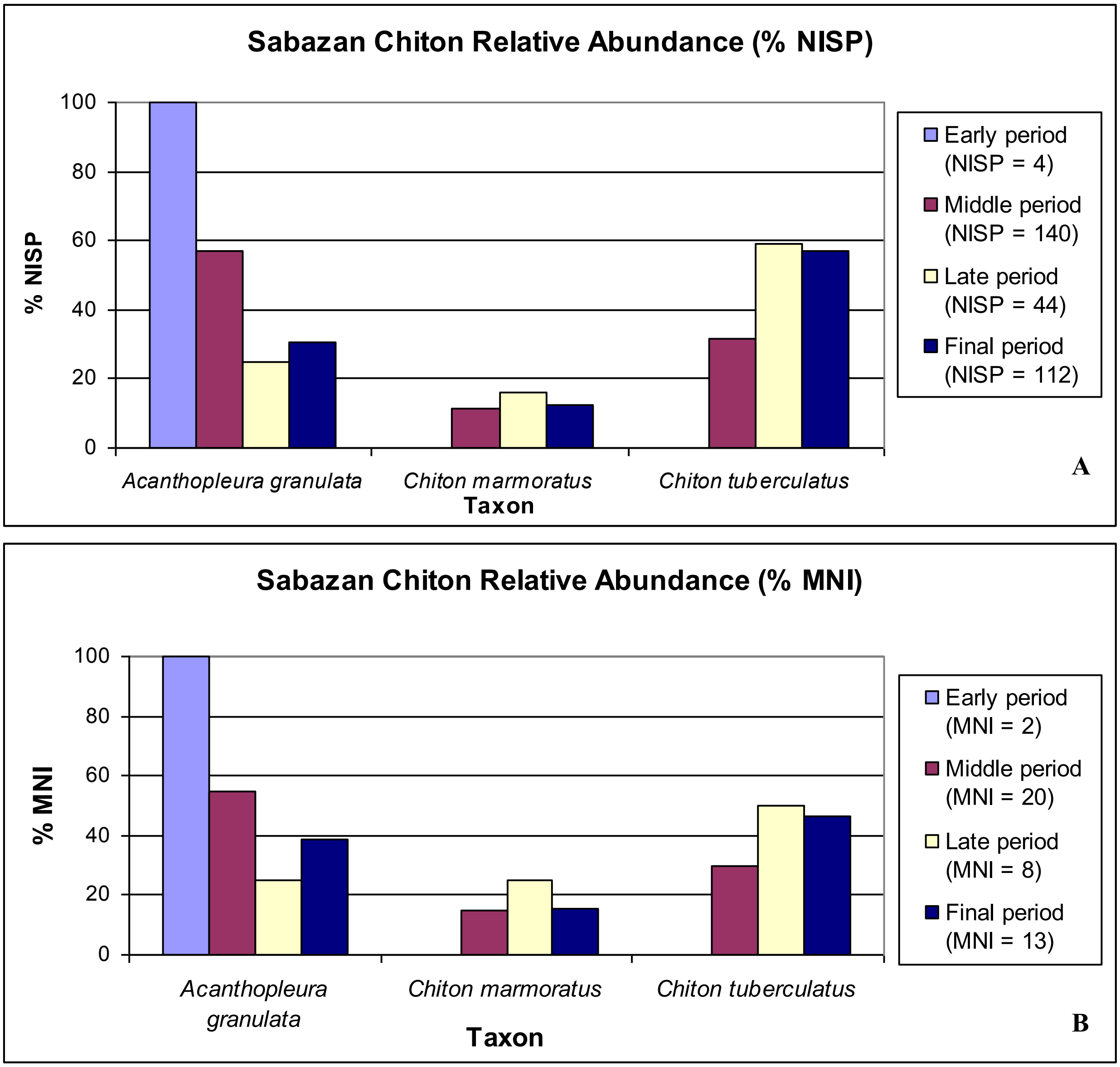


Figure 5.8 Chiton taxa and relative abundance for Sabazan by A) % NISP and B) % MNI.

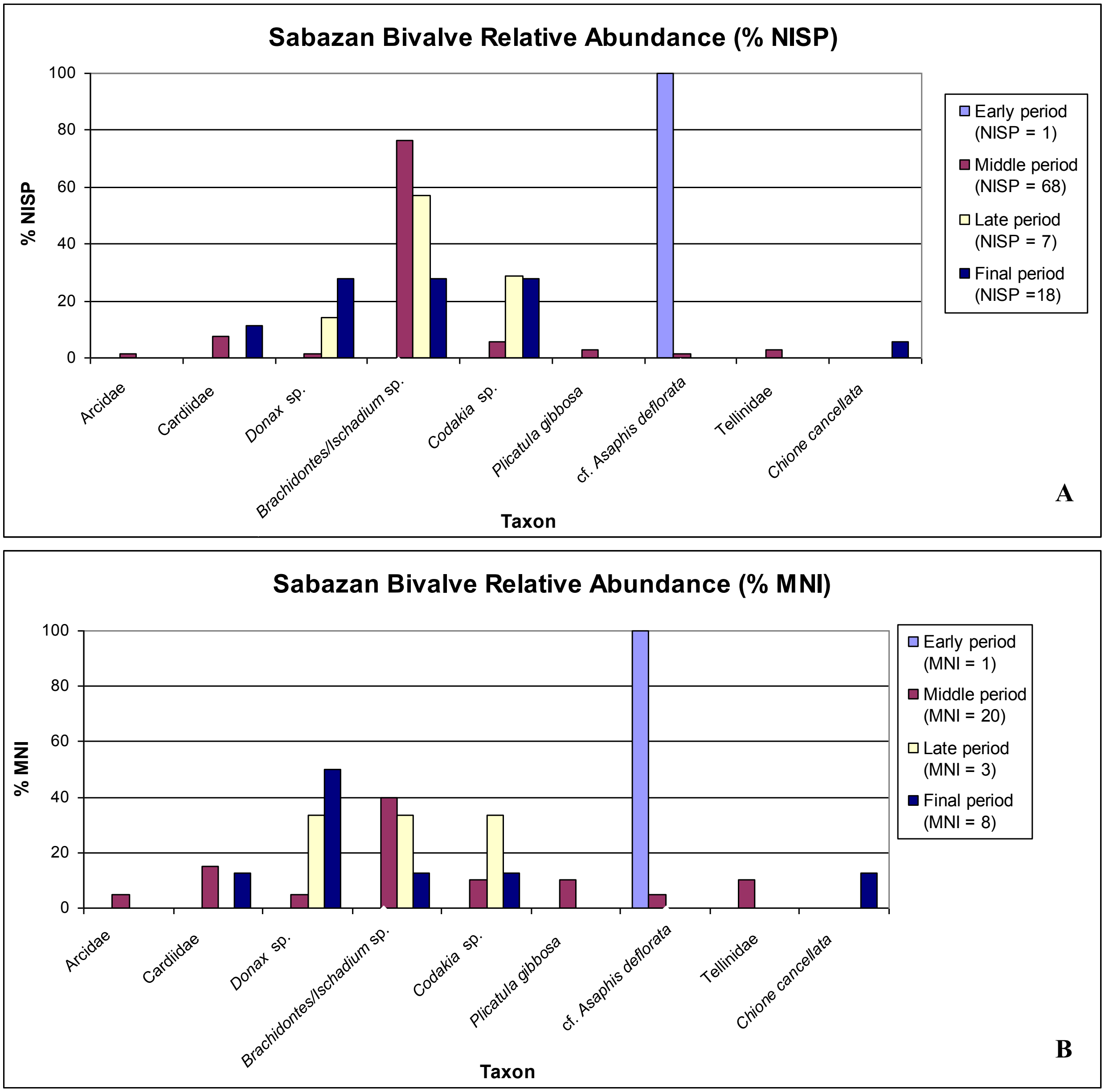


Figure 5.9 Bivalve taxa and relative abundance for Sabazan by A) % NISP and B) % MNI.

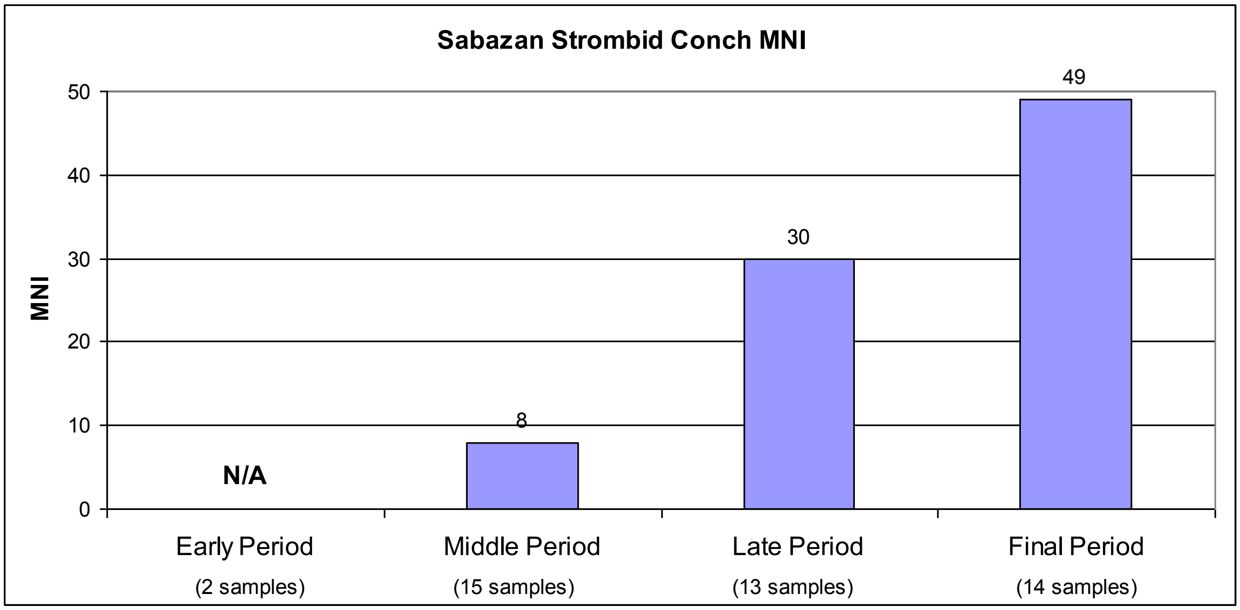


Figure 5.10 Minimum number of individuals for strombid conchs at Sabazan. “Sample” refers to sample contexts, that is, a given level within a unit and stratum.

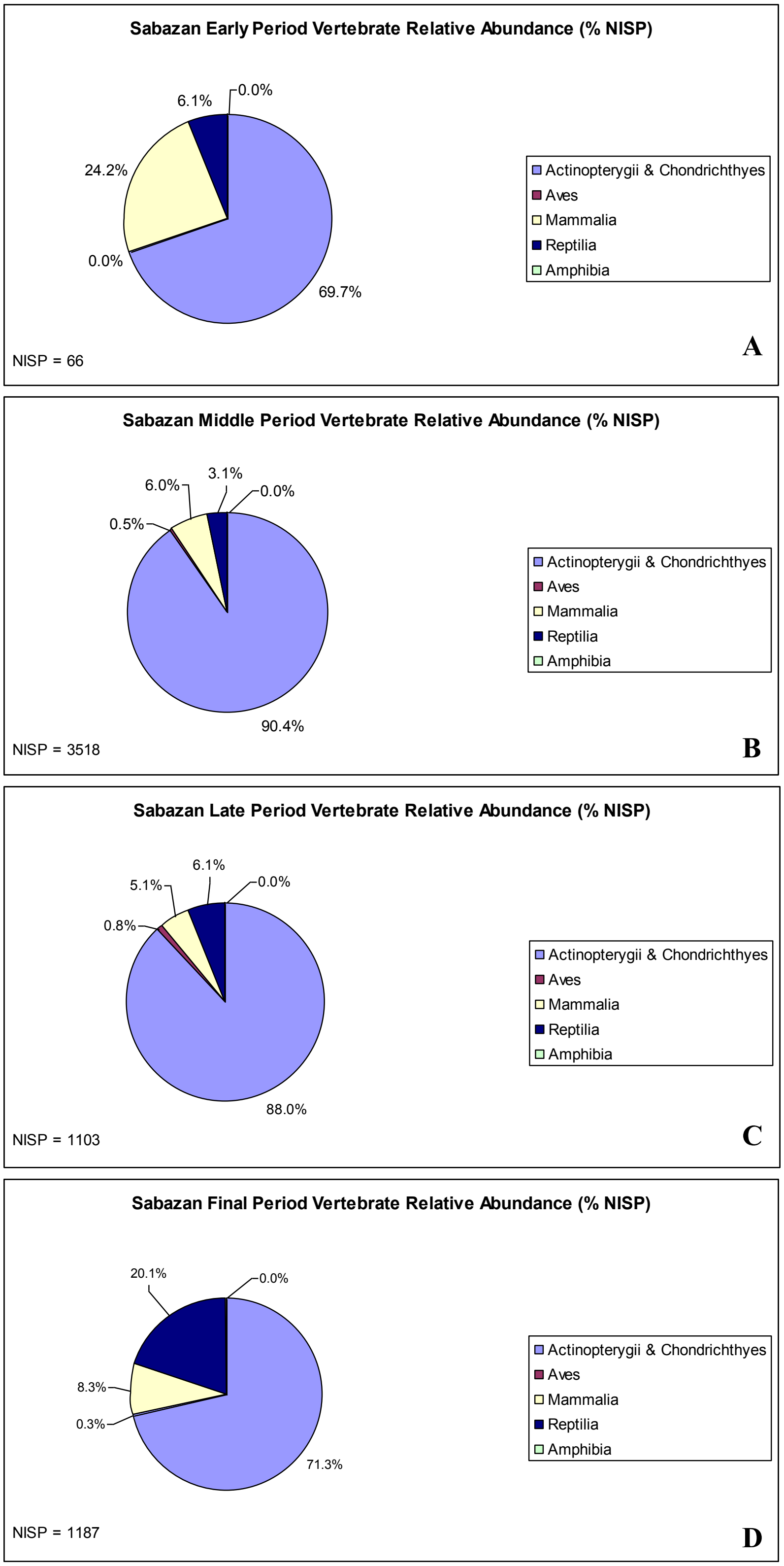


Figure 5.11 Vertebrate % NISP by class for the A) Early, B) Middle, C) Late, and D) Final periods at Sabazan. NISP values include specimens identified to class level and below.

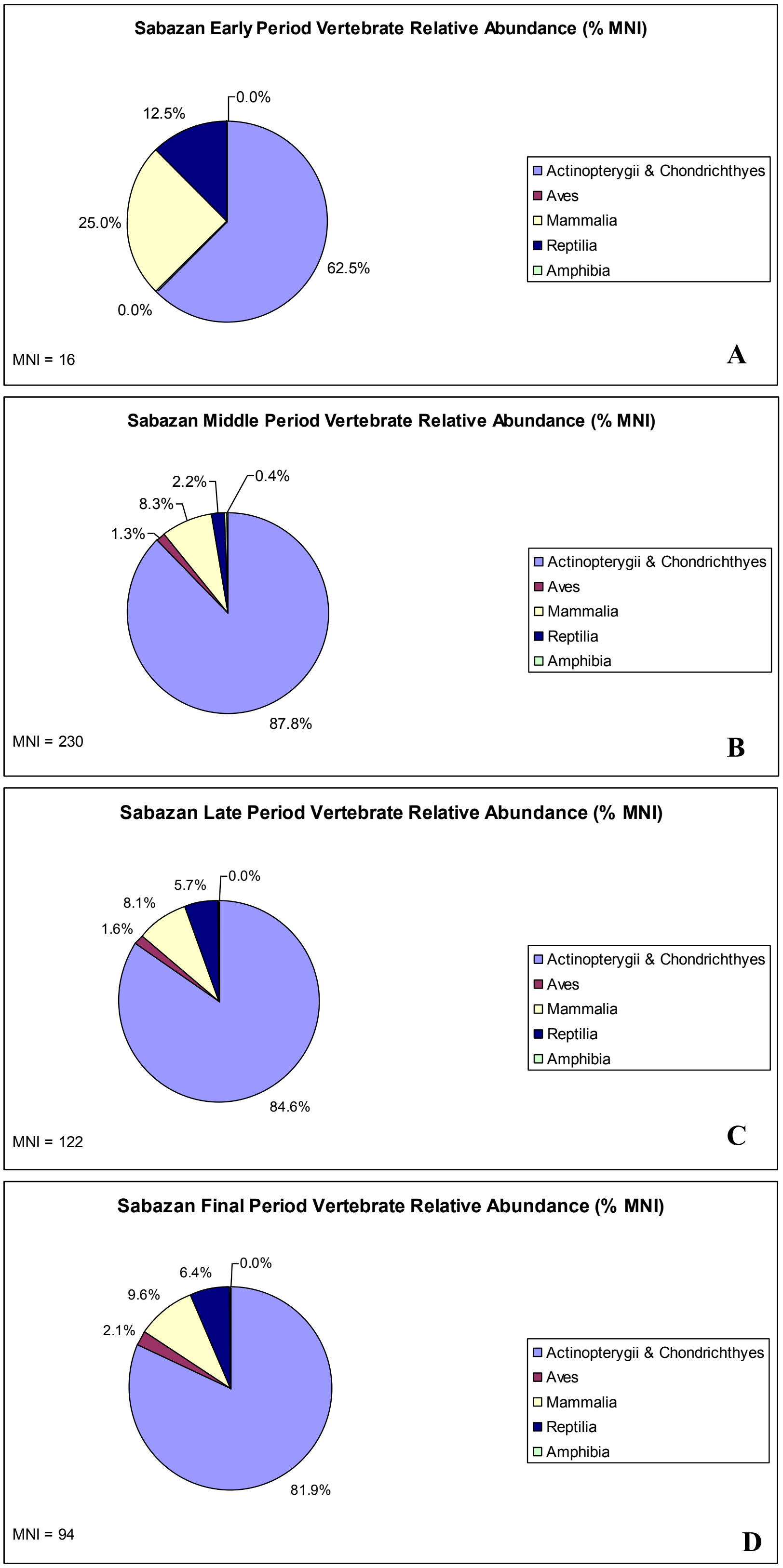
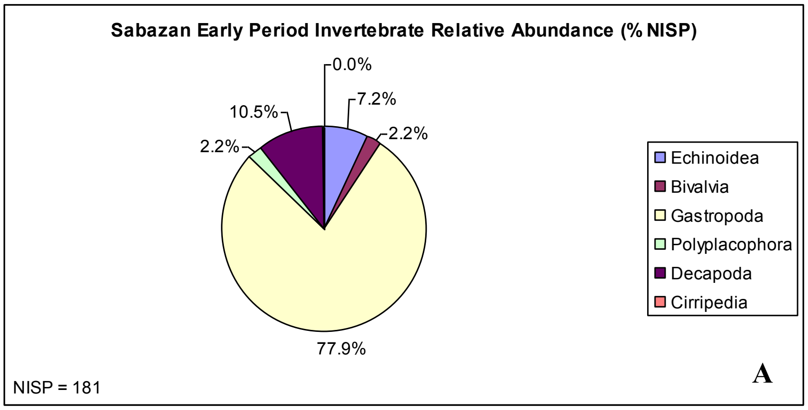
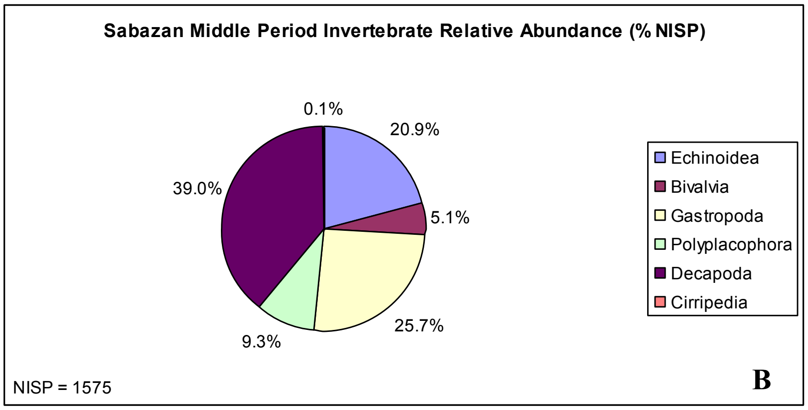
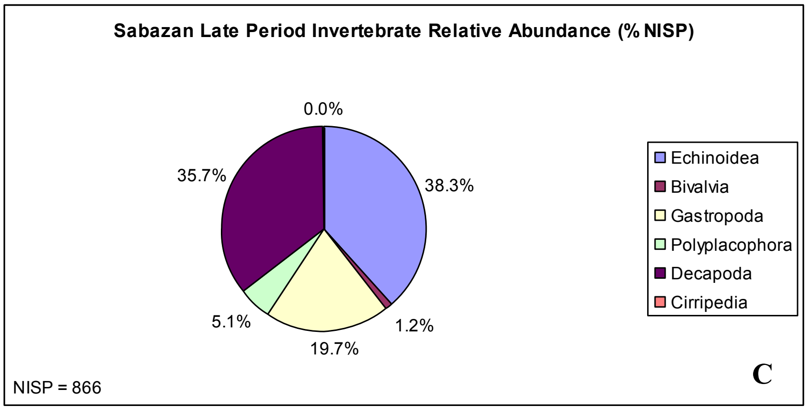


Figure 5.12 Vertebrate % MNI by class for the A) Early, B) Middle, C) Late, and D) Final periods at Sabazan. MNI values include specimens identified to class level and below.


Sabazan Early Period Invertebrate Relative Abundance (% NISP)
0.0%
7.2%
2.2%
10.5%
2.2%
77.9%
Echinoidea
Bivalvia
Gastropoda
Polyplacophora
Decapoda
Cirripedia
NISP = 181
A


Sabazan Middle Period Invertebrate Relative Abundance (% NISP)
0.1%
20.9%
39.0%
5.1%
25.7%
9.3%
Echinoidea
Bivalvia
Gastropoda
Polyplacophora
Decapoda
Cirripedia
NISP = 1575
B


Sabazan Late Period Invertebrate Relative Abundance (% NISP)
0.0%
35.7%
38.3%
5.1%
1.2%
19.7%
Echinoidea
Bivalvia
Gastropoda
Polyplacophora
Decapoda
Cirripedia
NISP = 866
C

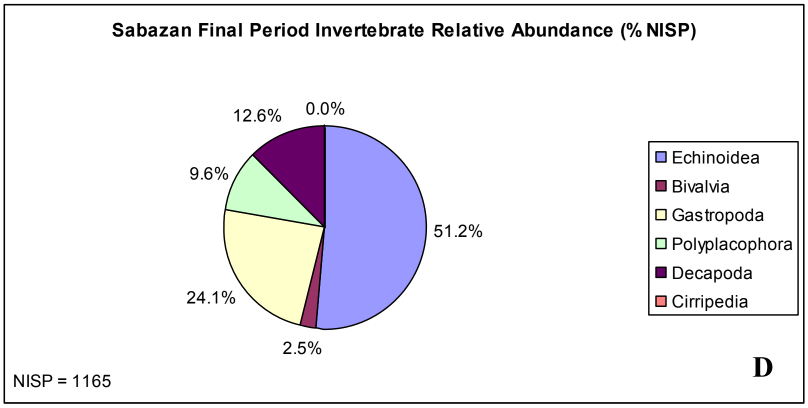

Sabazan Final Period Invertebrate Relative Abundance (% NISP)
12.6%
0.0%
9.6%
51.2%
24.1%
2.5%
Echinoidea
Bivalvia
Gastropoda
Polyplacophora
Decapoda
Cirripedia
NISP = 1165
D

Figure 5.13 Invertebrate % NISP by class for the A) Early, B) Middle, C) Late, and D) Final periods at Sabazan. NISP values include specimens identified to class level and below.

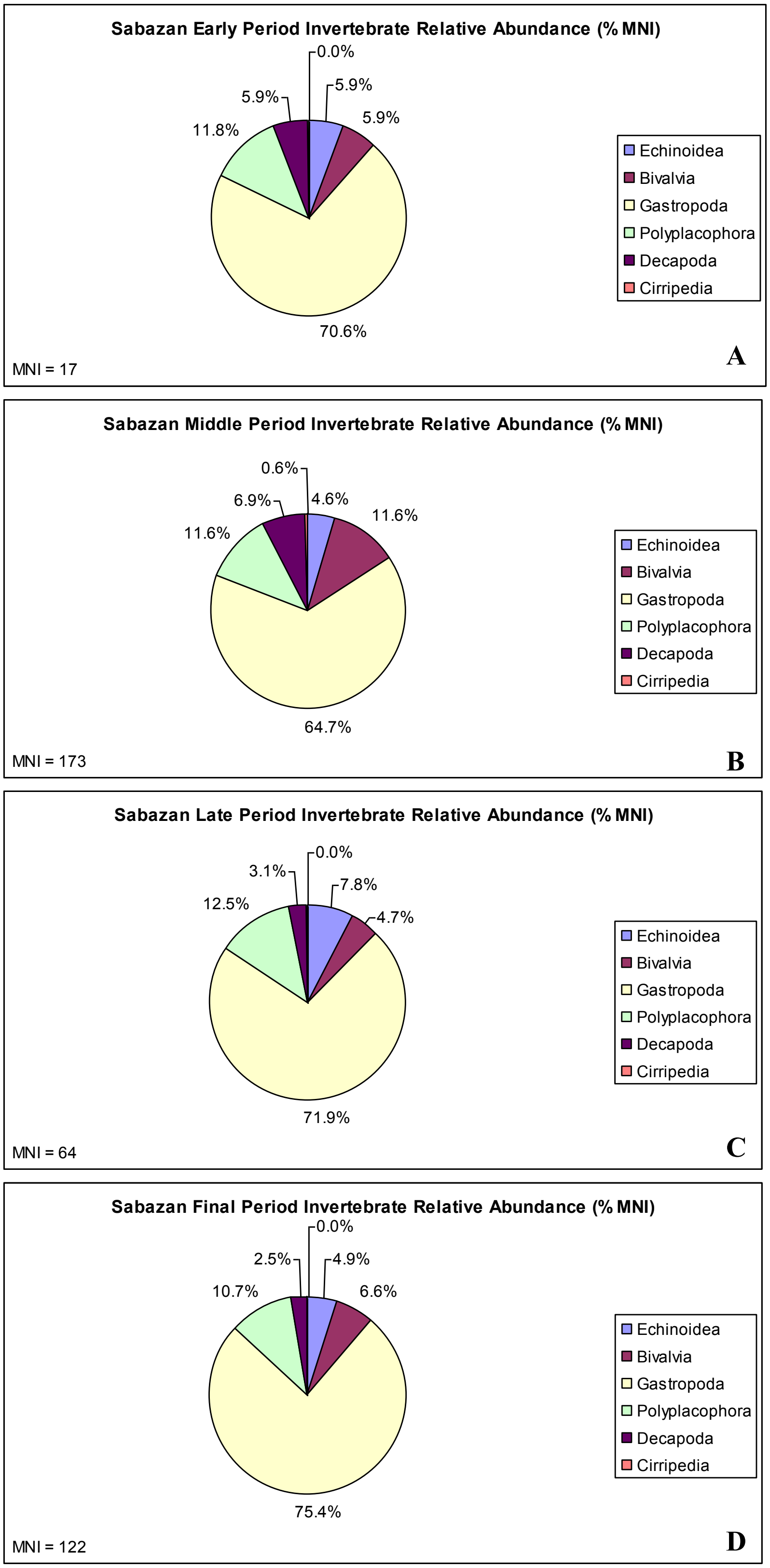


Figure 5.14 Invertebrate % MNI by class for the A) Early, B) Middle, C) Late, and D) Final periods at Sabazan. MNI values include specimens identified to class level and below.

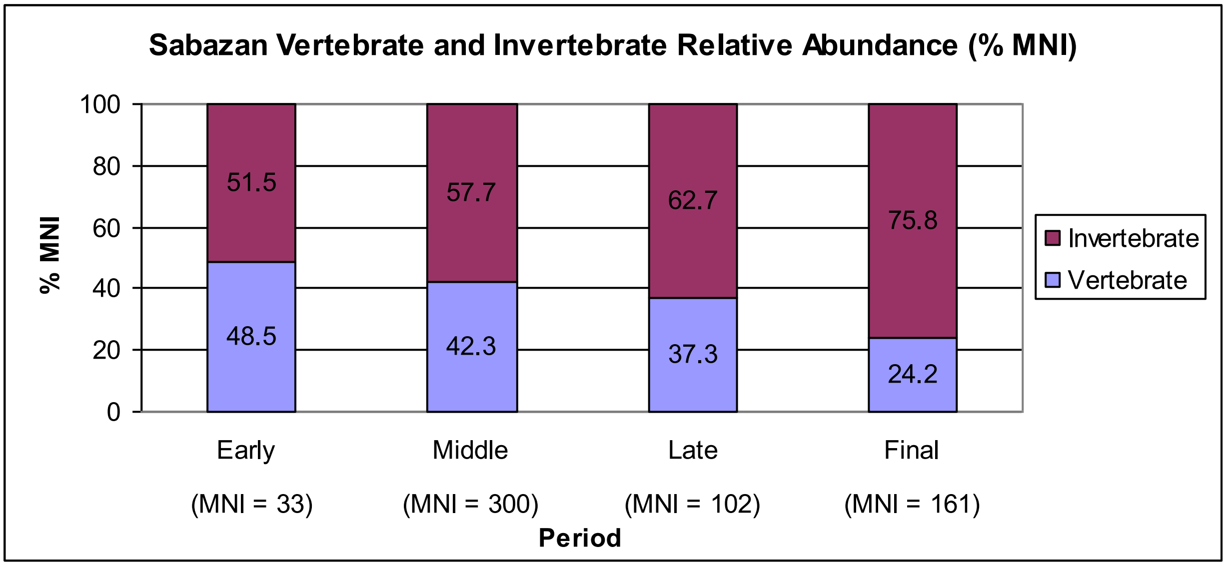


Figure 5.15 Vertebrate and invertebrate exploitation over time at Sabazan. Data based on the invertebrate and vertebrate comparative sub-assemblage (Table 5.8). Strombid conch counts not included.

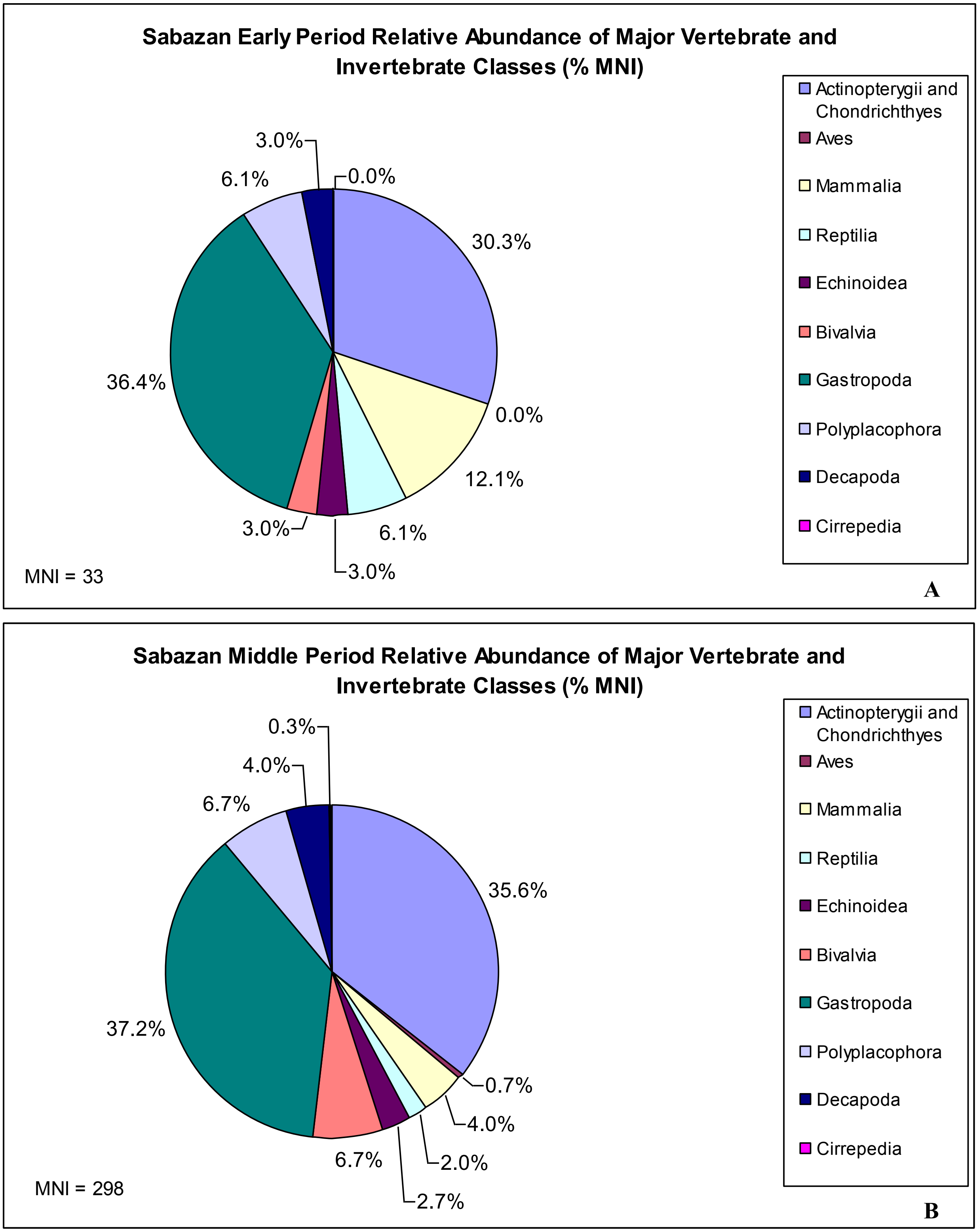
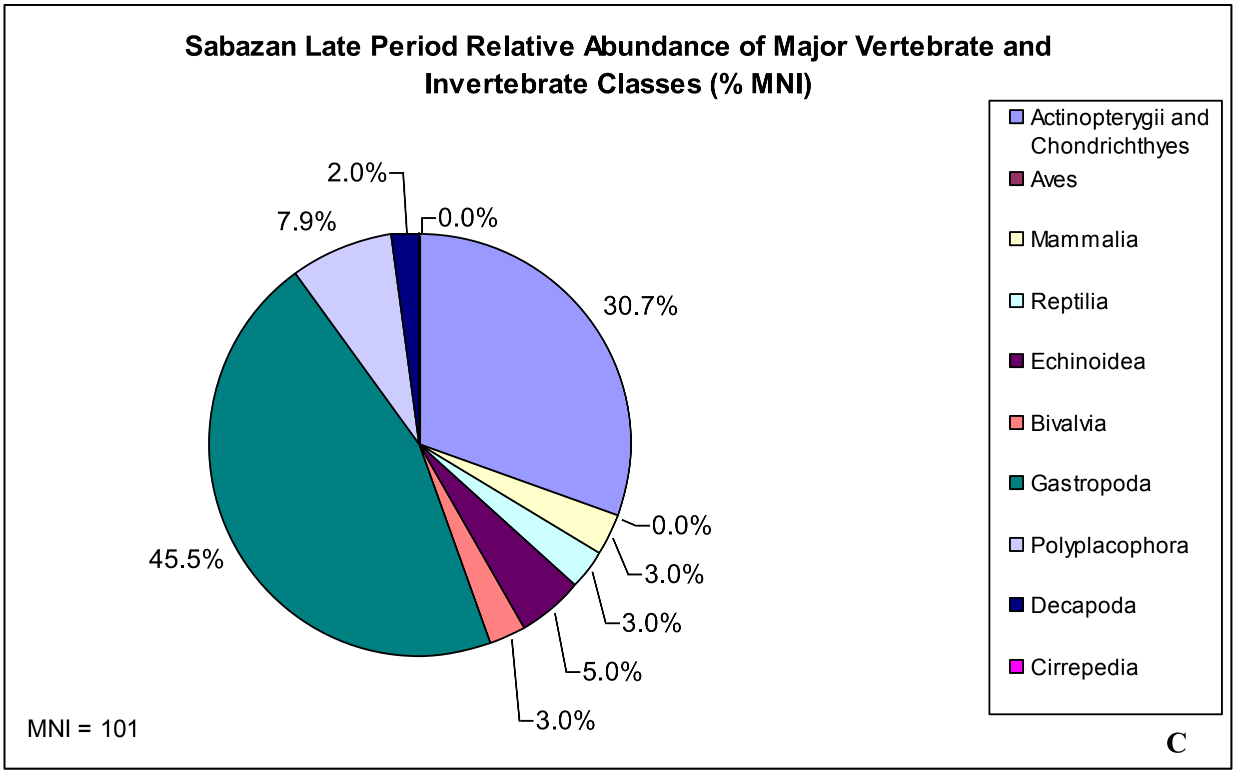


Figure 5.16 Relative abundance of vertebrate and invertebrate classes at Sabazan based on % MNI for the A) Early and B) Middle periods. Data based on the vertebrate and invertebrate comparative sub-assemblage (Table 5.8).



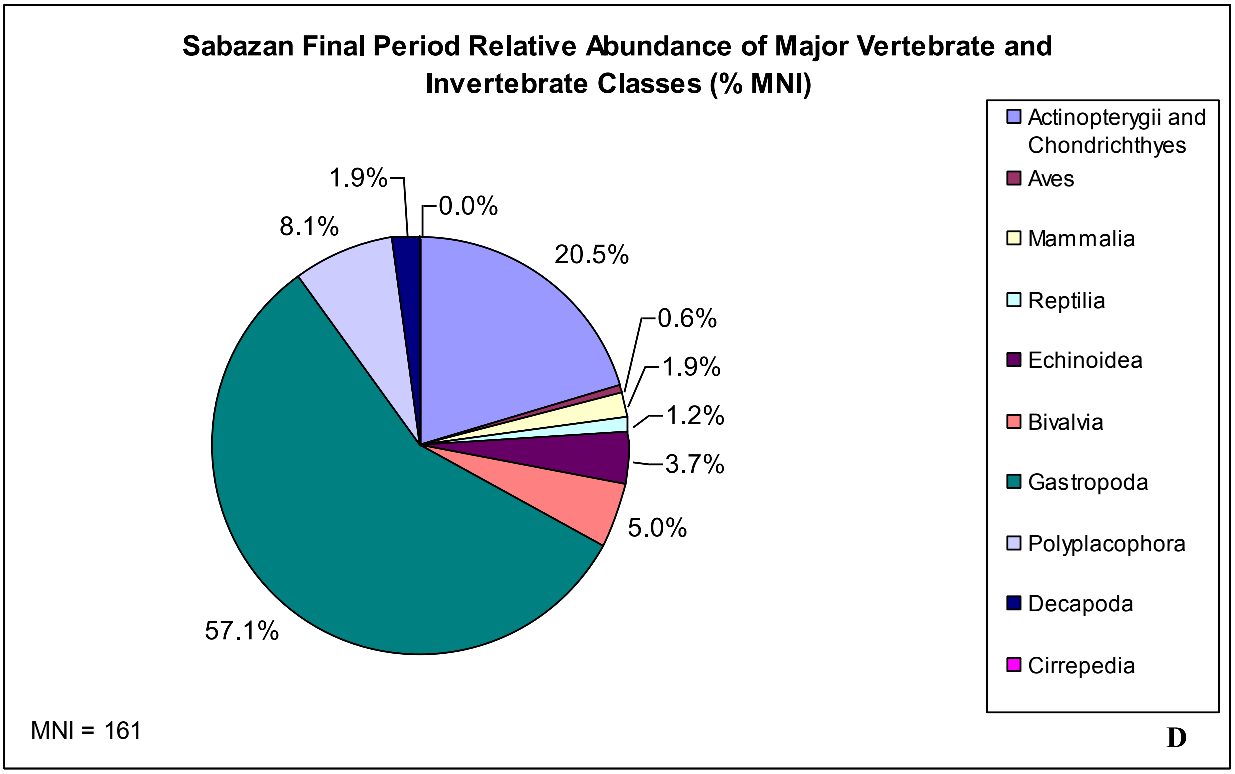


Figure 5.16 continued. Relative abundance of vertebrate and invertebrate classes at Sabazan based on % MNI for the C) Late and D) Final periods. Data based on the vertebrate and invertebrate sub-assemblage (Table 5.8).

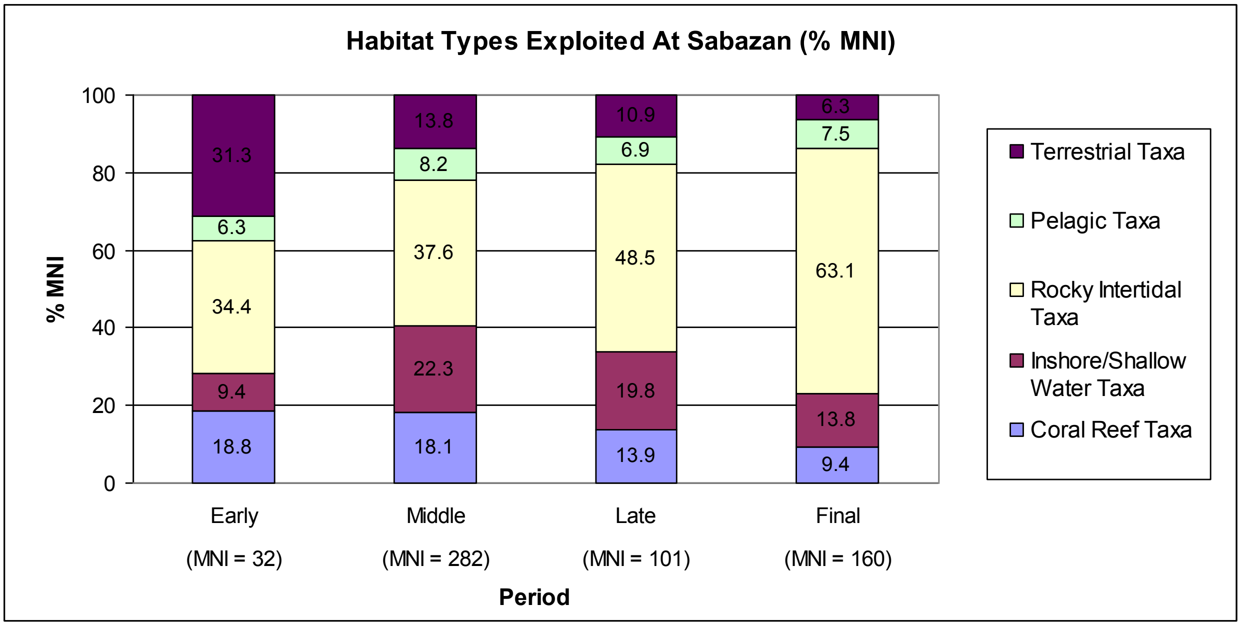


Figure 5.17 Habitat patch exploitation at Sabazan based on % MNI. Data based on Table 5.20.

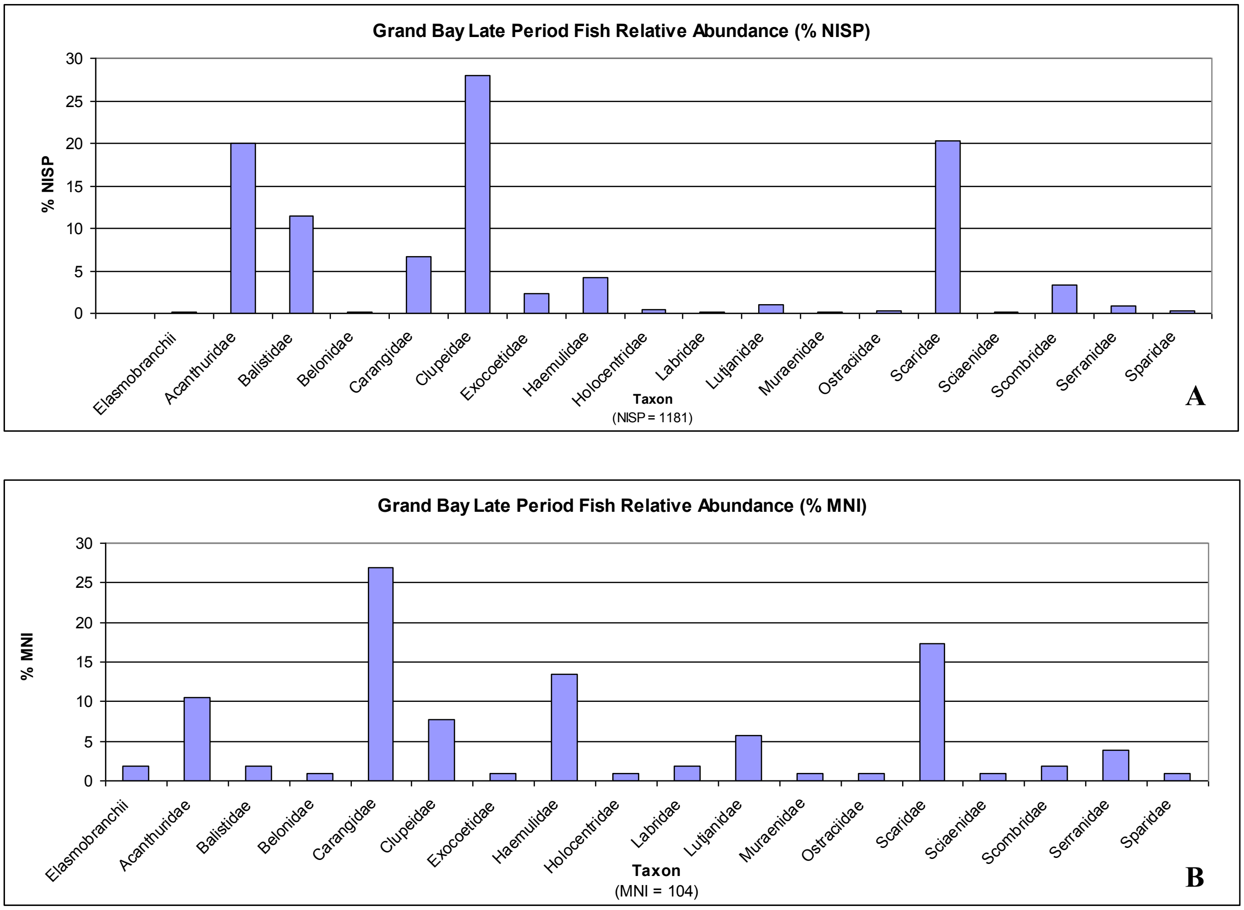


Figure 5.18 Grand Bay fish taxa and relative abundance for the Late Period by A) % NISP and B) % MNI.

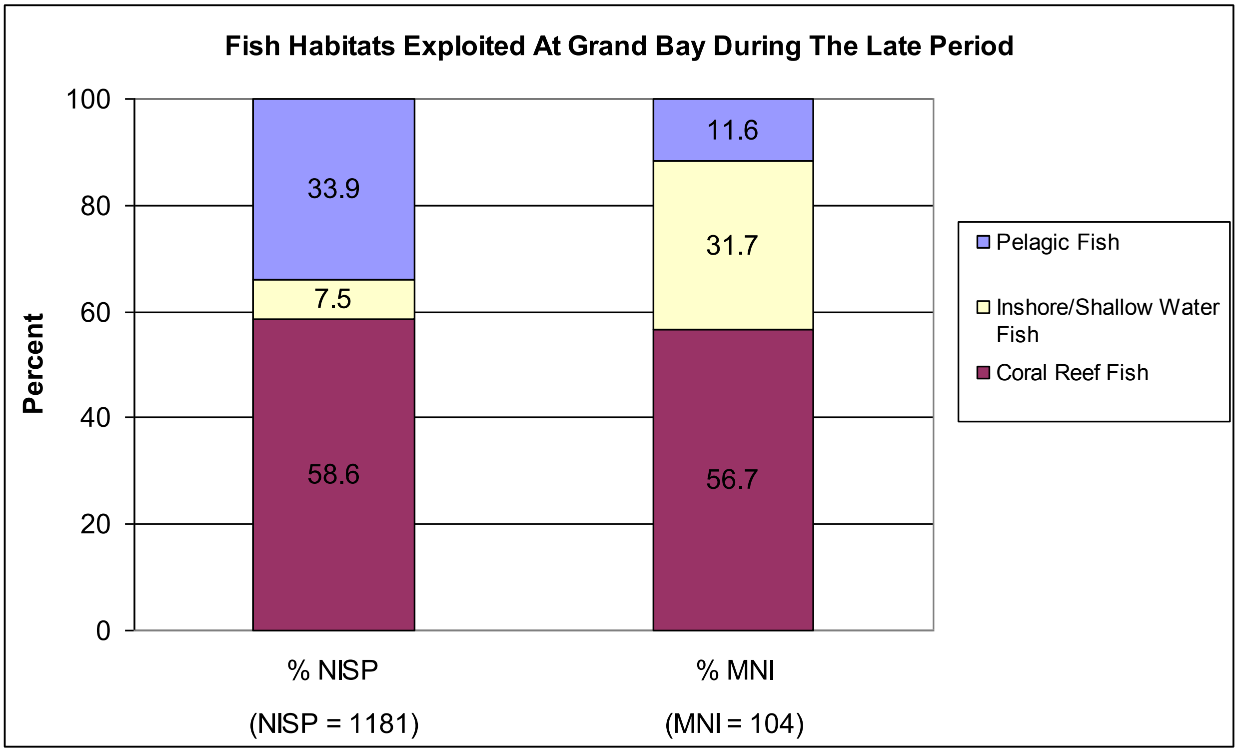


Figure 5.19 Relative representation of fishing by marine habitat patch for Grand Bay during the Late period.

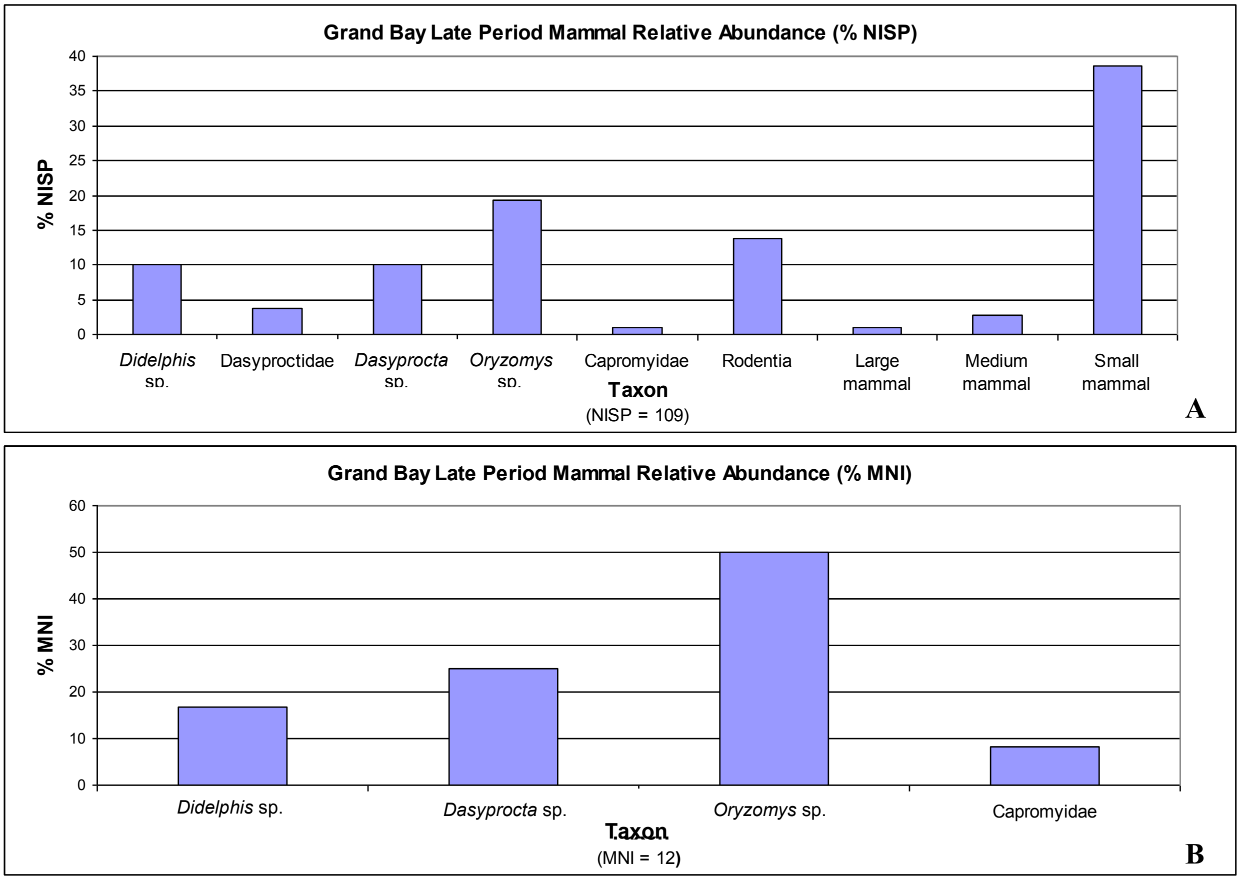


Figure 5.20 Grand Bay mammal taxa and relative abundance for the Late period by A) % NISP and B) % MNI.

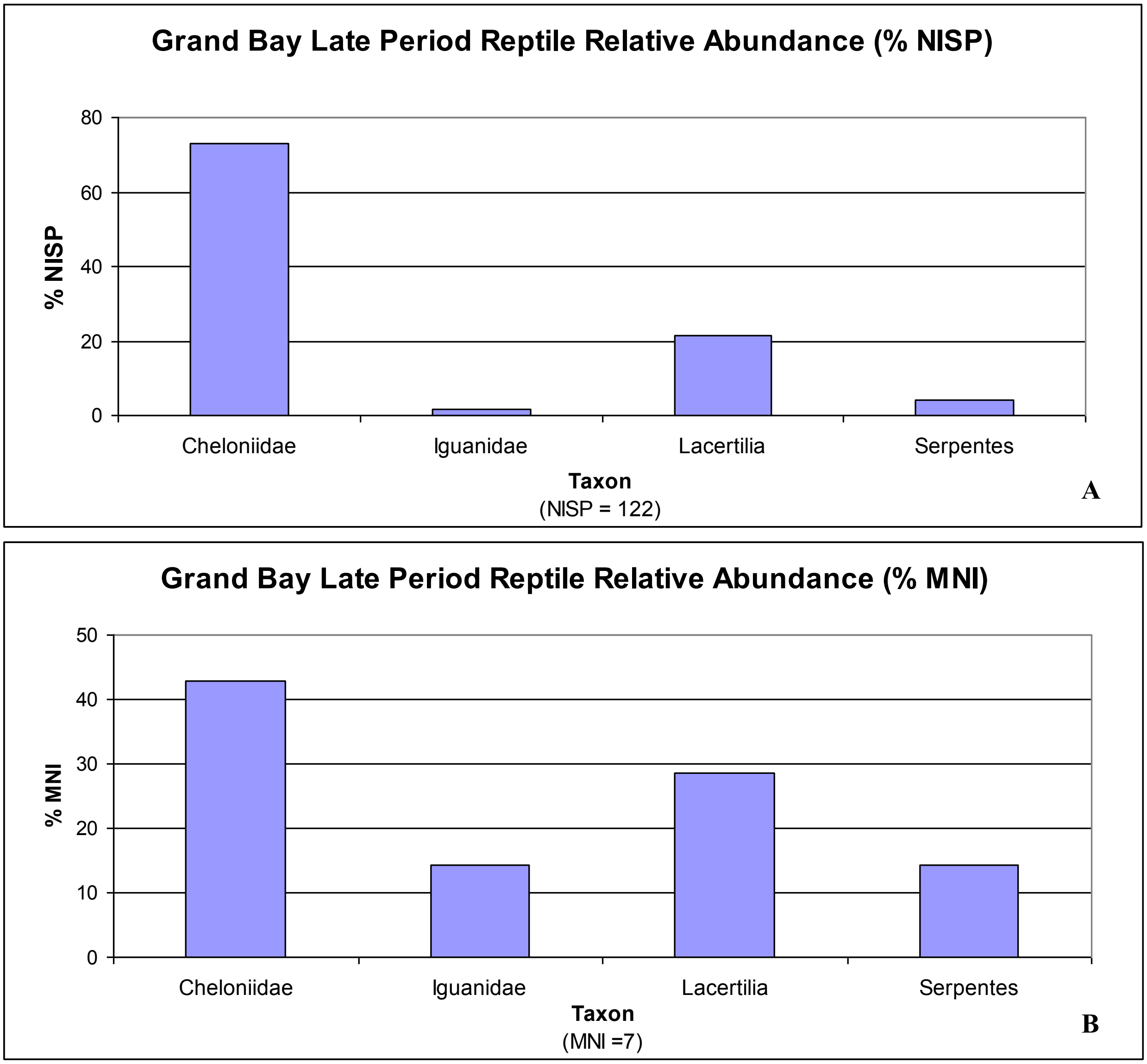


Figure 5.21 Grand Bay reptile taxa and relative abundance for the Late period by A) % NISP and B) % MNI.

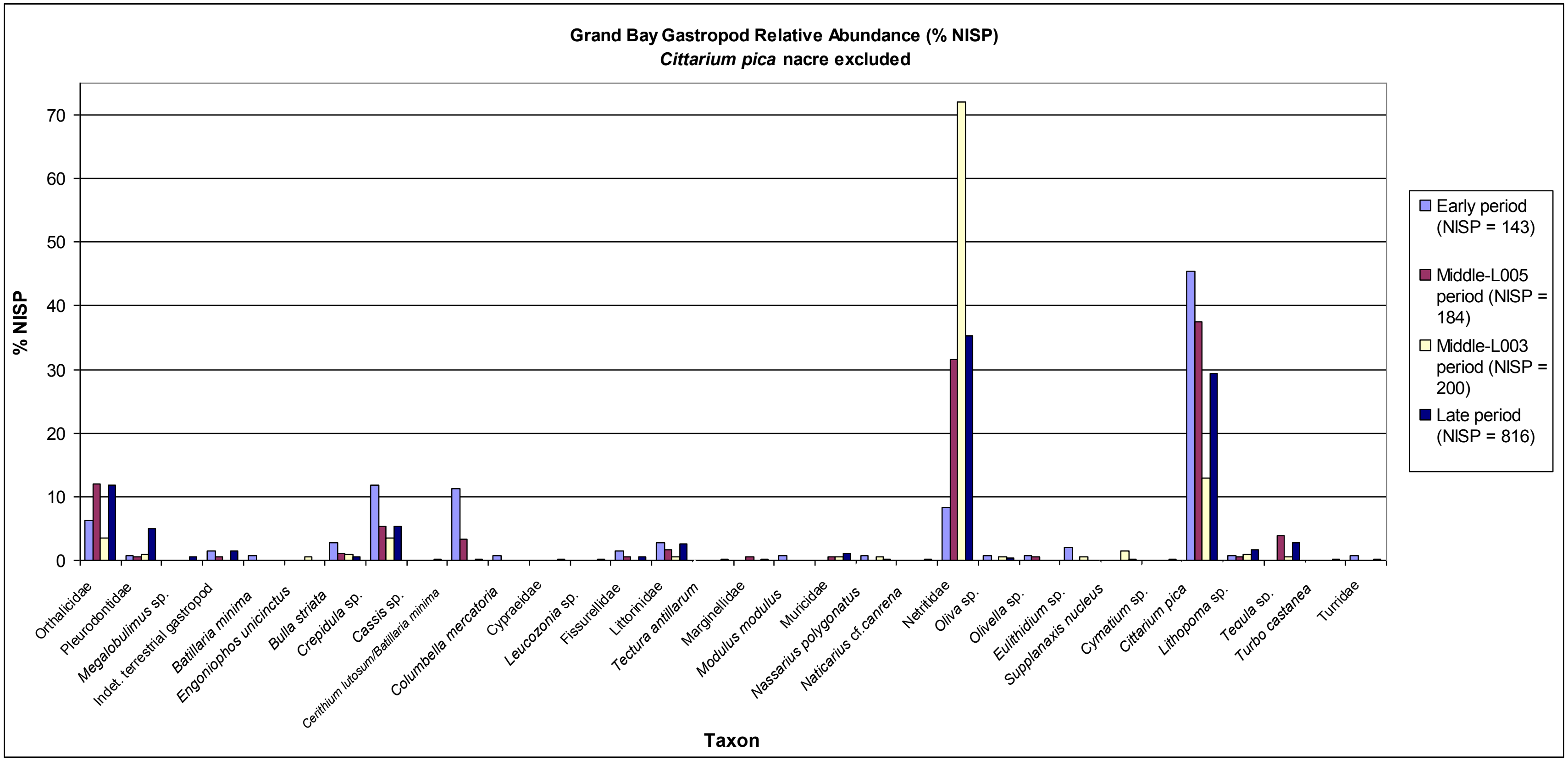


Figure 5.22A Gastropod taxa and relative abundance for Grand Bay by % NISP.

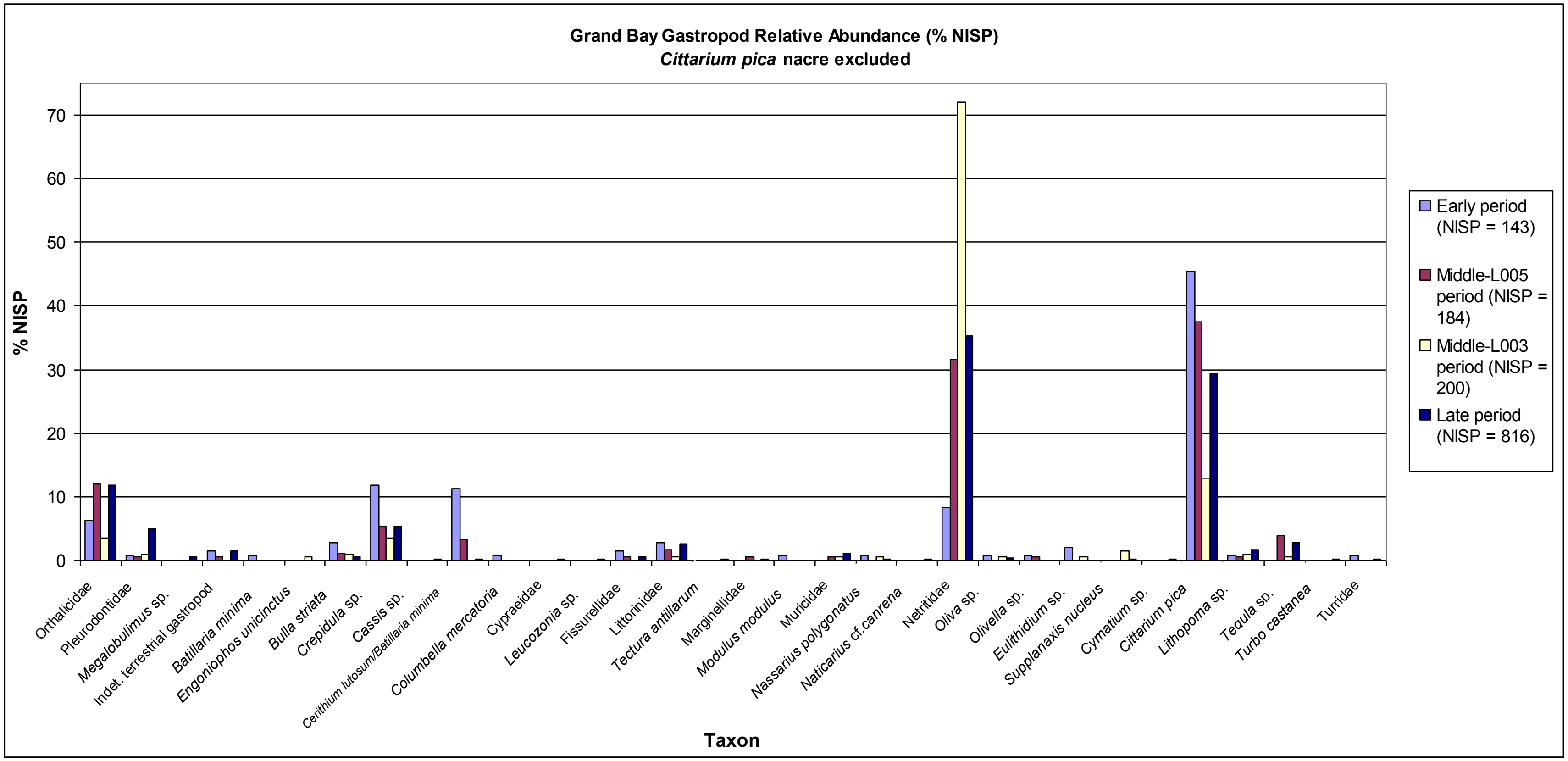


Figure 5.22B Gastropod taxa and relative abundance for Grand Bay by % MNI.

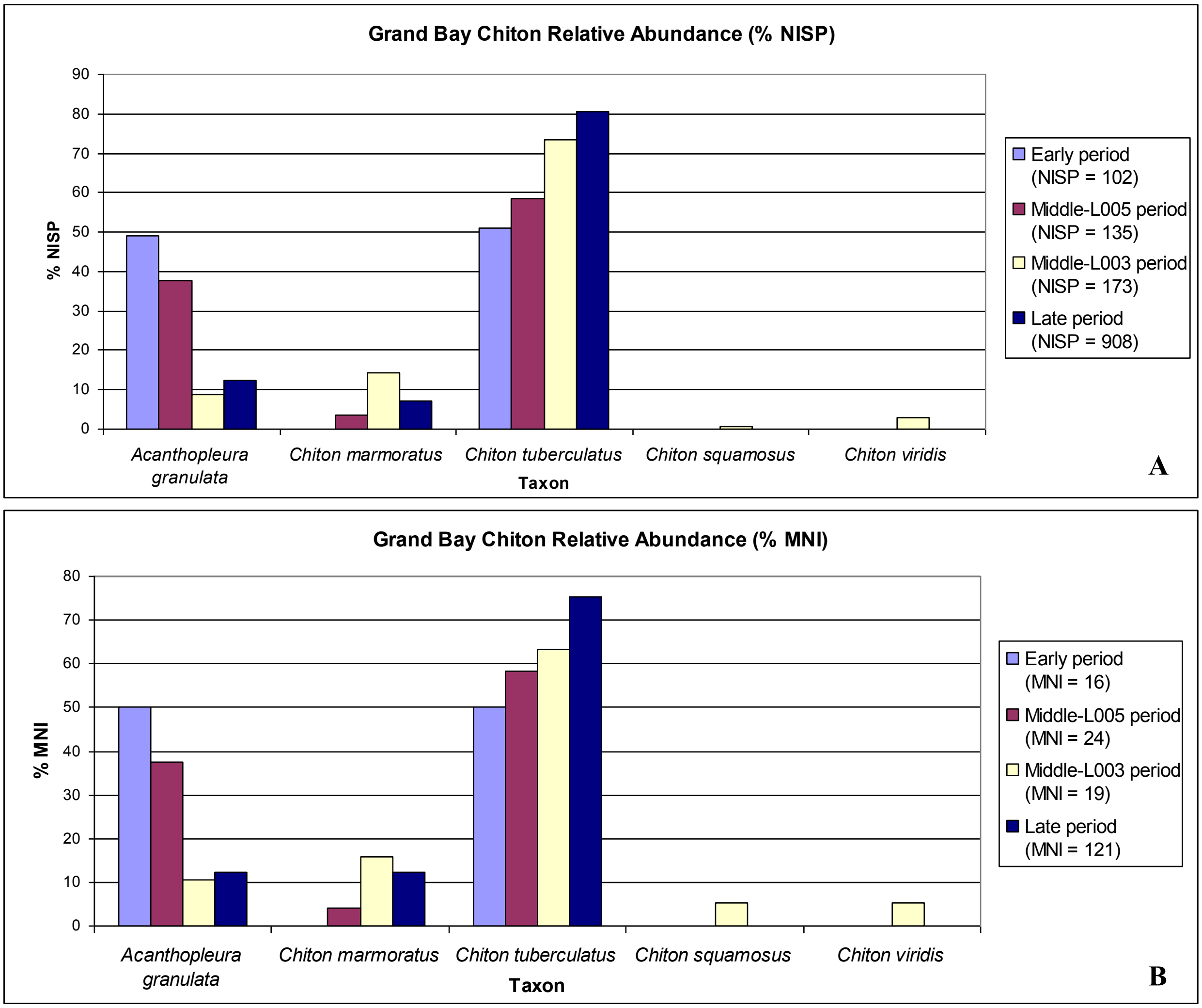


Figure 5.23 Chiton taxa and relative abundance for Grand Bay by A) % NISP and B) % MNI.

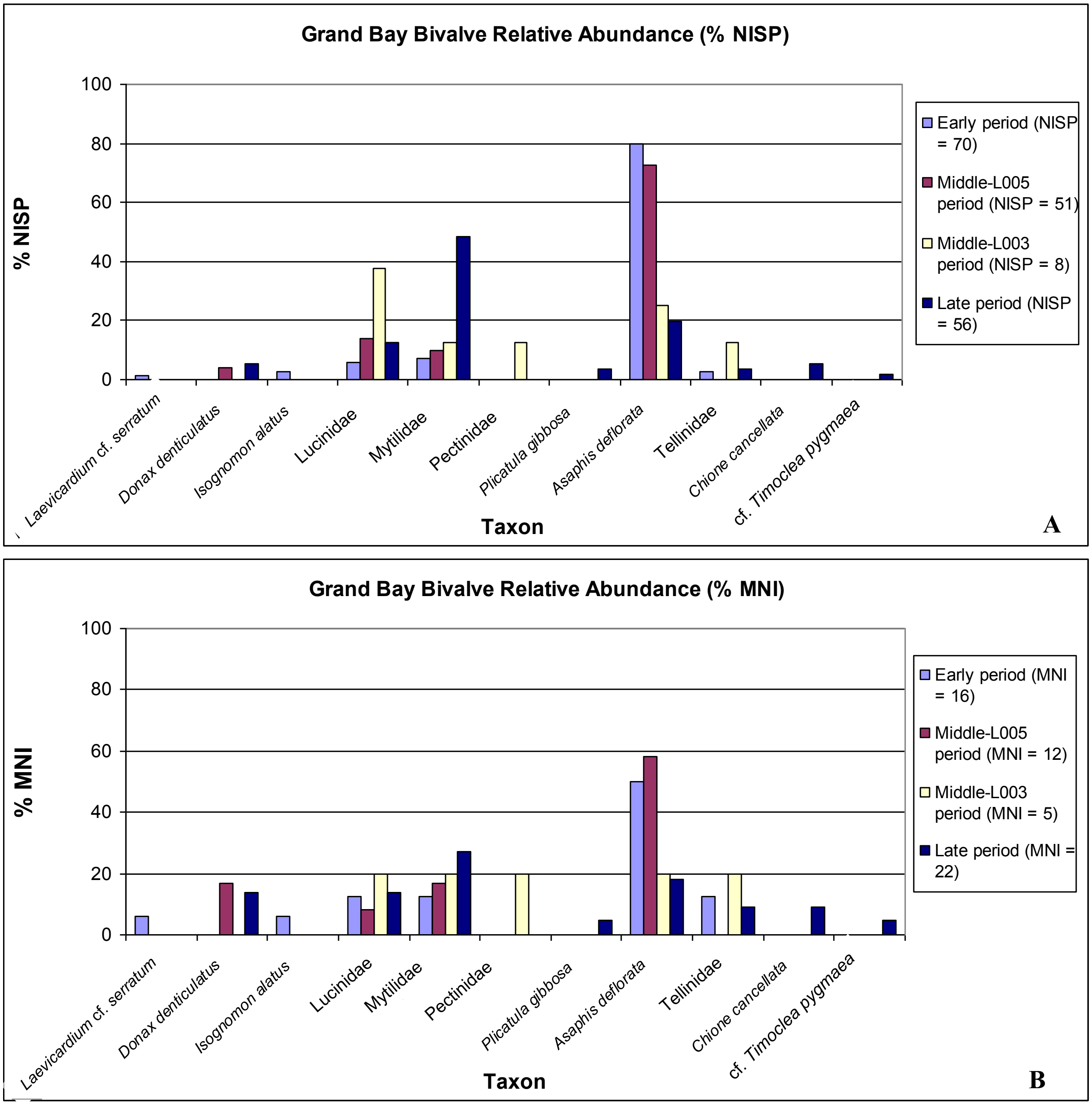


Figure 5.24 Bivalve taxa and relative abundance for Grand Bay by A) % NISP and B) % MNI.

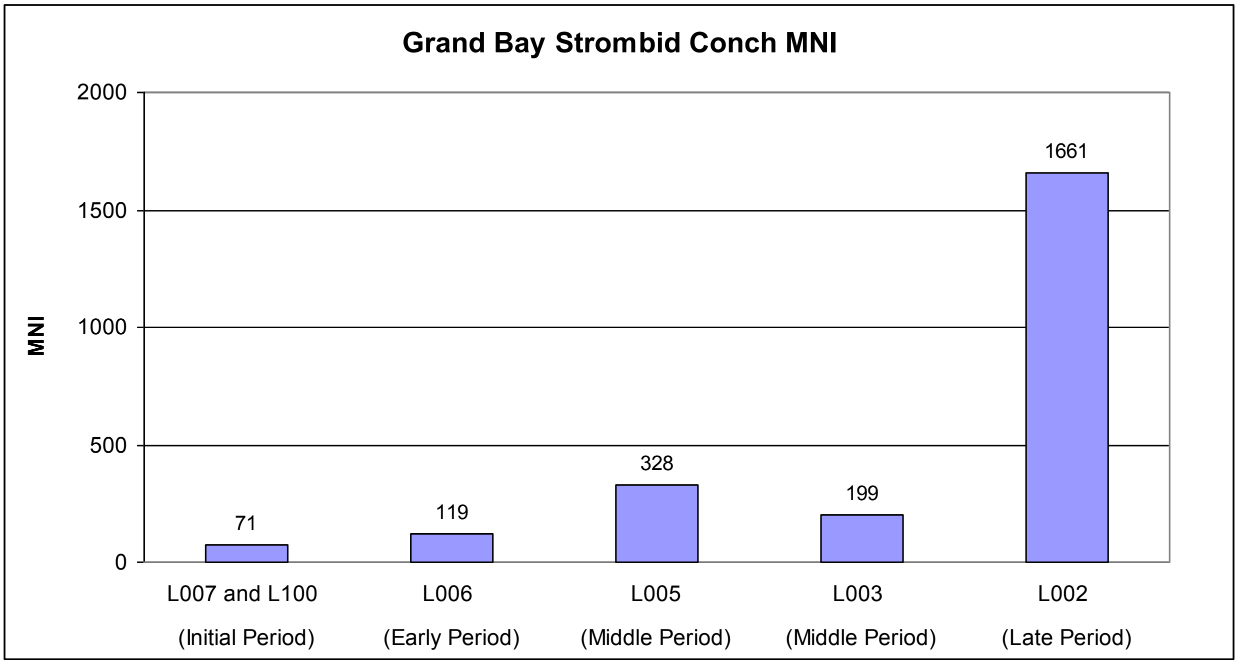


Figure 5.25 Strombid conch MNI for Grand Bay by stratum for all excavated contexts.

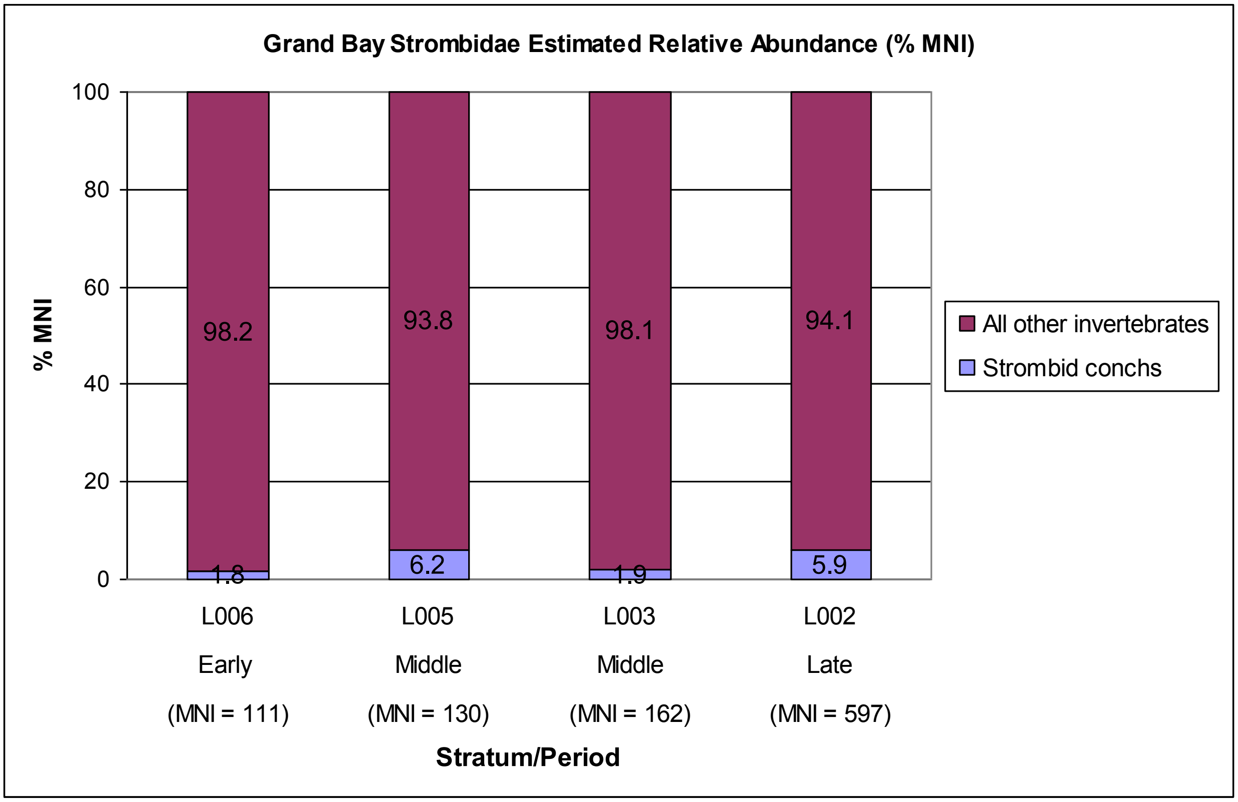


Figure 5.26 Estimates of relative abundance for strombid conchs at Grand Bay. See text for explanation of estimation method.

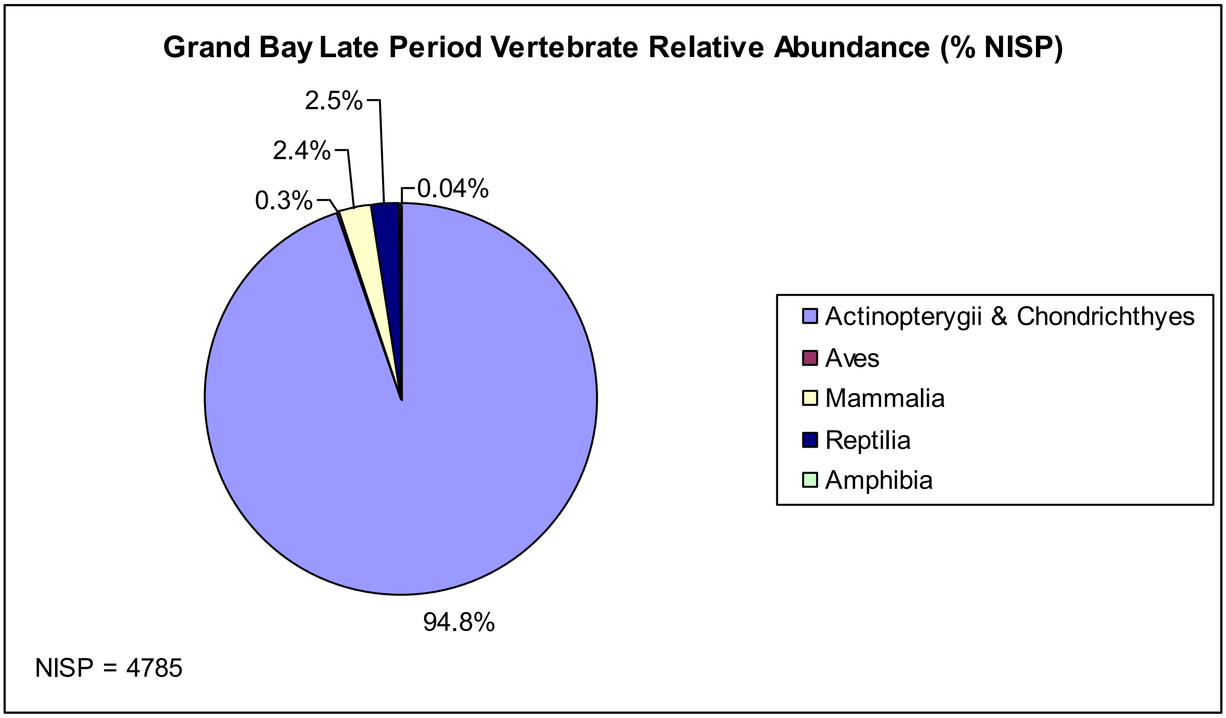


Figure 5.27 Vertebrate % NISP by class for the Late period at Grand Bay. NISP values include specimens identified to class level and below.

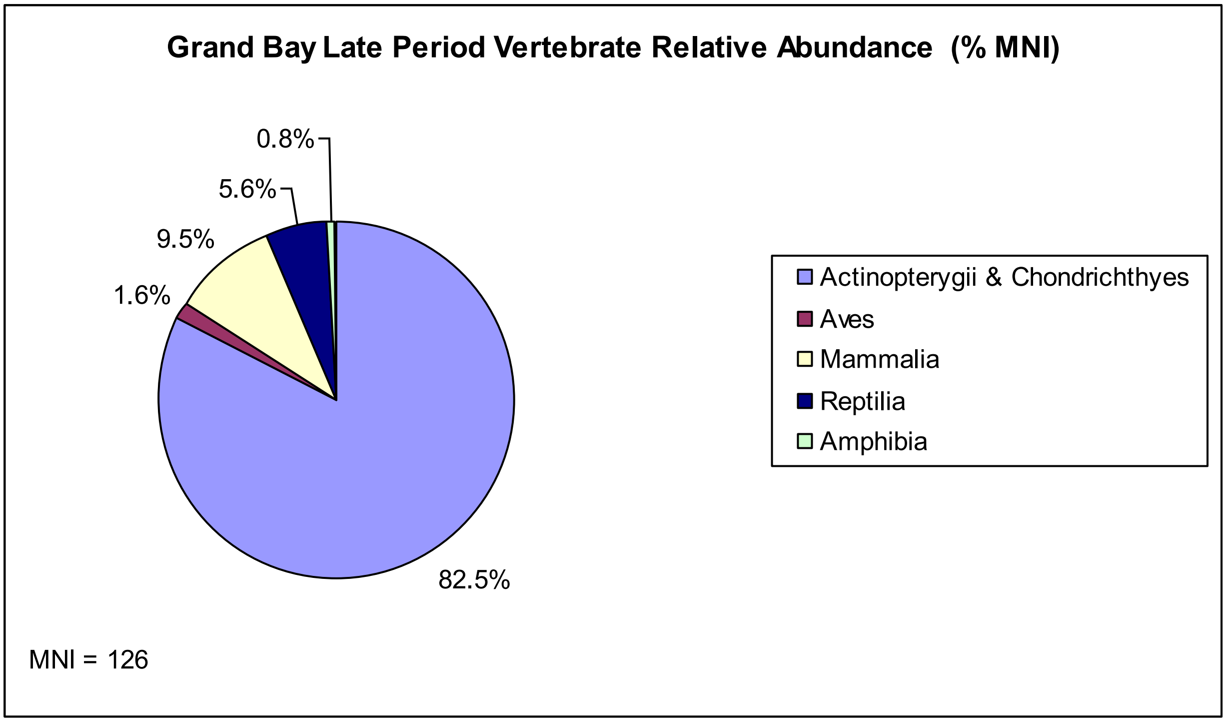


Figure 5.28 Vertebrate % MNI by class for the Late period at Grand Bay. MNI values include specimens identified to class level and below.

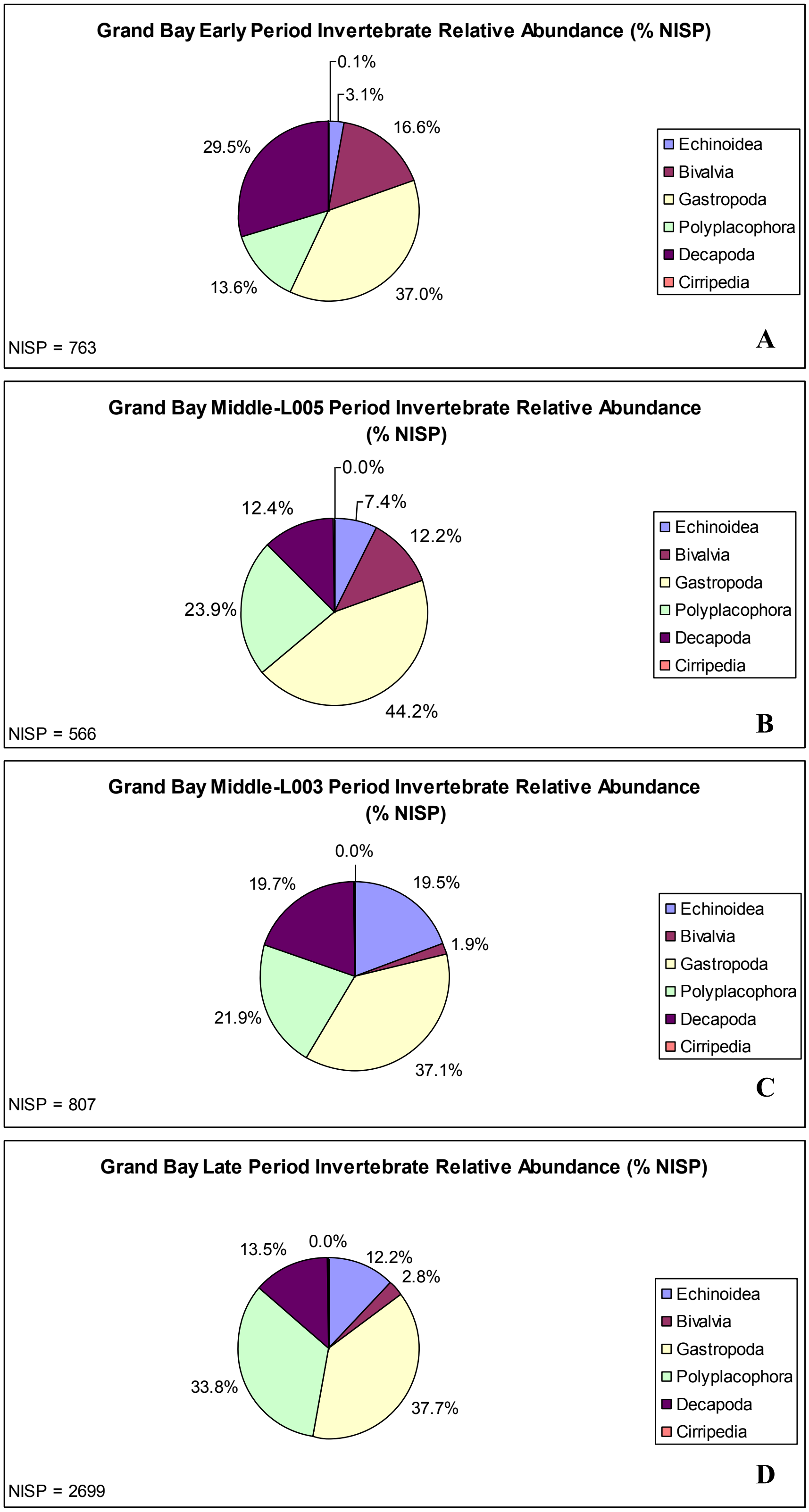


Figure 5.29 Invertebrate % NISP by class for the A) Early, B) Middle-L005, C) Middle-L003, and D) Late periods at Grand Bay. NISP values include specimens identified to class level and below.

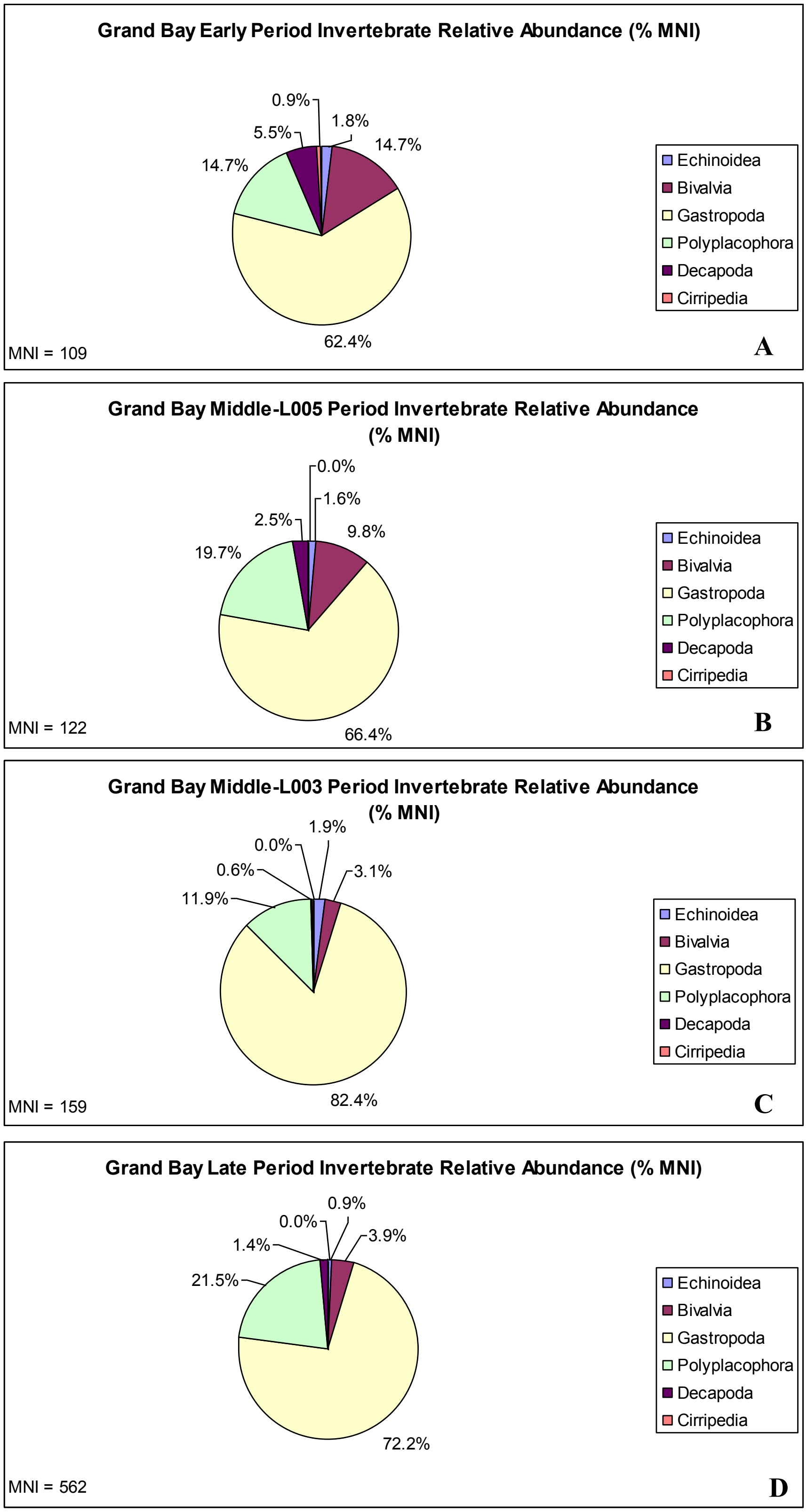


Figure 5.30 Invertebrate % MNI by class for the A) Early, B) Middle-L005, C) Middle-L003, and D) Late periods at Grand Bay. MNI values include specimens identified to class level and below.

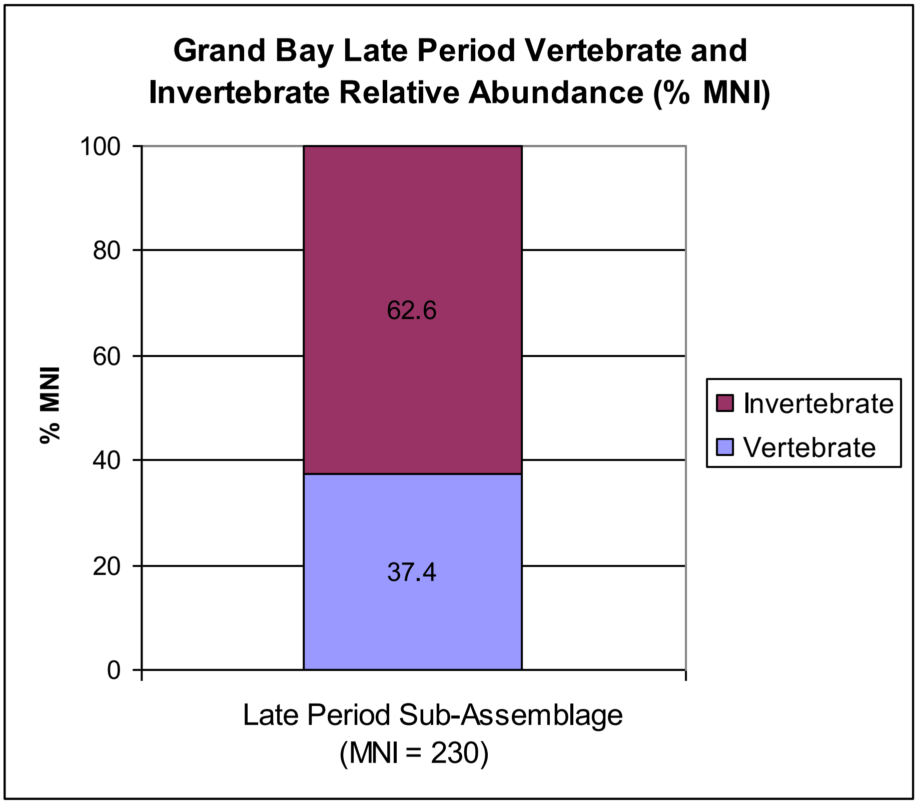


Figure 5.31 Invertebrate and vertebrate relative abundance at Grand Bay. Data based on the comparative vertebrate and invertebrate sub-assemblage (Table 5.23).

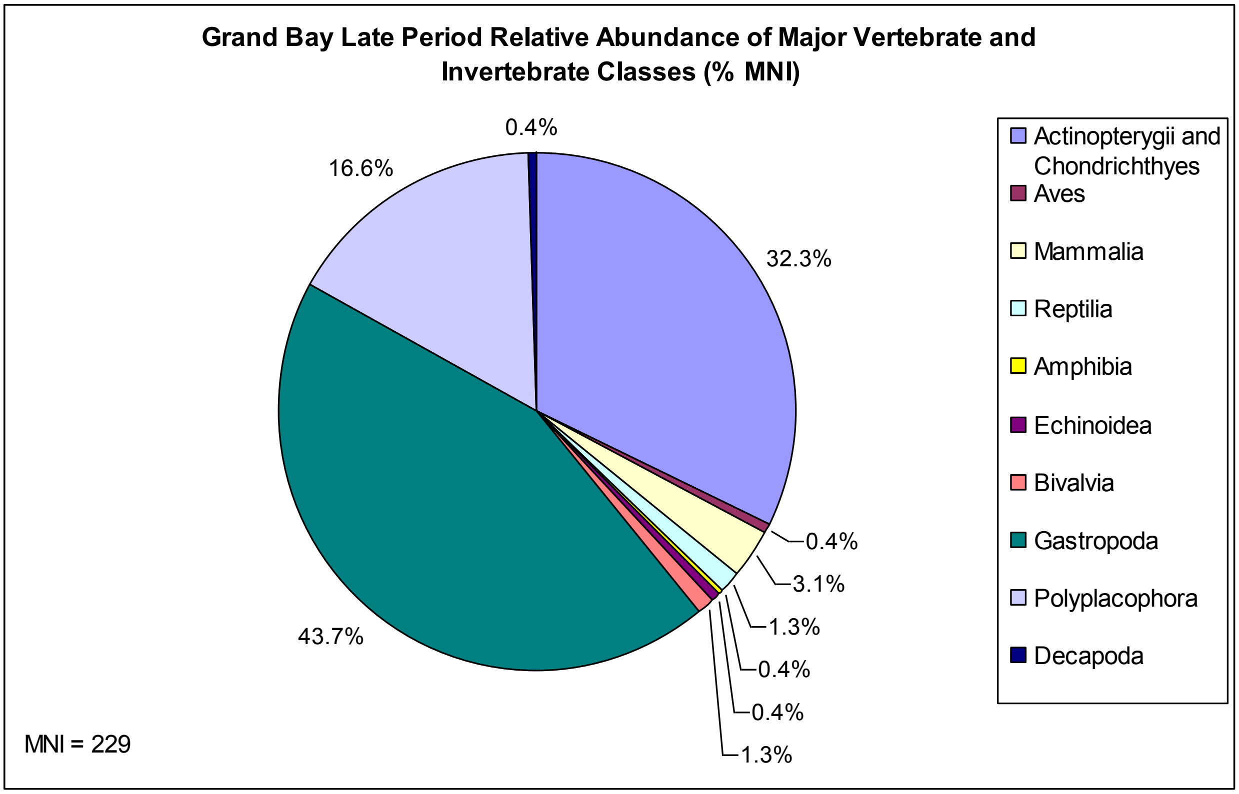


Figure 5.32 Relative abundance of vertebrate and invertebrate classes at Grand Bay based on % MNI for the Late period. Data based on the vertebrate and invertebrate comparative sub-assemblage (Table 5.23).

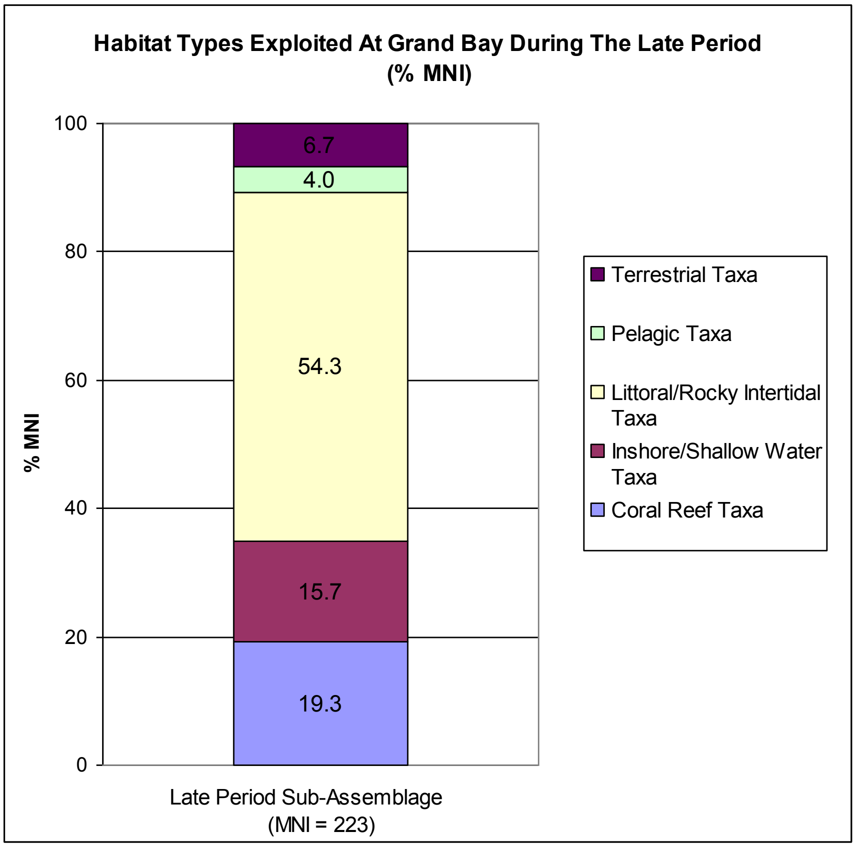


Figure 5.33 Habitat patch exploitation at Grand Bay based on % MNI. Data are based on Table 5.29.

Table 5.1 Faunal samples from the Sabazan site analyzed in this research. See Appendix A for subsampling treatment for each context analyzed.

Sabazan Faunal Samples Analyzed

Provenience			^{14}C Dates		Samples Analyzed			
Layer	Level	Stratum	Lab. No.	Calendar Age (2σ)	6.4 mm Vertebrate	1.6 mm Vertebrate	6.4 mm Invertebrate	1.6 mm Invertebrate
Trench 1, square 1								
2	1	2	AA81054	AD 1280-1400	CSZ-006			
2	2	2			CSZ-026			
2	3	2			CSZ-041			
2	4	2			CSZ-057			
3	1	4	OS-71407	AD 1020-1150	CSZ-053			
3	2	4			CSZ-075			
4	1	5	OS-71408	AD 1020-1150	CSZ-091			
4	2	5			CSZ-109			
5	1	6	AA81056	AD 910-1160	CSZ-116			
5	2	6	OS-71409	AD 1040-1160	CSZ-136			
5	3	6			CSZ-175			
5	4	6			CSZ-195			
5	5	6			CSZ-222			
Feat A	1	(within Stratum 4)			CSZ-081			
Trench 2, square 1								
2	1	2	OS-71410	modern	CSZ-013	CSZ-011		
2	2	2			CSZ-023	CSZ-024	CSZ-023	CSZ-024
3	1	3	OS-71462	AD 1020-1150	CSZ-035	CSZ-036	CSZ-035	CSZ-036
3	2	3			CSZ-046	CSZ-047		
3A	1	3A	AA81055	AD 730-990	CSZ-063	CSZ-064	CSZ-063	CSZ-064
3A	2	3A			CSZ-085	CSZ-086		
3A	3	3A			CSZ-100	CSZ-101		
3A	4	3A	OS-71463	AD 870-970	CSZ-113	CSZ-114	CSZ-113	CSZ-114
3A	5	3A			CSZ-126	CSZ-127		
3A	6	3A			CSZ-133	CSZ-135		
4	1	8	OS-71464	AD 890-990	CSZ-162	CSZ-164	CSZ-162	CSZ-164
5	1	9			CSZ-166	CSZ-168		
5	2	9			CSZ-213	CSZ-215	CSZ-213	CSZ-215
5	3	9	OS-71465	AD 900-1010	CSZ-239	CSZ-241		
Feat B	1	(within/above Stratum 8)				CSZ-179		
Feat C	1	(within/above Stratum 8)				CSZ-187		
Coastal Profile Column								
L11	N/A	L11	AA67529	AD 980-1160	03CAR-234	03CAR-234	03CAR-234	03CAR-234
			AA67530	AD 900-1120				
L14	N/A	L14	AA67533	AD 770-970	03CAR-235	03CAR-235	03CAR-235	03CAR-235
			AA67534	AD 600-860				
			UCIAMS-94046	AD 680-780				

Table 5.2 Faunal samples from the Grand Bay site analyzed for this research. Samples 04CGB000180, 04CGB000206, 04CGB000359 analyzed by LeFebvre (2005, 2007). No ^{14}C dates from analyzed proveniences; associated dates provided in Table 4.1.

Grand Bay Faunal Samples Analyzed

	Provenience			^{14}C Dates		Samples Analyzed			
	Square	Planum	Stratum	Lab. No.	Calendar Age (2σ)	6.4 mm Vertebrate	1.6 mm Vertebrate	6.4 mm Invertebrate	1.6 mm Invertebrate
Trench 415									
	07	2	L002					05CGB000911SHE	
	07	3	L002					05CGB001006SHE	
	07	4	L002					05CGB001101SHE	
	07	5	L002					07CGB001288SHE	
	07	6	L002					07CGB001326SHE	
	07	7	L005					07CGB001429SHE	
	07	8	L005					08CGB001475SHE	
	07	9	L006					08CGB001600SHE	
	07	10	L006					08CGB001651SHE1	
	17	2	L002					05CGB000908SHE	
	17	3	L002					05CGB001003SHE	
	17	4	L002					05CGB001103SHE	
	17	5	L002					07CGB001290SHE	
	17	6	L005					07CGB001330SHE	
	17	7	L005					07CGB001433SHE	
	17	8	L006					08CGB001479SHE	
	17	9	L006					08CGB001604SHE	
Trench 446									
	07	2	L002					04CGB000227SHE	
	07	3	L002						04CGB000336
	07	4	L003						05CGB000920
	07	6	L003					05CGB001020SHE	
	07	7	L005						07CGB001234SC
	07	8	L005					07CGB001334SHE	07CGB001335SC
	07	9	L006						07CGB001426SC
	07	10	L006					08CGB001493SHE	08CGB001494SAABO
	07	11	L006					08CGB001596SHE	08CGB001597SAABO
	07	12	L006					08CGB001637SHE	08CGB001638SAABO
	09	3	L002			04CGB000359	04CGB000359		
	19	3	L002					04CGB000299SHEa	
	19	4	L003					05CGB000921	
Trench 561									
	09	2	L002			04CGB000206	04CGB000206		
Trench 592									
	09	2	L002			04CGB000180	04CGB000180		

Table 5.3 Grand Bay strombid conch MNI from combined field counts and screened faunal material.

Grand Bay Strombid Conch MNI

Provenience	Stratum	Corresponding Period	Field Counts MNI	Screened Specimens MNI	Total MNI
Trench 415	L002	Late	802	4	806
Trench 446	L002	Late	792	2	794
Trench 561	L002	Late	35		35
Trench 592	L002	Late	26		26
Total L002			1655	6	1661
Trench 446	L003	Middle-L003	197	2	199
Total L003			197	2	199
Trench 415	L005	Middle-L005	174	1	175
Trench 446	L005	Middle-L005	153		153
Total L005			327	1	328
Trench 415	L006	Early/Initial	38	1	39
Trench 446	L006	Early/Initial	78		78
Trench 477	L006	Early/Initial	2		2
Total L006			118	1	119
Trench 415	L007	Initial	25		25
Trench 446	L007	Initial	38		38
Trench 563	100 (subsoil)	Initial	8		8
Total L007 and L100			71		71
Trench 446 L003A (sq 16 and 21)	hearth		15		15
F0024	unknown		1		1
F0036	posthole		3		3
F0094	posthole		7		7
F0179	pit		1		1
Total Feature			27		27
Total strombid conch			2395	10	2405
Total L001 disturbed layer			79		

Table 5.4 Sabazan conch counts from hand troweled/field recorded specimens and analyzed screened specimens from 6.4 and 1.6 mm fraction. MNI based on apex or columella counts.

Sabazan Strombid Conch MNI

	Taxon	Common name	Period	Square	Layer	Level	Stratum	Collection Method	NISP	MNI
Trench 1										
	Strombidae	conch	Final	1	2	1	2	trowel	14	5
	Aliger costatus	milk conch	Final	1	2	2	2	trowel	1	1
	Eustrombus gigas	queen conch	Final	1	2	2	2	trowel	1	1
	Strombidae	conch	Final	1	2	3	2	trowel	22	8
	Strombidae	conch	Final	1	2	4	2	trowel	4	1
	Strombidae	conch	Late	1	3	1	4	trowel	8	5
	Aliger gallus	rooster-tail conch	Late	1	3	2	4	trowel	1	1
	Strombidae	conch	Late	1	3	2	4	trowel	8	7
	Strombidae	conch	Late	1	4	1	5	trowel	2	1
	Strombidae	conch	Late	1	4	2	5	trowel	4	2
	Strombidae	conch	Final	2	2	1	2	trowel	18	8
	Strombidae	conch	Final	2	2	2	2	trowel	17	10
	Strombidae	conch	Final	2	2	3	2	trowel	12	6
	Strombidae	conch	Late	2	3	1	4	trowel	19	7
Trench 2										
	Strombidae	conch	Final	1	2	2	2	screen	15	–
	Strombidae	conch	Final	1	2	2	2	trowel	2	2
	Eustrombus gigas	queen conch	Late	1	3	1	3	screen	7	1
	Strombidae	conch	Late	1	3	1	3	screen	15	–
	Strombidae	conch	Late	1	3	1	3	trowel	1	1
	Eustrombus gigas	queen conch	Middle	1	3A	1	3A	screen	15	–
	Strombidae	conch	Middle	1	3A	1	3A	screen	23	–
	Strombidae	conch	Middle	1	3A	2	3A	trowel	1	–
	Strombidae	conch	Middle	1	3A	3	3A	trowel	1	–
	Strombidae	conch	Middle	1	3A	4	3A	screen	2	–
	Strombidae	conch	Middle	1	3A	4	3A	trowel	1	1
	Strombidae	conch	Middle	1	3A	6	3A	trowel	5	3
	Eustrombus gigas	queen conch	Middle	1	4	1	8	screen	1	–
	Strombidae	conch	Middle	1	4	1	8	screen	4	–
	Strombidae	conch	Middle	1	4	1	8	trowel	1	–
	Strombidae	conch	Middle	1	5	1	9	trowel	1	1
	Eustrombus gigas	queen conch	Middle	1	5	2	9	screen	16	–
	Strombidae	conch	Middle	1	5	2	9	screen	88	–
	Strombidae	conch	Middle	1	5	3	9	trowel	2	2
Trench 3										
	Strombidae	conch	N/A	1	1	1	1	trowel	1	1
	Aliger costatus	milk conch	Final	1	2	1	2	trowel	1	1
	Strombidae	conch	Final	1	2	1	2	trowel	7	3
	Aliger gallus or *Lobatus raninus*	rooster-tail or hawk-wing conch	Final	1	2	2	2	trowel	1	1
	Strombidae	conch	Final	1	2	2	2	trowel	4	2
	Strombidae	conch	Middle-Final	1	3	1	7	trowel	5	1
	Strombidae	conch	Middle-Final	1	3	2	7	trowel	1	1
	Strombidae	conch	Middle-Final	1	3	3	7	trowel	4	3
	Aliger costatus	milk conch	Middle	1	4	1	3A	trowel	1	1
Coastal Profile Column										
	Eustrombus gigas	queen conch	Late		L11	Column		screen	2	–
	Eustrombus gigas	queen conch	Early		L14	Column		screen	4	–
	Strombidae	conch	Early		L14	Column		screen	6	–
Total									369	88

Table 5.5 The occupation periods defined at Sabazan on the basis of the radiocarbon chronology and associated archaeological contexts.

Sabazan Occupation Periods

Period	Date Range	Assigned ^{14}C Dates and Lab No.	Assigned Strata	Strata Location(s)
Final	ca. AD 1250-1400			
		AD 1280-1400 (AA81054)	2	Trench 1
		AD 1280-1380 (OS-71466)	2	Trench 3
		modern (contaminated) (OS-71410)	2	Trench 2
Late	ca. AD 1000-1150			
		AD 900-1120 (AA67530)	XI (L11)	Column profile
		AD 980-1160 (AA67529)	XI (L11)	Column profile
		AD 1020-1150 (OS-71462)	3	Trench 2
		AD 1020-1150 (OS-71407)	4	Trench 1
		AD 1020-1150 (OS-71408)	5	Trench 1
		AD 910-1160 (AA81056)	6	Trench 1
		AD 1040-1160 (OS-71409)	6	Trench 1
			Feat. A	Trench 1 (within Stratum 4)
Middle	ca. AD 750/800-1000			
		AD 780-990 (AA67531)	XIII (L13)	Column profile
		AD 890-1020 (AA67532)	XIII (L13)	Column profile
		AD 730-990 (AA81055)	3A	Trench 2
		AD 870-970 (OS-71463)	3A	Trench 2
		AD 710-880 (OS-71467)	3A	Trench 3
		AD 890-990 (OS-71464)	8	Trench 2
		AD 900-1010 (OS-71465)	9	Trench 2
			Feat. B	Trench 2 (within Stratum 8)
			Feat. C	Trench 2 (within Stratum 8)
Early	ca. AD 600-800/850			
		AD 600-860 (AA67534)	XIV (L14)	Column profile
		AD 680-780 (UCIAMS-94046)	XIV (L14)	Column profile
		AD 770-970 (AA67533)	XIV (L14)	Column profile
Initial	ca. AD 400-550			
		AD 400-550 (AA67535)	XV (L15)	Column profile
		AD 410-560 (AA67536)	XV (L15)	Column profile

Table 5.6 The occupation periods defined at Grand Bay on the basis of stratigraphy with associated radiocarbon dates and archaeological contexts.

Grand Bay Occupation Periods

Period	Date Range	Assigned ^{14}C Dates and Lab No.	Assigned Strata	Strata Location(s)
Final	ca. AD 1250-1450			
		AD 1410-1450 (UCIAMS-111934)	N/A; Feat. F177 (Burial)	N/A
Late	ca. AD 1000-1250			
		AD 1050-1250 (AA-62283)	N/A; Feat. F006 (Burial)	N/A
		AD 1040-1260 (Beta-257793	N/A; Feat. F0164 (Burial)	N/A
		AD 1020-1190 (Beta-233647)	L002	All analyzed contexts
		AD 990-1150 (UCIAMS-94044)	L002	All analyzed contexts
		AD 990-1030 (UCIAMS-94045)	L002	All analyzed contexts
Middle	ca. AD 850-1000			
		Interpolation between Late and Early dates	L003	Trench 446
			L005	All analyzed contexts
Early	ca. AD 650-850/900			
		AD 620-680 (UCIAMS111935)	N/A; Feat. F180 (Burial)	N/A
		AD 690-890 (AA-62282)	L006 - Upper	All analyzed contexts
		AD 680-880 (AA-62279)	L006 - Upper	All analyzed contexts
		AD 640-770 (AA-62281)	L006 - Upper	All analyzed contexts
Initial	ca. AD 400-650			
		AD 530-690 (AA-62280)	L006 -Lower	N/A
		AD 470-670 (AA-62280)	L006 -Lower	N/A
		AD 380-670 (Beta-206685)	North profile, 108 cm below surface	
		AD 390-590 (AA-62278)	L007/subsoil transition	N/A

Table 5.7 The Sabazan zooarchaeological assemblage; %NISP and %MNI based on class totals. *Added to MNI because specimen represents a complete but unidentifiable individual or only individual from a specific context.

Sabazan Zooarchaeological Assemblage

Class	Taxon	Common Name	Early Period					Middle Period					Late Period					Final Period					Site Total				
			NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)
Vertebrata																											
Chondrichthyes: Elasmobranchii																											
	Myliobatidae	eagle ray	–	–	–	–	–	–	–	–	–	–	1	0.2	1	1.0	2.82	–	–	–	–	–	1	0.0	1	0.3	2.82
	Total Myliobatidae		–	–	–	–	–	–	–	–	–	–	1	0.2	1	1.0	2.82	–	–	–	–	–	1	0.0	1	0.3	2.82
Actinopterygii																											
	cf. Acanthuridae		–	–	–	–	–	1	0.1	–	–	0.03	–	–	–	–	–	2	0.4	–	–	0.45	3	0.1	–	–	0.48
	Acanthurus sp.	surgeonfish	–	–	–	–	–	161	8.1	12	5.9	22.30	82	13.1	8	7.8	13.59	63	12.7	6	7.8	11.37	306	9.7	26	6.6	47.26
	Total Acanthuridae		–	–	–	–	–	162	8.1	12	5.9	22.33	82	13.1	8	7.8	13.59	65	13.1	6	7.8	11.82	309	9.8	26	6.6	47.74
	Acanthuridae/ Pomacanthidae	surgeonfish/ angelfish	–	–	–	–	–	1	0.1	–	–	0.05	–	–	–	–	–	–	–	–	–	–	1	0.0	–	–	0.05
	Balistidae	triggerfish	–	–	–	–	–	23	1.2	5	2.5	15.92	12	1.9	4	3.9	4.12	6	1.2	3	3.9	1.62	41	1.3	12	3.1	21.66
	Belonidae	needlefish	–	–	–	–	–	4	0.2	1	0.5	0.44	–	–	–	–	–	2	0.4	2	2.6	0.12	6	0.2	3	0.8	0.56
	cf. *Strongylura* sp.	needlefish	–	–	–	–	–	2	0.1	1	0.5	0.01	–	–	–	–	–	–	–	–	–	–	2	0.1	1	0.3	0.01
	Total Belonidae		–	–	–	–	–	6	0.3	2	1.0	0.45	–	–	–	–	–	2	0.4	2	2.6	0.12	8	0.3	4	1.0	0.57
	Carangidae	jack, pompano, scad	6	20.0	–	–	0.02	219	11.0	2	1.0	6.06	21	3.3	4	3.9	1.11	25	5.0	–	–	1.92	271	8.6	6	1.5	9.11
	cf. Carangidae		–	–	–	–	–	2	0.1	–	–	0.01	–	–	–	–	–	3	0.6	–	–	1.18	5	0.2	–	–	1.19
	Caranx sp.	jack	–	–	–	–	–	1	0.1	1	0.5	0.64	–	–	–	–	–	2	0.4	2	2.6	0.73	3	0.1	3	0.8	1.37
	cf. *Caranx* sp.		–	–	–	–	–	4	0.2	1	0.5	3.70	–	–	–	–	–	–	–	–	–	–	4	0.1	1	0.3	3.70
	cf. *Elagatis bipinnulata*	rainbow runner	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.2	1	1.3	0.34	1	0.0	1	0.3	0.34
	Selar crumenophthalmus	bigeye scad	2	6.7	1	10.0	0.01	71	3.6	46	22.8	0.53	11	1.8	6	5.8	0.03	13	2.6	6	7.8	0.08	97	3.1	59	15.1	0.65
	cf. *Selar crumenophthalmus*		–	–	–	–	–	50	2.5	2	1.0	0.45	5	0.8	–	–	0.01	–	–	–	–	–	55	1.7	2	0.5	0.46
	Trachurus lathami	rough scad	–	–	–	–	–	–	–	–	–	–	1	0.2	1	1.0	<0.01	9	1.8	9	11.7	0.05	10	0.3	10	2.6	0.05
	cf. *Trachurus lathami*		–	–	–	–	–	15	0.8	10	5.0	0.03	2	0.3	2	1.9	<0.01	–	–	–	–	–	17	0.5	12	3.1	0.03
	cf. *Trachurus lathami*/*Selar crumenophthalmus*		2	6.7	1	10.0	<0.01	66	3.3	–	–	0.66	2	0.3	–	–	<0.01	5	1.0	–	–	0.01	75	2.4	1	0.3	0.67
	Total Carangidae		10	33.3	2	20.0	0.03	428	21.4	62	30.7	12.08	42	6.7	13	12.6	1.15	58	11.7	18	23.4	4.31	538	17.1	95	24.2	17.57
	Chaetodontidae	butterflyfish	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.2	1	1.3	0.03	1	0.0	1	0.3	0.03
	Clupeidae	herring, shad	2	6.7	1	10.0	<0.01	125	6.3	6	3.0	0.30	36	5.7	2	1.9	0.09	31	6.2	4	5.2	0.05	194	6.2	13	3.3	0.44
	Clupeidae/ Engraulidae	herring, shad/ anchovie	–	–	–	–	–	5	0.3	–	–	0.02	4	0.6	–	–	0.01	2	0.4	–	–	<0.01	11	0.3	–	–	0.03
	Diodontidae	porcupinefish	–	–	–	–	–	3	0.2	2	1.0	25.28	–	–	–	–	–	1	0.2	1	1.3	0.55	4	0.1	3	0.8	25.83
	Exocoetidae	flyingfish	–	–	–	–	–	4	0.2	3	1.5	0.14	4	0.6	1	1.0	0.03	4	0.8	2	2.6	0.19	12	0.4	6	1.5	0.36
	cf. Exocoetidae		–	–	–	–	–	1	0.1	–	–	0.06	–	–	–	–	–	2	0.4	–	–	0.01	3	0.1	–	–	0.07
	Total Exocoetidae		–	–	–	–	–	5	0.3	3	1.5	0.20	4	0.6	1	1.0	0.03	6	1.2	2	2.6	0.20	15	0.5	6	1.5	0.43

Table 5.7 continued

Sabazan Zooarchaeological Assemblage Continued

			Early Period					Middle Period					Late Period					Final Period					Site Total				
Class	Taxon	Common Name	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)
Actinopterygii continued																											
	Exocoetoidea	flyingfish, halfbeak	–	–	–	–	–	4	0.2	–	–	0.02	1	0.2	–	–	0.01	–	–	–	–	–	5	0.2	–	–	0.03
	Haemulidae	grunt	1	3.3	1	10.0	<0.01	42	2.1	5	2.5	5.28	20	3.2	3	2.9	3.64	28	5.6	4	5.2	3.00	91	2.9	13	3.3	11.92
	cf. Haemulidae		1	3.3	–	–	<0.01	4	0.2	–	–	0.05	1	0.2	–	–	0.09	1	0.2	1	1.3	0.01	7	0.2	1	0.3	0.15
	Anisotremus sp.	porkfish, black margate	–	–	–	–	–	1	0.1	1	0.5	0.15	–	–	–	–	–	–	–	–	–	–	1	0.0	1	0.3	0.15
	cf. *Haemulon* sp.	grunt	–	–	–	–	–	19	1.0	3	1.5	5.29	3	0.5	2	1.9	0.51	2	0.4	1	1.3	0.28	24	0.8	6	1.5	6.08
	Total Haemulidae		2	6.7	1	10.0	0.00	66	3.3	9	4.5	10.77	24	3.8	5	4.9	4.24	31	6.2	6	7.8	3.29	123	3.9	21	5.4	18.30
	Hemiramphidae	halfbeak	1	3.3	1	10.0	<0.01	33	1.7	5	2.5	0.21	6	1.0	1	1.0	0.02	–	–	–	–	–	40	1.3	7	1.8	0.23
	cf. Hemiramphidae		–	–	–	–	–	1	0.1	–	–	<0.01	–	–	–	–	–	–	–	–	–	–	1	0.0	–	–	<0.01
	Total Hemiramphidae		1	3.3	1	10.0	0.00	34	1.7	5	2.5	0.21	6	1.0	1	1.0	0.02	–	–	–	–	–	41	1.3	7	1.8	0.23
	Holocentridae	squirrelfish, soldierfish	–	–	–	–	–	23	1.2	3	1.5	2.47	3	0.5	3	2.9	0.22	6	1.2	1	1.3	0.78	32	1.0	7	1.8	3.47
	cf. Holocentridae		–	–	–	–	–	1	0.1	–	–	0.02	–	–	–	–	–	–	–	–	–	–	1	0.0	–	–	0.02
	cf. *Holocentrus* sp.	squirrelfish	–	–	–	–	–	2	0.1	1	0.5	0.30	–	–	–	–	–	–	–	–	–	–	2	0.1	1	0.3	0.30
	Total Holocentridae		–	–	–	–	–	26	1.3	4	2.0	2.79	3	0.5	3	2.9	0.22	6	1.2	1	1.3	0.78	35	1.1	8	2.0	3.79
	Labridae	wrasse, hogfish	–	–	–	–	–	17	0.9	3	1.5	1.65	6	1.0	2	1.9	1.22	2	0.4	1	1.3	0.27	25	0.8	6	1.5	3.14
	cf. Labridae		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.2	–	–	0.14	1	0.0	–	–	0.14
	Bodianus sp.	hogfish	–	–	–	–	–	–	–	–	–	–	1	0.2	1	1.0	0.03	–	–	–	–	–	1	0.0	1	0.3	0.03
	cf. *Bodianus* sp.		–	–	–	–	–	3	0.2	1	0.5	1.10	–	–	–	–	–	–	–	–	–	–	3	0.1	1	0.3	1.10
	Halichoeres sp.	wrasse	–	–	–	–	–	1	0.1	1	0.5	0.18	2	0.3	1	1.0	0.99	1	0.2	1	1.3	0.16	4	0.1	3	0.8	1.33
	cf. *Halichoeres* sp.		–	–	–	–	–	7	0.4	1	0.5	4.03	1	0.2	1	1.0	0.44	1	0.2	1	1.3	0.16	9	0.3	3	0.8	4.63
	Total Labridae		–	–	–	–	–	28	1.4	6	3.0	6.96	10	1.6	5	4.9	2.68	5	1.0	3	3.9	0.73	43	1.4	14	3.6	10.37
	Labroidei	wrasse, parrotfish	–	–	–	–	–	3	0.2	–	–	0.69	1	0.2	–	–	0.16	1	0.2	–	–	0.14	5	0.2	–	–	0.99
	cf. Labroidei		–	–	–	–	–	–	–	–	–	–	1	0.2	–	–	0.09	–	–	–	–	–	1	0.0	–	–	0.09
	Total Labroidei		–	–	–	–	–	3	0.2	–	–	0.69	2	0.3	–	–	0.25	1	0.2	–	–	0.14	6	0.2	–	–	1.08
	Lutjanidae	snapper	–	–	–	–	–	13	0.7	3	1.5	1.44	6	1.0	3	2.9	1.72	8	1.6	3	3.9	1.83	27	0.9	9	2.3	4.99
	cf. Lutjanidae		–	–	–	–	–	1	0.1	–	–	0.53	2	0.3	2	1.9	0.14	1	0.2	–	–	0.15	4	0.1	2	0.5	0.82
	cf. *Ocyurus chrysurus*	yellowtail snapper	–	–	–	–	–	1	0.1	1	0.5	0.12	–	–	–	–	–	–	–	–	–	–	1	0.0	1	0.3	0.12
	Total Lutjanidae		–	–	–	–	–	15	0.8	4	2.0	2.09	8	1.3	5	4.9	1.86	9	1.8	3	3.9	1.98	32	1.0	12	3.1	5.93
	Lutjanidae/ Serranidae	snapper/grouper, sea bass	–	–	–	–	–	1	0.1	–	–	0.52	8	1.3	–	–	4.16	2	0.4	–	–	0.40	11	0.3	–	–	5.08
	cf. Lutjanidae/ Serranidae		–	–	–	–	–	1	0.1	–	–	0.02	1	0.2	–	–	0.15	–	–	–	–	–	2	0.1	–	–	0.17
	Total Lutjanidae/Serranidae		–	–	–	–	–	2	0.1	–	–	0.54	9	1.4	–	–	4.31	2	0.4	–	–	0.40	13	0.4	–	–	5.25
	Malacanthidae	tilefish	–	–	–	–	–	1	0.1	1	0.5	0.02	–	–	–	–	–	–	–	–	–	–	1	0.0	1	0.3	0.02
	cf. *Mugil* sp.	mullet	–	–	–	–	–	1	0.1	1	0.5	0.06	–	–	–	–	–	–	–	–	–	–	1	0.0	1	0.3	0.06
	Total Mugilidae		–	–	–	–	–	1	0.1	1	0.5	0.06	–	–	–	–	–	–	–	–	–	–	1	0.0	1	0.3	0.06
	Mullidae	goatfish	–	–	–	–	–	5	0.3	1	0.5	0.05	1	0.2	1	1.0	0.03	–	–	–	–	–	6	0.2	2	0.5	0.08
	cf. Mullidae		–	–	–	–	–	21	1.1	4	2.0	0.05	4	0.6	–	–	0.01	2	0.4	1	1.3	<0.01	27	0.9	5	1.3	0.06
	Total Mullidae		–	–	–	–	–	26	1.3	5	2.5	0.10	5	0.8	1	1.0	0.04	2	0.4	1	1.3	0.00	33	1.0	7	1.8	0.14
	Ostraciidae	trunkfish, cowfish	–	–	–	–	–	1	0.1	1	0.5	0.02	1	0.2	1	1.0	<0.01	2	0.4	1	1.3	<0.01	4	0.1	3	0.8	0.02
	Pomacentridae	damselfish	1	3.3	1	10.0	<0.01	36	1.8	5	2.5	0.03	3	0.5	1	1.0	<0.01	4	0.8	2	2.6	0.06	44	1.4	9	2.3	0.09
	cf. Pomacentridae		–	–	–	–	–	5	0.3	1	0.5	<0.01	1	0.2	–	–	<0.01	1	0.2	–	–	<0.01	7	0.2	1	0.3	<0.01
	Total Pomacentridae		1	3.3	1	10.0	<0.01	41	2.1	6	3.0	0.03	4	0.6	1	1.0	<0.01	5	1.0	2	2.6	0.06	51	1.6	10	2.6	0.09

Table 5.7 continued

Sabazan Zooarchaeological Assemblage Continued

			Early Period					Middle Period					Late Period					Final Period					Site Total				
Class	Taxon	Common Name	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)
Actinopterygii continued																											
	Scaridae	parrotfish	5	16.7	–	–	0.15	160	8.0	1	0.5	22.04	78	12.4	3	2.9	21.48	53	10.7	–	–	12.36	296	9.4	4	1.0	56.03
	cf. Scaridae		–	–	–	–	–	1	0.1	–	–	0.07	–	–	–	–	–	1	0.2	1	1.3	<0.01	2	0.1	1	0.3	0.07
	Cryptotomus roseus	bluelip parrotfish	–	–	–	–	–	1	0.1	1	0.5	<0.01	–	–	–	–	–	–	–	–	–	–	1	0.0	1	0.3	<0.01
	Cryptotomus roseus / *Nicholsina usta*	bluelip/emerald parrotfish	–	–	–	–	–	1	0.1	1	0.5	0.02	1	0.2	1	1.0	<0.01	–	–	–	–	–	2	0.1	2	0.5	0.02
	Scarus sp.	parrotfish	1	3.3	1	10.0	0.04	49	2.5	7	3.5	12.76	12	1.9	9	8.7	12.58	12	2.4	3	3.9	2.79	74	2.3	20	5.1	28.17
	cf. *Scarus* sp.		–	–	–	–	–	1	0.1	–	–	0.09	1	0.2	–	–	0.71	2	0.4	–	–	0.53	4	0.1	–	–	1.33
	Sparisoma sp.	parrotfish	7	23.3	2	20.0	1.82	170	8.5	21	10.4	77.45	66	10.5	20	19.4	38.48	41	8.2	7	9.1	17.34	284	9.0	50	12.8	135.09
	cf. *Sparisoma* sp.		–	–	–	–	–	2	0.1	–	–	0.18	2	0.3	–	–	0.63	3	0.6	–	–	1.14	7	0.2	–	–	1.95
	Total Scaridae		13	43.3	3	30.0	2.01	385	19.3	31	15.3	112.61	160	25.5	33	32.0	73.88	112	22.5	11	14.3	34.16	670	21.2	78	19.9	222.66
	Cynoscion sp.	weakfish	–	–	–	–	–	1	0.1	1	0.5	0.06	–	–	–	–	–	–	–	–	–	–	1	0.0	1	0.3	0.06
	cf. *Cynoscion* sp.		–	–	–	–	–	–	–	–	–	–	1	0.2	1	1.0	0.27	–	–	–	–	–	1	0.0	1	0.3	0.27
	Total Sciaenidae		–	–	–	–	–	1	0.1	1	0.5	0.06	1	0.2	1	1.0	0.27	–	–	–	–	–	2	0.1	2	0.5	0.33
	Scombridae	tuna, mackerel	–	–	–	–	–	5	0.3	–	–	1.11	2	0.3	–	–	0.30	1	0.2	–	–	0.03	8	0.3	–	–	1.44
	cf. Scombridae		–	–	–	–	–	–	–	–	–	–	1	0.2	–	–	0.07	–	–	–	–	–	1	0.0	–	–	0.07
	Auxis sp.	bullet/frigate tuna	–	–	–	–	–	125	6.3	5	2.5	29.73	23	3.7	3	2.9	4.99	32	6.4	2	2.6	5.19	180	5.7	10	2.6	39.91
	cf. *Auxis* sp.		–	–	–	–	–	1	0.1	–	–	0.52	2	0.3	–	–	1.33	–	–	–	–	–	3	0.1	–	–	1.85
	Euthynnus alletteratus	little tunny	–	–	–	–	–	2	0.1	1	0.5	0.34	–	–	–	–	–	–	–	–	–	–	2	0.1	1	0.3	0.34
	Katsuwonus pelamis	skipjack	–	–	–	–	–	54	2.7	7	3.5	29.77	13	2.1	4	3.9	6.08	12	2.4	2	2.6	4.79	79	2.5	13	3.3	40.64
	cf. *Katsuwonus pelamis*		–	–	–	–	–	7	0.4	–	–	6.07	1	0.2	–	–	0.15	–	–	–	–	–	8	0.3	–	–	6.22
	Thunnus sp.	tuna	–	–	–	–	–	29	1.5	4	2.0	10.38	16	2.6	3	2.9	5.64	6	1.2	2	2.6	2.46	51	1.6	9	2.3	18.48
	cf. *Thunnus* sp.		–	–	–	–	–	1	0.1	–	–	0.31	1	0.2	–	–	0.84	1	0.2	–	–	1.04	3	0.1	–	–	2.19
	Auxis sp./ *Katsuwonus pelamis*	bullet/frigate tuna/ skipjack	–	–	–	–	–	8	0.4	–	–	7.26	5	0.8	–	–	1.17	1	0.2	–	–	0.12	14	0.4	–	–	8.55
	Katsuwonus pelamis / *Euthynnus alletteratus*	skipjack/little tunny	–	–	–	–	–	54	2.7	–	–	22.07	15	2.4	–	–	5.17	10	2.0	–	–	4.01	79	2.5	–	–	31.25
	Thunnus sp./ *Katsuwonus pelamis*	tuna/skipjack	–	–	–	–	–	10	0.5	–	–	4.62	5	0.8	–	–	2.39	9	1.8	–	–	4.47	24	0.8	–	–	11.48
	Thunnini	tuna	–	–	–	–	–	168	8.4	–	–	57.20	85	13.6	2	1.9	26.76	39	7.8	–	–	11.80	292	9.3	2	0.5	95.76
	cf. Thunnini		–	–	–	–	–	1	0.1	–	–	0.03	–	–	–	–	–	–	–	–	–	–	1	0.0	–	–	0.03
	Total Scombridae		–	–	–	–	–	465	23.3	17	8.4	169.41	169	27.0	12	11.7	54.89	111	22.3	6	7.8	33.91	745	23.6	35	8.9	258.21
	Serranidae	grouper, sea bass	–	–	–	–	–	87	4.4	6	3.0	28.95	32	5.1	3	2.9	16.46	31	6.2	1	1.3	15.47	150	4.8	10	2.6	60.88
	cf. Serranidae		–	–	–	–	–	4	0.2	–	–	0.64	3	0.5	–	–	0.32	1	0.2	–	–	0.38	8	0.3	–	–	1.34
	cf. *Cephalopholis fulva*	coney	1	3.3	1	10.0	0.11	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.0	1	0.3	0.11
	Epinephelus sp.	grouper	–	–	–	–	–	–	–	–	–	–	2	0.3	1	1.0	4.31	3	0.6	2	2.6	0.87	5	0.2	3	0.8	5.18
	cf. *Epinephelus* sp.		–	–	–	–	–	1	0.1	1	0.5	0.31	1	0.2	–	–	0.18	–	–	–	–	–	2	0.1	1	0.3	0.49
	Mycteroperca sp.	grouper	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.2	1	1.3	0.27	1	0.0	1	0.3	0.27
	Epinephelinae	coney/grouper	–	–	–	–	–	10	0.5	3	1.5	1.31	1	0.2	1	1.0	0.12	1	0.2	1	1.3	0.15	12	0.4	5	1.3	1.58
	cf. Epinephelinae		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.2	–	–	<0.01	1	0.0	–	–	<0.01
	Total Serranidae		1	3.3	1	10.0	0.11	102	5.1	10	5.0	31.21	39	6.2	5	4.9	21.39	38	7.6	5	6.5	17.14	180	5.7	21	5.4	69.85
	Sphyraena sp.	barracuda	–	–	–	–	–	1	0.1	1	0.5	0.29	–	–	–	–	–	–	–	–	–	–	1	0.0	1	0.3	0.29
	Total Sphyraenidae		–	–	–	–	–	1	0.1	1	0.5	0.29	–	–	–	–	–	–	–	–	–	–	1	0.0	1	0.3	0.29
	Tetraodontiformes	triggerfish, filefish, puffer, porcupinefish	–	–	–	–	–	–	–	–	–	–	1	0.2	–	–	0.33	–	–	–	–	–	1	0.0	–	–	0.33
	cf. Tetraodontiformes		–	–	–	–	–	1	0.1	–	–	0.58	–	–	–	–	–	–	–	–	–	–	1	0.0	–	–	0.58
	Total Tetraodontiformes		–	–	–	–	–	1	0.1	–	–	0.58	1	0.2	–	–	0.33	–	–	–	–	–	2	0.1	–	–	0.91

Table 5.7 continued

Sabazan Zooarchaeological Assemblage Continued

			Early Period					Middle Period					Late Period					Final Period					Site Total				
Class	Taxon	Common Name	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)
Actinopterygii continued																											
	Taxon B		–	–	–	–	–	17	0.9	3	1.5	0.01	–	–	–	–	–	–	–	–	–	–	17	0.5	3	0.8	0.01
	Taxon C		–	–	–	–	–	21	1.1	5	2.5	0.03	3	0.5	1	1.0	<0.01	1	0.2	1	1.3	<0.01	25	0.8	7	1.8	0.03
Total Identified Actinopterygii and Chondrichthyes			30	100.0	10	100.0	2.15	1999	100.0	202	100.0	416.03	627	100.0	103	100.0	186.20	497	100.0	77	100.0	111.29	3153	100.0	392	100.0	714.77
Indeterminate Actinopterygii (1.6 mm fraction excluded)			16	–	–	–	0.73	1181	–	–	–	166.39	344	–	–	–	57.43	349	–	–	–	56.60	1890	–	–	–	281.15
Aves																											
	Columbidae	pigeons and doves	–	–	–	–	–	2	50.0	2	66.7	0.56	1	100.0	1	100.0	0.26	3	100.0	2	100.0	0.31	6	75.0	5	83.3	1.13
	cf. Columbidae		–	–	–	–	–	1	25.0	–	–	0.13	–	–	–	–	–	–	–	–	–	–	1	12.5	–	–	0.13
	cf. Laridae	gulls	–	–	–	–	–	1	25.0	1	33.3	0.37	–	–	–	–	–	–	–	–	–	–	1	12.5	1	16.7	0.37
Total Identified Aves			–	–	–	–	–	4	100.0	3	100.0	1.06	1	100.0	1	100.0	0.26	3	100.0	2	100.0	0.31	8	100.0	6	100.0	1.63
Indeterminate Aves			–	–	–	–	–	13	–	–	–	1.01	8	–	1*	–	5.20	–	–	–	–	–	21	–	1	–	6.21
Mammalia																											
	Didelphis sp.	opossum	1	6.3	1	25.0	N/A	27	13.1	5	26.3	26.11	17	30.4	5	50.0	11.39	40	42.1	3	33.3	13.89	85	22.8	14	33.3	51.39
	cf. *Didelphis* sp.		–	–	–	–	–	1	0.5	–	–	0.10	–	–	–	–	–	–	–	–	–	–	1	0.3	–	–	0.10
	Dasypus sp.	armadillo	–	–	–	–	–	2	1.0	1	5.3	0.32	–	–	–	–	–	–	–	–	–	–	2	0.5	1	2.4	0.32
	Dasyprocta sp.	agouti	1	6.3	1	25.0	0.10	58	28.2	5	26.3	26.82	18	32.1	3	30.0	14.36	26	27.4	4	44.4	15.71	103	27.6	13	31.0	56.99
	cf. *Dasyprocta* sp.		–	–	–	–	–	5	2.4	–	–	1.07	1	1.8	–	–	0.17	1	1.1	–	–	0.33	7	1.9	–	–	1.57
	Oryzomyini	rice rat	13	81.3	2	50.0	0.32	65	31.6	8	42.1	2.46	5	8.9	2	20.0	0.14	3	3.2	2	22.2	0.01	86	23.1	14	33.3	2.93
	cf. Oryzomyini		1	6.3	–	–	< 0.01	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.3	–	–	< 0.01
	Medium mammal		–	–	–	–	–	41	19.9	–	–	7.74	12	21.4	–	–	1.30	23	24.2	–	–	3.04	76	20.4	–	–	12.08
	Small mammal		–	–	–	–	–	7	3.4	–	–	0.22	3	5.4	–	–	0.08	2	2.1	–	–	0.08	12	3.2	–	–	0.38
Total Identified Mammalia			16	100.0	4	100.0	0.42	206	100.0	19	100.0	64.84	56	100.0	10	100.0	27.44	95	100.0	9	100.0	33.06	373	100.0	42	100.0	125.76
Indeterminate Mammalia			–	–	–	–	–	5	–	–	–	0.13	–	–	–	–	–	4	–	–	–	0.36	9	–	–	–	0.49
Reptilia																											
	Cheloniidae	sea turtle	–	–	–	–	–	91	83.5	3	60.0	136.44	58	89.2	4	57.1	34.07	219	93.2	2	33.3	127.39	368	89.1	9	45.0	297.90
	Iguanidae	iguana	–	–	–	–	–	3	2.8	–	–	2.34	3	4.6	2	28.6	2.56	9	3.8	1	16.7	2.62	15	3.6	3	15.0	7.52
	cf. Iguanidae		–	–	–	–	–	5	4.6	–	–	0.60	–	–	–	–	–	2	0.9	–	–	0.63	7	1.7	0	0.0	1.23
	Iguana sp.	iguana	–	–	–	–	–	1	0.9	1	20.0	0.05	–	–	–	–	–	1	0.4	1	16.7	0.06	2	0.5	2	10.0	0.11
	Lacertilia	lizard	1	25.0	1	50.0	0.01	4	3.7	–	–	0.06	1	1.5	–	–	<0.01	1	0.4	–	–	0.15	7	1.7	1	5.0	0.22
	Colubridae	colubrid snake	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.4	1	16.7	0.24	1	0.2	1	5.0	0.24
	Serpentes	snake	3	75.0	1	50.0	0.04	2	1.8	–	–	0.17	1	1.5	1	14.3	0.21	2	0.9	1	16.7	0.25	8	1.9	3	15.0	0.67
	Squamata	snakes and lizards	–	–	–	–	–	3	2.8	1	20.0	0.30	2	3.1	–	–	0.13	–	–	–	–	–	5	1.2	1	5.0	0.43
Total Identified Reptilia			4	100.0	2	100.0	0.05	109	100.0	5	100.0	139.96	65	100.0	7	100.0	36.97	235	100.0	6	100.0	131.34	413	100.0	20	100.0	308.32
Indeterminate Reptilia			–	–	–	–	–	–	–	–	–	–	2	–	–	–	0.20	4	–	–	–	0.39	6	–	–	–	0.59
Amphibia		frogs and toads	–	–	–	–	–	1	100.0	1	100.0	0.07	–	–	–	–	–	–	–	–	–	–	1	100.0	1	100.0	0.07
Total Identified Vertebrata (below 'indeterminate' class-level)			50	–	16	–	2.62	2319	–	230	–	621.06	749	–	121	–	250.87	830	–	94	–	276.00	3948	–	461	–	1150.55
Total Vertebrata (includes 'indeterminate' at class-level)			66	–	16	–	3.35	3518	–	230	–	788.59	1103	–	122	–	313.70	1187	–	94	–	333.35	5874	–	462	–	1438.99
Indeterminate Vertebrata (1.6 mm fraction excluded)			6	–	–	–	0.27	40	–	–	–	4.52	12	–	–	–	1.80	38	–	–	–	7.72	96	–	–	–	14.31

Table 5.7 continued

Sabazan Zooarchaeological Assemblage Continued

			Early Period					Middle Period					Late Period					Final Period					Site Total				
Class	Taxon	Common Name	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)
Invertebrata																											
Echinoidea		sea urchin	13	100.0	1	100.0	0.16	329	100.0	8	100.0	9.97	332	100.0	5	100.0	7.48	596	100.0	6	100.0	16.42	1270	100.0	20	100.0	34.03
Bivalvia																											
	Arcidae	ark	–	–	–	–	–	1	1.5	1	5.0	<0.01	–	–	–	–	–	–	–	–	–	–	1	1.1	1	3.1	0.00
	Cardiidae	cockle	–	–	–	–	–	1	1.5	–	–	0.15	–	–	–	–	–	1	5.6	–	–	0.28	2	2.1	–	–	0.43
	Americardia media	Atlantic strawberry cockle	–	–	–	–	–	4	5.9	3	15.0	4.82	–	–	–	–	–	1	5.6	1	12.5	0.31	5	5.3	4	12.5	5.13
	Donax denticulatus	Caribbean coquina	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	16.7	3	37.5	0.84	3	3.2	3	9.4	0.84
	Donax sp.	coquina	–	–	–	–	–	1	1.5	1	5.0	0.16	1	14.3	1	33.3	0.21	2	11.1	1	12.5	0.23	4	4.3	3	9.4	0.60
	Codakia orbicularis	tiger lucine	–	–	–	–	–	4	5.9	2	10.0	5.98	1	14.3	1	33.3	7.29	–	–	–	–	–	5	5.3	3	9.4	13.27
	cf. *Codakia orbicularis*		–	–	–	–	–	–	–	–	–	–	1	14.3	–	–	0.38	–	–	–	–	–	1	1.1	–	–	0.38
	Codakia sp.	lucine	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	5	27.8	1	12.5	1.28	5	5.3	1	3.1	1.28
	Brachidontes sp.	mussel	–	–	–	–	–	52	76.5	8	40.0	8.49	–	–	–	–	–	–	–	–	–	–	52	55.3	8	25.0	8.49
	Brachidontes/ Ischadium sp.	mussel	–	–	–	–	–	–	–	–	–	–	4	57.1	1	33.3	0.11	5	27.8	1	12.5	0.29	9	9.6	2	6.3	0.40
	Plicatula gibbosa	kitten's paw	–	–	–	–	–	2	2.9	2	10.0	4.02	–	–	–	–	–	–	–	–	–	–	2	2.1	2	6.3	4.02
	cf. *Asaphis deflorata*	gaudy asaphis	1	100.0	1	100.0	0.10	1	1.5	1	5.0	0.04	–	–	–	–	–	–	–	–	–	–	2	2.1	2	6.3	0.14
	Tellinidae	tellin	–	–	–	–	–	1	1.5	1	5.0	0.46	–	–	–	–	–	–	–	–	–	–	1	1.1	1	3.1	0.46
	Arcopagia fausta	sunset tellin	–	–	–	–	–	1	1.5	1	5.0	5.87	–	–	–	–	–	–	–	–	–	–	1	1.1	1	3.1	5.87
	Chione cancellata	cross-barred venus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	5.6	1	12.5	0.64	1	1.1	1	3.1	0.64
Total Identified Bivalvia			1	100.0	1	100.0	0.10	68	100.0	20	100.0	29.99	7	100.0	3	100.0	7.99	18	100.0	8	100.0	3.87	94	100.0	32	100.0	41.95
Indeterminate Bivalvia			3	–	–	–	0.73	13	–	–	–	4.41	3	–	–	–	0.08	11	–	–	–	3.54	30	–	–	–	8.76
Gastropoda: Terrestrial																											
	Orthalicus undatus	wavy orthalicus	13	10.5	1	8.3	0.39	18	5.4	4	3.6	2.02	12	7.5	2	4.3	0.15	6	2.3	1	1.1	0.02	49	5.6	8	3.1	2.58
	cf. *Orthalicus undatus*		–	–	–	–	–	2	0.6	2	1.8	0.86	–	–	–	–	–	–	–	–	–	–	2	0.2	2	0.8	0.86
	Pleurodonte aff. *perplexa*	terrestrial snail	2	1.6	2	16.7	0.27	2	0.6	2	1.8	0.83	–	–	–	–	–	–	–	–	–	–	4	0.5	4	1.5	1.10
	Pleurodonte sp.	terrestrial snail	2	1.6	–	–	0.20	1	0.3	1	0.9	0.11	5	3.1	2	4.3	0.06	1	0.4	1	1.1	0.02	9	1.0	4	1.5	0.39
	cf. *Pleurodonte* sp.		1	0.8	–	–	<0.01	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.1	–	–	<0.01
	Megalobulimus sp.	giant terrestrial snail	–	–	–	–	–	5	1.5	1	0.9	2.22	1	0.6	1	2.2	0.39	2	0.8	1	1.1	3.25	8	0.9	3	1.1	5.86
	Indeterminate terrestrial Gastropoda		6	4.8	–	–	0.25	–	–	–	–	–	3	1.9	–	–	0.98	1	0.4	–	–	0.14	10	1.1	–	–	1.37
Gastropoda: Marine																											
	Bulla striata	common Atlantic bubble	–	–	–	–	–	3	0.9	2	1.8	2.04	–	–	–	–	–	–	–	–	–	–	3	0.3	2	0.8	2.04
	Crepidula maculosa	spotted slipper snail	–	–	–	–	–	7	2.1	7	6.3	0.94	–	–	–	–	–	–	–	–	–	–	7	0.8	7	2.7	0.94
	Cassidae	bonnet or cowrie helmet	–	–	–	–	–	1	0.3	1	0.9	1.11	–	–	–	–	–	–	–	–	–	–	1	0.1	1	0.4	1.11
	cf. *Cassis* sp.	helmet	–	–	–	–	–	1	0.3	1	0.9	100.47	–	–	–	–	–	–	–	–	–	–	1	0.1	1	0.4	100.47
	Columbella mercatoria	common dove snail	–	–	–	–	–	1	0.3	1	0.9	0.46	–	–	–	–	–	1	0.4	1	1.1	0.70	2	0.2	2	0.8	1.16
	Fissurellidae	keyhole limpet	–	–	–	–	–	2	0.6	1	0.9	0.57	–	–	–	–	–	–	–	–	–	–	2	0.2	1	0.4	0.57

Table 5.7 continued

Sabazan Zooarchaeological Assemblage Continued

			Early Period					Middle Period					Late Period					Final Period					Site Total				
Class	Taxon	Common Name	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)
Gstropoda continued																											
	Cenchritis muricata	beaded periwinkle	1	0.8	1	8.3	0.76	2	0.6	2	1.8	1.18	1	0.6	1	2.2	0.14	1	0.4	1	1.1	0.12	5	0.6	5	1.9	2.20
	Mancinella deltoidea	deltoid rock snail	–	–	–	–	–	2	0.6	2	1.8	5.42	–	–	–	–	–	–	–	–	–	–	2	0.2	2	0.8	5.42
	Plicopurpura patula	wide-mouthed purpura	–	–	–	–	–	1	0.3	1	0.9	37.42	1	0.6	1	2.2	0.29	–	–	–	–	–	2	0.2	2	0.8	37.71
	Stramonita rustica	rustic rock snail	–	–	–	–	–	1	0.3	1	0.9	1.76	–	–	–	–	–	–	–	–	–	–	1	0.1	1	0.4	1.76
	Stramonita haemastoma/rustica	Florida/rustic rock snail	–	–	–	–	–	1	0.3	1	0.9	1.14	–	–	–	–	–	–	–	–	–	–	1	0.1	1	0.4	1.14
	Nerita tessellata	tessellated nerite	5	4.0	5	41.7	1.77	97	29.0	56	50.5	46.22	34	21.4	24	52.2	21.87	105	40.1	72	78.3	72.48	241	27.4	157	60.2	142.34
	Nerita versicolor	four-toothed nerite	1	0.8	1	8.3	1.43	18	5.4	11	9.9	11.60	4	2.5	3	6.5	2.28	8	3.1	5	5.4	4.70	31	3.5	20	7.7	20.01
	Nerita peloronta/versicolor	bleeding tooth/four-toothed nerite	–	–	–	–	–	6	1.8	1	0.9	1.32	1	0.6	–	–	0.06	1	0.4	–	–	0.09	8	0.9	1	0.4	1.47
	Nerita sp.	nerite	1	0.8	–	–	0.10	28	8.4	–	–	2.71	20	12.6	1	2.2	1.60	33	12.6	–	–	1.65	82	9.3	1	0.4	6.06
	Olivellinae	dwarf olive	–	–	–	–	–	1	0.3	1	0.9	0.53	–	–	–	–	–	–	–	–	–	–	1	0.1	1	0.4	0.53
	Angiola lineata	dwarf Atlantic	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.4	1	1.1	0.06	1	0.1	1	0.4	0.06
	Supplanaxis nucleus	black Atlantic planaxis	–	–	–	–	–	1	0.3	1	0.9	0.28	6	3.8	6	13.0	1.72	5	1.9	5	5.4	0.97	12	1.4	12	4.6	2.97
	Cittarium pica	West Indian top snail	36	29.0	2	16.7	28.86	63	18.9	8	7.2	265.24	35	22.0	3	6.5	57.39	34	13.0	1	1.1	45.43	168	19.1	14	5.4	396.92
	Cittarium pica nacre		56	45.2	–	–	19.91	65	19.5	–	–	16.39	33	20.8	–	–	4.72	57	21.8	–	–	2.42	211	24.0	0	0.0	43.44
	Tegula excavata	green-base tegula	–	–	–	–	–	3	0.9	1	0.9	0.42	3	1.9	2	4.3	2.10	6	2.3	3	3.3	2.44	12	1.4	6	2.3	4.96
	Lithopoma caelatum	carved star snail	–	–	–	–	–	1	0.3	1	0.9	2.39	–	–	–	–	–	–	–	–	–	–	1	0.1	1	0.4	2.39
	Vermetidae/Turritellidae	worm shell	–	–	–	–	–	1	0.3	1	0.9	0.94	–	–	–	–	–	–	–	–	–	–	1	0.1	1	0.4	0.94
Total Identified Gastropoda			124	100.0	12	100.0	53.94	334	100.0	111	100.0	506.59	159	100.0	46	100.0	93.75	262	100.0	92	100.0	134.49	879	100.0	261	100.0	788.77
Indeterminate Gastropoda			17	–	–	–	1.80	70	–	1*	–	13.95	12	–	–	–	2.60	19	–	–	–	2.95	118	–	1	–	21.30
Polyplacophora																											
	Acanthopleura granulata	fuzzy chiton	4	100.0	2	100.0	3.09	80	57.1	11	55.0	67.58	11	25.0	2	25.0	10.96	34	30.4	5	38.5	31.41	129	43.0	20	46.5	113.04
	Chiton marmoratus	marbled chiton	–	–	–	–	–	16	11.4	3	15.0	8.76	7	15.9	2	25.0	4.26	14	12.5	2	15.4	7.18	37	12.3	7	16.3	20.20
	Chiton tuberculatus	West Indian chiton	–	–	–	–	–	44	31.4	6	30.0	17.11	26	59.1	4	50.0	8.66	64	57.1	6	46.2	19.83	134	44.7	16	37.2	45.60
Total Identified Polyplacophora			4	100.0	2	100.0	3.09	140	100.0	20	100.0	93.45	44	100.0	8	100.0	23.88	112	100.0	13	100.0	58.42	300	100.0	43	100.0	178.84
Indeterminate Polyplacophora			–	–	–	–	–	6	–	–	–	1.36	–	–	–	–	–	–	–	–	–	–	6	–	–	–	1.36
Total Identified Mollusca (below 'indeterminate' class-level)			129	–	15	–	57.13	542	–	151	–	630.03	210	–	57	–	125.62	392	–	113	–	196.78	1273	–	336	–	1009.56
Total Mollusca (includes 'indeterminate' at class-level)			149	–	15	–	59.66	631	–	152	–	649.75	225	–	57	–	128.30	422	–	113	–	203.27	1427	–	337	–	1040.98
Indeterminate Mollusca			138	–	–	–	2.44	692	–	–	–	30.23	480	–	–	–	8.10	260	–	–	–	8.52	1570	–	–	–	49.29
Malacostraca: Order Decapoda																											
	Gecarcinidae	land crab	–	–	–	–	–	2	0.3	–	–	0.05	1	0.3	–	–	0.41	–	–	–	–	–	3	0.3	–	–	0.46
	Cardisoma guanhumi	blue land crab	1	5.3	1	100.0	0.42	29	4.7	6	50.0	12.49	–	–	–	–	–	8	5.4	2	66.7	3.78	38	3.5	9	50.0	16.69
	Gecarcinus sp.	land crab	–	–	–	–	–	12	2.0	6	50.0	4.1	1	0.3	1	50.0	0.08	–	–	–	–	–	13	1.2	7	38.9	4.18
	Portunidae	swimming crab	–	–	–	–	–	–	–	–	–	–	2	0.6	1	50.0	1.45	1	0.7	1	33.3	0.07	3	0.3	2	11.1	1.52
	Decapoda	crab/lobster/shrimp	18	94.7	–	–	0.22	571	93.0	–	–	23.01	305	98.7	–	–	5.49	138	93.9	–	–	6.04	1032	94.8	–	–	34.76
Total Identified Decapoda			19	100.0	1	100.0	0.64	614	100.0	12	100.0	39.65	309	100.0	2	100.0	7.43	147	100.0	3	100.0	9.89	1089	100.0	18	100.0	57.61

Table 5.7 continued

Sabazan Zooarchaeological Assemblage Continued

Class	Taxon	Common Name	Early Period					Middle Period					Late Period					Final Period					Site Total				
			NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)
Maxillopoda																											
	Cirripedia	barnacle	–	–	–	–	–	1	100.0	1	100.0	0.28	–	–	–	–	–	–	–	–	–	–	1	100.0	1	100.0	0.28
Total Identified Invertebrata (below 'indeterminate' class-level)			161	–	17	–	57.93	1486	–	172	–	679.93	851	–	64	–	140.53	1135	–	122	–	223.09	3633	–	375	–	1101.48
Total Invertebrata (includes 'indeterminate' at class-level)			181	–	17	–	60.46	1575	–	173	–	699.65	866	–	64	–	143.21	1165	–	122	–	229.58	3787	–	376	–	1132.90
Indeterminate Invertebrata			–	–	–	–	–	4	–	–	–	0.08	–	–	–	–	–	–	–	–	–	–	4	–	–	–	0.08
Total Identified Vertebrata and Invertebrata (below 'indeterminate' class-level)			211	–	33	–	60.55	3805	–	402	–	1300.99	1600	–	185	–	391.40	1965	–	216	–	499.09	7581	–	836	–	2252.03
Total Vertebrata and Invertebrata (includes 'indeterminate' at class-level)			247	–	33	–	63.81	5093	–	403	–	1488.24	1969	–	186	–	456.91	2352	–	216	–	562.93	9661	–	838	–	2571.89
Total Indeterminate Vertetbrata and Invertebrata (above class-level; includes 'Indeterminate Mollusca')			144	–	–	–	2.71	736	–	–	–	34.83	492	–	–	–	9.90	298	–	–	–	16.24	1670	–	–	–	63.68
Total Assemblage			391	–	33	–	66.52	5829	–	403	–	1523.07	2461	–	186	–	466.81	2650	–	216	–	579.17	11331	–	838	–	2635.57

Table 5.8 The vertebrate and invertebrate comparative sub-assemblage from Sabazan. See text for explanation of data compilation procedure. *Added to MNI because specimen represents a complete but unidentifiable individual or only individual from a specific context.

Sabazan Comparative Vertebrate and Invertebrate Sub-Assemblage

			Early Period					Middle Period					Late Period					Final Period					Site Total				
Class	Taxon	Common Name	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)
Vertebrata																											
Actinopterygii																											
	Acanthurus sp.	surgeonfish	–	–	–	–	–	64	1.9	7	2.3	7.94	20	1.3	2	2.0	2.71	11	0.6	1	0.6	1.90	95	1.3	10	1.7	12.55
	Total Acanthuridae		–	–	–	–	–	64	1.9	7	2.3	7.94	20	1.3	2	2.0	2.71	11	0.6	1	0.6	1.90	95	1.3	10	1.7	12.55
	Acanthuridae/ Pomacanthidae	surgeonfish/angelfish	–	–	–	–	–	1	0.0	–	–	0.05	–	–	–	–	–	–	–	–	–	–	1	0.0	–	–	0.05
	Balistidae	triggerfish	–	–	–	–	–	9	0.3	1	0.3	4.93	1	0.1	1	1.0	0.28	1	0.1	1	0.6	0.10	11	0.2	3	0.5	5.31
	Belonidae	needlefish	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	0.1	1	0.6	0.12	2	0.0	1	0.2	0.12
	Total Belonidae		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	0.1	1	0.6	0.12	2	0.0	1	0.2	0.12
	Carangidae	jack, pompano, scad	6	1.5	–	–	0.02	65	1.9	–	–	3.74	9	0.6	2	2.0	0.09	18	1.0	–	–	0.45	98	1.4	2	0.3	4.30
	Caranx sp.	jack	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.1	1	0.6	0.58	1	0.0	1	0.2	0.58
	cf. *Caranx* sp.		–	–	–	–	–	1	0.0	1	0.3	0.09	–	–	–	–	–	–	–	–	–	–	1	0.0	1	0.2	0.09
	Selar crumenophthalmus	bigeye scad	2	0.5	1	3.0	0.01	29	0.8	21	7.0	0.29	9	0.6	5	4.9	0.03	8	0.5	2	1.2	0.07	48	0.7	29	4.9	0.40
	cf. *Selar crumenophthalmus*		–	–	–	–	–	20	0.6	–	–	0.14	1	0.1	–	–	<0.01	–	–	–	–	–	21	0.3	–	–	0.14
	Trachurus lathami	rough scad	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	6	0.3	6	3.7	0.05	6	0.1	6	1.0	0.05
	cf. Trachurus lathami		–	–	–	–	–	10	0.3	9	3.0	0.01	–	–	–	–	–	–	–	–	–	–	10	0.1	9	1.5	0.01
	cf. *Trachurus lathami*/*Selar crumenophthalmus*		2	0.5	1	3.0	<0.01	25	0.7	1	0.3	0.24	4	0.3	–	–	0.01	4	0.2	–	–	0.01	35	0.5	2	0.3	0.26
	Total Carangidae		10	2.6	2	6.1	0.03	150	4.4	32	10.7	4.51	23	1.5	7	6.9	0.13	37	2.2	9	5.6	1.16	220	3.1	50	8.4	5.83
	Chaetodontidae	butterflyfish	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.1	1	0.6	0.03	1	0.0	1	0.2	0.03
	Clupeidae	herring, shad	2	0.5	1	3.0	<0.01	37	1.1	3	1.0	0.05	26	1.7	2	2.0	0.07	19	1.1	1	0.6	0.02	84	1.2	7	1.2	0.14
	Clupeidae/Engraulidae	herring, shad/anchovie	–	–	–	–	–	–	–	–	–	–	3	0.2	–	–	<0.01	2	0.1	–	–	<0.01	5	0.1	–	–	<0.01
	Diodontidae	porcupinefish	–	–	–	–	–	2	0.1	2	0.7	24.21	–	–	–	–	–	–	–	–	–	–	2	0.0	2	0.3	24.21
	Exocoetidae	flyingfish	–	–	–	–	–	–	–	–	–	–	2	0.1	1	1.0	0.01	2	0.1	1	0.6	0.03	4	0.1	2	0.3	0.04
	cf. Exocoetidae		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.1	–	–	<0.01	1	0.0	–	–	<0.01
	Total Exocoetidae												2	0.1	1	1.0	0.01	3	0.2	1	0.6	0.03	5	0.1	2	0.3	0.04
	Exocoetoidea	flyingfish, halfbeak	–	–	–	–	–	1	0.0	–	–	<0.01	1	0.1	–	–	0.01	–	–	–	–	–	2	0.0	–	–	0.01
	Haemulidae	grunt	1	0.3	1	3.0	<0.01	15	0.4	4	1.3	1.72	7	0.5	2	2.0	0.82	11	0.6	1	0.6	0.69	34	0.5	8	1.3	3.23
	cf. Haemulidae		1	0.3	–	–	<0.01	–	–	–	–	–	–	–	–	–	–	1	0.1	–	–	0.01	2	0.0	–	–	0.01
	cf. *Haemulon* sp.	grunt	–	–	–	–	–	3	0.1	1	0.3	1.17	–	–	–	–	–	1	0.1	1	0.6	0.15	4	0.1	2	0.3	1.32
	Total Haemulidae		2	0.5	1	3.0	<0.01	18	0.5	5	1.7	2.89	7	0.5	2	2.0	0.82	13	0.8	2	1.2	0.85	40	0.6	10	1.7	4.56
	Hemiramphidae	halfbeak	1	0.3	1	3.0	<0.01	12	0.3	3	1.0	0.05	5	0.3	1	1.0	0.01	–	–	–	–	–	18	0.3	5	0.8	0.06
	cf. Hemiramphidae		–	–	–	–	–	1	0.0	–	–	<0.01	–	–	–	–	–	–	–	–	–	–	1	0.0	–	–	<0.01
	Total Hemiramphidae		1	0.3	1	3.0	<0.01	13	0.4	3	1.0	0.05	5	0.3	1	1.0	0.01	–	–	–	–	–	19	0.3	5	0.8	0.06

Table 5.8 continued

Sabazan Comparative Vertebrate and Invertebrate Sub-Assemblage Continued

			Early Period					Middle Period					Late Period					Final Period					Site Total				
Class	Taxon	Common Name	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)
Actinopterygii continued																											
	Holocentridae	squirrelfish, soldierfish	–	–	–	–	–	8	0.2	2	0.7	1.57	1	0.1	1	1.0	0.03	–	–	–	–	–	9	0.1	3	0.5	1.60
	cf. Holocentridae		–	–	–	–	–	1	0.0	–	–	0.02	–	–	–	–	–	–	–	–	–	–	1	0.0	–	–	0.02
	Total Holocentridae		–	–	–	–	–	9	0.3	2	0.7	1.59	1	0.1	1	1.0	0.03	–	–	–	–	–	10	0.1	3	0.5	1.62
	Labridae	wrasse, hogfish	–	–	–	–	–	7	0.2	2	0.7	0.42	–	–	–	–	–	–	–	–	–	–	7	0.1	2	0.3	0.42
	cf. *Bodianus* sp.		–	–	–	–	–	1	0.0	1	0.3	0.12	–	–	–	–	–	–	–	–	–	–	1	0.0	1	0.2	0.12
	Halichoeres sp.	wrasse	–	–	–	–	–	1	0.0	1	0.3	0.18	–	–	–	–	–	–	–	–	–	–	1	0.0	1	0.2	0.18
	cf. *Halichoeres* sp.		–	–	–	–	–	2	0.1	–	–	0.56	1	0.1	1	1.0	0.44	1	0.1	1	0.6	0.16	4	0.1	2	0.3	1.16
	Total Labridae		–	–	–	–	–	11	0.3	4	1.3	1.28	1	0.1	1	1.0	0.44	1	0.1	1	0.6	0.16	13	0.2	6	1.0	1.88
	Labroidei	wrasse, parrotfish	–	–	–	–	–	1	0.0	–	–	0.10	–	–	–	–	–	–	–	–	–	–	1	0.0	–	–	0.10
	Lutjanidae	snapper	–	–	–	–	–	9	0.3	4	1.3	1.11	1	0.1	1	1.0	0.04	1	0.1	1	0.6	0.04	11	0.2	6	1.0	1.19
	cf. Lutjanidae		–	–	–	–	–	–	–	–	–	–	1	0.1	–	–	<0.01	–	–	–	–	–	1	0.0	–	–	<0.01
	Total Lutjanidae		–	–	–	–	–	9	0.3	4	1.3	1.11	2	0.1	1	1.0	0.04	1	0.1	1	0.6	0.04	12	0.2	6	1.0	1.19
	Lutjanidae/Serranidae	snapper/grouper, sea bass	–	–	–	–	–	–	–	–	–	–	1	0.1	–	–	0.26	–	–	–	–	–	1	0.0	–	–	0.26
	Mullidae	goatfish	–	–	–	–	–	3	0.1	1	0.3	0.01	1	0.1	1	1.0	0.03	–	–	–	–	–	4	0.1	2	0.3	0.04
	cf. Mullidae		–	–	–	–	–	2	0.1	1	0.3	<0.01	3	0.2	–	–	<0.01	2	0.1	1	0.6	<0.01	7	0.1	2	0.3	<0.01
	Total Mullidae		–	–	–	–	–	5	0.1	2	0.7	0.01	4	0.3	1	1.0	0.03	2	0.1	1	0.6	<0.01	11	0.2	4	0.7	0.04
	Ostraciidae	trunkfish, cowfish	–	–	–	–	–	–	–	–	–	–	1	0.1	1	1.0	<0.01	2	0.1	1	0.6	<0.01	3	0.0	2	0.3	<0.01
	Pomacentridae	damselfish	1	0.3	1	3.0	<0.01	14	0.4	3	1.0	0.01	1	0.1	1	1.0	<0.01	2	0.1	1	0.6	<0.01	18	0.3	6	1.0	0.01
	cf. Pomacentridae		–	–	–	–	–	1	0.0	–	–	<0.01	–	–	–	–	–	–	–	–	–	–	1	0.0	–	–	<0.01
	Total Pomacentridae		1	0.3	1	3.0	<0.01	15	0.4	3	1.0	0.01	1	0.1	1	1.0	<0.01	2	0.1	1	0.6	<0.01	19	0.3	6	1.0	0.01
	Scaridae	parrotfish	5	1.3	–	–	0.15	57	1.7	–	–	8.11	18	1.2	1	1.0	2.83	12	0.7	–	–	3.13	92	1.3	1	0.2	14.22
	Cryptotomus roseus / *Nicholsina usta*	bluelip/emerald parrotfish	–	–	–	–	–	1	0.0	1	0.3	0.02	–	–	–	–	–	–	–	–	–	–	1	0.0	1	0.2	0.02
	Scarus sp.	parrotfish	1	0.3	1	3.0	0.04	16	0.5	5	1.7	4.59	1	0.1	1	1.0	0.04	2	0.1	1	0.6	0.32	20	0.3	8	1.3	4.99
	cf. *Scarus* sp.		–	–	–	–	–	1	0.0	–	–	0.09	–	–	–	–	–	–	–	–	–	–	1	0.0	–	–	0.09
	Sparisoma sp.	parrotfish	7	1.8	2	6.1	1.82	64	1.9	11	3.7	28.24	8	0.5	2	2.0	3.03	7	0.4	3	1.9	2.87	86	1.2	18	3.0	35.96
	cf. *Sparisoma* sp.		–	–	–	–	–	–	–	–	–	–	1	0.1	–	–	0.03	–	–	–	–	–	1	0.0	–	–	0.03
	Total Scaridae		13	3.3	3	9.1	2.01	139	4.0	17	5.7	41.05	28	1.8	4	3.9	5.93	21	1.2	4	2.5	6.32	201	2.8	28	4.7	55.31
	Cynoscion sp.	weakfish	–	–	–	–	–	1	0.0	1	0.3	0.06	–	–	–	–	–	–	–	–	–	–	1	0.0	1	0.2	0.06
	Total Sciaenidae		–	–	–	–	–	1	0.0	1	0.3	0.06	–	–	–	–	–	–	–	–	–	–	1	0.0	1	0.2	0.06
	Scombridae	tuna, mackerel	–	–	–	–	–	3	0.1	–	–	0.62	–	–	–	–	–	1	0.1	–	–	0.03	4	0.1	–	–	0.65
	Auxis sp.	bullet/frigate tuna	–	–	–	–	–	33	1.0	1	0.3	8.69	2	0.1	1	1.0	0.35	11	0.6	1	0.6	1.53	46	0.6	3	0.5	10.57
	Katsuwonus pelamis	skipjack	–	–	–	–	–	6	0.2	2	0.7	4.36	–	–	–	–	–	2	0.1	1	0.6	0.79	8	0.1	3	0.5	5.15
	cf. *Katsuwonus pelamis*		–	–	–	–	–	5	0.1	–	–	3.13	–	–	–	–	–	–	–	–	–	–	5	0.1	–	–	3.13
	Thunnus sp.	tuna	–	–	–	–	–	10	0.3	2	0.7	2.52	1	0.1	1	1.0	0.30	1	0.1	1	0.6	0.54	12	0.2	4	0.7	3.36
	cf. Thunnus sp.		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.1	–	–	1.04	1	0.0	–	–	1.04
	Auxis sp./ *Katsuwonus pelamis*	bullet/frigate tuna/skipjack	–	–	–	–	–	2	0.1	–	–	0.57	–	–	–	–	–	–	–	–	–	–	2	0.0	–	–	0.57
	Katsuwonus pelamis / *Euthynnus alletteratus*	skipjack/little tunny	–	–	–	–	–	10	0.3	1	0.3	3.81	2	0.1	1	1.0	0.49	–	–	–	–	–	12	0.2	2	0.3	4.30
	Thunnus sp./ *Katsuwonus pelamis*	tuna/skipjack	–	–	–	–	–	4	0.1	–	–	1.43	1	0.1	–	–	0.27	6	0.3	–	–	3.08	11	0.2	–	–	4.78
	Thunnini	tuna	–	–	–	–	–	51	1.5	2	0.7	14.86	10	0.6	–	–	4.15	9	0.5	–	–	0.93	70	1.0	2	0.3	19.94
	cf. Thunnini		–	–	–	–	–	1	0.0	–	–	0.03	–	–	–	–	–	–	–	–	–	–	1	0.0	–	–	0.03
	Total Scombridae		–	–	–	–	–	125	3.6	8	2.7	40.02	16	1.0	3	2.9	5.56	31	1.8	3	1.9	7.94	172	2.4	14	2.3	53.52

Table 5.8 continued

Sabazan Comparative Vertebrate and Invertebrate Sub-Assemblage Continued

			Early Period					Middle Period					Late Period					Final Period					Site Total				
Class	Taxon	Common Name	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)
Actinopterygii continued																											
	Serranidae	grouper, sea bass	–	–	–	–	–	35	1.0	4	1.3	13.99	5	0.3	1	1.0	1.22	4	0.2	2	1.2	0.45	44	0.6	7	1.2	15.66
	cf. Serranidae		–	–	–	–	–	2	0.1	–	–	0.19	–	–	–	–	–	1	0.1	–	–	0.38	3	0.0	–	–	0.57
	cf. Cephalopholis fulva	coney	1	0.3	1	3.0	0.11	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.0	1	0.2	0.11
	Mycteroperca sp.	grouper	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.1	1	0.6	0.27	1	0.0	1	0.2	0.27
	Epinephelinae	coney/grouper	–	–	–	–	–	4	0.1	2	0.7	0.51	–	–	–	–	–	–	–	–	–	–	4	0.1	2	0.3	0.51
	Total Serranidae		1	0.3	1	3.0	0.11	41	1.2	6	2.0	14.69	5	0.3	1	1.0	1.22	6	0.3	3	1.9	1.10	53	0.7	11	1.8	17.12
	Sphyraena sp.	barracuda	–	–	–	–	–	1	0.0	1	0.3	0.29	–	–	–	–	–	–	–	–	–	–	1	0.0	1	0.2	0.29
	Total Sphyraenidae		–	–	–	–	–	1	0.0	1	0.3	0.29	–	–	–	–	–	–	–	–	–	–	1	0.0	1	0.2	0.29
	Taxon B		–	–	–	–	–	12	0.3	2	0.7	<0.01	–	–	–	–	–	–	–	–	–	–	12	0.2	2	0.3	<0.01
	Taxon C		–	–	–	–	–	4	0.1	3	1.0	<0.01	3	0.2	1	1.0	<0.01	1	0.1	1	0.6	<0.01	8	0.1	5	0.8	<0.01
Total Identified Actinopterygii and Chondrichthyes			30	7.7	10	30.3	2.15	668	19.4	106	35.3	144.84	151	9.7	31	30.4	17.55	156	9.1	33	20.5	19.77	1005	14.1	180	30.2	184.31
Indeterminate Actinopterygii (1.6 mm fraction excluded)			16	4.1	–	–	0.73	327	9.5	–	–	45.35	28	1.8	–	–	3.84	60	3.5	–	–	8.47	431	6.1	–	–	58.39
Aves																											
	Columbidae	pigeons and doves	–	–	–	–	–	2	0.1	2	0.7	0.56	–	–	–	–	–	1	0.1	1	0.6	0.14	3	0.0	3	0.5	0.70
	cf. Columbidae		–	–	–	–	–	1	0.0	–	–	0.13	–	–	–	–	–	–	–	–	–	–	1	0.0	–	–	0.13
Total Identified Aves			–	–	–	–	–	3	0.1	2	0.7	0.69	–	–	–	–	–	1	0.1	1	0.6	0.14	4	0.1	3	0.5	0.83
Indeterminate Aves			–	–	–	–	–	10	0.3	1	0.3	0.99	1	0.1	1*	1.0	<0.01	–	–	–	–	–	11	0.2	2	0.3	0.99
Mammalia																											
	Didelphis sp.	opossum	1	0.3	1	3.0	–	10	0.3	2	0.7	6.71	2	0.1	1	1.0	1.20	2	0.1	1	0.6	0.71	15	0.2	5	0.8	8.62
	Dasypus sp.	armadillo	–	–	–	–	–	2	0.1	1	0.3	0.32	–	–	–	–	–	–	–	–	–	–	2	0.0	1	0.2	0.32
	Dasyprocta sp.	agouti	1	0.3	1	3.0	0.10	23	0.7	3	1.0	6.42	1	0.1	1	1.0	0.20	3	0.2	1	0.6	0.51	28	0.4	6	1.0	7.23
	cf. *Dasyprocta* sp.		–	–	–	–	–	2	0.1	–	–	0.30	–	–	–	–	–	–	–	–	–	–	2	0.0	–	–	0.30
	Oryzomyini	rice rat	13	3.3	2	6.1	0.32	31	0.9	5	1.7	1.00	2	0.1	1	1.0	0.07	1	0.1	1	0.6	<0.01	47	0.7	9	1.5	1.39
	cf. Oryzomyini		1	0.3	–	–	<0.01	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.0	–	–	<0.01
	Medium mammal		–	–	–	–	–	18	0.5	1	0.3	3.19	2	0.1	–	–	0.05	4	0.2	–	–	0.38	24	0.3	1	0.2	3.62
	Small mammal		–	–	–	–	–	4	0.1	–	–	0.21	2	0.1	–	–	0.01	–	–	–	–	–	6	0.1	–	–	0.22
Total Identified Mammalia			16	4.1	4	12.1	0.42	90	2.6	12	4.0	18.15	9	0.6	3	2.9	1.53	10	0.6	3	1.9	1.60	125	1.8	22	3.7	21.70
Indeterminate Mammalia			–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4	0.2	–	–	0.36	4	0.1	–	–	0.36
Reptilia																											
	Cheloniidae	sea turtle	–	–	–	–	–	49	1.4	3	1.0	27.89	14	0.9	1	1.0	3.86	48	2.8	1	0.6	16.66	111	1.6	5	0.8	48.41
	Iguanidae	iguana	–	–	–	–	–	2	0.1	1	0.3	1.11	1	0.1	1	1.0	0.38	2	0.1	–	–	0.82	5	0.1	2	0.3	2.31
	cf. Iguanidae		–	–	–	–	–	1	0.0	–	–	0.06	–	–	–	–	–	1	0.1	–	–	0.45	2	0.0	–	–	0.51
	Iguana sp.	iguana	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.1	1	0.6	0.06	1	0.0	1	0.2	0.06
	Lacertilia	lizard	1	0.3	1	3.0	0.01	–	–	–	–	–	1	0.1	1	1.0	<0.01	–	–	–	–	–	2	0.0	2	0.3	0.01
	Colubridae	colubrid snake	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Serpentes	snake	3	0.8	1	3.0	0.04	1	0.0	1	0.3	0.16	–	–	–	–	–	–	–	–	–	–	4	0.1	2	0.3	0.20
	Squamata	snakes and lizards	–	–	–	–	–	2	0.1	1	0.3	0.29	–	–	–	–	–	–	–	–	–	–	2	0.0	1	0.2	0.29
Total Identified Reptilia			4	1.0	2	6.1	0.05	55	1.6	6	2.0	29.51	16	1.0	3	2.9	4.24	52	3.0	2	1.2	17.99	127	1.8	13	2.2	51.79
Indeterminate Reptilia			–	–	–	–	–	–	–	–	–	–	1	0.1	–	–	0.02	2	0.1	–	–	0.06	3	0.0	–	–	0.08
Total Identified Vertebrata (below 'indeterminate' class-level)			50	12.8	16	48.5	2.62	816	23.7	126	42.0	193.19	176	11.3	37	36.3	23.32	219	12.7	39	24.2	39.50	1261	17.7	218	36.6	258.63
Total Vertebrata (includes 'indeterminate' at class-level)			66	16.9	16	48.5	3.35	1153	33.5	127	42.3	239.53	206	13.2	38	37.3	27.18	285	16.6	39	24.2	48.39	1710	24.1	220	36.9	318.45
Indeterminate Vertebrata (1.6 mm fraction excluded)			6	1.5	–	–	0.27	19	0.6	–	–	1.54	3	0.2	–	–	0.60	8	0.5	–	–	1.05	36	0.5	–	–	3.46

Table 5.8 continued

Sabazan Comparative Vertebrate and Invertebrate Sub-Assemblage Continued

			Early Period					Middle Period					Late Period					Final Period					Site Total				
Class	Taxon	Common Name	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)
Invertebrata																											
Echinoidea		sea urchin	13	3.3	1	3.0	0.16	329	9.6	8	2.7	9.97	332	21.4	5	4.9	7.48	596	34.7	6	3.7	16.42	1270	17.9	20	3.4	34.03
Bivalvia																											
	Arcidae	ark	–	–	–	–	–	1	0.0	1	0.3	<0.01	–	–	–	–	–	–	–	–	–	–	1	0.0	1	0.2	0.00
	Cardiidae	cockle	–	–	–	–	–	1	0.0	–	–	0.15	–	–	–	–	–	1	0.1	–	–	0.28	2	0.0	–	–	0.43
	Americardia media	Atlantic strawberry cockle	–	–	–	–	–	4	0.1	3	1.0	4.82	–	–	–	–	–	1	0.1	1	0.6	0.31	5	0.1	4	0.7	5.13
	Donax denticulatus	Caribbean coquina	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	0.2	3	1.9	0.84	3	0.0	3	0.5	0.84
	Donax sp.	coquina	–	–	–	–	–	1	0.0	1	0.3	0.16	1	0.1	1	1.0	0.21	2	0.1	1	0.6	0.23	4	0.1	3	0.5	0.60
	Codakia orbicularis	tiger lucine	–	–	–	–	–	4	0.1	2	0.7	5.98	1	0.1	1	1.0	7.29	–	–	–	–	–	5	0.1	3	0.5	13.27
	cf. *Codakia orbicularis*		–	–	–	–	–	–	–	–	–	–	1	0.1	–	–	0.38	–	–	–	–	–	1	0.0	–	–	0.38
	Codakia sp.	lucine	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	5	0.3	1	0.6	1.28	5	0.1	1	0.2	1.28
	Brachidontes sp.	mussel	–	–	–	–	–	52	1.5	8	2.7	8.49	–	–	–	–	–	–	–	–	–	–	52	0.7	8	1.3	8.49
	Brachidontes/ Ischadium sp.	mussel	–	–	–	–	–	–	–	–	–	–	4	0.3	1	1.0	0.11	5	0.3	1	0.6	0.29	9	0.1	2	0.3	0.40
	Plicatula gibbosa	kitten's paw	–	–	–	–	–	2	0.1	2	0.7	4.02	–	–	–	–	–	–	–	–	–	–	2	0.0	2	0.3	4.02
	cf. *Asaphis deflorata*	gaudy asaphis	1	0.3	1	3.0	0.10	1	0.0	1	0.3	0.04	–	–	–	–	–	–	–	–	–	–	2	0.0	2	0.3	0.14
	Tellinidae	tellin	–	–	–	–	–	1	0.0	1	0.3	0.46	–	–	–	–	–	–	–	–	–	–	1	0.0	1	0.2	0.46
	Arcopagia fausta	sunset tellin	–	–	–	–	–	1	0.0	1	0.3	5.87	–	–	–	–	–	–	–	–	–	–	1	0.0	1	0.2	5.87
	Chione cancellata	cross-barred venus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.1	1	0.6	0.64	1	0.0	1	0.2	0.64
Total Identified Bivalvia			1	0.3	1	3.0	0.10	68	2.0	20	6.7	29.99	7	0.5	3	2.9	7.99	18	1.0	8	5.0	3.87	94	1.3	32	5.4	41.95
Indeterminate Bivalvia			3	0.8	–	–	0.73	13	0.4	–	–	4.41	3	0.2	–	–	0.08	11	0.6	–	–	3.54	30	0.4	–	–	8.76
Gastropoda: Terrestrial																											
	Orthalicus undatus	wavy orthalicus	13	3.3	1	3.0	0.39	18	0.5	4	1.3	2.02	12	0.8	2	2.0	0.15	6	0.3	1	0.6	0.02	49	0.7	8	1.3	2.58
	cf. *Orthalicus undatus*		–	–	–	–	–	2	0.1	2	0.7	0.86	–	–	–	–	–	–	–	–	–	–	2	0.0	2	0.3	0.86
	Pleurodonte aff. *perplexa*	terrestrial snail	2	0.5	2	6.1	0.27	2	0.1	2	0.7	0.83	–	–	–	–	–	–	–	–	–	–	4	0.1	4	0.7	1.10
	Pleurodonte sp.	terrestrial snail	2	0.5	–	–	0.20	1	0.0	1	0.3	0.11	5	0.3	2	2.0	0.06	1	0.1	1	0.6	0.02	9	0.1	4	0.7	0.39
	cf. *Pleurodonte* sp.		1	0.3	–	–	<0.01	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.0	–	–	<0.01
	Megalobulimus sp.	giant terrestrial snail	–	–	–	–	–	5	0.1	1	0.3	2.22	1	0.1	1	1.0	0.39	2	0.1	1	0.6	3.25	8	0.1	3	0.5	5.86
	Indeterminate terrestrial Gastropoda		6	1.5	–	–	0.25	–	–	–	–	–	3	0.2	–	–	0.98	1	0.1	–	–	0.14	10	0.1	–	–	1.37
Gastropoda: Marine																											
	Bulla striata	common Atlantic bubble	–	–	–	–	–	3	0.1	2	0.7	2.04	–	–	–	–	–	–	–	–	–	–	3	0.0	2	0.3	2.04
	Crepidula maculosa	spotted slipper snail	–	–	–	–	–	7	0.2	7	2.3	0.94	–	–	–	–	–	–	–	–	–	–	7	0.1	7	1.2	0.94
	Cassidae	bonnet or cowrie helmet	–	–	–	–	–	1	0.0	1	0.3	1.11	–	–	–	–	–	–	–	–	–	–	1	0.0	1	0.2	1.11
	cf. *Cassis* sp.	helmet	–	–	–	–	–	1	0.0	1	0.3	100.47	–	–	–	–	–	–	–	–	–	–	1	0.0	1	0.2	100.47
	Columbella mercatoria	common dove snail	–	–	–	–	–	1	0.0	1	0.3	0.46	–	–	–	–	–	1	0.1	1	0.6	0.70	2	0.0	2	0.3	1.16
	Fissurellidae	keyhole limpet	–	–	–	–	–	2	0.1	1	0.3	0.57	–	–	–	–	–	–	–	–	–	–	2	0.0	1	0.2	0.57
	Cenchritis muricata	beaded periwinkle	1	0.3	1	3.0	0.76	2	0.1	2	0.7	1.18	1	0.1	1	1.0	0.14	1	0.1	1	0.6	0.12	5	0.1	5	0.8	2.20
	Mancinella deltoidea	deltoid rock snail	–	–	–	–	–	2	0.1	2	0.7	5.42	–	–	–	–	–	–	–	–	–	–	2	0.0	2	0.3	5.42
	Plicopurpura patula	wide-mouthed	–	–	–	–	–	1	0.0	1	0.3	37.42	1	0.1	1	1.0	0.29	–	–	–	–	–	2	0.0	2	0.3	37.71
	Stramonita rustica	rustic rock snail	–	–	–	–	–	1	0.0	1	0.3	1.76	–	–	–	–	–	–	–	–	–	–	1	0.0	1	0.2	1.76
	Stramonita haemastoma/rustica	Florida/rustic rock snail	–	–	–	–	–	1	0.0	1	0.3	1.14	–	–	–	–	–	–	–	–	–	–	1	0.0	1	0.2	1.14
	Nerita tessellata	tessellated nerite	5	1.3	5	15.2	1.77	97	2.8	56	18.7	46.22	34	2.2	24	23.5	21.87	105	6.1	72	44.7	72.48	241	3.4	157	26.3	142.34
	Nerita versicolor	four-toothed nerite	1	0.3	1	3.0	1.43	18	0.5	11	3.7	11.60	4	0.3	3	2.9	2.28	8	0.5	5	3.1	4.70	31	0.4	20	3.4	20.01
	Nerita peloronta/ versicolor	bleeding tooth/ four-toothed nerite	–	–	–	–	–	6	0.2	1	0.3	1.32	1	0.1	–	–	0.06	1	0.1	–	–	0.09	8	0.1	1	0.2	1.47
	Nerita sp.	nerite	1	0.3	–	–	0.10	28	0.8	–	–	2.71	20	1.3	1	1.0	1.60	33	1.9	–	–	1.65	82	1.2	1	0.2	6.06
	Olivellinae	dwarf olive	–	–	–	–	–	1	0.0	1	0.3	0.53	–	–	–	–	–	–	–	–	–	–	1	0.0	1	0.2	0.53

Table 5.8 continued

Sabazan Comparative Vertebrate and Invertebrate Sub-Assemblage Continued

			Early Period					Middle Period					Late Period					Final Period					Site Total				
Class	Taxon	Common Name	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)
Gastropoda continued																											
	Angiola lineata	dwarf Atlantic	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.1	1	0.6	0.06	1	0.0	1	0.2	0.06
	Supplanaxis nucleus	black Atlantic planaxis	–	–	–	–	–	1	0.0	1	0.3	0.28	6	0.4	6	5.9	1.72	5	0.3	5	3.1	0.97	12	0.2	12	2.0	2.97
	Cittarium pica	West Indian top snail	36	9.2	2	6.1	28.86	63	1.8	8	2.7	265.24	35	2.3	3	2.9	57.39	34	2.0	1	0.6	45.43	168	2.4	14	2.3	396.92
	Cittarium pica nacre		56	14.3	–	–	19.91	65	1.9	–	–	16.39	33	2.1	–	–	4.72	57	3.3	–	–	2.42	211	3.0	–	–	43.44
	Tegula excavata	green-base tegula	–	–	–	–	–	3	0.1	1	0.3	0.42	3	0.2	2	2.0	2.10	6	0.3	3	1.9	2.44	12	0.2	6	1.0	4.96
	Lithopoma caelatum	carved star snail	–	–	–	–	–	1	0.0	1	0.3	2.39	–	–	–	–	–	–	–	–	–	–	1	0.0	1	0.2	2.39
	Vermetidae/ Turritellidae	worm shell	–	–	–	–	–	1	0.0	1	0.3	0.94	–	–	–	–	–	–	–	–	–	–	1	0.0	1	0.2	0.94
Total Identified Gastropoda			124	31.7	12	36.4	53.94	334	9.7	111	37.0	506.59	159	10.2	46	45.1	93.75	262	15.3	92	57.1	134.49	879	12.4	261	43.8	788.77
Indeterminate Gastropoda			17	4.3	–	–	1.80	70	2.0	1*	0.3	13.95	12	0.8	–	–	2.60	19	1.1	–	–	2.95	118	1.7	1	0.2	21.30
Polyplacophora																											
	Acanthopleura granulata	fuzzy chiton	4	1.0	2	6.1	3.09	80	2.3	11	3.7	67.58	11	0.7	2	2.0	10.96	34	2.0	5	3.1	31.41	129	1.8	20	3.4	113.04
	Chiton marmoratus	marbled chiton	–	–	–	–	–	16	0.5	3	1.0	8.76	7	0.5	2	2.0	4.26	14	0.8	2	1.2	7.18	37	0.5	7	1.2	20.20
	Chiton tuberculatus	West Indian chiton	–	–	–	–	–	44	1.3	6	2.0	17.11	26	1.7	4	3.9	8.66	64	3.7	6	3.7	19.83	134	1.9	16	2.7	45.60
Total Identified Polyplacophora			4	1.0	2	6.1	3.09	140	4.1	20	6.7	93.45	44	2.8	8	7.8	23.88	112	6.5	13	8.1	58.42	300	4.2	43	7.2	178.84
Indeterminate Polyplacophora			–	–	–	–	–	6	0.2	–	–	1.36	–	–	–	–	–	–	–	–	–	–	6	0.1	–	–	1.36
Total Identified Mollusca (below 'indeterminate' class-level)			129	33.0	15	45.5	57.13	542	15.7	151	50.3	630.03	210	13.5	57	55.9	125.62	392	22.8	113	70.2	196.78	1273	17.9	336	56.4	1009.56
Total Mollusca (includes 'indeterminate' at class-level)			149	38.1	15	45.5	59.66	631	18.3	152	50.7	649.75	225	14.5	57	55.9	128.30	422	24.6	113	70.2	203.27	1427	20.1	337	56.5	1040.98
Indeterminate Mollusca			138	35.3	–	–	2.44	692	20.1	–	–	30.23	480	30.9	–	–	8.10	260	15.1	–	–	8.52	1570	22.1	–	–	49.29
Malacostraca: Order Decapoda																											
	Gecarcinidae	land crab	–	–	–	–	–	2	0.1	–	–	0.05	1	0.1	–	–	0.41	–	–	–	–	–	3	0.0	–	–	0.46
	Cardisoma guanhumi	blue land crab	1	0.3	1	3.0	0.42	29	0.8	6	2.0	12.49	–	–	–	–	–	8	0.5	2	1.2	3.78	38	0.5	9	1.5	16.69
	Gecarcinus sp.	land crab	–	–	–	–	–	12	0.3	6	2.0	4.10	1	0.1	1	1.0	0.08	–	–	–	–	–	13	0.2	7	1.2	4.18
	Portunidae	swimming crab	–	–	–	–	–	–	–	–	–	–	2	0.1	1	1.0	1.45	1	0.1	1	0.6	0.07	3	0.0	2	0.3	1.52
	Decapoda	crab/lobster/shrimp	18	4.6	–	–	0.22	571	16.6	–	–	23.01	305	19.6	–	–	5.49	138	8.0	–	–	6.04	1032	14.5	–	–	34.76
Total Identified Decapoda			19	4.9	1	3.0	0.64	614	17.8	12	4.0	39.65	309	19.9	2	2.0	7.43	147	8.6	3	1.9	9.89	1089	15.3	18	3.0	57.61
Maxillopoda																											
	Cirripedia	barnacle	–	–	–	–	–	1	0.0	1	0.3	0.28	–	–	–	–	–	–	–	–	–	–	1	0.0	1	0.2	0.28
Total Identified Invertebrata (below 'indeterminate' class-level)			161	41.2	17	51.5	57.93	1486	43.2	172	57.3	679.93	851	54.7	64	62.7	140.53	1135	66.1	122	75.8	223.09	3633	51.1	375	62.9	1101.48
Total Invertebrata (includes 'indeterminate' at class-level)			181	46.3	17	51.5	60.46	1575	45.7	173	57.7	699.65	866	55.7	64	62.7	143.21	1165	67.8	122	75.8	229.58	3787	53.3	376	63.1	1132.90
Indeterminate Invertebrata			–	–	–	–	–	4	0.1	–	–	0.08	–	–	–	–	–	–	–	–	–	–	4	0.1	–	–	0.08
Total Identified Vertebrata and Invertebrata (below 'indeterminate' class-level)			211	54.0	33	100.0	60.55	2302	66.9	298	99.3	873.12	1027	66.0	101	99.0	163.85	1354	78.8	161	100.0	262.59	4894	68.9	593	99.5	1360.11
Total Vertebrata and Invertebrata (includes 'indeterminate' at class-level)			247	63.2	33	100.0	63.81	2728	79.2	300	100.0	939.18	1072	68.9	102	100.0	170.39	1450	84.4	161	100.0	277.97	5497	77.3	596	100.0	1451.35
Total Indeterminate Vertetbrata and Invertebrata (above class-level; includes 'Indeterminate Mollusca')			144	36.8	–	–	2.71	715	20.8	–	–	31.85	483	31.1	–	–	8.7	268	15.6	–	–	9.57	1610	22.7	–	–	52.83
Total Assemblage			391	100.0	33	100.0	66.52	3443	100.0	300	100.0	971.03	1555	100.0	102	100.0	179.09	1718	100.0	161	100.0	287.54	7107	100.0	596	100.0	1504.18

Table 5.9 Taxonomic richness for Grand Bay and Sabazan based on number of mutually exclusive taxa. NISP and MNI based on specimen identifications below class level, except for Echinoidea.

Taxonomic Richness

Sabazan

	Vertebrate			Invertebrate			Total Assemblage		
Period	N Taxa	NISP	MNI	N Taxa	NISP	MNI	N Taxa	NISP	MNI
Early	14	50	16	10	161	17	24	211	33
Middle	40	2319	230	35	1486	172	75	3805	402
Late	31	749	121	19	851	64	50	1600	185
Final	32	830	94	22	1135	122	54	1965	216

Grand Bay

	Vertebrate			Invertebrate			Total Assemblage		
Period	N Taxa	NISP	MNI	N Taxa	NISP	MNI	N Taxa	NISP	MNI
Early	–	–	–	34	622	109	–	–	–
Middle-L005	–	–	–	25	517	122	–	–	–
Middle-L003	–	–	–	29	755	159	–	–	–
Late	34	1415	125	49	2499	561	83	3914	686

Table 5.10 Shannon-Weiner diversity and evenness measures for the Sabazan and Grand Bay archaeofaunal assemblages.

Vertebrate Diversity and Evenness

Sabazan

Period	*H'*	*E*	Number of Taxa	Sample Size (MNI)
Early	0.958	0.958	10	14
Middle	1.177	0.789	31	221
Late	1.137	0.824	24	119
Final	1.243	0.889	25	92
Total Site	1.214	0.793	34	446

Grand Bay

Period	*H'*	*E*	Number of Taxa	Sample Size (MNI)
Early	–	–	–	–
Middle-L005	–	–	–	–
Middle-L003	–	–	–	–
Late	1.122	0.803	25	120
	–	–	–	–
Total Site	1.122	0.803	25	120

Invertebrate Diversity and Evenness

Sabazan

Period	*H'*	*E*	Number of Taxa	Sample Size (MNI)
Early	0.850	0.890	9	17
Middle	1.013	0.716	26	171
Late	0.859	0.731	15	64
Final	0.656	0.533	17	122
Total Site	9.220	0.637	28	374

Grand Bay

Period	*H'*	*E*	Number of Taxa	Sample Size (MNI)
Early	1.233	0.862	27	94
Middle-L005	0.961	0.752	19	118
Middle-L003	0.620	0.477	20	158
Late	0.922	0.612	32	559
	–	–	–	–
Total Site	0.968	0.593	43	929

Total Assemblage Diversity and Evenness

Sabazan

Period	*H'*	*E*	Number of Taxa	Sample Size (MNI)
Early	1.197	0.936	19	31
Middle	1.403	0.800	57	392
Late	1.321	0.830	39	183
Final	1.205	0.742	42	214
Total Site	1.380	0.770	62	820

Grand Bay

Period	*H'*	*E*	Number of Taxa	Sample Size (MNI)
Early	–	–	–	–
Middle-L005	–	–	–	–
Middle-L003	–	–	–	–
Late	1.160	0.660	57	679
	–	–	–	–
Total Site	1.140	0.622	68	1049

Table 5.11 T-tests for equality of Shannon-Weiner diversity between periods at Sabazan and Grand Bay. The *p* value is significant at the α level indicated; significant tests in bold print.

T-Tests of Diversity for Sabazan and Grand Bay

Sabazan

	Period Comparison	α	*t*	d.f.	*p*
Total Assemblage					
	Early - Middle	**0.017**	**-3.517**	**51.22**	**0.001**
	Middle - Late	0.050	1.837	406.87	0.067
	Late - Final	0.033	2.041	388.34	0.042
Vertebrate					
	Middle - Late	0.050	0.526	270.62	0.599
	Late - Final	0.025	-1.863	210.43	0.064
Invertebrate					
	Middle - Late	**0.050**	**1.979**	**130.46**	**0.050**
	Late - Final	**0.025**	**2.348**	**158.26**	**0.020**

Grand Bay

	Period Comparison	α	*t*	d.f.	*p*
Invertebrate					
	Early - Middle-L005	**0.013**	**4.440**	**211.44**	**< 0.001**
	Middle-L005 - Middle-L003	**0.025**	**4.873**	**275.59**	**< 0.001**
	Middle-L005 - Late	0.050	0.774	198.21	0.440
	Middle-L003 - Late	**0.038**	**-5.084**	**229.69**	**< 0.001**

Table 5.12 Relative abundance and rank by NISP and MNI of fish from the Sabazan site. Taxa appearing in bold print constitute five percent or more of fish relative abundance in at least one period.

Sabazan Fish Ranking by % NISP

Taxon	Early Period	Middle Period	Late Period	Final Period	All Periods	Overall Rank
Scombridae	**0.0**	**23.3**	**27.0**	**22.3**	**23.6**	**1**
Scaridae	**43.3**	**19.3**	**25.5**	**22.5**	**21.2**	**2**
Carangidae	**33.3**	**21.4**	**6.7**	**11.7**	**17.1**	**3**
Acanthuridae	**0.0**	**8.1**	**13.1**	**13.1**	**9.8**	**4**
Clupeidae	**6.7**	**6.3**	**5.7**	**6.2**	**6.2**	**5**
Serranidae	**3.3**	**5.1**	**6.2**	**7.6**	**5.7**	**6**
Haemulidae	**6.7**	**3.3**	**3.8**	**6.2**	**3.9**	**7**
Pomacentridae	3.3	2.1	0.6	1.0	1.6	8
Labridae	0.0	1.4	1.6	1.0	1.4	9
Balistidae	0.0	1.2	1.9	1.2	1.3	10.5
Hemiramphidae	3.3	1.7	1.0	0.0	1.3	10.5
Holocentridae	0.0	1.3	0.5	1.2	1.1	12
Lutjanidae	0.0	0.8	1.3	1.8	1.0	13.5
Mullidae	0.0	1.3	0.8	0.4	1.0	13.5
Exocoetidae	0.0	0.3	0.6	1.2	0.5	15
Belonidae	0.0	0.3	0.0	0.4	0.3	16
Diodontidae	0.0	0.2	0.0	0.2	0.1	18
Ostraciidae	0.0	0.1	0.2	0.4	0.1	18
Sciaenidae	0.0	0.1	0.2	0.0	0.1	18
Chaetodontidae	0.0	0.0	0.0	0.2	0.03	22
Malacanthidae	0.0	0.1	0.0	0.0	0.03	22
Mugilidae	0.0	0.1	0.0	0.0	0.03	22
Myliobatidae	0.0	0.0	0.2	0.0	0.03	22
Sphyraenidae	0.0	0.1	0.0	0.0	0.03	22
Others	0.0	2.7	3.2	1.2	2.5	N/A
Others:						
Acanthuridae/Pomacanthidae	0.0	0.1	0.0	0.0	0.03	N/A
Clupeidae/Engraulidae	0.0	0.3	0.6	0.4	0.3	N/A
Exocoetoidea	0.0	0.2	0.2	0.0	0.2	N/A
Labroidei	0.0	0.2	0.3	0.2	0.2	N/A
Lutjanidae/Serranidae	0.0	0.1	1.4	0.4	0.4	N/A
Tetraodontiformes	0.0	0.1	0.2	0.0	0.1	N/A
Taxon B	0.0	0.9	0.0	0.0	0.5	N/A
Taxon C	0.0	1.1	0.5	0.2	0.8	N/A

Sabazan Fish Ranking by % MNI

Taxon	Early Period	Middle Period	Late Period	Final Period	All Periods	Overall Rank
Carangidae	**20.0**	**30.7**	**12.6**	**23.4**	**24.2**	**1**
Scaridae	**30.0**	**15.3**	**32.0**	**14.3**	**19.9**	**2**
Scombridae	**0.0**	**8.4**	**11.7**	**7.8**	**8.9**	**3**
Acanthuridae	**0.0**	**5.9**	**7.8**	**7.8**	**6.6**	**4**
Haemulidae	**10.0**	**4.5**	**4.9**	**7.8**	**5.4**	**5.5**
Serranidae	**10.0**	**5.0**	**4.9**	**6.5**	**5.4**	**5.5**
Labridae	0.0	3.0	4.9	3.9	3.6	7
Clupeidae	**10.0**	**3.0**	**1.9**	**5.2**	**3.3**	**8**
Balistidae	0.0	2.5	3.9	3.9	3.1	9.5
Lutjanidae	0.0	2.0	4.9	3.9	3.1	9.5
Pomacentridae	10.0	3.0	1.0	2.6	2.6	11
Holocentridae	0.0	2.0	2.9	1.3	2.0	12
Hemiramphidae	10.0	2.5	1.0	0.0	1.8	13.5
Mullidae	0.0	2.5	1.0	1.3	1.8	13.5
Exocoetidae	0.0	1.5	1.0	2.6	1.5	15
Belonidae	0.0	1.0	0.0	2.6	1.0	16
Diodontidae	0.0	1.0	0.0	1.3	0.8	17.5
Ostraciidae	0.0	0.5	1.0	1.3	0.8	17.5
Sciaenidae	0.0	0.5	1.0	0.0	0.5	19
Myliobatidae	0.0	0.0	1.0	0.0	0.3	22
Chaetodontidae	0.0	0.0	0.0	1.3	0.3	22
Malacanthidae	0.0	0.5	0.0	0.0	0.3	22
Mugilidae	0.0	0.5	0.0	0.0	0.3	22
Sphyraenidae	0.0	0.5	0.0	0.0	0.3	22
Others	0.0	4.0	1.0	1.3	2.6	N/A
Others:						
Acanthuridae/Pomacanthidae	0.0	0.0	0.0	0.0	0.0	N/A
Clupeidae/Engraulidae	0.0	0.0	0.0	0.0	0.0	N/A
Exocoetoidea	0.0	0.0	0.0	0.0	0.0	N/A
Labroidei	0.0	0.0	0.0	0.0	0.0	N/A
Lutjanidae/Serranidae	0.0	0.0	0.0	0.0	0.0	N/A
Tetraodontiformes	0.0	0.0	0.0	0.0	0.0	N/A
Taxon B	0.0	1.5	0.0	0.0	0.8	N/A
Taxon C	0.0	2.5	1.0	1.3	1.8	N/A

Table 5.13 Chi square tests for the fish assemblage at Sabazan. Monte Carlo approximations (200,000 replicates) used to calculate *p*-values for chi square statistic. See text for explanation of table format. Between the Final and Middle period columns at the far right the sign of the adjusted residual should be read chronologically from right to left.

Chi Square Tests for Sabazan Fish

Taxon	Common Name	Early Period NISP	Adjusted Residual	*p*	Middle Period NISP	Adjusted Residual	*p*	Late Period NISP	Adjusted Residual	*p*	Final Period NISP	Adjusted Residual	*p*	Middle Period NISP	Assemblage Total
Myliobatidae	eagle ray	–			–	1.790	>0.05	1	-0.900	>0.05	–			–	1
Acanthuridae	surgeonfish	–	1.650	>0.05	162	**3.789**	**<0.001**	82	-0.131	>0.05	65	**3.344**	**<0.001**	162	309
Balistidae	triggerfish	–	0.599	>0.05	23	1.469	>0.05	12	-0.979	>0.05	6	0.072	>0.05	23	41
Belonidae	needlefish	–	0.305	>0.05	6	-1.370	>0.05	–	1.574	>0.05	2	0.342	>0.05	6	8
Carangidae	jack, pompano, scad	10	-1.482	>0.05	428	**-8.371**	**<0.001**	42	**2.802**	**0.005**	58	**-5.050**	**<0.001**	428	538
Chaetodontidae	butterflyfish	–			–			–	1.112	>0.05	1	**1.991**	**0.047**	–	1
Clupeidae	herring, shad	2	-0.053	>0.05	125	-0.439	>0.05	36	0.264	>0.05	31	-0.091	>0.05	125	194
Diodontidae	porcupinefish	–	0.215	>0.05	3	-0.968	>0.05	–	1.112	>0.05	1	0.242	>0.05	3	4
Exocoetidae	flyingfish	–	0.278	>0.05	5	1.458	>0.05	4	0.976	>0.05	6	**2.850**	**0.004**	5	15
Haemulidae	grunt	2	-0.976	>0.05	66	0.654	>0.05	24	1.782	>0.05	31	**2.957**	**0.003**	66	123
Hemiramphidae	halfbeak	1	-0.653	>0.05	34	-1.315	>0.05	6	**-2.209**	**0.027**	–	**-2.950**	**0.003**	34	41
Holocentridae	squirrelfish	–	0.637	>0.05	26	-1.710	>0.05	3	1.330	>0.05	6	-0.200	>0.05	26	35
Labridae	wrasse, hogfish	–	0.662	>0.05	28	0.369	>0.05	10	-0.893	>0.05	5	-0.722	>0.05	28	43
Lutjanidae	snapper	–	0.483	>0.05	15	1.244	>0.05	8	0.687	>0.05	9	**2.129**	**0.033**	15	32
Malacanthidae	tilefish	–	0.124	>0.05	1	-0.559	>0.05	–			–	-0.503	>0.05	1	1
Mugilidae	mullet	–	0.124	>0.05	1	-0.559	>0.05	–		>0.05	–	-0.503	>0.05	1	1
Mullidae	goatfish	–	0.637	>0.05	26	-1.007	>0.05	5	-0.862	>0.05	2	-1.726	>0.05	26	33
Ostraciidae	trunkfish, cowfish	–	0.124	>0.05	1	0.871	>0.05	1	0.766	>0.05	2	**2.009**	**0.045**	1	4
Pomacentridae	damselfish	1	-0.462	>0.05	41	**-2.368**	**0.018**	4	0.657	>0.05	5	-1.585	>0.05	41	51
Scaridae	parrotfish	13	-3.190	<0.001	385	**3.445**	**<0.001**	160	-1.354	>0.05	112	1.482	>0.05	385	670
Sciaenidae	weakfish	–	0.124	>0.05	1	0.871	>0.05	1	-0.900	>0.05	–	-0.503	>0.05	1	2
Scombridae	tuna, mackerel	–	3.063	0.002	465	1.958	>0.05	169	**-1.979**	**0.048**	111	-0.606	>0.05	465	745
Serranidae	grouper, sea bass	1	0.467	>0.05	102	1.112	>0.05	39	0.848	>0.05	38	**2.123**	**0.034**	102	180
Sphyraenidae	barracuda	–	0.124	>0.05	1	-0.559	>0.05	–			–	-0.503	>0.05	1	1
Total		30			1945			607			491			1945	3073
		χ^2 = 23.37		*p* = 0.228	χ^2 = 109.620		*p* < 0.001	χ^2 = 33.26		*p* = 0.017	χ^2 = 81.53		*p* < 0.001		

Table 5.14 Chi square tests for fish habitats exploited at Sabazan. Fisher's exact test used to calculate *p*-values for chi square statistic where appropriate. See text for explanation of table format. Between the Final and Middle period columns at the far right the sign of the adjusted residual should be read chronologically from right to left.

Chi Square Tests for Sabazan Fish Taxa By Habitat

Habitat Type	Early Period NISP	Adjusted Residual	*p*	Middle Period NISP	Adjusted Residual	*p*	Late Period NISP	Adjusted Residual	*p*	Final Period NISP	Adjusted Residual	*p*	Middle Period NISP	Assemblage Total
Coral Reef Taxa	17	-1.611	>0.05	856	**5.118**	**<0.001**	353	0.190	>0.05	283	**4.905**	**<0.001**	856	1509
Inshore/Shallow Water Taxa	8	-1.113	>0.05	378	**-7.332**	**<0.001**	45	1.378	>0.05	47	**-5.371**	**<0.001**	378	478
Pelagic Taxa	3	**2.635**	**0.008**	650	0.402	>0.05	218	-1.001	>0.05	159	-0.825	>0.05	650	1030
Total	28			1884			616			489			1884	3017
	χ^2 = 6.97		p = 0.031	χ^2 = 58.29		p < 0.001	χ^2 = 2.42		p = 0.299	χ^2 = 36.64		p < 0.001		

Habitat Type	Early Period MNI	Adjusted Residual	*p*	Middle Period MNI	Adjusted Residual	*p*	Late Period MNI	Adjusted Residual	*p*	Final Period MNI	Adjusted Residual	*p*	Middle Period MNI	Assemblage Total
Coral Reef Taxa	6	-1.222	>0.05	89	**3.471**	**<0.001**	69	-1.512	>0.05	43	1.582	>0.05	89	207
Inshore/Shallow Water Taxa	1	1.322	>0.05	62	**-3.256**	**0.001**	14	-0.110	>0.05	10	**-3.142**	**0.002**	62	87
Pelagic Taxa	2	-0.004	>0.05	43	-0.750	>0.05	19	1.808	>0.05	23	1.392	>0.05	43	87
Total	9			194			102			76			194	381
	χ^2 = 2.00		p = 0.443	χ^2 = 13.94		p = 0.001	χ^2 = 3.36		p = 0.187	χ^2 = 9.98		p < 0.007		

Table 5.15 Chi square tests for the mammal assemblage at Sabazan; armadillo omitted from analysis due to its rarity. Fisher's exact test used to calculate *p*-values for chi square statistic. See text for explanation of table format. Between the Final and Middle period columns at the far right the sign of the adjusted residual should be read chronologically from right to left.

Chi Square Tests for Sabazan Mammals

Taxon	Common Name	Early Period NISP	Adjusted Residual	*p*	Middle Period NISP	Adjusted Residual	*p*	Late Period NISP	Adjusted Residual	*p*	Final Period NISP	Adjusted Residual	*p*	Middle Period NISP	Assemblage Total
Didelphis sp.	opossum	1	1.190	>0.05	28	**3.192**	**0.001**	17	1.595	>0.05	40	**5.940**	**<0.001**	28	71
Dasypocta sp.	agouti	1	**2.690**	**0.007**	63	0.689	>0.05	19	-0.802	>0.05	27	-0.257	>0.05	63	309
Oryzomyini	rice rat	14	**-3.504**	**<0.001**	65	**-3.509**	**<0.001**	5	-1.555	>0.05	3	**-5.665**	**<0.001**	65	41
Total		16			156			41			70			156	421
		χ^2 = 12.36		p = 0.002	χ^2 = 16.07		p < 0.001	χ^2 = 3.86		p = 0.150	χ^2 = 47.15		p < 0.001		

Table 5.16 Chi square tests for the gastropod assemblage at Sabazan. Monte Carlo approximations (200,000 replicates) used to calculate *p*-values for chi square statistics. See text for explanation of table format. Between the Final and Middle period columns at the far right the sign of the adjusted residual should be read chronologically from right to left.

Chi Square Tests for Sabazan Gastropods

Taxon	Common Name	Early Period NISP	Adjusted Residual	*p*	Middle Period NISP	Adjusted Residual	*p*	Late Period NISP	Adjusted Residual	*p*	Final Period NISP	Adjusted Residual	*p*	Middle Period NISP	Assemblage Total
Orthalicus undatus	wavy orthalicus	13	**-3.206**	**0.001**	20	0.779	>0.05	12	**-2.618**	**0.009**	6	**-2.124**	**0.034**	20	51
Pleurodonte sp.	terrestrial snail	5	**-3.212**	**0.001**	3	1.917	>0.05	5	**-2.333**	**0.020**	1	-0.735	>0.05	3	14
Megalobulimus sp.	giant terrestrial snail	–	1.082	>0.05	5	-0.783	>0.05	1	0.154	>0.05	2	-0.784	>0.05	5	8
Bulla striata	common Atlantic bubble	–	0.835	>0.05	3	-1.176	>0.05	–			–	-1.513	>0.05	3	3
Crepidula maculosa	spotted slippersnail	–	1.284	>0.05	7	-1.805	>0.05	–			–	**-2.321**	**0.203**	7	7
Cassidae	bonnet/cowrie helmet	–	0.681	>0.05	2	-0.959	>0.05	–			–	-1.234	>0.05	2	2
Columbella mercatoria	common dove shell	–	0.481	>0.05	1	-0.677	>0.05	–	0.778	>0.05	1	0.197	>0.05	1	2
Fissurellidae	keyhole limpet	–	0.681	>0.05	2	-0.959	>0.05	–			–	-1.234	>0.05	2	2
Cenchritis muricata	beaded periwinkle	1	-0.651	>0.05	2	0.073	>0.05	1	-0.363	>0.05	1	-0.344	>0.05	2	5
Mancinella deltoidea	deltoid rock snail	–	0.681	>0.05	2	-0.959	>0.05	–			–	-1.234	>0.05	2	2
Plicopurpura patula	wide-mouthed purpura	–	0.481	>0.05	1	0.569	>0.05	1	-1.290	>0.05	–	-0.872	>0.05	1	2
Stramonita sp.	rock snail	–	0.681	>0.05	2	-0.959	>0.05	–			–	-1.234	>0.05	2	2
Nerita spp.	nerite	7	**6.271**	**<0.001**	149	-1.366	>0.05	59	**4.371**	**<0.001**	147	**3.710**	**<0.001**	149	362
Olivellinae	dwarf olive	–	0.481	>0.05	1	-0.677	>0.05	–			–	-0.872	>0.05	1	1
Angiola lineata	dwarf Atlantic planaxis	–			–			–	0.778	>0.05	1	1.150	>0.05	–	1
Supplanaxis nucleus	black Atlantic planaxis	–	0.481	>0.05	1	**3.126**	**0.002**	6	-1.179	>0.05	5	**2.001**	**0.045**	1	12
Cittarium pica	West Indian top snail	36	**-5.371**	**<0.001**	63	1.068	>0.05	35	**-2.531**	**0.011**	34	-1.802	>0.05	63	168
Tegula excavata	green-base tegula	–	0.835	>0.05	3	0.991	>0.05	3	0.269	>0.05	6	1.440	>0.05	3	12
Lithopoma caelatum	carved star snail	–	0.481	>0.05	1	-0.677	>0.05	–			–	-0.872	>0.05	1	1
Vermetidae/Turritellidae	worm shell	–	0.481	>0.05	1	-0.677	>0.05	–			–	-0.872	>0.05	1	1
Total		62			269			123			204			269	658
		χ^2 = 68.13		p < 0.001	χ^2 = 27.44		p = 0.044	χ^2 = 28.37		p < 0.001	χ^2 = 37.28		p < 0.001		

Table 5.17 Chi square tests for the chiton assemblage at Sabazan. Fisher's exact test used to calculate *p*-values for chi square statistics where appropriate. See text for explanation of table format. Between the Final and Middle period columns at the far right the sign of the adjusted residual should be read chronologically from right to left.

Chi Square Tests for Sabazan Chiton

Taxon	Common Name	Early Period NISP	Adjusted Residual	*p*	Middle Period NISP	Adjusted Residual	*p*	Late Period NISP	Adjusted Residual	*p*	Final Period NISP	Assemblage Total
Acanthopleura granulata	fuzzy chiton	4	-1.714	>0.05	80	**-3.720**	**<0.001**	11	0.665	>0.05	34	129
Chiton marmoratus	marbled chiton	0	0.717	>0.05	16	0.784	>0.05	7	-0.561	>0.05	14	37
Chiton tuberculatus	West Indian chiton	0	1.345	>0.05	44	**3.297**	**0.001**	26	-0.222	>0.05	64	134
Total		4			140			44			112	300
		χ^2 = 2.94		p = 0.421	χ^2 = 14.270		p = 0.001	χ^2 = 0.61		p = 0.738		

Table 5.18 Chi square tests for comparison of classes in the Sabazan assemblage. Monte Carlo approximations (200,000 replicates) or Fisher's exact test used to calculate *p*-values for chi square statistics. See text for explanation of table format. Between the Final and Middle period columns at the far right the sign of the adjusted residual should be read chronologically from right to left.

Chi Square Tests for Sabazan Vertebrate and Invertebrate Classes

Taxon	Common Name	Early Period MNI	Adjusted Residual	*p*	Middle Period MNI	Adjusted Residual	*p*	Late Period MNI	Adjusted Residual	*p*	Final Period MNI	Adjusted Residual	*p*	Middle Period MNI	Assemblage Total
Actinopterygii and Chondrichthyes	fish	10	0.615	>0.05	106	-0.913	>0.05	31	-1.870	>0.05	33	**-3.377**	**<0.001**	106	180
Aves	bird	0	0.473	>0.05	2	-0.827	>0.05	0	0.794	>0.05	1	-0.066	>0.05	2	3
Mammalia	mammal	4	-2.050	0.404	12	-0.488	>0.05	3	-0.583	>0.05	3	-1.250	>0.05	12	22
Reptilia	reptile	2	-1.432	>0.05	6	0.555	>0.05	3	-0.995	>0.05	2	-0.607	>0.05	6	13
Echinoidea	sea urchin	1	-0.113	>0.05	8	1.102	>0.05	5	-0.481	>0.05	6	0.613	>0.05	8	20
Bivalvia	clam, mussel, oyster	1	0.827	>0.05	20	-1.400	>0.05	3	0.785	>0.05	8	-0.753	>0.05	20	32
Gastropoda	snail	12	0.114	>0.05	111	1.451	>0.05	46	1.830	>0.05	92	**4.066**	**<0.001**	111	261
Polyplacophora	chiton	2	0.147	>0.05	20	0.403	>0.05	8	0.045	>0.05	13	0.530	>0.05	20	43
Decapoda	crab, lobster, shrimp	1	0.283	>0.05	12	-0.971	>0.05	2	-0.067	>0.05	3	-1.250	>0.05	12	18
Total		33			297			101			161			297	592
		χ^2 = 7.23		*p* = 0.452	χ^2 = 7.120		*p* = 0.525	χ^2 = 6.98		*p* = 0.513	χ^2 = 21.69		*p* = 0.004		

Table 5.19 Chi square tests for comparison of vertebrate and invertebrate families at Sabazan based on comparative vertebrate and invertebrate sub-assemblage data (Table 5.8). Monte Carlo approximations (200,000 replicates) used to calculate *p*-values for chi square statistics. See text for explanation of table format. Between the Final and Middle period columns at the far right the sign of the adjusted residual should be read chronologically from right to left.

Chi Square Tests for Sabazan Vertebrate and Invertebrate Families

Taxon	Common Name	Early Period MNI	Adjusted Residual	*p*	Middle Period MNI	Adjusted Residual	*p*	Late Period MNI	Adjusted Residual	*p*	Final Period MNI	Adjusted Residual	*p*	Middle Period MNI	Assemblage Total
Acanthuridae	surgeonfish	–	0.897	>0.05	7	-0.288	>0.05	2	-1.002	>0.05	1	-1.411	>0.05	7	10
Balistidae	triggerfish	–	0.336	>0.05	1	0.759	>0.05	1	-0.330	>0.05	1	0.405	>0.05	1	3
Carangidae	jack, pompano, scad	2	0.865	>0.05	32	-1.265	>0.05	7	-0.431	>0.05	9	-2.003	>0.05	32	50
Clupeidae	herring, shad	1	-0.996	>0.05	3	0.695	>0.05	2	-1.002	>0.05	1	-0.471	>0.05	3	7
Diodontidae	porcupinefish	–	0.476	>0.05	2	-0.849	>0.05	–			–	-1.069	>0.05	2	2
Exocoetidae	flyingfish	–			–	1.672	>0.05	1	-0.330	>0.05	1	1.327	>0.05	–	2
Haemulidae	grunt	1	-0.539	>0.05	5	0.132	>0.05	2	-0.469	>0.05	2	-0.427	>0.05	5	10
Hemiramphidae	halfbeak	1	-0.996	>0.05	3	-0.064	>0.05	1	-1.262	>0.05	–	-1.311	>0.05	3	5
Holocentridae	squirrelfish	–	0.476	>0.05	2	0.274	>0.05	1	-1.262	>0.05	–	-1.069	>0.05	2	3
Labridae	wrasse, hogfish	–	0.675	>0.05	4	-0.327	>0.05	1	-0.330	>0.05	1	-0.761	>0.05	4	6
Lutjanidae	snapper	–	0.675	>0.05	4	-0.327	>0.05	1	-0.330	>0.05	1	-0.761	>0.05	4	6
Mullidae	goatfish	–	0.476	>0.05	2	0.274	>0.05	1	-0.330	>0.05	1	-0.106	>0.05	2	4
Ostraciidae	trunkfish	–			–	1.672	>0.05	1	-0.330	>0.05	1	1.327	>0.05	–	2
Pomacentridae	damselfish	1	-0.996	>0.05	3	-0.064	>0.05	1	-0.330	>0.05	1	-0.471	>0.05	3	6
Scaridae	parrotfish	3	-0.753	>0.05	17	-0.787	>0.05	4	-0.668	>0.05	4	-1.682	>0.05	17	28
Scombridae	tuna, mackerel	–	0.961	>0.05	8	0.067	>0.05	3	-0.577	>0.05	3	-0.628	>0.05	8	14
Serranidae	grouper, sea bass	1	-0.372	>0.05	6	-0.734	>0.05	1	0.566	>0.05	3	-0.184	>0.05	6	11
Columbidae	pigeon, dove	–	0.476	>0.05	2	-0.849	>0.05	–	0.796	>0.05	1	-0.106	>0.05	2	3
Didelphidae	opossum	1	-1.342	>0.05	2	0.274	>0.05	1	-0.330	>0.05	1	-0.106	>0.05	2	5
Dasyproctidae	agouti	1	-0.996	>0.05	3	-0.064	>0.05	1	-0.330	>0.05	1	-0.471	>0.05	3	6
Cricetidae:															
Oryzomyini	rice rat	2	-1.641	>0.05	5	-0.545	>0.05	1	-0.330	>0.05	1	-1.005	>0.05	5	9
Cheloniidae	sea turtle	–	0.583	>0.05	3	-0.064	>0.05	1	-0.330	>0.05	1	-0.471	>0.05	3	5
Iguanidae	iguana	–	0.336	>0.05	1	0.759	>0.05	1	-0.330	>0.05	1	0.405	>0.05	1	3
Echinoidea	sea urchin	1	-0.102	>0.05	8	1.004	>0.05	5	-0.472	>0.05	6	0.522	>0.05	8	20
Cardiidae	cockle	–	0.583	>0.05	3	-1.042	>0.05	–	0.796	>0.05	1	-0.471	>0.05	3	4
Donacidae	coquina clam	–	0.336	>0.05	1	0.759	>0.05	1	0.866	>0.05	4	**2.046**	**0.041**	1	6
Lucinidae	lucine	–	0.476	>0.05	2	0.274	>0.05	1	-0.330	>0.05	1	-0.106	>0.05	2	4
Mytilidae	mussel	–	0.961	>0.05	8	-1.053	>0.05	1	-0.330	>0.05	1	-1.586	>0.05	8	10
Plicatulidae	kitten's paw	–	0.476	>0.05	2	-0.849	>0.05	–			–	-1.069	>0.05	2	2
Psammobiidae	sunset clam	1	-1.879	>0.05	1	-0.600	>0.05	–			–	-0.755	>0.05	1	2
Tellinidae	tellin	–	0.476	>0.05	2	-0.849	>0.05	–			–	-1.069	>0.05	2	2
Orthalicidae	tree snail	1	-0.372	>0.05	6	-0.091	>0.05	2	-1.002	>0.05	1	-1.219	>0.05	6	10
Pleurodontidae	terrestrial snail	2	-2.237	>0.05	3	0.695	>0.05	2	-1.002	>0.05	1	-0.471	>0.05	3	8
Strophocheilidae	giant terrestrial snail	–	0.336	>0.05	1	0.759	>0.05	1	-0.330	>0.05	1	0.405	>0.05	1	3

Table 5.19 continued.

Chi Square Tests for Sabazan Vertebrate and Invertebrate Families Continued

Taxon	Common Name	Early Period MNI	Adjusted Residual	*p*	Middle Period MNI	Adjusted Residual	*p*	Late Period MNI	Adjusted Residual	*p*	Final Period MNI	Adjusted Residual	*p*	Middle Period MNI	Assemblage Total
Bullidae	bubble	–	0.476	>0.05	2	-0.849	>0.05	–			–	-1.069	>0.05	2	2
Calyptraeidae	slipper snail	–	0.897	>0.05	7	-1.600	>0.05	–			–	**-2.012**	**0.044**	7	7
Cassidae	bonnet, cowrie helmet	–	0.476	>0.05	2	-0.849	>0.05	–			–	-1.069	>0.05	2	2
Collumbellidae	dove snail	–	0.336	>0.05	1	-0.600	>0.05	–	0.796	>0.05	1	0.405	>0.05	1	2
Littorinidae	periwinkle	1	-1.342	>0.05	2	0.274	>0.05	1	-0.330	>0.05	1	-0.106	>0.05	2	5
Muricidae	murex	–	0.756	>0.05	5	-0.545	>0.05	1	-1.262	>0.05	–	-1.696	>0.05	5	6
Neritidae	nerite	6	0.652	>0.05	68	0.713	>0.05	28	3.289	0.001	77	**5.173**	**<0.001**	68	179
Planaxidae	planaxis	–	0.336	>0.05	1	3.594	<0.001	6	-0.825	>0.05	6	**2.744**	**0.006**	1	13
Turbinidae	turban, top snail	2	-0.770	>0.05	10	0.622	>0.05	5	-1.059	>0.05	4	-0.608	>0.05	10	21
Chitonidae	chiton	2	0.163	>0.05	20	0.271	>0.05	8	0.057	>0.05	13	0.390	>0.05	20	43
Gecarcinidae	terrestrial crab	1	-0.372	>0.05	6	-0.734	>0.05	1	0.191	>0.05	2	-0.669	>0.05	6	10
Portunidae	swimming crab	–			–	1.672	>0.05	1	-0.330	>0.05	1	1.327	>0.05	–	2
Total		31			276			99			157			276	561
		χ^2 = 29.56		*p* = 0.886	χ^2 = 40.130		*p* = 0.708	χ^2 = 23.02		*p* = 0.994	χ^2 = 68.72		*p* = 0.004		

Table 5.20 Sabazan taxa grouped by habitat type. Taxa which could not be assigned to a single or dominant habitat are excluded. Data based on the comparative vertebrate and invertebrate sub-assemblage (Table 5.8).

Sabazan Taxa By Habitat

Habitat	Taxon	Common Name	Early					Middle					Late					Final					Site Total				
			NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)
Coral Reef																											
	Acanthurus sp.	surgeonfish	–	–	–	–	–	64	3.8	7	2.5	7.94	20	2.8	2	2.0	2.71	11	0.9	1	0.6	1.90	95	2.5	10	1.7	12.55
	Acanthuridae/ Pomacanthidae	surgeonfish/angelfish	–	–	–	–	–	1	0.1	–	–	0.05	–	–	–	–	–	–	–	–	–	–	1	0.0	–	–	0.05
	Balistidae	triggerfish	–	–	–	–	–	9	0.5	1	0.4	4.93	1	0.1	1	1.0	0.28	1	0.1	1	0.6	0.10	11	0.3	3	0.5	5.31
	Chaetodontidae	butterflyfish	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.1	1	0.6	0.03	1	0.0	1	0.2	0.03
	Diodontidae	porcupinefish	–	–	–	–	–	2	0.1	2	0.7	24.21	–	–	–	–	–	–	–	–	–	–	2	0.1	2	0.3	24.21
	Haemulidae	grunt	1	0.5	1	3.1	<0.01	15	0.9	4	1.4	1.72	7	1.0	2	2.0	0.82	11	0.9	1	0.6	0.69	34	0.9	8	1.4	3.23
	cf. Haemulidae		1	0.5	–	–	<0.01	–	–	–	–	–	–	–	–	–	–	1	0.1	–	–	0.01	2	0.1	–	–	0.01
	cf. *Haemulon* sp.	grunt	–	–	–	–	–	3	0.2	1	0.4	1.17	–	–	–	–	–	1	0.1	1	0.6	0.15	4	0.1	2	0.3	1.32
	Holocentridae	squirrelfish, soldierfish	–	–	–	–	–	8	0.5	2	0.7	1.57	1	0.1	1	1.0	0.03	–	–	–	–	–	9	0.2	3	0.5	1.60
	cf. Holocentridae		–	–	–	–	–	1	0.1	–	–	0.02	–	–	–	–	–	–	–	–	–	–	1	0.0	–	–	0.02
	Labridae	wrasse, hogfish	–	–	–	–	–	7	0.4	2	0.7	0.42	–	–	–	–	–	–	–	–	–	–	7	0.2	2	0.3	0.42
	cf. *Bodianus* sp.		–	–	–	–	–	1	0.1	1	0.4	0.12	–	–	–	–	–	–	–	–	–	–	1	0.0	1	0.2	0.12
	Halichoeres sp.	wrasse	–	–	–	–	–	1	0.1	1	0.4	0.18	–	–	–	–	–	–	–	–	–	–	1	0.0	1	0.2	0.18
	cf. *Halichoeres* sp.		–	–	–	–	–	2	0.1	–	–	0.56	1	0.1	1	1.0	0.44	1	0.1	1	0.6	0.16	4	0.1	2	0.3	1.16
	Labroidei	wrasse, parrotfish	–	–	–	–	–	1	0.1	–	–	0.10	–	–	–	–	–	–	–	–	–	–	1	0.0	–	–	0.10
	Lutjanidae	snapper	–	–	–	–	–	9	0.5	4	1.4	1.11	1	0.1	1	1.0	0.04	1	0.1	1	0.6	0.04	11	0.3	6	1.0	1.19
	cf. Lutjanidae		–	–	–	–	–	–	–	–	–	–	1	0.1	–	–	<0.01	–	–	–	–	–	1	0.0	–	–	<0.01
	Lutjanidae/Serranidae	snapper/grouper, sea bass	–	–	–	–	–	–	–	–	–	–	1	0.1	–	–	0.26	–	–	–	–	–	1	0.0	–	–	0.26
	Pomacentridae	damselfish	1	0.5	1	3.1	<0.01	14	0.8	3	1.1	0.01	1	0.1	1	1.0	<0.01	2	0.2	1	0.6	<0.01	18	0.5	6	1.0	0.01
	cf. Pomacentridae		–	–	–	–	–	1	0.1	–	–	<0.01	–	–	–	–	–	–	–	–	–	–	1	0.0	–	–	<0.01
	Scaridae	parrotfish	5	2.6	–	–	0.15	57	3.3	–	–	8.11	18	2.5	1	1.0	2.83	12	1.0	–	–	3.13	92	2.4	1	0.2	14.22
	Cryptotomus roseus / *Nicholsina usta*	bluelip/emerald parrotfish	–	–	–	–	–	1	0.1	1	0.4	0.02	–	–	–	–	–	–	–	–	–	–	1	0.0	1	0.2	0.02
	Scarus sp.	parrotfish	1	0.5	1	3.1	0.04	16	0.9	5	1.8	4.59	1	0.1	1	1.0	0.04	2	0.2	1	0.6	0.32	20	0.5	8	1.4	4.99
	cf. *Scarus* sp.		–	–	–	–	–	1	0.1	–	–	0.09	–	–	–	–	–	–	–	–	–	–	1	0.0	–	–	0.09
	Sparisoma sp.	parrotfish	7	3.7	2	6.3	1.82	64	3.8	11	3.9	28.24	8	1.1	2	2.0	3.03	7	0.6	3	1.9	2.87	86	2.3	18	3.1	35.96
	cf. Sparisoma sp.		–	–	–	–	–	–	–	–	–	–	1	0.1	–	–	0.03	–	–	–	–	–	1	0.0	–	–	0.03
	Serranidae	grouper, sea bass	–	–	–	–	–	35	2.1	4	1.4	13.99	5	0.7	1	1.0	1.22	4	0.3	2	1.3	0.45	44	1.2	7	1.2	15.66
	cf. Serranidae		–	–	–	–	–	2	0.1	–	–	0.19	–	–	–	–	–	1	0.1	–	–	0.38	3	0.1	–	–	0.57
	cf. *Cephalopholis fulva*	coney	1	0.5	1	3.1	0.11	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.0	1	0.2	0.11
	Mycteroperca sp.	grouper	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.1	1	0.6	0.27	1	0.0	1	0.2	0.27
	Epinephelinae	coney/grouper	–	–	–	–	–	4	0.2	2	0.7	0.51	–	–	–	–	–	–	–	–	–	–	4	0.1	2	0.3	0.51
Total Coral Reef Taxa			17	8.9	6	18.8	2.12	319	18.7	51	18.1	99.85	67	9.4	14	13.9	11.73	57	4.7	15	9.4	10.5	460	12.1	86	15.0	124.2
Inshore/Shallow Water																											
	Carangidae	jack, pompano, scad	6	3.1	–	–	0.02	65	3.8	–	–	3.74	9	1.3	2	2.0	0.09	18	1.5	–	–	0.45	98	2.6	2	0.3	4.30
	Caranx sp.	jack	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.1	1	0.6	0.58	1	0.0	1	0.2	0.58
	Selar crumenophthalmus	bigeye scad	2	1.0	1	3.1	0.01	29	1.7	21	7.4	0.29	9	1.3	5	5.0	0.03	8	0.7	2	1.3	0.07	48	1.3	29	5.0	0.40
	cf. *Selar crumenophthalmus*		–	–	–	–	–	20	1.2	–	–	0.14	1	0.1	–	–	<0.01	–	–	–	–	–	21	0.6	–	–	0.14
	cf. *Caranx* sp.		–	–	–	–	–	1	0.1	1	0.4	0.09	–	–	–	–	–	–	–	–	–	–	1	0.0	1	0.2	0.09
	Mullidae	goatfish	–	–	–	–	–	3	0.2	1	0.4	0.01	1	0.1	1	1.0	0.03	–	–	–	–	–	4	0.1	2	0.3	0.04
	cf. Mullidae		–	–	–	–	–	2	0.1	1	0.4	<0.01	3	0.4	–	–	<0.01	2	0.2	1	0.6	<0.01	7	0.2	2	0.3	<0.01
	Ostraciidae	trunkfish, cowfish	–	–	–	–	–	–	–	–	–	–	1	0.1	1	1.0	<0.01	2	0.2	1	0.6	<0.01	3	0.1	2	0.3	<0.01
	Cynoscion sp.	weakfish	–	–	–	–	–	1	0.1	1	0.4	0.06	–	–	–	–	–	–	–	–	–	–	1	0.0	1	0.2	0.06
	Sphyraena sp.	barracuda	–	–	–	–	–	1	0.1	1	0.4	0.29	–	–	–	–	–	–	–	–	–	–	1	0.0	1	0.2	0.29
	Cheloniidae	sea turtle	–	–	–	–	–	49	2.9	3	1.1	27.89	14	2.0	1	1.0	3.86	48	4.0	1	0.6	16.66	111	2.9	5	0.9	48.41
	Echinoidea	sea urchin	13	6.8	1	3.1	0.16	329	19.3	8	2.8	9.97	332	46.6	5	5.0	7.48	596	49.3	6	3.8	16.42	1270	33.5	20	3.5	34.03
	Arcidae	ark	–	–	–	–	–	1	0.1	1	0.4	<0.01	–	–	–	–	–	–	–	–	–	–	1	0.0	1	0.2	0.00
	Cardiidae	cockle	–	–	–	–	–	1	0.1	–	–	0.15	–	–	–	–	–	1	0.1	–	–	0.28	2	0.1	–	–	0.43
	Americardia media	Atlantic strawberry cockle	–	–	–	–	–	4	0.2	3	1.1	4.82	–	–	–	–	–	1	0.1	1	0.6	0.31	5	0.1	4	0.7	5.13

Table 5.20 continued

Sabazan Taxa By Habitat Continued

		Early					Middle					Late					Final					Site Total				
Habitat Taxon	Common Name	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)
Inshore/Shallow Water continued																										
Donax denticulatus	Caribbean coquina	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	0.2	3	1.9	0.84	3	0.1	3	0.5	0.84
Donax sp.	coquina	–	–	–	–	–	1	0.1	1	0.4	0.16	1	0.1	1	1.0	0.21	2	0.2	1	0.6	0.23	4	0.1	3	0.5	0.60
Brachidontes sp.	mussel	–	–	–	–	–	52	3.1	8	2.8	8.49	–	–	–	–	–	–	–	–	–	–	52	1.4	8	1.4	8.49
Brachidontes/Ischadium sp.	mussel	–	–	–	–	–	–	–	–	–	–	4	0.6	1	1.0	0.11	5	0.4	1	0.6	0.29	9	0.2	2	0.3	0.40
Codakia orbicularis	tiger lucine	–	–	–	–	–	4	0.2	2	0.7	5.98	1	0.1	1	1.0	7.29	–	–	–	–	–	5	0.1	3	0.5	13.27
cf. *Codakia orbicularis*		–	–	–	–	–	–	–	–	–	–	1	0.1	–	–	0.38	–	–	–	–	–	1	0.0	–	–	0.38
Codakia sp.	lucine	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	5	0.4	1	0.6	1.28	5	0.1	1	0.2	1.28
cf. *Asaphis deflorata*	gaudy asaphis	1	0.5	1	3.1	0.10	1	0.1	1	0.4	0.04	–	–	–	–	–	–	–	–	–	–	2	0.1	2	0.3	0.14
Tellinidae	tellin	–	–	–	–	–	1	0.1	1	0.4	0.46	–	–	–	–	–	–	–	–	–	–	1	0.0	1	0.2	0.46
Arcopagia fausta	sunset tellin	–	–	–	–	–	1	0.1	1	0.4	5.87	–	–	–	–	–	–	–	–	–	–	1	0.0	1	0.2	5.87
Chione cancellata	cross-barred venus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.1	1	0.6	0.64	1	0.0	1	0.2	0.64
Plicatula gibbosa	kitten's paw	–	–	–	–	–	2	0.1	2	0.7	4.02	–	–	–	–	–	–	–	–	–	–	2	0.1	2	0.3	4.02
Bulla striata	common Atlantic bubble	–	–	–	–	–	3	0.2	2	0.7	2.04	–	–	–	–	–	–	–	–	–	–	3	0.1	2	0.3	2.04
Cassidae	bonnet or cowrie helmet	–	–	–	–	–	1	0.1	1	0.4	1.11	–	–	–	–	–	–	–	–	–	–	1	0.0	1	0.2	1.11
cf. *Cassis* sp.	helmet	–	–	–	–	–	1	0.1	1	0.4	100.47	–	–	–	–	–	–	–	–	–	–	1	0.0	1	0.2	100.47
Columbella mercatoria	common dove snail	–	–	–	–	–	1	0.1	1	0.4	0.46	–	–	–	–	–	1	0.1	1	0.6	0.70	2	0.1	2	0.3	1.16
Olivellinae	dwarf olive	–	–	–	–	–	1	0.1	1	0.4	0.53	–	–	–	–	–	–	–	–	–	–	1	0.0	1	0.2	0.53
Lithopoma caelatum	carved star snail	–	–	–	–	–	–	–	–	–	–	1	0.1	1	0.3	2.39	–	–	–	–	–	1	0.0	1	0.2	2.39
Portunidae	swimming crab	–	–	–	–	–	–	–	–	–	–	2	0.3	1	1.0	1.45	1	0.1	1	0.6	0.07	3	0.1	2	0.3	1.52
Total Inshore/Shallow Water		22	11.5	3	9.4	0.29	575	34.2	63	22.3	177.1	380	53.3	20	19.8	23.32	695	57.5	22	13.8	38.82	1672	44.1	108	18.8	239.51
Littoral/Rocky Intertidal																										
Fissurellidae	keyhole limpet	–	–	–	–	–	2	0.1	1	0.4	0.57	–	–	–	–	–	–	–	–	–	–	2	0.1	1	0.2	0.57
Cenchritis muricata	beaded periwinkle	1	0.5	1	3.1	0.76	2	0.1	2	0.7	1.18	1	0.1	1	1.0	0.14	1	0.1	1	0.6	0.12	5	0.1	5	0.9	2.20
Mancinella deltoidea	deltoid rock snail	–	–	–	–	–	2	0.1	2	0.7	5.42	–	–	–	–	–	–	–	–	–	–	2	0.1	2	0.3	5.42
Plicopurpura patula	wide-mouthed purpura	–	–	–	–	–	1	0.1	1	0.4	37.42	1	0.1	1	1.0	0.29	–	–	–	–	–	2	0.1	2	0.3	37.71
Stramonita rustica	rustic rock snail	–	–	–	–	–	1	0.1	1	0.4	1.76	–	–	–	–	–	–	–	–	–	–	1	0.0	1	0.2	1.76
Stramonita haemastoma / *rustica*	Florida/rustic rock snail	–	–	–	–	–	1	0.1	1	0.4	1.14	–	–	–	–	–	–	–	–	–	–	1	0.0	1	0.2	1.14
Nerita peloronta / *versicolor*	bleeding tooth/four-toothed nerite	–	–	–	–	–	6	0.4	1	0.4	1.32	1	0.1	–	–	0.06	1	0.1	–	–	0.09	8	0.2	1	0.2	1.47
Nerita sp.	nerite	1	0.5	–	–	0.10	28	1.7	–	–	2.71	20	2.8	1	1.0	1.60	33	2.7	–	–	1.65	82	2.2	1	0.2	6.06
Nerita tessellata	tessellated nerite	5	2.6	5	15.6	1.77	97	5.8	56	19.9	46.22	34	4.8	24	23.8	21.87	105	8.7	72	45.0	72.48	241	6.4	157	27.3	142.34
Nerita versicolor	four-toothed nerite	1	0.5	1	3.1	1.43	18	1.1	11	3.9	11.60	4	0.6	3	3.0	2.28	8	0.7	5	3.1	4.70	31	0.8	20	3.5	20.01
Angiola lineata	dwarf Atlantic planaxis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.1	1	0.6	0.06	1	0.0	1	0.2	0.06
Supplanaxis nucleus	black Atlantic planaxis	–	–	–	–	–	1	0.1	1	0.4	0.28	6	0.8	6	5.9	1.72	5	0.4	5	3.1	0.97	12	0.3	12	2.1	2.97
Cittarium pica	West Indian top snail	36	18.8	2	6.3	28.86	63	3.8	8	2.8	265.24	35	4.9	3	3.0	57.39	34	2.8	1	0.6	45.43	168	4.4	14	2.4	396.92
Cittarium pica nacre		56	29.3	–	–	19.91	65	3.9	–	–	16.39	33	4.6	–	–	4.72	57	4.7	–	–	2.42	211	5.6	–	–	43.44
Tegula excavata	green-base tegula	–	–	–	–	–	3	0.2	1	0.4	0.42	3	0.4	2	2.0	2.10	6	0.5	3	1.9	2.44	12	0.3	6	1.0	4.96
Acanthopleura granulata	fuzzy chiton	4	2.1	2	6.3	3.09	80	4.8	11	3.9	67.58	11	1.5	2	2.0	10.96	34	2.8	5	3.1	31.41	129	3.4	20	3.5	113.04
Chiton marmoratus	marbled chiton	–	–	–	–	–	16	1.0	3	1.1	8.76	7	1.0	2	2.0	4.26	14	1.2	2	1.3	7.18	37	1.0	7	1.2	20.20
Chiton tuberculatus	West Indian chiton	–	–	–	–	–	44	2.6	6	2.1	17.11	26	3.6	4	4.0	8.66	64	5.3	6	3.8	19.83	134	3.5	16	2.8	45.60
Total Littoral/Rocky Intertidal Taxa		104	54.5	11	34.4	55.92	430	25.6	106	37.6	485.1	182	25.5	49	48.5	116.1	363	30.0	101	63.1	188.8	1079	28.4	267	46.4	845.87
Pelagic																										
Belonidae	needlefish	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	0.2	1	0.6	0.12	2	0.1	1	0.2	0.12
Trachurus lathami	rough scad	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	6	0.5	6	3.8	0.05	6	0.2	6	1.0	0.05
cf. *Trachurus lathami*		–	–	–	–	–	10	0.6	9	3.2	0.01	–	–	–	–	–	–	–	–	–	–	10	0.3	9	1.6	0.01

Table 5.20 continued

Sabazan Taxa By Habitat Continued

			Early					Middle					Late					Final					Site Total				
Habitat	Taxon	Common Name	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)
Pelagic continued																											
	Clupeidae	herring, shad	2	1.0	1	3.1	<0.01	37	2.2	3	1.1	0.05	26	3.6	2	2.0	0.07	19	1.6	1	0.6	0.02	84	2.2	7	1.2	0.14
	Exocoetidae	flyingfish	–	–	–	–	–	–	–	–	–	–	2	0.3	1	1.0	0.01	2	0.2	1	0.6	0.03	4	0.1	2	0.3	0.04
	cf. Exocoetidae		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.1	–	–	<0.01	1	0.0	–	–	<0.01
	Exocoetoidea	flyingfish, halfbeak	–	–	–	–	–	1	0.1	–	–	<0.01	1	0.1	–	–	0.01	–	–	–	–	–	2	0.1	–	–	0.01
	Hemiramphidae	halfbeak	1	0.5	1	3.1	<0.01	12	0.7	3	1.1	0.05	5	0.7	1	1.0	0.01	–	–	–	–	–	18	0.5	5	0.9	0.06
	cf. Hemiramphidae		–	–	–	–	–	1	0.1	–	–	<0.01	–	–	–	–	–	–	–	–	–	–	1	0.0	–	–	<0.01
	Scombridae	tuna, mackerel	–	–	–	–	–	3	0.2	–	–	0.62	–	–	–	–	–	1	0.1	–	–	0.03	4	0.1	–	–	0.65
	Auxis sp.	bullet/frigate tuna	–	–	–	–	–	33	2.0	1	0.4	8.69	2	0.3	1	1.0	0.35	11	0.9	1	0.6	1.53	46	1.2	3	0.5	10.57
	Katsuwonus pelamis	skipjack	–	–	–	–	–	6	0.4	2	0.7	4.36	–	–	–	–	–	2	0.2	1	0.6	0.79	8	0.2	3	0.5	5.15
	cf. *Katsuwonus pelamis*		–	–	–	–	–	5	0.3	–	–	3.13	–	–	–	–	–	–	–	–	–	–	5	0.1	–	–	3.13
	Thunnus sp.	tuna	–	–	–	–	–	10	0.6	2	0.7	2.52	1	0.1	1	1.0	0.30	1	0.1	1	0.6	0.54	12	0.3	4	0.7	3.36
	cf. *Thunnus* sp.		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.1	–	–	1.04	1	0.0	–	–	1.04
	Auxis sp./ *Katsuwonus pelamis*	bullet/frigate tuna/skipjack	–	–	–	–	–	2	0.1	–	–	0.57	–	–	–	–	–	–	–	–	–	–	2	0.1	–	–	0.57
	Katsuwonus pelamis / *Euthynnus alletteratus*	skipjack/little tunny	–	–	–	–	–	10	0.6	1	0.4	3.81	2	0.3	1	1.0	0.49	–	–	–	–	–	12	0.3	2	0.3	4.30
	Thunnus sp./ *Katsuwonus pelamis*	tuna/skipjack	–	–	–	–	–	4	0.2	–	–	1.43	1	0.1	–	–	0.27	6	0.5	–	–	3.08	11	0.3	–	–	4.78
	Thunnini	tuna	–	–	–	–	–	51	3.0	2	0.7	14.86	10	1.4	–	–	4.15	9	0.7	–	–	0.93	70	1.8	2	0.3	19.94
	cf. Thunnini		–	–	–	–	–	1	0.1	–	–	0.03	–	–	–	–	–	–	–	–	–	–	1	0.0	–	–	0.03
Total Pelagic Taxa			3	1.6	2	6.3	0.00	186	11.1	23	8.2	40.13	50	7.0	7	6.9	5.66	61	5.0	12	7.5	8.16	300	7.9	44	7.7	53.95
Terrestrial																											
	Columbidae	pigeons and doves	–	–	–	–	–	2	0.1	2	0.7	0.56	–	–	–	–	–	1	0.1	1	0.6	0.14	3	0.1	3	0.5	0.70
	cf. Columbidae		–	–	–	–	–	1	0.1	–	–	0.13	–	–	–	–	–	–	–	–	–	–	1	0.0	–	–	0.13
	Didelphis sp.	opossum	1	0.5	1	3.1	–	10	0.6	2	0.7	6.71	2	0.3	1	1.0	1.20	2	0.2	1	0.6	0.71	15	0.4	5	0.9	8.62
	Dasypus sp.	armadillo	–	–	–	–	–	2	0.1	1	0.4	0.32	–	–	–	–	–	–	–	–	–	–	2	0.1	1	0.2	0.32
	Dasyprocta sp.	agouti	1	0.5	1	3.1	0.10	23	1.4	3	1.1	6.42	1	0.1	1	1.0	0.20	3	0.2	1	0.6	0.51	28	0.7	6	1.0	7.23
	cf. *Dasyprocta* sp.		–	–	–	–	–	2	0.1	–	–	0.30	–	–	–	–	–	–	–	–	–	–	2	0.1	–	–	0.30
	Oryzomyini	rice rat	13	6.8	2	6.3	0.32	31	1.8	5	1.8	1.00	2	0.3	1	1.0	0.07	1	0.1	1	0.6	<0.01	47	1.2	9	1.6	1.39
	cf. Oryzomyini		1	0.5	–	–	<0.01	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.0	–	–	<0.01
	Medium mammal		–	–	–	–	–	18	1.1	1	0.4	3.19	2	0.3	–	–	0.05	4	0.3	–	–	0.38	24	0.6	1	0.2	3.62
	Small mammal		–	–	–	–	–	4	0.2	–	–	0.21	2	0.3	–	–	0.01	–	–	–	–	–	6	0.2	–	–	0.22
	Iguanidae	iguana	–	–	–	–	–	2	0.1	1	0.4	1.11	1	0.1	1	1.0	0.38	2	0.2	–	–	0.82	5	0.1	2	0.3	2.31
	cf. Iguanidae		–	–	–	–	–	1	0.1	–	–	0.06	–	–	–	–	–	1	0.1	–	–	0.45	2	0.1	–	–	0.51
	Iguana sp.	iguana	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.1	1	0.6	0.06	1	0.0	1	0.2	0.06
	Lacertilia	lizard	1	0.5	1	3.1	0.01	–	–	–	–	–	1	0.1	1	1.0	<0.01	–	–	–	–	–	2	0.1	2	0.3	0.01
	Serpentes	snake	3	1.6	1	3.1	0.04	1	0.1	1	0.4	0.16	–	–	–	–	–	–	–	–	–	–	4	0.1	2	0.3	0.20
	Squamata	snakes and lizards	–	–	–	–	–	2	0.1	1	0.4	0.29	–	–	–	–	–	–	–	–	–	–	2	0.1	1	0.2	0.29
	Orthalicus undatus	wavy orthalicus	13	6.8	1	3.1	0.39	18	1.1	4	1.4	2.02	12	1.7	2	2.0	0.15	6	0.5	1	0.6	0.02	49	1.3	8	1.4	2.58
	cf. *Orthalicus undatus*		–	–	–	–	–	2	0.1	2	0.7	0.86	–	–	–	–	–	–	–	–	–	–	2	0.1	2	0.3	0.86
	Pleurodonte aff. *perplexa*	terrestrial snail	2	1.0	2	6.3	0.27	2	0.1	2	0.7	0.83	–	–	–	–	–	–	–	–	–	–	4	0.1	4	0.7	1.10
	Pleurodonte sp.	terrestrial snail	2	1.0	–	–	0.20	1	0.1	1	0.4	0.11	5	0.7	2	2.0	0.06	1	0.1	1	0.6	0.02	9	0.2	4	0.7	0.39
	cf. *Pleurodonte* sp.		1	0.5	–	–	<0.01	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.0	–	–	<0.01
	Megalobulimus sp.	giant terrestrial snail	–	–	–	–	–	5	0.3	1	0.4	2.22	1	0.1	1	1.0	0.39	2	0.2	1	0.6	3.25	8	0.2	3	0.5	5.86
	Indeterminate terrestrial gastropod		6	3.1	–	–	0.25	–	–	–	–	–	3	0.4	–	–	0.98	1	0.1	–	–	0.14	10	0.3	–	–	1.37
	Gecarcinidae	land crab	–	–	–	–	–	2	0.1	–	–	0.05	1	0.1	–	–	0.41	–	–	–	–	–	3	0.1	–	–	0.46
	Cardisoma guanhumi	blue land crab	1	0.5	1	3.1	0.42	29	1.7	6	2.1	12.49	–	–	–	–	–	8	0.7	2	1.3	3.78	38	1.0	9	1.6	16.69
	Gecarcinus sp.	land crab	–	–	–	–	–	12	0.7	6	2.1	4.10	1	0.1	1	1.0	0.08	–	–	–	–	–	13	0.3	7	1.2	4.18
Total Terrestrial Taxa			45	23.6	10	31.3	2	170	10.1	39	13.8	43.14	34	4.8	11	10.9	3.98	33	2.7	10	6.3	10.28	282	7.4	70	12.2	59.4
Habitat Totals			191	100.0	32	100.0	60.33	1680	100.0	282	100.0	845.6	713	100.0	101	100.0	160.8	1209	100.0	160	100.0	256.6	3793	100.0	575	100.0	1323.2

Table 5.21 Chi square tests for habitat types represented in the Sabazan assemblage based on data in Table 5.20. Fisher's exact test used to calculate *p*-values for chi square statistics where appropriate. See text for explanation of table format. Between the Final and Middle period columns the sign of the adjusted residual should be read chronologically from right to left.

Chi Square Tests for Sabazan Habitats

Habitat Type	Early Period MNI	Adjusted Residual	*p*	Middle Period MNI	Adjusted Residual	*p*	Late Period MNI	Adjusted Residual	*p*	Final Period MNI	Adjusted Residual	*p*	Middle Period MNI	Assemblage Total
Coral Reef Taxa	6	-0.092	>0.05	51	0.611	>0.05	14	-1.123	>0.05	15	**-2.469**	**0.014**	51	86
Inshore/Shallow Water Taxa	3	1.706	>0.05	63	0.577	>0.05	20	-1.296	>0.05	22	**-2.202**	**0.028**	63	108
Rocky Intertidal Taxa	11	0.356	>0.05	106	0.438	>0.05	49	2.325	>0.05	101	**5.171**	**<0.001**	106	267
Pelagic Taxa	2	0.377	>0.05	23	0.679	>0.05	7	0.172	>0.05	12	-0.245	>0.05	23	44
Terrestrial Taxa	10	-2.573	0.010	39	0.640	>0.05	11	-1.343	>0.05	10	**-2.439**	**0.015**	39	70
Total	32			282			101			160			282	575
	$\chi^2 = 8.10$		$p = 0.108$	$\chi^2 = 3.83$		$p = 0.429$	$\chi^2 = 6.52$		$p = 0.164$	$\chi^2 = 28.66$		$p < 0.001$		

Table 5.22 The Grand Bay zooarchaeological assemblage; % NISP and % MNI based on class totals. Analyzed vertebrate samples come from the Later Period (ca. AD 1000 – 1250) only. Vertebrate data not available for Early, Middle-L005, or Middle-L003 deposits. *Added to MNI because specimen represents a complete but unidentifiable individual or only individual from a specific context.

Grand Bay Zooarchaeological Assemblage

			Early Period					Middle-L005 Period					Middle-L003 Period					Late Period					Site Total				
Class	Taxon	Common Name	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)
Vertebrata			Vertebrate Data Not Available					Vertebrate Data Not Available					Vertebrate Data Not Available														
Chondrichthyes																											
	Elasmobranchii	shark																2	0.2	2	1.9	0.17	2	0.2	2	1.9	0.17
Actinopterygii																											
	Acanthuridae	surgeonfish																208	17.6	–	–	13.44	208	17.6	–	–	13.44
	Acanthurus sp.	surgeonfish																28	2.4	11	10.6	1.32	28	2.4	11	10.6	1.32
	Total Acanthuridae																	236	20.0	11	10.6	14.76	236	20.0	11	10.6	14.76
	Balistidae	triggerfish																133	11.3	–	–	0.65	133	11.3	–	–	0.65
	Balistes sp.	triggerfish																3	0.3	2	1.9	1.54	3	0.3	2	1.9	1.54
	Total Balistidae																	136	11.5	2	1.9	2.19	136	11.5	2	1.9	2.19
	Belonidae	needlefish																2	0.2	1	1.0	0.03	2	0.2	1	1.0	0.03
	Carangidae	jack, pompano, scad																43	3.6	–	–	0.99	43	3.6	–	–	0.99
	Caranx sp.	jack																1	0.1	1	1.0	0.63	1	0.1	1	1.0	0.63
	Selar crumenophthalmus	bigeye scad																34	2.9	26	25.0	0.45	34	2.9	26	25.0	0.45
	Trachinotus sp.	pompano																1	0.1	1	1.0	0.06	1	0.1	1	1.0	0.06
	Total Carangidae																	79	6.7	28	26.9	2.13	79	6.7	28	26.9	2.13
	Clupeidae	herring, shad																331	28.0	8	7.7	0.92	331	28.0	8	7.7	0.92
	Exocoetidae	flyingfish																28	2.4	1	1.0	0.20	28	2.4	1	1.0	0.20
	Haemulidae	grunt																24	2.0	1	1.0	3.49	24	2.0	1	1.0	3.49
	Haemulon aurolineatum	tomtate																1	0.1	1	1.0	0.01	1	0.1	1	1.0	0.01
	Haemulon chrysargyreum	smallmouth grunt																3	0.3	3	2.9	0.06	3	0.3	3	2.9	0.06
	Haemulon sciurus	bluestriped grunt																3	0.3	3	2.9	0.03	3	0.3	3	2.9	0.03
	Haemulon sp.	grunt																19	1.6	6	5.8	0.37	19	1.6	6	5.8	0.37
	Total Haemulidae																	50	4.2	14	13.5	3.96	50	4.2	14	13.5	3.96
	Holocentrus rufus	longpsine squirrelfish																1	0.1	1	1.0	0.01	1	0.1	1	1.0	0.01
	Holocentrus sp.	squirrelfish																4	0.3	–	–	0.13	4	0.3	–	–	0.13
	Total Holocentridae																	5	0.4	1	1.0	0.14	5	0.4	1	1.0	0.14
	Halichoeres sp.	wrasse																2	0.2	2	1.9	0.05	2	0.2	2	1.9	0.05
	Total Labridae																	2	0.2	2	1.9	0.05	2	0.2	2	1.9	0.05
	Lutjanidae	snapper																2	0.2	–	–	0.09	2	0.2	–	–	0.09
	Lutjanus apodus	schoolmaster																1	0.1	1	1.0	0.02	1	0.1	1	1.0	0.02
	Lutjanus sp.	snapper																8	0.7	4	3.8	0.14	8	0.7	4	3.8	0.14
	cf. *Ocyurus chrysurus*	yellowtail snapper																1	0.1	1	1.0	0.01	1	0.1	1	1.0	0.01
	Total Lutjanidae																	12	1.0	6	5.8	0.26	12	1.0	6	5.8	0.26

Table 5.22 continued

Grand Bay Zooarchaeological Assemblage Continued

			Early Period					Middle-L005 Period					Middle-L003 Period					Late Period					Site Total				
Class	Taxon	Common Name	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)
Actinopterygii continued																											
			Vertebrate Data Not Available					Vertebrate Data Not Available					Vertebrate Data Not Available														
	Muraenidae	eel																1	0.1	1	1.0	0.01	1	0.1	1	1.0	0.01
	Lactophyrs sp.	trunkfish																4	0.3	1	1.0	0.06	4	0.3	1	1.0	0.06
	Total Ostraciidae																	4	0.3	1	1.0	0.06	4	0.3	1	1.0	0.06
	Scaridae	parrotfish																160	13.5	–	–	8.07	160	13.5	–	–	8.07
	Scarus sp.																	37	3.1	9	8.7	5.19	37	3.1	9	8.7	5.19
	Sparisoma sp.																	43	3.6	9	8.7	10.34	43	3.6	9	8.7	10.34
	Total Scaridae																	240	20.3	18	17.3	23.60	240	20.3	18	17.3	23.60
	Sciaenidae	drum, weakfish, croaker																1	0.1	1	1.0	0.09	1	0.1	1	1.0	0.09
	Scombridae	tuna, mackerel																38	3.2	1	1.0	19.16	38	3.2	1	1.0	19.16
	Scomberomorus sp.	mackerel																1	0.1	1	1.0	0.88	1	0.1	1	1.0	0.88
	Total Scombridae																	39	3.3	2	1.9	20.04	39	3.3	2	1.9	20.04
	Serranidae	grouper, sea bass																6	0.5	1	1.0	2.00	6	0.5	1	1.0	2.00
	Epinephelus sp.	grouper																3	0.3	2	1.9	0.69	3	0.3	2	1.9	0.69
	Mycteroperca sp.	grouper																1	0.1	1	1.0	2.64	1	0.1	1	1.0	2.64
	Total Serranidae																	10	0.8	4	3.8	5.33	10	0.8	4	3.8	5.33
	Sparidae	porgy																2	0.2	–	–	0.16	2	0.2	–	–	0.16
	Calamus sp.	porgy																1	0.1	1	1.0	0.02	1	0.1	1	1.0	0.02
	Total Sparidae																	3	0.3	1	1.0	0.18	3	0.3	1	1.0	0.18
Total Identified Actinopterygii and Chondrichthyes																		1181	100.0	104	100.0	74.12	1181	100.0	104	100.0	74.12
Indeterminate Actinopterygii																		3354	–	–	–	239.88	3354	–	–	–	239.88
Aves																											
	Columbidae	pigeons and doves																1	100.0	1	100.0	0.15	1	100.0	1	100.0	0.15
Total Identified Aves																		1	100.0	1	100.0	0.15	1	100.0	1	100.0	0.15
Indeterminate Aves																		12	–	1	–	2.06	12	–	1	–	2.06
Mammalia																											
	Capromyidae	capromyid rodent																1	0.9	1	8.3	1.53	1	0.9	1	8.3	1.53
	Didelphis sp.	opossum																11	10.1	2	16.7	3.44	11	10.1	2	16.7	3.44
	Dasyproctidae	agouti																4	3.7	–	–	1.58	4	3.7	–	–	1.58
	Dasyprocta sp.	agouti																10	9.2	3	25.0	4.78	10	9.2	3	25.0	4.78
	cf. *Dasyprocta* sp.																	1	0.9	–	–	0.41	1	0.9	–	–	0.41
	Oryzomys sp.	rice rat																21	19.3	6	50.0	0.89	21	19.3	6	50.0	0.89
	Rodentia																	15	13.8	–	–	0.71	15	13.8	–	–	0.71
	Large mammal																	1	0.9	–	–	8.58	1	0.9	–	–	8.58
	Medium mammal																	3	2.8	–	–	5.23	3	2.8	–	–	5.23
	Small mammal																	42	38.5	–	–	6.30	42	38.5	–	–	6.30
Total Identified Mammalia																		109	100.0	12	100.0	33.45	109	100.0	12	100.0	33.45
Indeterminate Mammalia																		4	–	–	–	4.13	4	–	–	–	4.13

Table 5.22 continued

Grand Bay Zooarchaeological Assemblage Continued

Class	Taxon	Common Name	Early Period					Middle-L005 Period					Middle-L003 Period					Late Period					Site Total				
			NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)
			Vertebrate Data Not Available					Vertebrate Data Not Available					Vertebrate Data Not Available														
Reptilia																											
	Cheloniidae	sea turtle																89	73.0	3	42.9	186.33	89	73.0	3	42.9	186.33
	Iguanidae	iguana																2	1.6	1	14.3	13.37	2	1.6	1	14.3	13.37
	Lacertilia	lizard																26	21.3	2	28.6	2.44	26	21.3	2	28.6	2.44
	Serpentes	snake																5	4.1	1	14.3	0.08	5	4.1	1	14.3	0.08
Total Identified Reptilia																		122	100.0	7	100.0	202.22	122	100.0	7	100.0	202.22
Amphibia																											
	Anura	frogs and toads																2	100.0	1	100.0	0.01	2	100.0	1	100.0	0.01
Total Identified Amphibia																		2	100.0	1	100.0	0.01	2	100.0	1	100.0	0.01
Total Identified Vertebrata (below 'indeterminate' class-level)																		1415	–	125	–	309.95	1415	–	125	–	309.95
Total Vertebrata (includes 'indeterminate' at class-level)																		4785	–	126	–	240.47	4785	–	126	–	556.02
Indeterminate Vertebrata (above class level; not quantified)																		>1	–	–	–	342.67	>1	–	–	–	342.67
Invertebrata																											
Echinoidea		sea urchin	24	100.0	2	100.0	0.53	42	100.0	2	100.0	1.68	157	100.0	3	100.0	7.59	329	100.0	5	100.0	22.09	552	100.0	12	100.0	31.89
Bivalvia																											
	Laevicardium cf. *serratum*	common egg cockle	1	1.4	1	6.3	0.83	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.5	1	1.8	0.83
	Donax denticulatus	Caribbean coquina	–	–	–	–	–	2	3.9	2	16.7	0.96	–	–	–	–	–	3	5.4	3	13.6	1.05	5	2.7	5	9.1	2.01
	Isognomon alatus	flat tree oyster	2	2.9	1	6.3	1.45	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	1.1	1	1.8	1.45
	Lucinidae	lucine	1	1.4	–	–	0.05	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.5	–	–	0.05
	Codakia orbicularis	tiger lucine	3	4.3	2	12.5	2.40	7	13.7	1	8.3	13.17	3	37.5	1	20.0	2.36	5	8.9	3	13.6	21.77	18	9.7	7	12.7	39.70
	cf. *Codakia orbicularis*		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	3.6	–	–	1.59	2	1.1	–	–	1.59
	Mytilidae	mussel	3	4.3	1	6.3	0.01	3	5.9	1	8.3	0.04	1	12.5	1	20.0	<0.01	–	–	–	–	–	7	3.8	3	5.5	0.05
	Brachidontes sp.	mussel	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	27	48.2	6	27.3	6.10	27	14.6	6	10.9	6.10
	Brachidontes/ Ischadium sp.	mussel	2	2.9	1	6.3	0.15	2	3.9	1	8.3	0.21	–	–	–	–	–	–	–	–	–	–	4	2.2	2	3.6	0.36
	Pectinidae	scallop	–	–	–	–	–	–	–	–	–	–	1	12.5	1	20.0	3.83	–	–	–	–	–	1	0.5	1	1.8	3.83
	Plicatula gibbosa	kitten's paw	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	3.6	1	4.5	4.43	2	1.1	1	1.8	4.43
	Asaphis deflorata	gaudy asaphis	27	38.6	8	50.0	17.58	23	45.1	7	58.3	34.42	1	12.5	1	20.0	2.60	5	8.9	2	9.1	9.30	56	30.3	18	32.7	63.90
	cf. *Asaphis deflorata*		29	41.4	–	–	8.11	14	27.5	–	–	5.04	1	12.5	–	–	0.97	6	10.7	2	9.1	1.37	50	27.0	2	3.6	15.49
	Tellinidae	tellin	1	1.4	1	6.3	0.52	–	–	–	–	–	1	12.5	1	20.0	0.44	–	–	–	–	–	2	1.1	2	3.6	0.96
	Arcopagia fausta	sunset tellin	1	1.4	1	6.3	0.62	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.5	1	1.8	0.62
	Tellinella listeri	speckled tellin	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1.8	1	4.5	0.18	1	0.5	1	1.8	0.18
	Tellina sp.	tellin	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1.8	1	4.5	10.55	1	0.5	1	1.8	10.55

Table 5.22 continued

Grand Bay Zooarchaeological Assemblage Continued

			Early Period					Middle-L005 Period					Middle-L003 Period					Late Period					Site Total				
Class	Taxon	Common Name	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)
Bivalvia continued																											
	Chione cancellata	cross-barred venus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	5.4	2	9.1	1.97	3	1.6	2	3.6	1.97
	cf. *Timoclea pygmaea*	pygmy venus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1.8	1	4.5	0.06	1	0.5	1	1.8	0.06
Total Identified Bivalvia			70	100.0	16	100.0	31.72	51	100.0	12	100.0	53.84	8	100.0	5	100.0	10.20	56	100.0	22	100.0	58.37	185	100.0	55	100.0	154.13
Indeterminate Bivalvia			57	–	–	–	32.33	18	–	–	–	7.49	7	–	–	–	3.55	19	–	–	–	8.99	101	–	–	–	52.36
Gastropoda: Terrestrial																											
	Orthalicidae	tree snail	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	0.2	–	–	0.25	2	0.1	–	–	0.25
	Orthalicus undatus	wavy orthalicus	9	4.5	2	2.9	0.83	22	10.0	6	7.4	2.63	7	2.7	1	0.8	0.70	94	11.2	17	4.2	31.69	132	8.7	26	3.8	35.85
	Pleurodontidae	terrestrial snail	–	–	–	–	–	–	–	–	–	–	1	0.4	–	–	0.18	–	–	–	–	–	1	0.1	–	–	0.18
	Pleurodonte aff. *perplexa*	terrestrial snail	–	–	–	–	–	1	0.5	1	1.2	1.38	–	–	–	–	–	15	1.8	13	3.2	6.84	16	1.1	14	2.0	8.22
	Pleurodonte sp.	terrestrial snail	1	0.5	1	1.5	0.09	–	–	–	–	–	1	0.4	1	0.8	<0.01	25	3.0	1	0.2	2.83	27	1.8	3	0.4	2.92
	Megalobulimus sp.	giant terrestrial snail	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	0.4	1	0.2	2.00	3	0.2	1	0.1	2.00
	cf. *Megalobulimus* sp.		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.1	–	–	0.24	1	0.1	–	–	0.24
	Indeterminate terrestrial Gastropoda		2	1.0	–	–	0.02	1	0.5	–	–	0.02	–	–	–	–	–	12	1.4	1	0.2	4.26	15	1.0	1	0.1	4.30
Gastropoda: Marine																											
	Batillaria minima	false cerith	1	0.5	1	1.5	<0.01	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.1	1	0.1	<0.01
	Engoniophos unicinctus	Guadeloupe phos	–	–	–	–	–	–	–	–	–	–	1	0.4	1	0.8	0.60	–	–	–	–	–	1	0.1	1	0.1	0.60
	Bulla striata	common Atlantic bubble	4	2.0	4	5.9	5.70	1	0.5	1	1.2	0.26	2	0.8	2	1.5	2.54	3	0.4	3	0.7	3.59	10	0.7	10	1.5	12.09
	cf. *Bulla striata*		–	–	–	–	–	1	0.5	1	1.2	0.23	–	–	–	–	–	1	0.1	–	0.0	0.67	2	0.1	1	0.1	0.90
	Crepidula maculosa	spotted slipper snail	17	8.5	14	20.6	2.51	10	4.6	10	12.3	2.54	7	2.7	7	5.3	2.50	42	5.0	41	10.1	14.87	76	5.0	72	10.5	22.42
	Crepidula sp.	slipper snail	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	0.2	2	0.5	0.30	2	0.1	2	0.3	0.30
	Cassis sp.	helmet	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.1	1	0.2	2.20	1	0.1	1	0.1	2.20
	Cerithium lutosum	dwarf cerith	2	1.0	2	2.9	0.22	3	1.4	3	3.7	0.36	–	–	–	–	–	–	–	–	–	–	5	0.3	5	0.7	0.58
	Cerithium lutosum / *Batillaria minima*	dwarf cerith/false cerith	14	7.0	13	19.1	0.04	3	1.4	3	3.7	0.01	–	–	–	–	–	1	0.1	1	0.2	<.01	18	1.2	17	2.5	0.05
	Columbella mercatoria	common dove snail	1	0.5	1	1.5	0.42	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.1	1	0.1	0.42
	Cypraeidae	cowry	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.1	1	0.2	4.60	1	0.1	1	0.1	4.60
	Leucozonia nassa	chestnut latirus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.1	1	0.2	3.26	1	0.1	1	0.1	3.26
	Leucozonia sp.	latirus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.1	1	0.2	1.08	1	0.1	1	0.1	1.08
	Fissurellidae	keyhole limpet	–	–	–	–	–	1	0.5	1	1.2	0.26	–	–	–	–	–	–	–	–	–	–	1	0.1	1	0.1	0.26
	Fissurella barbadensis	Barbados keyhole limpet	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	0.2	2	0.5	4.14	2	0.1	2	0.3	4.14
	Fissurella nodosa	knobby keyhole limpet	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.1	1	0.2	4.27	1	0.1	1	0.1	4.27
	Fissurella sp.	keyhole limpet	2	1.0	2	2.9	3.26	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	0.1	2	0.3	3.26
	Fissurella / *Diadora* sp.	keyhole limpet	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	0.2	2	0.5	0.79	2	0.1	2	0.3	0.79
	Littorinidae	periwinkle	1	0.5	1	1.5	0.51	–	–	–	–	–	–	–	–	–	–	2	0.2	1	0.2	0.36	3	0.2	2	0.3	0.87
	Cenchritis muricata	beaded periwinkle	3	1.5	3	4.4	2.08	2	0.9	2	2.5	1.66	1	0.4	1	0.8	0.50	14	1.7	14	3.5	16.08	20	1.3	20	2.9	20.32
	Echinolittorina tuberculata	prickly periwinkle	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.1	1	0.2	0.11	1	0.1	1	0.1	0.11
	Echinolittorina ziczac	zebra periwinkle	–	–	–	–	–	1	0.5	1	1.2	0.43	–	–	–	–	–	2	0.2	2	0.5	1.06	3	0.2	3	0.4	1.49

Table 5.22 continued

Grand Bay Zooarchaeological Assemblage Continued

			Early Period					Middle-L005 Period					Middle-L003 Period					Late Period					Site Total				
Class	Taxon	Common Name	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)
Gastropoda continued																											
	Echinolittorina sp.	periwinkle	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.1	1	0.2	0.17	1	0.1	1	0.1	0.17
	Littoraria sp.	periwinkle	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.1	1	0.2	0.39	1	0.1	1	0.1	0.39
	Tectura antillarum	southern limpet	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.1	1	0.2	0.10	1	0.1	1	0.1	0.10
	Marginellidae	marginella	–	–	–	–	–	1	0.5	1	1.2	0.02	–	–	–	–	–	1	0.1	1	0.2	<.01	2	0.1	2	0.3	0.02
	Modulus modulus	Atlantic modulus	1	0.5	1	1.5	0.45	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.1	1	0.1	0.45
	Muricidae	murex, rock snail, drill	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.1	1	0.2	0.21	1	0.1	1	0.1	0.21
	Plicopurpura patula	wide-mouthed purpura	–	–	–	–	–	1	0.5	1	1.2	1.72	–	–	–	–	–	2	0.2	2	0.5	1.15	3	0.2	3	0.4	2.87
	Stramonita haemastoma / rustica	Florida/rustic rock snail	–	–	–	–	–	–	–	–	–	–	1	0.4	1	0.8	3.36	6	0.7	6	1.5	13.05	7	0.5	7	1.0	16.41
	Nassarius polygonatus	black-spot nassa	1	0.5	1	1.5	0.28	–	–	–	–	–	1	0.4	1	0.8	0.30	1	0.1	1	0.2	0.53	3	0.2	3	0.4	1.11
	Naticarius cf. *canrena*	colorful Atlantic natica	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.1	1	0.2	3.00	1	0.1	1	0.1	3.00
	Netritidae	nerite	–	–	–	–	–	–	–	–	–	–	2	0.8	2	1.5	0.02	–	–	–	–	–	2	0.1	2	0.3	0.02
	Nerita peloronta	bleeding tooth nerite	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4	0.5	4	1.0	9.37	4	0.3	4	0.6	9.37
	Nerita tessellata	tessellated nerite	5	2.5	4	5.9	1.01	36	16.4	29	35.8	26.62	114	44.2	93	71.0	70.18	203	24.1	149	36.8	134.82	358	23.6	275	40.1	232.63
	Nerita cf. *tessellata*		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	0.4		0.0	1.00	3	0.2	–	–	1.00
	Nerita versicolor	four-toothed nerite	2	1.0	1	1.5	0.72	11	5.0	9	11.1	12.10	11	4.3	9	6.9	8.36	55	6.5	43	10.6	64.88	79	5.2	62	9.1	86.06
	Nerita cf. *versicolor*		–	–	–	–	–	1	0.5	–	–	0.14	–	–	–	–	–	2	0.2	2	0.5	2.70	3	0.2	2	0.3	2.84
	Nerita peloronta / versicolor	bleeding tooth/ four-toothed nerite	1	0.5	–	–	0.42	–	–	–	–	–	–	–	–	–	–	5	0.6	–	–	1.19	6	0.4	–	–	1.61
	Nerita tessellata/ fulgurans	tessellated or Antillean nerite	1	0.5	1	1.5	0.57	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.1	1	0.1	0.57
	Nerita sp.	nerite	2	1.0	–	–	0.37	10	4.6	–	–	0.97	17	6.6	–	–	2.69	15	1.8	–	–	2.51	44	2.9	–	–	6.54
	cf. *Nerita* sp.		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.1	–	–	0.20	1	0.1	–	–	0.20
	Smaragdia viridis	emerald nerite	1	0.5	1	1.5	<.01	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.1	1	0.1	<.01
	Oliva sp.	olive	1	0.5	1	1.5	2.00	–	–	–	–	–	1	0.4	1	0.8	0.26	2	0.2	2	0.5	5.35	4	0.3	4	0.6	7.61
	cf. *Oliva* sp.		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.1	1	0.2	1.00	1	0.1	1	0.1	1.00
	Olivella sp.	dwarf olive	1	0.5	1	1.5	<0.01	1	0.5	1	1.2	0.04	–	–	–	–	–	–	–	–	–	–	2	0.1	2	0.3	0.04
	Eulithidium bellum	pheasant snail	1	0.5	1	1.5	<.01	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.1	1	0.1	<0.01
	Eulithidium sp.	pheasant snail	2	1.0	2	2.9	<.01	–	–	–	–	–	1	0.4	1	0.8	<0.01	–	–	–	–	–	3	0.2	3	0.4	<0.01
	Supplanaxis nucleus	black Atlantic planaxis	–	–	–	–	–	–	–	–	–	–	3	1.2	3	2.3	1.00	2	0.2	2	0.5	1.08	5	0.3	5	0.7	2.08
	Cymatium nicobaricum	gold-mouth triton	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.1	1	0.2	1.30	1	0.1	1	0.1	1.30
	Cymatium sp.	triton	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.1	1	0.2	0.41	1	0.1	1	0.1	0.41
	Cittarium pica	West Indian top snail	65	32.5	8	11.8	629.72	69	31.5	8	9.9	752.98	26	10.1	4	3.1	46.33	239	28.4	56	13.8	2907.16	399	26.3	76	11.1	4336.19
	Cittarium pica nacre		57	28.5	–	–	1.10	35	16.0	–	–	0.77	58	22.5	–	–	8.94	26	3.1	–	–	4.05	176	11.6	–	–	14.86
	Lithopoma caelatum	carved star snail	1	0.5	1	1.5	1.04	–	–	–	–	–	1	0.4	1	0.8	0.50	3	0.4	3	0.7	30.98	5	0.3	5	0.7	32.52
	Lithopoma tectum	roof-tile star snail	–	–	–	–	–	1	0.5	1	1.2	34.73	–	–	–	–	–	–	–	–	–	–	1	0.1	1	0.1	34.73
	Lithopoma tuber	green star snail	–	–	–	–	–	–	–	–	–	–	1	0.4	1	0.8	3.61	9	1.1	3	0.7	13.64	10	0.7	4	0.6	17.25
	Lithopoma sp.	star snail	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.1	–	–	0.86	1	0.1	–	–	0.86
	Tegula excavata	green-base tegula	–	–	–	–	–	7	3.2	2	2.5	1.73	1	0.4	1	0.8	0.08	21	2.5	12	3.0	16.67	29	1.9	15	2.2	18.48
	Tegula sp.		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.1	1	0.2	0.16	1	0.1	1	0.1	0.16
	Turbo castanea	knobby (or chestnut) turban	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.1	1	0.2	1.40	1	0.1	1	0.1	1.40
	Turridae	turrid	1	0.5	1	1.5	<0.01	–	–	–	–	–	–	–	–	–	–	2	0.2	2	0.5	0.06	3	0.2	3	0.4	0.06
Total Identified Gastropoda			200	100.0	68	100.0	653.36	219	100.0	81	100.0	841.60	258	100.0	131	100.0	152.65	842	100.0	405	100.0	3324.88	1519	100.0	685	100.0	4972.49
Indeterminate Gastropoda			82	–	–	–	6.51	31	–	–	–	0.99	41	–	–	–	9.39	176	–	1*	–	74.98	330	–	1*	–	91.87

Table 5.22 continued

Grand Bay Zooarchaeological Assemblage Continued

			Early Period					Middle-L005 Period					Middle-L003 Period					Late Period					Site Total				
Class	Taxon	Common Name	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)
Polyplacophora																											
	Acanthopleura granulata	fuzzy chiton	49	48.0	8	50.0	56.14	51	37.8	9	37.5	57.36	15	8.7	2	10.5	24.36	111	12.2	15	12.4	141.69	226	17.1	34	18.9	279.55
	cf. *Acanthopleura granulata*		1	1.0	–	–	0.30	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.1	–	–	0.30
	Chiton marmoratus	marbled chiton	–	–	–	–	–	5	3.7	1	4.2	5.37	25	14.5	3	15.8	15.56	64	7.0	15	12.4	50.36	94	7.1	19	10.6	71.29
	Chiton tuberculatus	West Indian chiton	52	51.0	8	50.0	24.63	79	58.5	14	58.3	48.46	127	73.4	12	63.2	60.16	730	80.4	90	74.4	425.47	988	75.0	124	68.9	558.72
	Chiton cf. *tuberculatus*		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	0.3	1	0.8	0.65	3	0.2	1	0.6	0.65
	Chiton squamosus	squamose chiton	–	–	–	–	–	–	–	–	–	–	1	0.6	1	5.3	0.31	–	–	–	–	–	1	0.1	1	0.6	0.31
	Chiton viridis	green chiton	–	–	–	–	–	–	–	–	–	–	5	2.9	1	5.3	1.11	–	–	–	–	–	5	0.4	1	0.6	1.11
Total Identified Polyplacophora			102	100.0	16	100.0	81.07	135	100.0	24	100.0	111.19	173	100.0	19	100.0	101.50	908	100.0	121	100.0	618.17	1318	100.0	180	100.0	911.93
Indeterminate Polyplacophora			2	–	–	–	0.23	–	–	–	–	–	4	–	–	–	0.64	5	–	–	–	2.63	11	–	–	–	3.50
Total Identified Mollusca (below 'indeterminate' class-level)			372	–	100	–	766.15	405	–	117	–	1006.63	439	–	155	–	264.35	1806	–	548	–	4001.42	3022	–	920	–	6038.55
Total Mollusca (includes 'indeterminate' at class-level)			513	–	100	–	805.22	454	–	117	–	1015.11	491	–	155	–	277.93	2006	–	549	–	4088.02	3464	–	921	–	6186.28
Indeterminate Mollusca			678	–	–	–	50.81	351	–	–	–	31.43	237	–	–	–	9.22	542	–	–	–	79.49	1808	–	–	–	170.95
Malacostraca: Order Decapoda																											
	Gecarcinidae	land crab	–	–	–	–	–	2	2.9	–	–	0.76	–	–	–	–	–	18	4.9	1	12.5	8.56	20	2.4	1	5.6	9.32
	Cardisoma guanhumi	blue land crab	6	2.7	2	33.3	4.01	4	5.7	2	66.7	5.25	–	–	–	–	–	15	4.1	3	37.5	12.36	25	3.1	7	38.9	21.62
	Gecarcinus sp.	land crab	2	0.9	1	16.7	0.37	–	–	–	–	–	–	–	–	–	–	6	1.6	1	12.5	1.52	8	1.0	2	11.1	1.89
	Grapsidae	shore crab	1	0.4	1	16.7	0.55	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.1	1	5.6	0.55
	Portunidae	swimming crab	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	6	1.6	2	25.0	1.06	6	0.7	2	11.1	1.06
	cf. Portunidae		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	6	1.6	1	12.5	0.96	6	0.7	1	5.6	0.96
	Decapoda	crab/lobster/shrimp	216	96.0	2	33.3	9.90	64	91.4	1	33.3	7.53	159	100.0	1	100.0	13.78	313	86.0	–	–	32.90	752	91.9	4	22.2	64.11
Total Identified Decapoda			225	100.0	6	100.0	14.83	70	100.0	3	100.0	13.54	159	100.0	1	100.0	13.78	364	100.0	8	100.0	57.36	818	100.0	18	100.0	99.51
Maxillopoda																											
	Cirripedia	barnacle	1	100.0	1	100.0	1.48	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	100.0	1	100.0	1.48
Total Identified Invertebrata (below 'indeterminate' class-level)			622	–	109	–	782.99	517	–	122	–	1021.85	755	–	159	–	285.72	2499	–	561	–	4080.87	4393	–	951	–	6171.43
Total Invertebrata (includes 'indeterminate' at class-level)			763	–	109	–	822.06	566	–	122	–	1030.33	807	–	159	–	299.30	2699	–	562	–	4167.47	4835	–	952	–	6319.16
Indeterminate Invertebrata			3	–	–	–	0.01	–	–	–	–	–	7	–	–	–	0.06	7	–	–	–	1.26	17	–	–	–	1.33
Total Identified Vertebrata and Invertebrata (below 'indeterminate' class-level)			–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3914	–	686	–	4390.82	5808	–	1076	–	6481.38
Total Vertebrata and Invertebrata (includes 'indeterminate' at class-level)			–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	7484	–	688	–	4407.94	9620	–	1078	–	6875.18
Total Indeterminate Vertetbrata and Invertebrata (above class-level; includes 'Indeterminate Mollusca')			–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	549	–	–	–	423.42	1825	–	–	–	514.95
Total Assemblage			1444	–	109	–	872.88	917	–	122	–	1061.76	1051	–	159	–	308.58	8033	–	688	–	4831.36	11445	–	1078	–	7390.13

Table 5.23 The vertebrate and invertebrate comparative sub-assemblage from Grand Bay. See text for explanation of data compilation procedure. *Added to MNI because specimen represents a complete but unidentifiable individual or only individual from a specific context.

Grand Bay Comparative Vertebrate and Invertebrate Sub-Assemblage

			Late Period					Site Total				
Class	Taxon	Common Name	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)
Vertebrata												
Chondrichthyes												
	Elasmobranchii	shark	1	0.0	1	0.4	0.09	1	0.0	1	0.4	0.09
Actinopterygii												
	Acanthuridae	surgeonfish	191	4.1	–	–	12.83	191	4.1	–	–	12.83
	Acanthurus sp.	surgeonfish	25	0.0	9	3.9	1.24	25	0.0	9	3.9	1.24
	Total Acanthuridae		216	4.6	9	3.9	14.07	216	4.6	9	3.9	14.07
	Balistidae	triggerfish	133	2.9	–	–	0.65	133	2.9	–	–	0.65
	Balistes sp.	triggerfish	3	0.1	2	0.9	1.54	3	0.1	2	0.9	1.54
	Total Balistidae		136	2.9	2	0.9	2.19	136	2.9	2	0.9	2.19
	Belonidae	needlefish	2	0.0	1	0.4	0.03	2	0.0	1	0.4	0.03
	Carangidae	jack, pompano, scad	41	0.9	–	–	0.92	41	0.9	–	–	0.92
	Caranx sp.	jack	1	0.0	1	0.4	0.63	1	0.0	1	0.4	0.63
	Selar crumenophthalmus	bigeye scad	25	0.5	17	7.4	0.35	25	0.5	17	7.4	0.35
	Trachinotus sp.	pompano	1	0.0	1	0.4	0.06	1	0.0	1	0.4	0.06
	Total Carangidae		68	1.5	19	8.3	1.96	68	1.5	19	8.3	1.96
	Clupeidae	herring, shad	300	6.5	6	2.6	0.83	300	6.5	6	2.6	0.83
	Exocoetidae	flyingfish	28	0.6	1	0.4	0.20	28	0.6	1	0.4	0.20
	Total Exocoetidae		28	0.6	1	0.4	0.20	28	0.6	1	0.4	0.20
	Haemulidae	grunt	15	0.3	–	–	3.19	15	0.3	–	–	3.19
	Haemulon	tomtate	1	0.0	1	0.4	0.01	1	0.0	1	0.4	0.01
	Haemulon chrysargyreum	smallmouth grunt	3	0.1	3	1.3	0.06	3	0.1	3	1.3	0.06
	Haemulon sciurus	bluestriped grunt	3	0.1	3	1.3	0.03	3	0.1	3	1.3	0.03
	Haemulon sp.	grunt	13	0.3	–	–	0.28	13	0.3	–	–	0.28
	Total Haemulidae		35	0.8	7	3.0	3.57	35	0.8	7	3.0	3.57
	Holocentrus rufus	longpsine squirrelfish	1	0.0	1	0.4	0.01	1	0.0	1	0.4	0.01
	Holocentrus sp.	squirrelfish	4	0.1	–	–	0.13	4	0.1	–	–	0.13
	Total Holocentridae		5	0.1	1	0.4	0.14	5	0.1	1	0.4	0.14
	Halichoeres sp.	wrasse	2	0.0	2	0.9	0.05	2	0.0	2	0.9	0.05
	Total Labridae		2	0.0	2	0.9	0.05	2	0.0	2	0.9	0.05
	Lutjanidae	snapper	2	0.0	–	–	0.09	2	0.0	–	–	0.09
	Lutjanus apodus	schoolmaster	1	0.0	1	0.4	0.02	1	0.0	1	0.4	0.02
	Lutjanus sp.	snapper	7	0.2	3	1.3	0.11	7	0.2	3	1.3	0.11
	cf. *Ocyurus chrysurus*	yellowtail snapper	1	0.0	1	0.4	0.01	1	0.0	1	0.4	0.01
	Total Lutjanidae		11	0.2	5	2.2	0.23	11	0.2	5	2.2	0.23
	Muraenidae	eel	1	0.0	1	0.4	0.01	1	0.0	1	0.4	0.01
	Lactophyrs sp.	trunkfish	4	0.1	1	0.4	0.06	4	0.1	1	0.4	0.06
	Total Ostraciidae		4	0.1	1	0.4	0.06	4	0.1	1	0.4	0.06
	Scaridae	parrotfish	92	2.0	–	–	6.07	92	2.0	–	–	6.07
	Scarus sp.	parrotfish	27	0.6	7	3.0	4.07	27	0.6	7	3.0	4.07
	Sparisoma sp.	parrotfish	28	0.6	6	2.6	8.55	28	0.6	6	2.6	8.55
	Total Scaridae		147	3.2	13	5.7	18.69	147	3.2	13	5.7	18.69
	Scombridae	tuna, mackerel	34	0.7	–	–	17.17	34	0.7	–	–	17.17
	Scomberomorus sp.	mackerel	1	0.0	1	0.4	0.88	1	0.0	1	0.4	0.88
	Total Scombridae		35	0.8	1	0.4	18.05	35	0.8	1	0.4	18.05

Table 5.23 continued

Grand Bay Comparative Vertebrate and Invertebrate Sub-Assemblage Continued

			Late Period					Site Total				
Class	Taxon	Common Name	NISP	% NISP	MNI	% MNI	Weight (g)	NISP	% NISP	MNI	% MNI	Weight (g)
Actinopterygii continued												
	Serranidae	grouper, sea bass	2	0.0	–	–	0.74	2	0.0	–	–	0.74
	Epinephelus sp.	grouper	3	0.1	2	0.9	0.69	3	0.1	2	0.9	0.69
	Mycteroperca sp.	grouper	1	0.0	1	0.4	2.64	1	0.0	1	0.4	2.64
	Total Serranidae		6	0.1	3	1.3	4.07	6	0.1	3	1.3	4.07
	Sparidae	porgy	2	0.0	–	–	0.16	2	0.0	–	–	0.16
	Calamus sp.	porgy	1	0.0	1	0.4	0.02	1	0.0	1	0.4	0.02
	Total Sparidae		3	0.1	1	0.4	0.18	3	0.1	1	0.4	0.18
Total Identified Actinopterygii and Chondrichthyes			1000	21.5	74	32.2	64.42	1000	21.5	74	32.2	64.42
Indeterminate Actinopterygii			2426	52.2	–	–	218.05	2426	52.2	–	–	218.05
Aves												
	Columbidae	pigeons and doves	1	0.0	1	0.4	0.15	1	0.0	1	0.4	0.15
Total Identified Aves			1	0.0	1	0.4	0.15	1	0.0	1	0.4	0.15
Indeterminate Aves			11	0.2	–	–	1.98	11	0.2	–	–	1.98
Mammalia												
	Capromyidae	capromyid rodent	1	0.0	1	0.4	1.53	1	0.0	1	0.4	1.53
	Didelphis sp.	opossum	11	0.2	2	0.9	3.44	11	0.2	2	0.9	3.44
	Dasyproctidae	agouti	4	0.1	–	–	1.58	4	0.1	–	–	1.58
	Dasyprocta sp.	agouti	6	0.1	1	0.4	2.99	6	0.1	1	0.4	2.99
	cf. *Dasyprocta* sp.		0	0.0	–	–	0.00	0	0.0	–	–	0.00
	Oryzomys sp.	rice rat	13	0.3	3	1.3	0.76	13	0.3	3	1.3	0.76
	Rodentia		6	0.1	–	–	0.47	6	0.1	–	–	0.47
	Large mammal		1	0.0	–	–	8.58	1	0.0	–	–	8.58
	Medium mammal		3	0.1	–	–	5.23	3	0.1	–	–	5.23
	Small mammal		33	0.7	–	–	3.70	33	0.7	–	–	3.70
Total Identified Mammalia			78	1.7	7	3.0	28.28	78	1.7	7	3.0	28.28
Indeterminate Mammalia			4	0.1	–	–	4.13	4	0.1	–	–	4.13
Reptilia												
	Cheloniidae	sea turtle	78	1.7	1	0.4	180.56	78	1.7	1	0.4	180.56
	Iguanidae	iguana	2	0.0	1	0.4	13.37	2	0.0	1	0.4	13.37
	Lacertilia	lizard	15	0.3	–	–	2.18	15	0.3	–	–	2.18
	Serpentes	snake	5	0.1	1	0.4	0.08	5	0.1	1	0.4	0.08
Total Identified Reptilia			100	2.2	3	1.3	196.19	100	2.2	3	1.3	196.19
Amphibia												
	Anura	frogs and toads	2	0.0	1	0.4	0.01	2	0.0	1	0.4	0.01
Total Identified Amphibia			2	0.0	1	0.4	0.01	2	0.0	1	0.4	0.01
Total Identified Vertebrata (below 'indeterminate' class-level)			1181	25.4	86	37.4	289.05	1181	25.4	86	37.4	289.05
Total Vertebrata (includes 'indeterminate' at class-level)			3622	77.9	86	37.4	513.21	3622	77.9	86	37.4	513.21
Indeterminate Vertebrata (above class level; not quantified)			>1	0.0	–	–	266.85	>1	0.0	–	–	266.85
Invertebrata												
Echinoidea		sea urchin	132	2.8	1	0.4	2.03	132	2.8	1	0.4	2.03
Bivalvia												
	Codakia orbicularis	tiger lucine	2	0.0	1	0.4	15.10	2	0.0	1	0.4	15.10
	cf. *Asaphis deflorata*	gaudy asaphis	1	0.0	1	0.4	0.29	1	0.0	1	0.4	0.29
	Tellina sp.	tellin	1	0.0	1	0.4	10.55	1	0.0	1	0.4	10.55
Total Identified Bivalvia			4	0.1	3	1.3	25.94	4	0.1	3	1.3	25.94
Indeterminate Bivalvia			3	0.1	–	–	0.36	3	0.1	–	–	0.36
Gastropoda: Terrestrial												
	Orthalicus undatus	wavy orthalicus	4	0.1	2	0.9	4.65	4	0.1	2	0.9	4.65
	Pleurodonte sp.	terrestrial snail	2	0.0	1	0.4	0.02	2	0.0	1	0.4	0.02
	Indeterminate terrestrial Gastropoda		4	0.1	–	–	0.03	4	0.1	–	–	0.03

Table 5.23 continued

Grand Bay Comparative Vertebrate and Invertebrate Sub-Assemblage Continued

Class	Taxon	Common Name	Late Period NISP	% NISP	MNI	% MNI	Weight (g)	Site Total NISP	% NISP	MNI	% MNI	Weight (g)
Gastropoda: Marine												
	Crepidula maculosa	spotted slipper snail	7	0.2	7	3.0	3.69	7	0.2	7	3.0	3.69
	Cerithium lutosum/ Batillaria minima	dwarf cerith/false cerith	1	0.0	1	0.4	<0.01	1	0.0	1	0.4	<0.01
	Cenchritis muricata	beaded periwinkle	4	0.1	4	1.7	5.70	4	0.1	4	1.7	5.70
	Marginellidae	marginella	1	0.0	1	0.4	<0.01	1	0.0	1	0.4	<0.01
	Stramonita haemastoma/rustica	Florida/rustic rock snail	4	0.1	4	1.7	11.15	4	0.1	4	1.7	11.15
	Naticarius cf. *canrena*	colorful Atlantic natica	1	0.0	1	0.4	3.00	1	0.0	1	0.4	3.00
	Nerita peloronta	bleeding tooth nerite	1	0.0	1	0.4	4.30	1	0.0	1	0.4	4.30
	Nerita tessellata	tessellated nerite	40	0.9	31	13.5	29.64	40	0.9	31	13.5	29.64
	Nerita cf. *tessellata*		2	0.0	–	–	0.30	2	0.0	–	–	0.30
	Nerita versicolor	four-toothed nerite	6	0.1	6	2.6	20.98	6	0.1	6	2.6	20.98
	Nerita cf. *versicolor*		2	0.0	2	0.9	2.70	2	0.0	2	0.9	2.70
	Nerita sp.	nerite	6	0.1	–	–	1.31	6	0.1	–	–	1.31
	Supplanaxis nucleus	black Atlantic planaxis	1	0.0	1	0.4	0.60	1	0.0	1	0.4	0.60
	Cittarium pica	West Indian top snail	73	1.6	30	13.0	1605.66	73	1.6	30	13.0	1605.66
	Cittarium pica nacre		14	0.3	–	–	0.17	14	0.3	–	–	0.17
	Lithopoma caelatum	carved star snail	2	0.0	2	0.9	16.10	2	0.0	2	0.9	16.10
	Lithopoma tuber	green star snail	5	0.1	2	0.9	10.50	5	0.1	2	0.9	10.50
	Tegula excavata	green-base tegula	11	0.2	3	1.3	3.60	11	0.2	3	1.3	3.60
	Turridae	turrid	1	0.0	1	0.4	<0.01	1	0.0	1	0.4	<0.01
Total Identified Gastropoda			192	4.1	100	43.5	1724.10	192	4.1	100	43.5	1724.10
Indeterminate Gastropoda			70	1.5	1*	0.4	24.24	70	1.5	1*	0.4	24.24
Polyplacophora												
	Acanthopleura granulata	fuzzy chiton	28	0.6	5	2.2	55.93	28	0.6	5	2.2	55.93
	Chiton marmoratus	marbled chiton	17	0.4	3	1.3	17.60	17	0.4	3	1.3	17.60
	Chiton tuberculatus	West Indian chiton	196	4.2	30	13.0	127.85	196	4.2	30	13.0	127.85
	Chiton cf. *tuberculatus*		2	0.0	1	0.4	0.45	2	0.0	1	0.4	0.45
Total Identified Polyplacophora			241	5.2	38	16.5	201.38	241	5.2	38	16.5	201.38
Indeterminate Polyplacophora			2	0.0	–	–	1.50	2	0.0	–	–	1.50
Total Identified Mollusca (below 'indeterminate' class-level)			437	9.4	141	61.3	1951.42	437	9.4	141	61.3	1951.42
Total Mollusca (includes 'indeterminate' at class-level)			512	11.0	142	61.7	1977.52	512	11.0	142	61.7	1977.52
Indeterminate Mollusca			241	5.2	–	–	4.46	241	5.2	–	–	4.46
Malacostraca: Order Decapoda												
	Cardisoma guanhumi	blue land crab	2	0.0	1	0.4	1.78	2	0.0	1	0.4	1.78
	Decapoda	crab/lobster/shrimp	133	2.9	–	–	1.81	133	2.9	–	–	1.81
Total Identified Decapoda			135	2.9	1	0.4	3.59	135	2.9	1	0.4	3.59
Total Identified Invertebrata (below 'indeterminate' class-level)			704	15.1	143	62.2	1957.04	704	15.1	143	62.2	1957.04
Total Invertebrata (includes 'indeterminate' at class-level)			779	16.8	144	62.6	1983.14	779	16.8	144	62.6	1983.14
Indeterminate Invertebrata			4	0.1	–	–	0.16	4	0.1	–	–	0.16
Total Identified Vertebrata and Invertebrata (below 'indeterminate' class-level)			1885	40.6	229	99.6	2246.09	1885	40.6	229	99.6	2246.09
Total Vertebrata and Invertebrata (includes 'indeterminate' at class-level)			4401	94.7	230	100.0	2496.35	4401	94.7	230	100.0	2496.35
Total Indeterminate Vertetbrata and Invertebrata (above class-level; includes 'Indeterminate Mollusca')			246	5.3	–	–	271.47	246	5.3	–	–	271.47
Total Assemblage			4647	100.0	230	100.0	2767.82	4647	100.0	230	100.0	2767.82

Table 5.24 Relative abundance and rank by NISP and MNI of fish at Grand Bay for the Late Period. Taxa contributing at least 5% to fish NISP and MNI appear in bold print.

Grand Bay Fish Ranking for the Late Period

Taxon	%NISP	Rank	Taxon	%MNI	Rank
Clupeidae	**28.0**	**1**	**Carangidae**	**26.9**	**1**
Scaridae	**20.3**	**2**	**Scaridae**	**17.3**	**2**
Acanthuridae	**20.0**	**3**	**Haemulidae**	**13.5**	**3**
Balistidae	**11.5**	**4**	**Acanthuridae**	**10.6**	**4**
Carangidae	**6.7**	**5**	**Clupeidae**	**7.7**	**5**
Haemulidae	4.2	6	**Lutjanidae**	**5.8**	**6**
Scombridae	3.3	7	Serranidae	3.8	7
Exocoetidae	2.4	8	Elasmobranchii	1.9	9.5
Lutjanidae	1.0	9	Balistidae	1.9	9.5
Serranidae	0.8	10	Labridae	1.9	9.5
Holocentridae	0.4	11	Scombridae	1.9	9.5
Ostraciidae	0.3	12	Belonidae	1.0	15
Sparidae	0.3	13	Exocoetidae	1.0	15
Elasmobranchii	0.2	15	Holocentridae	1.0	15
Belonidae	0.2	15	Muraenidae	1.0	15
Labridae	0.2	15	Ostraciidae	1.0	15
Muraenidae	0.1	17.5	Sciaenidae	1.0	15
Sciaenidae	0.1	17.5	Sparidae	1.0	15

Table 5.25 Chi square tests for the gastropod assemblage at Grand Bay. Monte Carlo approximations (200,000 replicates) used to calculate *p*-values for chi square statistics. See text for explanation of table format. Between the Late and Middle-L005 period columns at the far right the sign of the adjusted residual should be read chronologically from right to left.

Chi Square Tests for Grand Bay Gastropods

Taxon	Common Name	Early Period NISP	Adjusted Residual	*p*	Middle-L005 Period NISP	Adjusted Residual	*p*	Middle-L003 Period NISP	Adjusted Residual	*p*	Late Period NISP	Adjusted Residual	*p*	Middle-L005 Period NISP	Assemblage Total
Orthalicidae	tree snail	9	1.711	>0.05	22	**-3.149**	**0.002**	7	**3.520**	**<0.001**	96	-0.031	>0.05	22	134
Pleurodontidae	terrestrial snail	1	-0.185	>0.05	1	0.503	>0.05	2	**2.513**	**0.012**	40	**2.710**	**0.007**	1	44
Megalobulimus sp.	giant terrestrial snail	–			–			–	1.000	>0.05	4	0.956	>0.05	–	4
Engoniophos unicinctus	Guadeloupe phos	–			–	0.958	>0.05	1	**-2.006**	**0.045**	–			–	1
Bulla striata	common Atlantic bubble	4	-1.154	>0.05	2	-0.089	>0.05	2	-0.825	>0.05	4	-0.935	>0.05	2	12
Crepidula sp.	slipper snail	17	**-2.129**	**0.033**	10	-0.932	>0.05	7	1.137	>0.05	44	0.004	>0.05	10	78
Cassis sp.	helmet	–			–			–	0.499	>0.05	1	0.477	>0.05	–	1
Cerithium lutosum / *Batillaria minima*	dwarf cerith/ false cerith	17	**-3.050**	**0.002**	6	**-2.581**	**0.010**	–	0.499	>0.05	1	**-4.589**	**<0.001**	6	24
Columbella mercatoria	common dove snail	1	-1.141	>0.05	–			–			–			–	1
Cypraeidae	cowry	–			–			–	0.499	>0.05	1	0.477	>0.05	–	1
Leucozonia sp.	latirus	–			–			–	0.706	>0.05	2	0.675	>0.05	–	2
Fissurellidae	keyhole limpet	2	-0.812	>0.05	1	-1.047	>0.05	–	1.118	>0.05	5	0.118	>0.05	1	8
Littorinidae	periwinkle	4	-0.735	>0.05	3	-1.096	>0.05	1	1.826	>0.05	21	0.771	>0.05	3	29
Tectura antillarum	southern limpet	–			–			–	0.499	>0.05	1	0.477	>0.05	–	1
Marginellidae	marginella	–	0.879	>0.05	1	-1.047	>0.05	–	0.499	>0.05	1	-1.146	>0.05	1	2
Modulus modulus	Atlantic modulus	1	-1.141	>0.05	–			–			–			–	1
Muricidae	murex	–	0.879	>0.05	1	-0.063	>0.05	1	0.789	>0.05	9	0.699	>0.05	1	11
Nassarius polygonatus	black-spot nassa	1	-1.141	>0.05	–	0.958	>0.05	1	-1.066	>0.05	1	0.477	>0.05	–	3
Naticarius cf. *canrena*	colorful Atlantic natica	–			–			–	0.499	>0.05	1	0.477	>0.05	–	1
Netritidae	nerite	12	**5.027**	**<0.001**	58	**7.892**	**<0.001**	144	**-9.248**	**<0.001**	288	1.056	>0.05	58	502
Oliva sp.	olive	1	-1.141	>0.05	–	0.958	>0.05	1	-0.255	>0.05	3	0.828	>0.05	–	5
Olivella sp.	dwarf olive	1	-0.185	>0.05	1	-1.047	>0.05	–			–	**-2.097**	**0.036**	1	2
Eulithidium sp.	pheasant snail	3	**-1.982**	**0.048**	–	0.958	>0.05	1	**-2.006**	**0.045**	–			–	4
Supplanaxis nucleus	black Atlantic planaxis	–			–	1.663	>0.05	3	**-2.249**	**0.025**	2	0.675	>0.05	–	5
Cymatium sp.	triton	–			–			–	0.706	>0.05	2	0.675	>0.05	–	2
Cittarium pica	West Indian top snail	65	-1.521	>0.05	69	**-5.592**	**<0.001**	26	**4.802**	**<0.001**	239	**-2.102**	**0.036**	69	399
Lithopoma spp.	star snail	1	-0.185	>0.05	1	0.503	>0.05	2	0.644	>0.05	13	1.105	>0.05	1	17
Tegula sp.	tegula	–	**2.348**	**0.019**	7	**-2.273**	**0.023**	1	1.892	>0.05	22	-0.787	>0.05	7	30
Turbo castanea	knoby turban	–			–			–	0.499	>0.05	1	0.477	>0.05	–	1
Turridae	turrid	1	-1.141	>0.05	–			–	0.706	>0.05	2	0.675	>0.05	–	3
Total		141			183			200			804			183	1328
		χ^2 = 56.52		p < 0.001	χ^2 = 85.95		p < 0.001	χ^2 = 112.30		p < 0.001	χ^2 = 45.95		p = 0.009		

Table 5.26 Chi square tests for the chiton assemblage from Grand Bay. Fisher's exact test used to calculate *p*-values for chi square statistic. See text for explanation of table format. Between the Late and Middle-L005 period columns at the far right the sign of the adjusted residual should be read chronologically from right to left.

Chi Square Tests for Grand Bay Chitons

Taxon	Common Name	Early Period NISP	Adjusted Residual	*p*	Middle-L005 Period NISP	Adjusted Residual	*p*	Middle-L003 Period NISP	Adjusted Residual	*p*	Late Period NISP	Adjusted Residual	*p*	Middle-L005 Period NISP	Assemblage Total
Acanthopleura granulata	fuzzy chiton	50	-1.733	>0.05	51	**-6.177**	**<0.001**	15	1.335	>0.05	111	**-7.648**	**<0.001**	51	227
Chiton marmoratus	marbled chiton	–	**1.964**	**0.050**	5	**3.156**	**0.002**	25	**-3.246**	**0.001**	64	1.459	>0.05	5	94
Chiton tuberculatus	West Indian chiton	52	1.156	>0.05	79	**2.755**	**0.006**	127	**2.187**	**0.029**	733	**5.798**	**<0.001**	79	991
Chiton squamosus	squamose chiton	–			–	0.885	>0.05	1	**-2.292**	**0.022**	–			–	1
Chiton viridis	green chiton	–			–	**1.992**	**0.046**	5	**-5.135**	**<0.001**	–			–	5
Total		102			135			173			908			135	1318
		χ^2 = 6.10		*p* = 0.045	χ^2 = 46.17		*p* <0.001	χ^2 = 43.72		*p* <0.001	χ^2 = 58.84		*p* <0.001		

Table 5.27 Chi square tests for the bivalve assemblage from Grand Bay. Fisher's exact test used to calculate *p*-values for chi square statistic. See text for explanation of table format. Between the Late and Middle-L005 period columns at the far right the sign of the adjusted residual should be read chronologically from right to left.

Chi Square Tests for Grand Bay Bivalves

Taxon	Common Name	Early Period NISP	Adjusted Residual	*p*	Middle-L005 Period NISP	Adjusted Residual	*p*	Middle-L003 Period NISP	Adjusted Residual	*p*	Late Period NISP	Adjusted Residual	*p*	Middle-L005 Period NISP	Assemblage Total
Laevicardium cf. *serratum*	common egg cockle	1	-0.857	>0.05	–			–			–			–	1
Donax denticulatus	Caribbean coquina	–	1.671	>0.05	2	-0.570	>0.05	–	0.671	>0.05	3	0.351	>0.05	2	5
Isognomon alatus	flat tree oyster	2	-1.217	>0.05	–			–			–			–	2
Lucinidae	lucine	4	1.514	>0.05	7	1.666	>0.05	3	-1.822	>0.05	7	-0.188	>0.05	7	21
Mytilidae	mussel	5	0.525	>0.05	5	0.235	>0.05	1	1.905	>0.05	27	**4.334**	**<0.001**	5	38
Pectinidae	scallop	–			–	**2.547**	**0.011**	1	-2.667	0.008	–			–	1
Plicatula gibbosa	kitten's paw	–			–			–	0.543	>0.05	2	1.362	>0.05	–	2
Asaphis deflorata	gaudy asaphis	56	-0.960	>0.05	37	**-2.641**	**0.008**	2	-0.352	>0.05	11	**-5.496**	**<0.001**	37	106
Tellinidae	tellin	2	-1.217	>0.05	–	**2.547**	**0.011**	1	-1.118	>0.05	2	1.362	>0.05	–	5
Chione cancellata	cross-barred venus	–			–			–	0.671	>0.05	3	1.677	>0.05	–	3
cf. *Timoclea pygmaea*	pygmy venus	–			–			–	0.381	>0.05	1	0.959	>0.05	–	1
Total		70			51			8			56			51	185
		$\chi^2 = 8.94$		$p = 0.177$	$\chi^2 = 17.78$		$p = 0.007$	$\chi^2 = 14.42$		$p = 0.08$	$\chi^2 = 37.26$		$p < 0.001$		

Table 5.28 Chi square tests for invertebrate classes exploited at Grand Bay. Fisher's exact test used to calculate *p*-values for chi square statistic. See text for explanation of table format. Between the Late and Early period columns at the far right the sign of the adjusted residual should be read chronologically from right to left.

Chi Square Tests for Grand Bay Invertebrate Classes

Taxon	Common Name	Early Period MNI	Adjusted Residual	*p*	Middle-L005 Period MNI	Adjusted Residual	*p*	Middle-L003 Period MNI	Adjusted Residual	*p*	Late Period MNI	Adjusted Residual	*p*	Early Period MNI	Assemblage Total
Echinoidea	sea urchin	2	-0.123	>0.05	2	0.156	>0.05	3	-1.060	>0.05	5	-0.901	>0.05	2	12
Bivalvia	clam, oyster, mussel	16	-1.152	>0.05	12	**-2.332**	**1.980**	5	0.451	>0.05	22	**-4.485**	**<0.001**	16	55
Gastropoda	snail	68	0.544	>0.05	81	**3.088**	**0.002**	131	**-2.591**	**0.010**	406	1.941	0.052	68	686
Polyplacophora	chiton	16	0.970	>0.05	24	-1.782	>0.05	19	**2.696**	**0.007**	121	1.585	>0.05	16	180
Decapoda	crab, lobster, shrimp	6	-1.209	>0.05	3	-1.284	>0.05	1	0.797	>0.05	8	**-2.750**	**0.006**	6	18
Total		108			122			159			562			108	951
		$\chi^2 = 3.47$		$p = 0.479$	$\chi^2 = 11.79$		$p = 0.012$	$\chi^2 = 9.51$		$p = 0.037$	$\chi^2 = 30.28$		$p < 0.001$		

Table 5.29 Grand Bay taxa grouped by habitat type. Taxa which could not be assigned to a single or dominant habitat are excluded. Data based on comparative vertebrate and invertebrate sub-assemblage (Table 5.23).

Grand Bay Taxa By Habitat for the Late Period

Habitat	Taxon	Common Name	NISP	% NISP	MNI	% MNI	Weight (g)
Coral Reef							
	Acanthuridae	surgeonfish	191	10.9	–	–	12.83
	Acanthurus sp.	surgeonfish	25	1.4	9	4.0	1.24
	Balistidae	triggerfish	133	7.6	–	–	0.65
	Balistes sp.	triggerfish	3	0.2	2	0.9	1.54
	Haemulidae	grunt	15	0.9	–	–	3.19
	Haemulon aurolineatum	tomtate	1	0.1	1	0.4	0.01
	Haemulon chrysargyreum	smallmouth grunt	3	0.2	3	1.3	0.06
	Haemulon sciurus	bluestriped grunt	3	0.2	3	1.3	0.03
	Haemulon sp.	grunt	13	0.7	–	–	0.28
	Halichoeres sp.	wrasse	2	0.1	2	0.9	0.05
	Holocentrus rufus	longpsine squirrelfish	1	0.1	1	0.4	0.01
	Holocentrus sp.	squirrelfish	4	0.2	–	–	0.13
	Lutjanidae	snapper	2	0.1	–	–	0.09
	Lutjanus apodus	schoolmaster	1	0.1	1	0.4	0.02
	Lutjanus sp.	snapper	7	0.4	3	1.3	0.11
	cf. *Ocyurus chrysurus*	yellowtail snapper	1	0.1	1	0.4	0.01
	Muraenidae	eel	1	0.1	1	0.4	0.01
	Scaridae	parrotfish	92	5.3	–	–	6.07
	Scarus sp.	parrotfish	27	1.5	7	3.1	4.07
	Sparisoma sp.	parrotfish	28	1.6	6	2.7	8.55
	Serranidae	grouper, sea bass	2	0.1	–	–	0.74
	Epinephelus sp.	grouper	3	0.2	2	0.9	0.69
	Mycteroperca sp.	grouper	1	0.1	1	0.4	2.64
Total Coral Reef Taxa			559	32.0	43	19.3	43.02
Inshore/Shallow Water							
	Elasmobranchii	shark	1	0.1	1	0.4	0.09
	Carangidae	jack, pompano, scad	41	2.3	–	–	0.92
	Caranx sp.	jack	1	0.1	1	0.4	0.63
	Selar crumenophthalmus	bigeye scad	25	1.4	17	7.6	0.35
	Trachinotus sp.	pompano	1	0.1	1	0.4	0.06
	Lactophyrs sp.	trunkfish	4	0.2	1	0.4	0.06
	Sparidae	porgy	2	0.1	–	–	0.16
	Calamus sp.	porgy	1	0.1	1	0.4	0.02
	Cheloniidae	sea turtle	78	4.5	1	0.4	180.56
	Echinoidea	sea urchin	132	7.6	1	0.4	2.03
	Codakia orbicularis	tiger lucine	2	0.1	1	0.4	15.10
	cf. *Asaphis deflorata*	gaudy asaphis	1	0.1	1	0.4	0.29
	Tellina sp.	tellin	1	0.1	1	0.4	10.55
	Cerithium lutosum / *Batillaria minima*	dwarf cerith/false cerith	1	0.1	1	0.4	<0.01
	Marginellidae	marginella	1	0.1	1	0.4	<0.01
	Naticarius cf. *canrena*	colorful Atlantic natica	1	0.1	1	0.4	3.00
	Lithopoma caelatum	carved star snail	2	0.1	2	0.9	16.10
	Lithopoma tuber	green star shell	5	0.3	2	0.9	10.50
	Turridae	turrid	1	0.1	1	0.4	<0.01
Total Inshore/Shallow Water Taxa			301	17.2	35	15.7	240.42

Table 5.29 continued

Grand Bay Taxa By Habitat for the Late Period Continued

Habitat	Taxon	Common Name	NISP	% NISP	MNI	% MNI	Weight (g)
Littoral/Rocky Intertidal							
	Cenchritis muricata	beaded periwinkle	4	0.2	4	1.8	5.70
	Stramonita haemastoma/ rustica	Florida/rustic rock snail	4	0.2	4	1.8	11.15
	Nerita peloronta	bleeding tooth nerite	1	0.1	1	0.4	4.30
	Nerita tessellata	tessellated nerite	40	2.3	31	13.9	29.64
	Nerita cf. *tessellata*		2	0.1	–	–	0.30
	Nerita versicolor	four-toothed nerite	6	0.3	6	2.7	20.98
	Nerita cf. *versicolor*		2	0.1	2	0.9	2.70
	Nerita sp.	nerite	6	0.3	–	–	1.31
	Supplanaxis nucleus	black Atlantic planaxis	1	0.1	1	0.4	0.60
	Cittarium pica	West Indian top snail	73	4.2	30	13.5	1605.66
	Cittarium pica nacre		14	0.8	–	–	0.17
	Tegula excavata	green-base tegula	11	0.6	3	1.3	3.60
	Acanthopleura granulata	fuzzy chiton	28	1.6	5	2.2	55.93
	Chiton marmoratus	marbled chiton	17	1.0	3	1.3	17.60
	Chiton tuberculatus	West Indian chiton	196	11.2	30	13.5	127.85
	Chiton cf. *tuberculatus*		2	0.1	1	0.4	0.45
Total Littoral/Rocky Intertidal Taxa			407	23.3	121	54.3	1887.94
Pelagic							
	Belonidae	needlefish	2	0.1	1	0.4	0.03
	Clupeidae	herring, shad	300	17.2	6	2.7	0.83
	Exocoetidae	flyingfish	28	1.6	1	0.4	0.20
	Scombridae	tuna, mackerel	34	1.9	–	–	17.17
	Scomberomorus sp.	mackerel	1	0.1	1	0.4	0.88
Total Pelagic Taxa			365	20.9	9	4.0	19.11
Terrestrial							
	Columbidae	pigeon, dove	1	0.1	1	0.4	0.15
	Capromyidae	capromyid rodent	1	0.1	1	0.4	1.53
	Dasyproctidae	agouti	4	0.2	–	–	1.58
	Dasyprocta sp.	agouti	6	0.3	1	0.4	2.99
	Didelphis sp.	opossum	11	0.6	2	0.9	3.44
	Oryzomys sp.	rice rat	13	0.7	3	1.3	0.76
	Rodentia		6	0.3	–	–	0.47
	Large mammal		1	0.1	–	–	8.58
	Medium mammal		3	0.2	–	–	5.23
	Small mammal		33	1.9	–	–	3.70
	Indeterminate Mammalia		4	0.2	–	–	4.13
	Iguanidae	iguana	2	0.1	1	0.4	13.37
	Serpentes	snake	5	0.3	1	0.4	0.08
	Lacertilia	lizard	15	0.9	–	–	2.18
	Anura	frog/toad	2	0.1	1	0.4	0.01
	Orthalicus undatus	wavy orthalicus	4	0.2	2	0.9	4.65
	Pleurodonte sp.	terrestrial snail	2	0.1	1	0.4	0.02
	Cardisoma guanhumi	blue land crab	2	0.1	1	0.4	1.78
Total Terrestrial Taxa			115	6.6	15	6.7	54.65
Habita Totals			1747	100.0	223	100.0	2245.14

Chapter 6

ZOOARCHAEOLOGICAL COMPARISONS BETWEEN THE SABAZAN AND GRAND BAY SITES

Life to men and death to fish!

-Manx proverb

6.1 Taxonomic Comparisons Between Sites

In this chapter I explore foraging variability at Sabazan and Grand Bay by comparing zooarchaeological patterning between the sites, focusing on the most important, top ranking taxa.

6.1.1 Comparison of Taxonomic Ranks by Relative Abundance

Rankings of vertebrate fauna indicate that Sabazan and Grand Bay foragers tended to focus on the same set of taxa (Table 6.1). Although the exact levels of exploitation differ between sites and over time, there is considerable taxonomic overlap in the set of families that collectively comprise the top 50% of MNI at each site. Jacks/scads and parrotfish are the most abundant vertebrates at Sabazan from the Middle period onward and at Grand Bay during the Late period. Surgeonfish and grunts also rank among the top taxa at both sites, but are of comparatively moderate importance.

In contrast to this pattern, tunas are clearly an important, high ranking fish at Sabazan, but do not place among the top vertebrate taxa at Grand Bay. Additional variability is masked by the family-level aggregation of taxa. For instance, at Grand Bay, identified species within the family Carangidae belong primarily to the bigeye scad, *Selar crumenophthalmus*, and other inshore/shallow water carangids. Bigeye scad is present at Sabazan, but declines relative to the pelagic rough scad, *Trachurus lathami*, after the Middle period. The rough scad is not recorded for Grand Bay.

For the invertebrate assemblages, strong consistencies in taxonomic rank order are apparent (Table 6.2). At both sites, the heaviest emphasis is placed on nerites and chitons. At Grand Bay, these two taxa become most important after the Early period. Turbans/top snails (including the West Indian top snail) and slipper snails follow nerites and chitons as the highest ranking invertebrates at this site. Their relative rank order is fixed throughout site occupation. At Sabazan, turbans/top snails and land crabs, which rank highly during the Early period, decline over time to be replaced by planaxis snails and sea urchins later in occupation. In general, at Sabazan there is a somewhat greater fluctuation in the taxa constituting the top ranking set.

6.1.2 Comparison of Vertebrate Relative Abundance

I employed chi square tests to determine whether significant differences exist between the Sabazan and Grand Bay zooarchaeological assemblages. Taxa were aggregated by family, amphibians were left at the class level, and identifications above the class level were excluded. Both MNI- and NISP-based test results are statistically significant, indicating that vertebrate foraging behavior differs between the two sites (Table 6.3). Here, I focus on MNI-based testing since comparisons cut across classes and across sites where differences in levels of identification between analysts might be an issue. Chi square tests for the vertebrates indicate that four fish families, Carangidae, Haemulidae, Scaridae, and Scombridae, differ significantly in relative abundance between the two sites. Jacks/scads and grunts are relatively more common at Grand Bay, while parrotfish and tunas are comparatively more abundant at Sabazan.

These findings are consistent with patterns noted in the taxonomic rankings above and in statistical tests from the previous chapter. The most significant among these is the fact that tuna fishing appears to have been a much more important activity at Sabazan. Recall that by the Late period at Sabazan, tuna fishing had declined significantly (Table 5.13). This raises the possibility that the disparity in tuna exploitation between the two sites may have been even greater at one point in time. Unfortunately, the samples from earlier deposits at Grand Bay that would be needed to answer this question have not been analyzed.

Another possibility, of course, is that tunas were once more abundant at Grand Bay, but tuna fishing declined sooner there then at Sabazan. In fact, it could be the case that the same foraging trends occur at each site, but simply happen sooner at Grand Bay. This would dovetail well with the fact that occupation at Grand Bay ends 100 – 200 years earlier than at Sabazan, i.e., in the Late period versus the Final period. I return to the issue of temporally staggered differences in foraging later in this section.

There are no statistical differences in the levels of exploitation of non-fish vertebrate taxa based on MNI, but a NISP-based test indicates that agoutis and opossums are significantly more abundant at Sabazan (Table 6.3). This is in keeping with the previously identified trend for an increase in agouti and opossum over time in the mammalian assemblage at Sabazan (Table 5.15). The discrepancy in significance between MNI- and NISP-based tests may have to do with the reduction in sample size that accompanies conversion of NISP into MNI counts, or it may arise from differences in rates of fragmentation, preservation, butchering practices, or analysts' methods.

Overall, focusing on just the higher ranking vertebrate taxa and taking into consideration temporal patterning for Sabazan, the most significant findings for vertebrates involve the discrepancy in tuna abundance between the two sites, the relatively heavier emphasis on grunts at Grand Bay, and the primary importance of jacks/scads and parrotfish at both Grand Bay and Sabazan.

To explore the potential for similar, but temporally staggered foraging trends, I employed chi square tests, comparing Grand Bay's Late period vertebrate assemblage to that of Sabazan's Final period. If the faunal patterning present at Grand Bay during the Late period is evident later at Sabazan, then a comparison between the Late and Final period assemblages should be insignificant. In fact, the MNI-based test (but not the NISP-based test) indicates no significant difference between the assemblages, lending support to the proposition that vertebrate faunal exploitation at the terminal phase of occupation is similar at each site (Table 6.3). For a chronological lag in foraging trends to be confirmed, however, insignificant results would need to be repeated for chi square tests at all levels and taxonomic groupings between Grand Bay's Late and Sabazan's Final periods, i.e., tests of invertebrates, tests at class-level, etc. The results of these additional tests, which appear in the following pages, reveal that this does not occur. Test results are almost always significant, indicating that there is insufficient evidence to support the conclusion that foraging trends are temporally staggered between the sites. Because of this, I do not discuss the results in great detail below, but chi square tests between Grand Bay's Late and Sabazan's Final periods are included in all tables (Tables 6.3-6.6, 6.8, 6.9).

6.1.3 Comparison of Invertebrate Relative Abundance

To facilitate invertebrate comparisons across sites, taxa were aggregated at the family level (except Echinoidea), employing MNI-based data, with non-dietary specimens (Batallariidae, Cerithidae, Cirripedia, and Turridae) excluded from analysis. The Middle-L005 and Middle-L003 phases from Grand Bay were each separately compared to Sabazan's Middle period. (Table 6.4). All comparisons, except that for the Early period, are statistically significant. In the case of the Early period, Sabazan's sample size (invertebrate MNI = 17) is probably a factor in the non-significant results. On a presence/absence basis the sample at least gives an indication that many of the same invertebrate taxa are being exploited at both sites.

For the Middle-L005 phase at Grand Bay and Middle period at Sabazan, differences between the assemblages are driven by a higher relative abundance of gecarcinid land crabs at Sabazan, and a comparatively greater number of sunset clams (Psammobiidae) and chitons at Grand Bay. For nerites, generally the highest ranking invertebrate taxon at both sites, no significant difference is indicated. This is also the case for turbans/top snails, another high-ranking taxon at both sites.

Comparison between Grand Bay's Middle-L003 and Sabazan's Middle period invertebrate assemblages again yields statistically significant results (Table 6.4). Mussels and gecarcinid land crabs are relatively more abundant at Sabazan than at Grand Bay, where they are rare or absent for this period. Nerites are the number one ranking invertebrate taxon at both sites, but consistent with the spike in abundance previously identified for the Middle-L003 phase at Grand Bay, they register as significantly more abundant at this site compared to Sabazan. In fact, at Grand Bay, nerites are now more than five times as abundant as chitons, the next most important invertebrate taxon.

A chi square test for the Late period indicates significantly larger numbers of sea urchin and planaxis snails at Sabazan and a greater abundance of slipper snails at Grand Bay (Table 6.4). This is notable because sea urchins, planaxis snails, and slipper snails are ranked among the top taxa at one site, but at the other are extremely rare or absent altogether. The results of a chi square test between Grand Bay's Late period and Sabazan's Final period are significant, and as previously discussed, refute the possibility of a temporal lag between sites in the onset of foraging behavioral changes.

6.1.4 Comparison of Combined Vertebrate and Invertebrate

In this section, I examine overall faunal exploitation for the Late period, comparing the combined vertebrate and invertebrate MNI-based sub-assemblages (Table 5.8 and Table 5.23) at the family level (except Amphibia and Echinoidea). Higher order taxonomic identifications and non-dietary taxa (see section 6.1.3) were excluded from the analysis. Since comparisons cut across multiple faunal classes they are based on MNI. Data aggregation along these lines yielded a set of 48 taxa for comparison.

The chi square test indicates statistically significant differences between the vertebrate-invertebrate sub-assemblages from each site (Table 6.5). Adjusted residuals reveal that all significant differences are to be found within the invertebrate portion of the assemblage. Specifically, sea urchins, nerites, and planaxis snails are significantly more abundant at Sabazan, while chitons and turbans/top snails are significantly more abundant at Grand Bay. The statistically significant differences in abundance previously indicated for fish do not register as such here, except possibly for the greater abundance of tunas at Sabazan. This rests on the cusp of statistical significance (adjusted residual = 1.929, $p = 0.054$).

Clearly, there are disparities in which taxa register as statistically different between the sites, depending on whether tests are based on the collective assemblage or the separate vertebrate and invertebrate components. There are several potential reasons for this, most of which relate to differences in data resolution between the full and sub-assemblages. However, in terms of major trends, both methods reveal a relatively greater abundance of invertebrate to vertebrate taxa at each site in the Late period, as well as a significantly heavier emphasis on planaxis snails, sea urchins, and tunas at Sabazan. Nerites and chitons are clearly an extremely important prey item at both sites.

To facilitate a more robust analysis of the combined vertebrate and invertebrate assemblage, I collapsed the data into their respective classes. Chi square results are statistically significant, driven by a significantly greater abundance of chitons at Grand Bay and relatively more sea urchins at Sabazan (Table 6.6). These results underscore the earlier findings. Chiton and sea urchin exploitation is fundamentally different between the sites for the Late period, even at higher levels of analysis. Otherwise, when measured at the class level, overall exploitation of fish, mammals, herpetofauna, birds, bivalves, gastropods, and decapods is comparable between sites.

6.2 Comparison of Faunal Diversity

Sequential pairwise *t*-tests of diversity (Magurran 1988) were used to compare Shannon-Weiner diversity indices between the two sites. Significant test results are indicated in bold print in Table 6.7 for cases where *p* falls below the designated Benjamini–Hochberg corrected α (Waite and Campbell 2006). For the invertebrate assemblage, diversity is significantly lower in the Early period at Sabazan compared to Grand Bay. This probably reflects nothing more than the extremely small sample from Sabazan for this period, which is unlikely to be representative of the archaeological population. These results, therefore, cannot support any firm conclusions about differences in diversity between the two sites early in their occupation.

Invertebrate diversity index values for Grand Bay's Middle-L003 period and for Sabazan's Middle period also differ significantly from each other. This is due to the comparatively low invertebrate diversity and evenness values for the Middle-L003 deposits (Table 5.10)—the lowest encountered at the site—and is consistent with the other unusual findings for this sample (see Chapter 5). Although it is not clear why, evidently the activities represented in this deposit are different from the zooarchaeological signature of other nearby deposits representing the same period. They may relate to the large pit/hearth feature (F0179) located in close proximity to the excavation units from which the samples derive (Figure 4.23B).

Lastly, collective vertebrate and invertebrate diversity for the Late period is significantly greater at Sabazan. However, when the separate vertebrate and invertebrate assemblages are each compared, no statistically significant difference is registered (Table 6.7). It is not clear why these disparate results occur. It may relate to differences between sites in the relative contribution of invertebrate and vertebrate components to the whole assemblage. If this is the case, tests of diversity measures conducted at separate vertebrate and invertebrate levels are probably a more reliable reflection of site comparability. With the exception of the anomalous findings for Grand

Bay's Middle-L003 period, overall these data suggest similar degrees of faunal diversity between the sites.

6. 3 Comparison of Habitat Use

Here, I explore the comparative use of environmental patches for vertebrates and invertebrates collectively as well as for the separate fish assemblage. The data for the overall habitat comparison come from the MNI-based datasets provided in Tables 5.20 and 5.29, which are based on the vertebrate-invertebrate sub-assemblages for each site (Tables 5.8 and 5.23). Comparison of fishing habitats exploited is based on the full fish assemblage (MNI data) for each site.

The chi square test is insignificant for differences between levels of exploitation between habitats at each site (Table 6.8), despite the appearance of a slightly heavier emphasis on coral reef taxa relative to inshore/shallow water species at Grand Bay (Figures 5.17 and 5.33). Significant differences are detected between Grand Bay's Late period and the Final period at Sabazan, where coral reef taxa are less heavily fished.

The chi square test for fish habitats in the Late period is statistically significant (Table 6.9). Fishing of inshore and shallow water habitats is emphasized significantly more at Grand Bay. Most likely, this is due to the significantly greater abundance of inshore/shallow water jacks and scads, especially *S. crumenophthalmus*, at Grand Bay during this period (Table 6.3). NISP-based tests are insignificant.

6.4 Summary of Results from the Intersite Comparisons

The habitat comparisons suggest that at both Grand Bay and Sabazan, the five major environmental patches were each fished, hunted, and shellfished to a similar degree. When combined with the earlier statistical assessments, the data indicate variation in taxon preference within habitat patches. For example, both sites exhibit similar levels of pelagic fishing, but at Sabazan, tuna species, particularly *Auxis* sp., *Thunnus* sp., and *Katsuwonus pelamis*, were targeted. At Grand Bay, herrings (Clupeidae) seemed to have been the pelagic fish of choice. The rough scad, *T. lathami*, is the second most important pelagic species at Sabazan overall, but is not recorded for Grand Bay (Tables 5.7 and 5.22).

Levels of coral reef exploitation and inshore/shallow water exploitation are also similar between sites during the Late period. At both locations, the principal coral reef taxa captured are parrotfish and surgeonfish. Parrotfish, however, were far more heavily emphasized at Sabazan compared to other reef fish. By contrast, at Grand Bay exploitation of the top ranking coral reef fish—parrotfish, grunts, and surgeonfish—is more equitable. Inshore and shallow water habitat exploitation at Grand Bay emphasized fish over invertebrate taxa, while at Sabazan, vertebrate and invertebrate taxa are about equally represented. This is reflected in the significantly higher quantities of sea urchin at Sabazan (Table 6.6) and the significantly greater abundance at Grand Bay of inshore/shallow water fish, specifically jacks/scads (Tables 6.3 and 6.9).

Both Sabazan and Grand Bay exhibit an increasing reliance on rocky intertidal taxa with a major focus on nerites and chitons. However, chitons, along with slipper snails and turbans/top snails, including *C. pica*, were more important at Grand Bay than Sabazan. At the latter site, turbans/top snails decline over time and are replaced by sea urchins and the much smaller planaxis snail, consistent with earlier findings (Table 5.16).

Of all the habitats exploited, the terrestrial environment seems to show the most consistency between the sites in terms of taxonomic composition and MNI-based relative abundance. There are some slight differences in mammals between the sites, but for both locations, all identified mammalian taxa are either introduced or commensal species. Armadillo remains were identified at Sabazan, but not at Grand Bay, while peccary and guinea pig have been recorded for Grand Bay—they are not part of the analyzed assemblage—but are not present at Sabazan (Giovas et al. 2012). At both sites, however, these taxa are quite rare overall. Among terrestrial invertebrates, tests suggest that Gecarcinidae were more heavily exploited at Sabazan during the Middle period (Table 6.4), but given the low rate of identification for decapods and the insignificant difference for this taxon in the class-based comparisons between the two sites (Table 6.6), this conclusion should be treated with caution.

In general, the similarities in zooarchaeological pattering observed for each site are consistent with foragers living in similar environments, informed by the same cultural prescriptions about resource exploitation and use. Differences exist between the sites, however, in terms of which specific taxa were targeted and the degree to which some species were emphasized over others. The following chapter explores the potential role that anthropogenic environmental impacts might play in accounting for these differences.

Table 6.1 Top ranking vertebrate taxa at Sabazan and Grand Bay based on relative abundance of MNI.

Most Abundant VertebrateTaxa by Rank at Grand Bay and Sabazan

Grand Bay

Early Period

N/A

Middle-L005 Period

N/A

Middle-L003 Period

N/A

Late Period

Taxon	Common Name	Rank	MNI	% MNI
Carangidae	jack, scad	1	28	23.3
Scaridae	parrotfish	2	18	15.0
Haemulidae	grunt	3	14	11.7
Acanthuridae	surgeonfish	4	11	9.2
Others			49	40.8
Total			120	100.0

Sabazan

Early Period

Taxon	Common Name	Rank	MNI	% MNI
Scaridae	parrotfish	1	3	21.4
Carangidae	jack, scad	2.5	2	14.3
Oryzomyini	rice rat	2.5	2	14.3
Others			7	50.0
Total			14	100.0

Middle Period

Taxon	Common Name	Rank	MNI	% MNI
Carangidae	jack, scad	1	62	28.1
Scaridae	parrotfish	2	31	14.0
Scombridae	tuna	3	17	7.7
Acanthuridae	sugeonfish	4	12	5.4
Others			99	44.8
Total			221	100.0

Late Period

Taxon	Common Name	Rank	MNI	% MNI
Scaridae	parrotfish	1	33	27.7
Carangidae	jack, scad	2	13	10.9
Scombridae	tuna	3	12	10.1
Acanthuridae	sugeonfish	4	8	6.7
Others			53	44.5
Total			119	100.0

Final Period

Taxon	Common Name	Rank	MNI	% MNI
Carangidae	jack, scad	1	18	19.6
Scaridae	parrotfish	2	11	12.0
Scombridae	tuna	4	6	6.5
Acanthuridae	sugeonfish	4	6	6.5
Haemulidae	grunt	4	6	6.5
Others			45	48.9
Total			92	100.0

Table 6.2 Top ranking invertebrate taxa at Sabazan and Grand Bay based on relative abundance of MNI. Non-dietary taxa excluded.

Most Abundant InvertebrateTaxa by Rank at Grand Bay and Sabazan

Grand Bay

Early Period

Taxon	Common Name	Rank	MNI	% MNI
Chitonidae	chiton	1	16	18.0
Calyptraeidae	slipper snail	2	14	15.7
Turbinidae	turban, top snail	3	9	10.1
Psammobiidae	sunset clam	4	8	9.0
Others			42	47.2
Total			89	100.0

Middle-L005 Period

Taxon	Common Name	Rank	MNI	% MNI
Neritidae	nerite	1	38	33.0
Chitonidae	chiton	2	24	20.9
Turbinidae	turban, top snail	3	11	9.6
Calyptraeidae	slipper snail	4	10	8.7
Others			32	27.8
Total			115	100.0

Middle-L003 Period

Taxon	Common Name	Rank	MNI	% MNI
Neritidae	nerite	1	104	65.8
Chitonidae	chiton	2	19	12.0
Turbinidae	turban, top snail	3.5	7	4.4
Calyptraeidae	slipper snail	3.5	7	4.4
Others			21	13.3
Total			158	100.0

Late Period

Taxon	Common Name	Rank	MNI	% MNI
Neritidae	nerite	1	198	35.5
Chitonidae	chiton	2	121	21.7
Turbinidae	turban, top snail	3	76	13.6
Calyptraeidae	slipper snail	4	43	7.7
Others			119	21.4
Total			557	100.0

Sabazan

Early Period

Taxon	Common Name	Rank	MNI	% MNI
Neritidae	nerite	1	6	35.3
Chitonidae	chiton	3	2	11.8
Turbinidae	turban, top snail	3	2	11.8
Pleurodontidae	pleurodonte land snail	3	2	11.8
Others			5	29.4
Total			17	100.0

Middle Period

Taxon	Common Name	Rank	MNI	% MNI
Neritidae	nerite	1	68	40.0
Chitonidae	chiton	2	20	11.8
Gecarcinidae	land crab	3	12	7.1
Turbinidae	turban, top snail	4	10	5.9
Others			60	35.3
Total			170	100.0

Late Period

Taxon	Common Name	Rank	MNI	% MNI
Neritidae	nerite	1	28	43.8
Chitonidae	chiton	2	8	12.5
Planaxidae	planaxis	3	6	9.4
Turbinidae	turban, top snail	4.5	5	7.8
Echinoidea	sea urchin	4.5	5	7.8
Others			12	18.8
Total			64	100.0

Final Period

Taxon	Common Name	Rank	MNI	% MNI
Neritidae	nerite	1	77	63.1
Chitonidae	chiton	2	13	10.7
Planaxidae	planaxis	3.5	6	4.9
Echinoidea	sea urchin	3.5	6	4.9
Others			20	16.4
Total			122	100.0

Table 6.3 Chi square tests comparing Sabazan and Grand Bay’s vertebrate assemblages. Monte Carlo approximations (200,000 replicates) used to calculate *p*-values for chi square statistic. See text for explanation of table format.

Chi Square Tests for Grand Bay and Sabazan Vertebrates

Taxon	Common Name	Grand Bay Late Period MNI	Adjusted Residual	*p*	Sabazan Late Period MNI
Myliobatidae	eagle ray	–	1.006	>0.05	1
Acanthuridae	surgeonfish	11	-0.698	>0.05	8
Balistidae	triggerfish	2	0.837	>0.05	4
Belonidae	needlefish	1	-0.998	>0.05	–
Carangidae	jack, pompano, scad	28	**-2.544**	**0.011**	13
Clupeidae	herring, shad	8	-1.925	>0.05	2
Exocoetidae	flyingfish	1	0.006	>0.05	1
Haemulidae	grunt	14	**-2.133**	**0.033**	5
Hemiramphidae	halfbeak	–	1.006	>0.05	1
Holocentridae	squirrelfish	1	1.017	>0.05	3
Labridae	wrasse, hogfish	2	1.162	>0.05	5
Lutjanidae	snapper	6	-0.294	>0.05	5
Mullidae	goatfish	–	1.006	>0.05	1
Muraenidae	eel	1	-0.998	>0.05	–
Ostraciidae	boxfish	1	0.006	>0.05	1
Pomacentridae	damselfish	–	1.006	>0.05	1
Scaridae	parrotfish	18	**2.402**	**0.016**	33
Sciaenidae	weakfish	1	0.006	>0.05	1
Scombridae	tuna, mackerel	2	**2.771**	**0.006**	12
Serranidae	grouper, sea bass	4	0.353	>0.05	5
Sparidae	porgy	1	-0.998	>0.05	–
Columbidae	pigeon, dove	1	0.006	>0.05	1
Didelphidae	opossum	2	1.162	>0.05	5
Dasyproctidae	agouti	3	0.010	>0.05	3
Cricetidae:					
Oryzomyini	rice rat	6	-1.426	>0.05	2
Capromyidae	capromyid rodent	1	-0.998	>0.05	–
Cheloniidae	sea turtle	3	0.395	>0.05	4
Iguanidae	iguana	1	0.588	>0.05	2
Amphibia	frog, toad	1	-0.998	>0.05	–
Total		120			119
		χ^2 = 41.29		p = 0.018	

Taxon	Common Name	Grand Bay Late Period MNI	Adjusted Residual	*p*	Sabazan Final Period MNI
Acanthuridae	surgeonfish	11	-0.703	>0.05	6
Balistidae	triggerfish	2	0.758	>0.05	3
Belonidae	needlefish	1	0.819	>0.05	2
Carangidae	jack, pompano, scad	28	-0.660	>0.05	18
Chaetodontidae	butterflyfish	–	1.145	>0.05	1
Clupeidae	herring, shad	8	-0.724	>0.05	4
Diodontidae	porcupinefish	–	1.145	>0.05	1
Exocoetidae	flyingfish	1	0.819	>0.05	2
Haemulidae	grunt	14	-1.270	>0.05	6
Holocentridae	squirrelfish	1	0.189	>0.05	1
Labridae	wrasse, hogfish	2	0.758	>0.05	3
Lutjanidae	snapper	6	-0.622	>0.05	3
Mullidae	goatfish	–	1.145	>0.05	1
Muraenidae	eel	1	-0.878	>0.05	–
Ostraciidae	boxfish	1	0.189	>0.05	1
Pomacentridae	damselfish	–	1.623	>0.05	2
Scaridae	parrotfish	18	-0.639	>0.05	11
Sciaenidae	weakfish	1	-0.878	>0.05	–
Scombridae	tuna, mackerel	2	1.839	>0.05	6
Serranidae	grouper, sea bass	4	0.752	>0.05	5
Sparidae	porgy	1	-0.878	>0.05	–
Columbidae	pigeon, dove	1	0.819	>0.05	2
Didelphidae	opossum	2	0.758	>0.05	3
Dasyproctidae	agouti	3	0.746	>0.05	4
Cricetidae:					
Oryzomyini	rice rat	6	-1.070	>0.05	2
Capromyidae	capromyid rodent	1	-0.878	>0.05	–
Cheloniidae	sea turtle	3	-0.155	>0.05	2
Iguanidae	iguana	1	0.819	>0.05	2
Colubridae	snake	–	1.145	>0.05	1
Amphibia	frog, toad	1	-0.878	>0.05	–
		120			92
		χ^2 = 24.99		p = 0.758	

Table 6.3 Continued

Chi Square Tests for Grand Bay and Sabazan Vertebrates Continued

Taxon	Common Name	Grand Bay Late Period NISP	Adjusted Residual	*p*	Sabazan Late Period NISP
Myliobatidae	eagle ray	–	1.364	>0.05	1
Acanthuridae	surgeonfish	236	**-3.735**	**<0.001**	82
Balistidae	triggerfish	136	**-7.114**	**<0.001**	12
Belonidae	needlefish	2	-1.037	>0.05	–
Carangidae	jack, pompano, scad	79	-0.059	>0.05	42
Clupeidae	herring, shad	331	**-11.162**	**<0.001**	36
Exocoetidae	flyingfish	28	**-2.686**	**0.007**	4
Haemulidae	grunt	50	-0.464	>0.05	24
Hemiramphidae	halfbeak	–	**3.346**	**<0.001**	6
Holocentridae	squirrelfish	5	0.151	>0.05	3
Labridae	wrasse, hogfish	2	**3.525**	**<0.001**	10
Lutjanidae	snapper	12	0.475	>0.05	8
Mullidae	goatfish	–	**3.054**	**0.002**	5
Muraenidae	eel	1	-0.733	>0.05	–
Ostraciidae	boxfish	4	-0.702	>0.05	1
Pomacentridae	damselfish	–	**2.731**	**0.006**	4
Scaridae	parrotfish	240	**2.360**	**0.018**	160
Sciaenidae	weakfish	1	0.446	>0.05	1
Scombridae	tuna, mackerel	39	**14.778**	**<0.001**	169
Serranidae	grouper, sea bass	10	**6.633**	**<0.001**	39
Sparidae	porgy	3	-1.271	>0.05	–
Columbidae	pigeon, dove	1	0.446	>0.05	1
Didelphidae	opossum	11	**2.878**	**0.004**	17
Dasyproctidae	agouti	15	**2.580**	**0.010**	19
Cricetidae: Oryzomyini	rice rat	21	-1.693	>0.05	5
Capromyidae	capromyid rodent	1	-0.733	>0.05	–
Cheloniidae	sea turtle	89	1.187	>0.05	58
Iguanidae	iguana	2	1.176	>0.05	3
Amphibia	frog, toad	2	-1.037	>0.05	–
Total		1321			710

$\chi^2 = 479.85$ $p < 0.001$

Taxon	Common Name	Grand Bay Late Period NISP	Adjusted Residual	*p*	Sabazan Final Period NISP
Acanthuridae	surgeonfish	236	**-6.190**	**<0.001**	65
Balistidae	triggerfish	136	**-8.501**	**<0.001**	6
Belonidae	needlefish	2	0.512	>0.05	2
Carangidae	jack, pompano, scad	79	1.183	>0.05	58
Chaetodontidae	butterflyfish	–	1.289	>0.05	1
Clupeidae	herring, shad	331	**-12.527**	**<0.001**	31
Diodontidae	porcupinefish	–	1.289	>0.05	1
Exocoetidae	flyingfish	28	**-2.421**	**0.016**	6
Haemulidae	grunt	50	0.127	>0.05	31
Holocentridae	squirrelfish	5	1.163	>0.05	6
Labridae	wrasse, hogfish	2	1.851	>0.05	5
Lutjanidae	snapper	12	0.500	>0.05	9
Mullidae	goatfish	–	1.823	>0.05	2
Muraenidae	eel	1	-0.776	>0.05	–
Ostraciidae	boxfish	4	-0.216	>0.05	2
Pomacentridae	damselfish	–	**2.884**	**0.004**	5
Scaridae	parrotfish	240	**-2.453**	**0.014**	112
Sciaenidae	weakfish	1	-0.776	>0.05	–
Scombridae	tuna, mackerel	39	**9.548**	**<0.001**	111
Serranidae	grouper, sea bass	10	**6.014**	**<0.001**	38
Sparidae	porgy	3	-1.345	>0.05	–
Columbidae	pigeon, dove	1	1.546	>0.05	3
Didelphidae	opossum	11	**6.094**	**<0.001**	40
Dasyproctidae	agouti	15	**3.606**	**<0.001**	27
Cricetidae: Oryzomyini	rice rat	21	**-2.553**	**0.011**	3
Capromyidae	capromyid rodent	1	-0.776	>0.05	–
Cheloniidae	sea turtle	89	**13.132**	**<0.001**	219
Iguanidae	iguana	2	**3.729**	**<0.001**	12
Colubridae	snake	–	1.289	>0.05	1
Amphibia	frog, toad	2	-1.098	>0.05	–
		1321			796

$\chi^2 = 608.24$ $p < 0.001$

Table 6.4 Chi square tests comparing Sabazan and Grand Bay's invertebrate assemblages. Non-dietary taxa, excluded. Monte Carlo approximations (200,000 replicates) used to calculate *p*-values for chi square statistic. See text for explanation of table format.

Chi Square Tests for Grand Bay and Sabazan Invertebrates

Taxon	Common Name	Grand Bay Early Period MNI	Adjusted Residual	*p*	Sabazan Early Period MNI	Taxon	Common Name	Grand Bay Middle-L005 Period MNI	Adjusted Residual	*p*	Sabazan Middle Period MNI
Echinoidea	sea urchin	2	0.828	>0.05	1	Echinoidea	sea urchin	2	1.335	>0.05	8
Cardiidae	cockle	1	-0.439	>0.05	–	Arcidae	ark	–	0.824	>0.05	1
Isognomonidae	flat tree oyster	1	-0.439	>0.05	–	Cardiidae	cockle	–	1.432	>0.05	3
Lucinidae	lucine	2	-0.624	>0.05	–	Donacidae	coquina	2	-0.934	>0.05	1
Mytilidae	mussel	2	-0.624	>0.05	–	Lucinidae	lucine	1	0.249	>0.05	2
Psammobiidae	sunset clam	8	-0.421	>0.05	1	Mytilidae	mussel	2	1.335	>0.05	8
Tellinidae	tellin	2	-0.624	>0.05	–	Plicatulidae	kitten's paw	–	1.167	>0.05	2
Orthalicidae	tree snail	2	0.828	>0.05	1	Psammobiidae	sunset clam	7	**-2.757**	**0.006**	1
Pleurodontidae	terrestrial snail	1	2.424	0.015	2	Tellinidae	tellin	–	1.167	>0.05	2
Bullidae	bubble	4	-0.891	>0.05	–	Orthalicidae	tree snail	6	-0.696	>0.05	6
Calyptraeidae	slipper snail	14	-1.755	>0.05	–	Pleurodontidae	terrestrial snail	1	0.630	>0.05	3
Collumbellidae	dove snail	1	-0.439	>0.05	–	Strophocheilidae	giant terrestrial snail	–	0.824	>0.05	1
Fissurellidae	keyhole limpet	2	-0.624	>0.05	–	Bullidae	bubble	2	-0.396	>0.05	2
Littorinidae	periwinkle	4	0.247	>0.05	1	Calyptraeidae	slipper snail	10	-1.601	>0.05	7
Modulidae	modulus	1	-0.439	>0.05	–	Cassidae	helmet	–	1.167	>0.05	2
Nassariidae	nassa	1	-0.439	>0.05	–	Collumbellidae	dove snail	–	0.824	>0.05	1
Neritidae	nerite	7	3.159	0.002	6	Fissurellidae	keyhole limpet	1	-0.279	>0.05	1
Olividae	planaxis	2	-0.624	>0.05	–	Littorinidae	periwinkle	3	-0.904	>0.05	2
Phasianellidae	pheasant snail	3	-0.768	>0.05	–	Marginellidae	margin snail	1	-1.218	>0.05	–
Turbinidae	turban, top snail	9	0.205	>0.05	2	Muricidae	murex	1	1.195	>0.05	5
Chitonidae	chiton	16	-0.625	>0.05	2	Neritidae	nerite	38	1.192	>0.05	68
Gecarcinidae	terrestrial crab	3	0.498	>0.05	1	Olividae	olive	1	-0.279	>0.05	1
Grapsidae	shore crab	1	-0.439	>0.05	–	Planaxidae	planaxis	–	0.824	>0.05	1
						Turbinidae	turban, top snail	11	-1.168	>0.05	10
						Chitonidae	chiton	24	**-2.087**	**0.037**	20
						Gecarcinidae	terrestrial crab	2	**2.039**	**0.042**	12
Total		89			17			115			170
			χ^2 = 23.69	p = 0.374					χ^2 = 37.59	p = 0.022	

Table 6.4 Continued

Chi Square Tests for Grand Bay and Sabazan Invertebrates Continued

Taxon	Common Name	Grand Bay Middle-L003 Period MNI	Adjusted Residual	*p*	Sabazan Middle Period MNI
Echinoidea	sea urchin	3	1.411	>0.05	8
Arcidae	ark	–	0.966	>0.05	1
Cardiidae	cockle	–	1.677	>0.05	3
Donacidae	coquina	–	0.966	>0.05	1
Lucinidae	lucine	1	0.517	>0.05	2
Mytilidae	mussel	1	**2.256**	**0.024**	8
Pectinidae	scallop	1	-1.039	>0.05	–
Plicatulidae	kitten's paw	–	1.368	>0.05	2
Psammobiidae	sunset clam	1	-0.052	>0.05	1
Tellinidae	tellin	1	0.517	>0.05	2
Orthalicidae	tree snail	1	1.814	>0.05	6
Pleurodontidae	terrestrial snail	1	0.933	>0.05	3
Strophocheilidae	giant terrestrial snail	–	0.966	>0.05	1
Buccinidae	whelk	1	-1.039	>0.05	–
Bullidae	bubble	2	-0.074	>0.05	2
Calyptraeidae	slipper snail	7	-0.140	>0.05	7
Cassidae	helmet	–	1.368	>0.05	2
Collumbellidae	dove snail	–	0.966	>0.05	1
Fissurellidae	keyhole limpet	–	0.966	>0.05	1
Littorinidae	periwinkle	1	0.517	>0.05	2
Muricidae	murex	1	1.559	>0.05	5
Nassariidae	nassa	1	-1.039	>0.05	–
Neritidae	nerite	104	**-4.679**	**<0.001**	68
Olividae	olive	1	-0.052	>0.05	1
Phasianellidae	pheasant snail	1	-1.039	>0.05	–
Planaxidae	planaxis	3	-1.080	>0.05	1
Turbinidae	turban, top snail	7	0.593	>0.05	10
Chitonidae	chiton	19	-0.073	>0.05	20
Gecarcinidae	terrestrial crab	–	**3.402**	**<0.001**	12
Total		158			170
		χ^2 = 52.68		p < 0.001	

Taxon	Common Name	Grand Bay Late Period MNI	Adjusted Residual	*p*	Sabazan Late Period MNI
Echinoidea	sea urchin	5	**4.162**	**<0.001**	5
Donacidae	coquina	3	0.970	>0.05	1
Lucinidae	lucine	3	0.970	>0.05	1
Mytilidae	mussel	6	0.348	>0.05	1
Plicatulidae	kitten's paw	1	-0.339	>0.05	–
Psammobiidae	sunset clam	4	-0.680	>0.05	–
Tellinidae	tellin	2	-0.480	>0.05	–
Veneridae	venus	3	-0.589	>0.05	–
Orthalicidae	tree snail	17	0.032	>0.05	2
Pleurodontidae	terrestrial snail	14	0.292	>0.05	2
Strophocheilidae	giant terrestrial snail	1	1.849	>0.05	1
Bullidae	bubble	3	-0.589	>0.05	–
Calyptraeidae	slipper snail	43	**-2.304**	**0.021**	–
Cassidae	helmet	1	-0.339	>0.05	–
Cypraeidae	cowrie	1	-0.339	>0.05	–
Fasciolariidae	tulip snail	2	-0.480	>0.05	–
Fissurellidae	keyhole limpet	5	-0.761	>0.05	–
Littorinidae	periwinkle	20	-0.850	>0.05	1
Lottiidae	limpet	1	-0.339	>0.05	–
Marginellidae	margin snail	1	-0.339	>0.05	–
Muricidae	murex	9	-0.032	>0.05	1
Nassariidae	nassa	1	-0.339	>0.05	–
Naticidae	natica	1	-0.339	>0.05	–
Neritidae	nerite	198	1.292	>0.05	28
Olividae	olive	3	-0.589	>0.05	–
Planaxidae	planaxis	2	**6.058**	**<0.001**	6
Ranellidae	triton	2	-0.480	>0.05	–
Turbinidae	turban, top snail	76	-1.312	>0.05	5
Chitonidae	chiton	121	-1.723	>0.05	8
Gecarcinidae	terrestrial crab	5	0.515	>0.05	1
Portunidae	swimming crab	3	0.970	>0.05	1
Total		557			64
		χ^2 = 74.06		p = 0.001	

Table 6.4 Continued

Chi Square Tests for Grand Bay and Sabazan Invertebrates Continued

Taxon	Common Name	Grand Bay Late Period MNI	Adjusted Residual	*p*	Sabazan Final Period MNI
Echinoidea	sea urchin	5	**3.186**	**0.001**	6
Cardiidae	ark	–	**2.138**	**0.033**	1
Donacidae	coquina	3	**2.714**	**0.007**	4
Lucinidae	lucine	3	0.367	>0.05	1
Mytilidae	mussel	6	-0.255	>0.05	1
Plicatulidae	kitten's paw	1	-0.468	>0.05	–
Psammobiidae	sunset clam	4	-0.939	>0.05	–
Tellinidae	tellin	2	-0.663	>0.05	–
Veneridae	venus	3	0.367	>0.05	1
Orthalicidae	tree snail	17	-1.390	>0.05	1
Pleurodontidae	terrestrial snail	14	-1.153	>0.05	1
Strophocheilidae	giant terrestrial snail	1	1.182	>0.05	1
Bullidae	bubble	3	-0.812	>0.05	–
Calyptraeidae	slipper snail	43	**-3.171**	**0.002**	–
Cassidae	helmet	1	-0.468	>0.05	–
Collumbellidae	dove snail	–	**2.138**	**0.033**	1
Cypraeidae	cowrie	1	-0.468	>0.05	–
Fasciolariidae	tulip snail	2	-0.663	>0.05	–
Fissurellidae	keyhole limpet	5	-1.050	>0.05	–
Littorinidae	periwinkle	20	-1.601	>0.05	1
Lottiidae	limpet	1	-0.468	>0.05	–
Marginellidae	margin snail	1	-0.468	>0.05	–
Muricidae	murex	9	-1.413	>0.05	–
Nassariidae	nassa	1	-0.468	>0.05	–
Naticidae	natica	1	-0.468	>0.05	–
Neritidae	nerite	198	**5.618**	**<0.001**	77
Olividae	olive	3	-0.812	>0.05	–
Planaxidae	pheasant snail	2	**4.227**	**<0.001**	6
Ranellidae	planaxis	2	-0.663	>0.05	–
Turbinidae	turban, top snail	76	**-3.217**	**0.001**	4
Chitonidae	chiton	121	**-2.782**	**0.005**	13
Gecarcinidae	terrestrial crab	5	0.735	>0.05	2
Portunidae	swimming crab	3	0.367	>0.05	1
Total		557			122

$\chi^2 = 103.76$ $p < 0.001$

Table 6.5 Chi square tests comparing Sabazan and Grand Bay's vertebrate and invertebrate assemblages. Non-dietary taxa excluded. Monte Carlo approximations (200,000 replicates) used to calculate *p*-values for chi square statistic. See text for explanation of table format.

Chi Square Tests for Grand Bay and Sabazan Vertbrates and Invertebrates

Taxon	Common Name	Grand Bay Late Period MNI	Adjusted Residual	*p*	Sabazan Late Period MNI
Acanthuridae	surgeonfish	9	-0.920	>0.05	2
Balistidae	triggerfish	2	0.097	>0.05	1
Belonidae	needlefish	1	-0.668	>0.05	–
Carangidae	jack, pompano, scad	19	-0.443	>0.05	7
Clupeidae	herring, shad	6	-0.358	>0.05	2
Exocoetidae	flyingfish	1	0.591	>0.05	1
Haemulidae	grunt	7	-0.563	>0.05	2
Hemiramphidae	halfbeak	–	1.502	>0.05	1
Holocentridae	squirrelfish	1	0.591	>0.05	1
Labridae	wrasse, hogfish	2	0.097	>0.05	1
Lutjanidae	snapper	5	-0.755	>0.05	1
Mullidae	goatfish	–	1.502	>0.05	1
Muraenidae	eel	1	-0.668	>0.05	–
Ostraciidae	boxfish	1	0.591	>0.05	1
Pomacentridae	damselfish	–	1.502	>0.05	1
Scaridae	parrotfish	13	-0.664	>0.05	4
Scombridae	tuna, mackerel	1	1.929	>0.05	3
Serranidae	grouper, sea bass	3	-0.252	>0.05	1
Sparidae	porgy	1	-0.668	>0.05	–
Columbidae	pigeon, dove	1	-0.668	>0.05	–
Didelphidae	opossum	2	0.097	>0.05	1
Dasyproctidae	agouti	1	0.591	>0.05	1
Cricetidae: Oryzomyini	rice rat	3	-0.252	>0.05	1
Capromyidae	capromyid rodent	1	-0.668	>0.05	–
Cheloniidae	sea turtle	1	0.591	>0.05	1
Iguanidae	iguana	1	0.591	>0.05	1
Amphibia	frog, toad	1	-0.668	>0.05	–
Echinoidea	sea urchin	1	**2.816**	**0.005**	5
Donacidae	coquina	–	1.502	>0.05	1
Lucinidae	lucine	1	0.591	>0.05	1
Mytilidae	mussel	–	1.502	>0.05	1
Psammobiidae	sunset clam	1	-0.668	>0.05	–
Tellinidae	tellin	1	-0.668	>0.05	–
Orthalicidae	tree snail	2	0.839	>0.05	2
Pleurodontidae	terrestrial snail	1	1.353	>0.05	2
Strophocheilidae	giant terrestrial snail	–	1.502	>0.05	1
Calyptraeidae	slipper snail	7	-1.783	>0.05	–
Littorinidae	periwinkle	4	-0.526	>0.05	1
Marginellidae	margin snail	1	-0.668	>0.05	–
Muricidae	murex	4	-0.526	>0.05	1
Naticidae	natica	1	-0.668	>0.05	–
Neritidae	nerite	40	**2.091**	**0.037**	28
Planaxidae	planaxis	1	**3.184**	**0.002**	6
Turbinidae	turban, top snail	37	**-2.839**	**0.005**	5
Chitonidae	chiton	38	**-2.122**	**0.034**	8
Gecarcinidae	terrestrial crab	1	0.591	>0.05	1
Grapsidae	shore crab	–	1.502	>0.05	1
Portunidae	swimming crab	–	1.502	>0.05	1
Total		225			100
		χ^2 = 69.67		*p* = 0.018	

Taxon	Common Name	Grand Bay Late Period MNI	Adjusted Residual	*p*	Sabazan Final Period MNI
Acanthuridae	surgeonfish	9	**-2.052**	**0.040**	1
Balistidae	triggerfish	2	-0.290	>0.05	1
Belonidae	needlefish	1	0.243	>0.05	1
Carangidae	jack, pompano, scad	19	-1.050	>0.05	9
Chaetodontidae	butterflyfish	–	1.187	>0.05	1
Clupeidae	herring, shad	6	-1.478	>0.05	1
Exocoetidae	flyingfish	1	0.243	>0.05	1
Haemulidae	grunt	7	-1.191	>0.05	2
Holocentridae	squirrelfish	1	-0.844	>0.05	–
Labridae	wrasse, hogfish	2	-0.290	>0.05	1
Lutjanidae	snapper	5	-1.247	>0.05	1
Mullidae	goatfish	–	1.187	>0.05	1
Muraenidae	eel	1	-0.844	>0.05	–
Ostraciidae	boxfish	1	0.243	>0.05	1
Pomacentridae	damselfish	–	1.187	>0.05	1
Scaridae	parrotfish	13	-1.543	>0.05	4
Scombridae	tuna, mackerel	1	1.364	>0.05	3
Serranidae	grouper, sea bass	3	0.423	>0.05	3
Sparidae	porgy	1	-0.844	>0.05	–
Columbidae	pigeon, dove	1	0.243	>0.05	1
Didelphidae	opossum	2	-0.290	>0.05	1
Dasyproctidae	agouti	1	0.243	>0.05	1
Cricetidae: Oryzomyini	rice rat	3	-0.676	>0.05	1
Capromyidae	capromyid rodent	1	-0.844	>0.05	–
Cheloniidae	sea turtle	1	0.243	>0.05	1
Iguanidae	iguana	1	0.243	>0.05	1
Amphibia	frog, toad	1	-0.844	>0.05	–
Echinoidea	sea urchin	1	**2.392**	**0.017**	6
Cardiidae	cockle	–	1.187	>0.05	1
Donacidae	coquina	–	**2.384**	**0.017**	4
Lucinidae	lucine	1	0.243	>0.05	1
Mytilidae	mussel	–	1.187	>0.05	1
Psammobiidae	sunset clam	1	-0.844	>0.05	–
Tellinidae	tellin	1	-0.844	>0.05	–
Veneridae	venus	–	1.187	>0.05	1
Orthalicidae	tree snail	2	-0.290	>0.05	1
Pleurodontidae	terrestrial snail	1	0.243	>0.05	1
Strophocheilidae	giant terrestrial snail	–	1.187	>0.05	1
Calyptraeidae	slipper snail	7	**-2.252**	**0.024**	–
Collumbellidae	dove snail	–	1.187	>0.05	1
Littorinidae	periwinkle	4	-0.985	>0.05	1
Marginellidae	margin snail	1	-0.844	>0.05	–
Muricidae	murex	4	-1.695	>0.05	–
Naticidae	natica	1	-0.844	>0.05	–
Neritidae	nerite	40	**6.380**	**<0.001**	77
Planaxidae	planaxis	1	**2.392**	**0.017**	6
Turbinidae	turban, top snail	37	**-4.371**	**<0.001**	4
Chitonidae	chiton	38	**-2.500**	**0.012**	13
Gecarcinidae	terrestrial crab	1	0.886	>0.05	2
Portunidae	swimming crab	–	1.187	>0.05	1
		225			160
		χ^2 = 112.10		*p* < 0.001	

Table 6.6 Chi square tests comparing Sabazan and Grand Bay's vertebrate and invertebrate assemblages at the class level. Fisher's exact test (Late-Late period comparison) and Monte Carlo approximations (200,000 replicates) (Late-Final period comparison) used to calculate *p*-values for chi square statistic. See text for explanation of table format.

Chi Square Tests for Grand Bay and Sabazan Vertebrate and Invertebrate Classes

Taxon	Common Name	Grand Bay Late Period MNI	Adjusted Residual	*p*	Sabazan Late Period MNI	Taxon	Common Name	Grand Bay Late Period MNI	Adjusted Residual	*p*	Sabazan Final Period MNI
Actinopterygii and Chondrichthyes	bony and cartilagenous fish	74	-0.291	>0.05	31	Actinopterygii and Chondrichthyes	bony and cartilagenous fish	74	**-2.575**	**0.010**	33
Aves	bird	1	-0.665	>0.05	–	Aves	bird	1	0.251	>0.05	1
Mammalia	mammal	7	-0.042	>0.05	3	Mammalia	mammal	7	-0.734	>0.05	3
Reptilia	repitle	3	1.040	>0.05	3	Reptilia	repitle	3	-0.059	>0.05	2
Amphibia	frogs, toads	1	-0.665	>0.05	–	Amphibia	frogs, toads	1	-0.840	>0.05	–
Echinoidea	sea urchin	1	**2.828**	**0.005**	5	Echinoidea	sea urchin	1	**2.409**	**0.016**	6
Bivalvia	clam, mussel	3	1.040	>0.05	3	Bivalvia	clam, mussel	3	**2.149**	**0.032**	8
Gastropoda	snail	100	0.316	>0.05	46	Gastropoda	snail	100	**2.621**	**0.009**	92
Polyplacophora	chiton	38	**-2.096**	**0.036**	8	Polyplacophora	chiton	38	**-2.457**	**0.014**	13
Decapoda	crab, lobster, shrimp	1	1.361	>0.05	2	Decapoda	crab, lobster, shrimp	1	1.377	>0.05	3
Total		229			101			229			161
		$\chi^2 = 16.60$		$p = 0.033$				$\chi^2 = 26.90$		$p < 0.001$	

Table 6.7 *T-test* for differences in Shannon-Weiner diversity (*H′*) between vertebrate, invertebrate, and combined assemblages from Sabazan and Grand Bay. Significance level (α) based on Benjamini-Hochberg correction.

		H′	*t*	df	*p*	α
Vertebrate	GB Late	1.122	-0.248	238.94	0.804	0.050
	SZ Late	1.137				
Invertebrate	GB Early	1.233	4.379	28.18	**<0.001**	0.025
	SZ Early	0.850				
	GB Middle-L005	0.961	-0.824	279.22	0.410	0.050
	SZ Middle	1.013				
	GB Middle-L003	0.620	-5.620	313.39	**<0.001**	0.013
	SZ Middle	1.013				
	GB Late	0.922	0.911	84.68	0.365	0.038
	SZ Late	0.859				
Vertebrate and Invertebrate	GB Late	1.160	-3.725	390.44	**<0.001**	0.050
	SZ Late	1.321				

Table 6.8 Chi square tests comparing habitat exploitation at Sabazan and Grand Bay. See text for explanation of table format.

Chi Square Tests for Habitat Exploitation at Grand Bay and Sabazan

Habitat Type	Grand Bay Late Period MNI	Adjusted Residual	*p*	Sabazan Late Period MNI	Habitat Type	Grand Bay Late Period MNI	Adjusted Residual	*p*	Sabazan Final Period MNI
Coral Reef Taxa	43	-1.187	>0.05	14	Coral Reef Taxa	43	**-2.668**	**0.008**	15
Inshore/Shallow Water Taxa	35	0.912	>0.05	20	Inshore/Shallow Water Taxa	35	-0.527	>0.05	22
Rocky Intertidal Taxa	121	-0.959	>0.05	49	Rocky Intertidal Taxa	121	1.733	>0.05	101
Pelagic Taxa	9	1.114	>0.05	7	Pelagic Taxa	9	1.469	>0.05	12
Terrestrial Taxa	15	1.278	>0.05	11	Terrestrial Taxa	15	-0.186	>0.05	10
Total	223			101		223			160
	χ^2 = 4.97		*p* = 0.290			χ^2 = 9.61		*p* = 0.048	

Table 6.9 Chi square tests comparing marine habitats fished at Sabazan and Grand Bay. See text for explanation of table format.

Chi Square Tests for Fish Habitat Exploitation at Grand Bay and Sabazan

Habitat Type	Grand Bay Late Period MNI	Adjusted Residual	*p*	Sabazan Late Period MNI
Coral Reef Taxa	59	1.615	>0.05	69
Inshore/Shallow Water Taxa	33	**-3.079**	**0.002**	14
Pelagic Taxa	12	1.423	>0.05	19
	104			102

χ^2 = 10.02 p = 0.007

Habitat Type	Grand Bay Late Period MNI	Adjusted Residual	*p*	Sabazan Final Period MNI
Coral Reef Taxa	59	-0.020	>0.05	43
Inshore/Shallow Water Taxa	33	**-2.886**	**0.004**	10
Pelagic Taxa	12	**3.135**	**0.002**	23
	104			76

χ^2 = 14.26 p = 0.001

Habitat Type	Grand Bay Late Period NISP	Adjusted Residual	*p*	Sabazan Late Period NISP
Coral Reef Taxa	692	-0.526	>0.05	353
Inshore/Shallow Water Taxa	89	-0.177	>0.05	45
Pelagic Taxa	400	0.644	>0.05	218
Total	1181			616

χ^2 = 0.42 p = 0.812

Habitat Type	Grand Bay Late Period NISP	Adjusted Residual	*p*	Sabazan Final Period NISP
Coral Reef Taxa	692	-0.272	>0.05	283
Inshore/Shallow Water Taxa	89	1.411	>0.05	47
Pelagic Taxa	400	-0.534	>0.05	159
Total	1181			489

χ^2 = 2.05 p = 0.359

Chapter 7

EVIDENCE FOR ANTHROPOGENIC ENVIRONMENTAL IMPACTS: *NERITA TESSELLATA* EXPLOITATION OVER TIME

What is a snail's fury?

-Thom Gunn, *Consider the Snail*

7.1 Evidence for Environmental Impacts: **Nerita tessellata** *Exploitation*

Zooarchaeologists routinely employ a decrease in the mean shell size of molluscs from archaeological contexts as evidence for intensifying human predation pressure on shellfish populations (e.g., Allen 2012; Braje et al. 2012; Erlandson et al. 2008, 2011; Erlandson and Rick 2010; Faulkner 2009; Jerardino 1997; Lasiak 1991; Mannino and Thomas, 2001, 2002; Milner et al. 2007; Morrison and Hunt 2007; Morrison and Cochrane 2008; Prummel 2005; Stager and Chen 1996). These studies rest on the connection between selective exploitation of larger individuals and the correlation between age and size previously discussed. Targeted harvest of older (larger) individuals is expected to depress the mean size of a population, but may result in many other life history and ecological consequences for prey organisms if predation pressure is significant (Fenberg and Roy 2007, 2012).

At Sabazan and Grand Bay, archaeomalacological samples indicate increasing nerite exploitation based on both relative and absolute abundances. In this chapter, I investigate the potential for human impact on nerite populations by assessing nerite shell size over time at both sites. I focus on *Nerita tessellata* for this study, as this species is the most abundant nerite and is responsible for most of the increase in *Nerita* snails over time.

7.2 Biological Considerations in the Size Analysis of Archaeological **Nerita tessellata**

7.2.1 Life History and Ecology of Nerita tessellata

The tessellated or checkered nerite, *Nerita tessellata*, is the smallest of the major nerite species identified at Sabazan and Grand Bay. This Western Atlantic gastropod is found along warm water coastlines from Florida to Texas, throughout the Caribbean and south to Brazil (Abbott and Morris 1995; Rehder 1981; Rosenberg 2009). The species inhabits rocky shorelines typically just at or above the tide line, but sometimes immersed up to 0.5 m (Axelsen 1968; Bovbjerg 1984; Chislett 1969). Snails may be easily collected from these locations by hand, especially at low tide.

Nerita tessellata is readily recognized by the black and white checkered markings that give it its name. The shell is sturdy, thick and globose, with spiral cords, and a low apex (Figure 7.1). The D-shaped aperture exhibits a well-defined parietal area marked with small irregular beads and two inconspicuous teeth on the columellar margin. Snails reach a reported maximum length of 25 mm (Rosenberg 2009), but specimens are typically less than 20 mm (Axelsen 1968; Lewis 1971). Like other nerite species, as the tessellated nerite grows it resorbs posterior portions of its shell, enlarging the interior chamber from within to accommodate its relatively ample visceral mass (Vermeij 1987). This process also allows the snail to maintain a reservoir of water within the shell, a key adaptation that facilitates evaporative cooling and prevents desiccation with exposure above the tide line (Vermeij 1973).

The marked habitat zonation exhibited by this species and its congeners, *N. peloronta* and *N. versiclor*, is well documented (Axelsen 1968; Bovbjerg 1984; Cairns and Wagner 2000; Chislett 1969; Kolipinski 1964). *Nerita peloronta*, *N. versicolor,* and *N. tessellata* arrange themselves, respectively, within the high, medium, and low intertidal zone, maintaining their relative position within these sectors by migrating with the tide as it moves in and out. Rather than being driven by competitive exclusion, this zonation appears to arrive from physiological adaptations that make certain microhabitats more suitable for each species. For example, *N. tessellata*'s relatively large gill capacity allows it to tolerate the lowered oxygen levels associated with frequent submersion in the splash zone (Cairns and Wagner 2000).

The tessellated nerite is active at night, grazing the biofilm layer composed of detritus and microorganisms from the rocky substrate on which it lives (Bovbjerg 1984). The snail is photonegative and during the day seeks out crevices and the underside of rocks. Snails reach sexual maturity at between 14 to 17 mm in length (Chislett 1969; Kolipinski 1964). Sexes are separate and fertilization is internal within the female who lays egg capsules, each containing more than one hundred eggs, in water filled depressions on rocks (Hughes 1971a, Kolipinski 1964). Kolipinski (1964) reports that a typical female lays an average of 160 egg capsules annually. Once larvae hatch, they are dispersed by currents. The pelagic veliger stage is relatively long in *Nerita* spp., on the order of several months (Kolipinski 1964; Underwood 1975), which likely facilitates wide dispersal. Larvae remain in the water column until they reach the terminal developmental stage, whereupon they settle onto a suitable substrate and metamorphose into juvenile snails. *Nerita tessellata* has a lifespan of about three and half years

(Hughes 1971b; Kolipinski 1964). Information regarding natural mortality in tessellated nerites is limited, although octopuses have been recorded as a predator (Bovbjerg, 1984). Kolipinski (1964) suggests the possibility that fish or crustaceans may prey on nerites during high water periods or at night, but observed no such events during a lengthy field study.

7.2.2 Analytic Considerations Regarding Nerita tessellata *Size and Age*

Two aspects of tessellated nerite biology are relevant to zooarchaeological investigations of size change: growth rate and age structure of the population. For species of indeterminate growth that continue to increase in size throughout life, as *N. tessellata* does, shell size is determined by both the age of the snail and its rate of growth. For the tessellated nerite and its congeners, growth rate has been shown to be influenced by many factors, including microhabitat, seasonal air temperatures, sea surface temperatures, wave action, access to food, intraspecific competition, latitude, and the maturation of gonads during the spawning season (Axelsen 1968; Chislett 1969; Faulkner 2009; Kolipinski 1964; Lewis 1971, Lewis et al. 1969; Underwood 1975, 1976). For *N. tessellata*, these factors appear to interact in complex ways, with researchers encountering both positive and negative evidence for variation in population mean growth rate based on location, season, or year (e.g., Axelsen 1968; Chislett 1969; Kolipinski 1964).

That growth rate can be affected by a host of natural (non-human) factors is an important consideration when examining archaeological snail size. Anthropogenic decreases in mean snail length and/or width are expected in cases of intense human predation pressure based on the assumption that people will preferentially select larger (older) individuals when collecting molluscs (Fenberg and Roy 2007). Removing these individuals lowers the average age of the population and depresses mean size. However, a decline in mean size can also arise from a change in natural conditions that slows snail growth rate, although the age structure of the population remains unchanged. For this reason, a number of researchers (e.g., Campbell 2008; Claassen 1998; Giovas et al. 2010, 2013; Mannino and Thomas 2001, 2002; Milner et al. 2007; Roy et al. 2003) have cautioned that archaeological studies of mollusc size should ideally take into consideration snail age in addition to shell metrics. Claassen (1986, 1998) included this criterion among several recommended to demonstrate human impact on mollusc communities. The major criteria are: 1) a decline in the mean shell size over time; 2) a decrease in absolute abundance of favored species with an increase in species more laborious to collect and process; 3) and a decline in mean age over time with no accompanying decrease in the average size of snails within an age group. Mannino and Thomas (2002) have argued that the last criterion, while theoretically sound, is often difficult to accommodate in practice because the number of intact, measurable specimens required for each age class is often archaeologically prohibitive.

A further complication in this type of analysis is that many mollusc shells do not bear any overt age indicators that may be used to create mortality profiles for archaeological samples. This is, unfortunately, the case for the tessellated nerite. Size frequency histograms may be used as a proxy for these data where multiple modes, interpretable as age cohorts, are evident, although this approach is not without problems (see discussions in Campbell 2008; Claassen 1998; Giovas et al. 2010).

Living populations of *N. tessellata* have been shown to exhibit bimodality in size frequency histograms that corresponds to age cohorts. In a 13 – 16 month study of tessellated nerite growth at two distinct locations on Barbados, Axelsen (1968) found that the shell size structure of populations typically exhibited a bimodal distribution with the magnitude and placement of modes changing through the year. In initial observations at both localities, peaks were distributed at ~5-7 mm and ~15 mm (Axelsen 1968, Figures 24 and 25). With time, the modes shifted upwards as individuals grew older and larger. As snails aged, however, their growth rate slowed, declining dramatically at around 16 mm (Axelsen 1968), which corresponds roughly to the onset of sexual maturity at 14 – 17 mm (Chislett 1969). At this point, snails barely grew at all, and as they approached the effective upper limit of their size range, ~20 mm, the modes merged as the younger age cohort caught up in size with the older. Depending on the number of individuals in the younger cohort, this convergence has the effect of pulling the larger size peak back down somewhat. As this happens, the population may show unimodality (Axelsen 1968, Figure 25), but only briefly as new recruits enter the population and it once again displays a characteristic bimodal distribution.

Axelsen (1968:99) found that new recruits joined the population roughly once a year based on the appearance of a new, small mode in the late summer/early fall, but argued that the size range displayed by this mode suggested an extended breeding season. Data from other locations alternately indicate that *N. tessellata* spawns seasonally (Kolipinski 1964) or year round (Chislett 1969; Lewis 1971), suggesting that local conditions will affect the timing and frequency of recruitment to the population and, subsequently, their size frequency distributions.

For archaeological tessellataed nerite populations this has several implications. Assuming a single annual recruitment, living populations of *N. tessellata* exploited by prehistoric foragers should contain three to four separate age cohorts, two or three of which will fall into the same size distribution peak. It does not follow that archaeological samples will reflect this precise demography, however, since people will presumably harvest individuals from the upper end of the age (size) range. In fact, if only mature individuals are collected, then unimodality may be expected in the size frequency distributions, though this single mode may contain two or three age classes. In some cases (e.g., Sadosky et al. 2002; Leach and Davidson 2001) the decomposition of modes into separate age/size classes may be aided by statistical analysis. An additional consideration, however, is the effect of time and space averaging inherent to zooarchaeological assemblages, which can be expected to blur the distinction between size modes by lumping samples from different locations and temporal contexts (Lyman 2003).

While it may be difficult to separate age from size for archaeological nerites, it is possible to establish the potential for deleterious impacts on nerite populations by estimating the relative exploitation of adult to juvenile individuals. This assumes, of course, that snail size at the onset of sexual maturity has not altered with a change in growth rate. As Lasiak (1991) and others (Fenberg and Roy 2012; Mannino and Thomas 2002) have noted, if size at maturity is larger than the size at which foragers will reject the mollusc, then the recruitment potential of the population will be impacted as all reproducing individuals are potential targets for harvest. The negative effect on recruitment will depend on the degree to which individuals can be recruited from elsewhere, which in turn depends on veliger characteristics coupled with local and regional hydrographic conditions.

7.3 **Nerita tessellata:** ***Size Analysis Methods and Results***

7.3.1 Methods of Analysis

Despite these complications, I provide a size analysis of tessellated nerite specimens from Grand Bay and Sabazan to explore patterning in the record. Measurements were taken to two decimal places on shell length (height) and width using digital vernier callipers (Figure 7.1). Data were recorded for all securely identified *N. tessellata* specimens with intact measurement points from Trench 2 at Sabazan and Trench 446 at Grand Bay. Because the sample size for the Middle-L005 phase from Trench 446 was small, it was supplemented with Middle-L005 samples from Trench 415. Even so, the number of measurable specimens for this period is low, and sample size is relatively modest overall for both sites (Sabazan: $n_{\text{length}} = 113$, $n_{\text{width}} = 105$; Grand Bay: $n_{\text{length}} = 136$, $n_{\text{width}} = 127$). No intact specimens are available from the Early period deposits at either site, a function of both fragmentation and of the relatively low abundance of these snails during early occupation.

7.3.2 Results of Size Analysis

Mean tessellated nerite shell length and width for each period at Grand Bay and Sabazan, along with associated descriptive statistics, are presented in Table 7.1. At Sabazan, mean length increases by nearly 1 mm from 12.20 mm in the Middle period to 13.11 mm Late period. Mean length then falls slightly to 12.94 mm in the Final Period. Mean width follows the same trend, increasing from 14.62 mm to 15.41 mm and then declining somewhat to 15.22 mm. These changes occur while MNI-based relative abundance and MNI-based standardized absolute abundance of tessellated nerites increase over time (Tables 5.7, 5.22, and 7.2). Standardized absolute abundances were calculated by standardizing NISP and MNI counts by excavated 0.1 m^3 unit of volume (i.e., a 10 cm deep layer in a 1 x 1 m unit) and include cf. *N. tessellata* designations. By standardized counts, tessellated nerites are at least three to four times more abundant in the Final period than in any other temporal context at Sabazan.

At Grand Bay, the mean size trend differs from that of Sabazan (Table 7.1). From the L005 to L003 phase of the Middle period, mean length drops about 0.2 mm, from 12.52 mm to 12.35 mm, and mean width declines from 15.27 mm to 14.86 mm at this time. In the Late period, mean length and width increase to 13.29 mm and 16.07 mm, respectively. The decline in average tessellated nerite shell size in the Middle-L003 phase coincides with the spike in its relative and absolute abundance (Table 7.2). Setting the L003 sample aside for the moment and examining the transition from the Middle-L005 directly to the Late period, an increase in mean shell length and width of roughly 0.8 mm is evident. This increase in shell size is accompanied by an increase in *N. tessellata* relative and absolute abundance.

Box plots for length and width measurements illustrate these trends graphically (Figures 7.2 – 7.5). They also reveal a small number of outliers on both the low and high ends of the size range (represented by circles in the boxplots). In this particular case, all outliers are minor, with values falling between 1.5 and 3 box lengths (interquartile ranges) from the upper or lower edge of the box (Table 7.1). Data skewness is relatively low (Table 7.1). The box plots indicate a smaller range in snail length and width during Sabazan's Late period and Grand Bay's Middle-L005 period that likely arises from the smaller sample sizes here. Overall, the size range of exploited snails appears to decrease over time at Sabazan and increase over time at Grand Bay. By length, the largest snail measured at Sabazan is 16.53 mm and comes from the Middle period. At Grand Bay the largest snail is similarly sized at 16.58 mm, but is found in Late period deposits.

Analysis of variance methods for testing differences between means assume equal sample variances and normality of the data. For both Sabazan and Grand Bay, sample variances are not statistically different from each other for either length or width (Sabazan: Levene statistic$_{\text{length}}$ =

0.335, $p = 0.716$; Levene $\text{statistic}_{\text{width}} = 0.341$, $p = 0.712$; Grand Bay: Levene $\text{statistic}_{\text{length}} = 0.089$, $p = 0.915$; Levene $\text{statistic}_{\text{width}} = 0.259$, $p = 0.772$).

To explore the potential for detecting age classes in the data and assess data sample normality, length and width frequency histograms were generated and are presented in Figures 7.6 – 7.9. Several of the histograms show possible multimodality, in particular those for Late period length and width at Grand Bay, Late period width at Sabazan, and possibly Grand Bay Middle-L003 width. Multiple modes may be an artifact of modest sample sizes. Therefore, following the recommendation of Campbell (2008) for assessment of multimodality in size distributions of archaeological molluscs, I relied on Q-Q plots for this analysis. In a Q-Q plot, normally distributed data should conform closely to a straight line, but multimodal data will appear stepped. Q-Q plots for tessellated nerite length and width at each site appear in Figures 7.10 – 7.13. Surprisingly, the data conform for the most part to a normal distribution. Identifiable age/size classes are not indicated by the plots, with the possible exception of Late period width at Sabazan. Shapiro-Wilk tests for normality were insignificant for all samples, confirming that distributions are normal (Table 7.3). Possibly, because the bulk of observations are of individuals greater than 10 mm in length, only the merged, larger/older distribution mode of the population is being sampled by foragers. If this is so, the data probably represent two or three age classes.

Analysis of variance was conducted to determine whether the observed size changes are significant and post hoc tests used to explore the results. Scheffe and Tukey-Kramer tests were employed for pairwise comparisons between temporal periods at Grand Bay and Sabazan, consistent with recommended approaches for ANOVA post hoc testing for significant results and uneven sample sizes (Ruxton and Beauchamp 2008). As Table 7.4 illustrates, only the ANOVA test for mean nerite shell length and width at Grand Bay is significantly different between periods (length: F = 3.618, *p* = 0.030; width: F = 4.404, *p* = 0.014). The post hoc tests indicate this difference is attributable to a statistically significant increase in both length and width between the Middle-L003 and Late periods (Table 7.5). No size change is evident for Sabazan, despite increasing levels of exploitation over time.

7.4 Interpreting **Nerita tessellata** *Size Change*

Tessellated nerites were a principle component of the molluscan assemblage at Grand Bay and Sabazan after about AD 800. The abundance of *N. tessellata* at these sites is consistent with high levels of nerite exploitation observed for other Lesser Antillean archaeological sites, including those on St. Martin (Serrand and Bonnissent 2005), Nevis (Giovas et al. 2013; Poteate and Fitzpatrick 2013; Nokkert 2002b) and Grenada (Fandrich 1990 cited in Newsom and Wing 2004). Since the amount of meat delivered by individual neritids (*Nerita* sp. and *Neritina* spp.) is small, it is generally believed for the pre-Columbian Caribbean that these little gastropods were cooked in batches as an ingredient in soup (Riverra-Colazzo 2010). This would explain the low rates of burning observed for nerite specimens at Grand Bay and Sabazan (2.2% and 4.4%, respectively) as well as at other Caribbean sites (Riverra-Colazzo 2010; Serrand and Bonnissent 2005). Boiling also allows for subsequent easier extraction of flesh from the shell with a small, pointed implement, such as a sharp stick. Serrand (2003; Serrand and Bonnissent 2005), however, identified a consistent, standardized pattern of dorso-ventral impact, detached apertures, and aperture fragments in archaeological nerites that suggested percussion of shells for the removal of flesh by crushing or shearing away muscle attachment to the inner shell. Riverra-Colazzo (2010) speculated that such treatment of *Neritina* specimens at the Punta Candelero site, Puerto Rico indicated meat extraction before cooking, possibly for use as fishing bait (see also Milner et al. 2007 on use of limpets for bait). While similar patterns of breakage are found in *Nerita tessellata* at Grand Bay and Sabazan, complete or nearly complete shells are just as, or more, common at the sites.

Given the heavy exploitation of nerites at Grand Bay and Sabazan, the lack of evidence for a size decline is unexpected. At Grand Bay, size increase follows the most intense period of nerite exploitation in terms of relative, absolute, and standardized absolute abundances (Table 5.22, Table 7.2). Since the mean length and width increase in tessellated nerite shells during the Late period is accompanied by a decrease in exploitation from the preceding Middle-L003 phase, it is tempting to suggest that shell size rebounds when exploitation levels decrease. However, the data fail to show that shell size ever significantly *decreased* in response to intensifying predation by humans. Had this been the case, a statistically significant decline would be expected between the Middle-L005 and Middle-L003 phases. It is premature to conclude, therefore, that tessellated nerites become larger once predation pressure eases. In addition, nerite abundance in the Late period is not statistically different from the Middle-L005 period (Table 5.25), and pairwise comparisons between these two periods show no size change (Table 7.13), suggesting that for the bulk of the post-AD 850 deposits excavated at Grand Bay, no size impacts are detectable.

There are several possible explanations for the observed trend in tessellated nerite size at Grand Bay. For example, assuming that juvenile recruitment has not been impacted, size increase may be a response to thinning of the population and a reduction in intraspecific competition due to human harvesting. Nerite growth rate is negatively correlated with high population densities due to food competition, and adult mortality has been shown to increase with increasing snail density in the related species, *N. atramentosa* (Underwood 1976).

Researchers have also noted that because intertidal molluscs often exhibit a size gradient along the high-low tidal axis, a shift in the shore position where snails are exploited can change the mean size of zooarchaeological samples (Campbell 2008; Giovas et al. 2010). However, microhabitat studies indicate that *N. tessellata* is constrained to a narrow zone relative to the water line, particularly during the day, and that migration within this zone does not involve a shoreline gradient but movement above and under rocks to manage environmental exposure (Axelsen 1968; Bovbjerg 1984; Cairns and Wagner 2000; Chislett 1969).

More probably, if changes in foraging behavior are responsible for the observed size increase, they are due to changes in location of collection, season of collection, or identity of foragers. No evidence for seasonally-dependent shellfishing is evident at either Grand Bay or Sabazan, but sclerochronological analysis may offer some insight into time of death for the nerite assemblage. Bird and Bliege Bird (2000) have shown in ethnoarchaeological studies that children are more likely to collect smaller molluscs when foraging than adults, so a size increase could be interpreted as a shift away from children's foraging. Unfortunately, this hypothesis is largely untestable in an archaeological context.

Foraging more distant (less depleted) intertidal patches could yield a size increase in snails and, theoretically, could be tested by assessing utility-based field processing of shells associated with foraging from a central place (Binford 1978; Bird et al. 2002; Broughton 1999; Cannon 2003; Faith 2007; Nagaoka 2005; O'Day and Keegan 2001; Whitaker and Byrd 2012). However, the abundance of complete or nearly complete nerite shells in the zooarchaeological assemblages of both sites (Giovas 2009) suggests nerites were returned to the site intact, probably because of their small size, and are, therefore, not amenable to such studies. Thus, while patch switching could possibly explain the observed patterning, it too is problematical to test.

At present, there are insufficient data to favor one of these hypothesized explanations over another, or any other environmental or anthropogenic causes that could impact survivorship or growth rate for that matter. In addition there is also another key issue to consider. While the data indicate a statistically significant size increase at Grand Bay in the Late period, the biological significance of a ~1 mm size increase is open to question. This is especially so since it is still unclear whether size change reflects changes in growth rate, survivorship, foraging practices, or perhaps even a sampling artifact. Unfortunately, this aspect of the analysis—determining whether predation pressure impacted tessellated nerite size—remains, at least for the present, inconclusive. In addition, any broad causal mechanisms, such as climate change, invoked to explain shell size increase at Grand Bay must also account for why no such statistically significant changes occur at Sabazan.

One last observation may be made. For all samples from both sites, except that of Grand Bay's Late period, some 74% to 89% of tessellated nerites fall under the minimum size for onset of sexual maturity of 14 mm. Assuming *N. tessellata* growth rates at the sites have not changed over time and that size at sexual maturity is similar for snails on Carriacou as elsewhere, this means that most or all of the snails exploited are reproductively immature. If this is indeed the case, it clearly would have affected local spawning by reducing the size of the reproductively active population in the bays. The fact that no size decline is evident for tessellated nerites at either site suggests recruitment from outside sources is sufficient to replenish local populations at given levels of exploitation. In this sense, *N. tessellata* shellfishing at Sabazan and Grand Bay appears to be sustainable over time.

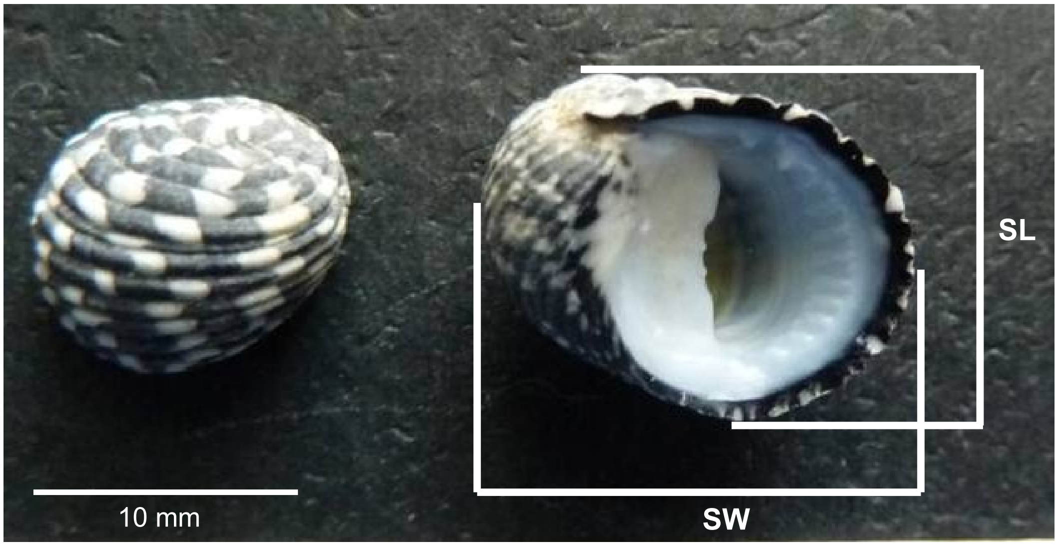


Figure 7.1 Location of measurements taken on *Nerita tessellata*. SL = shell length; SW = shell width. (Photograph by author)

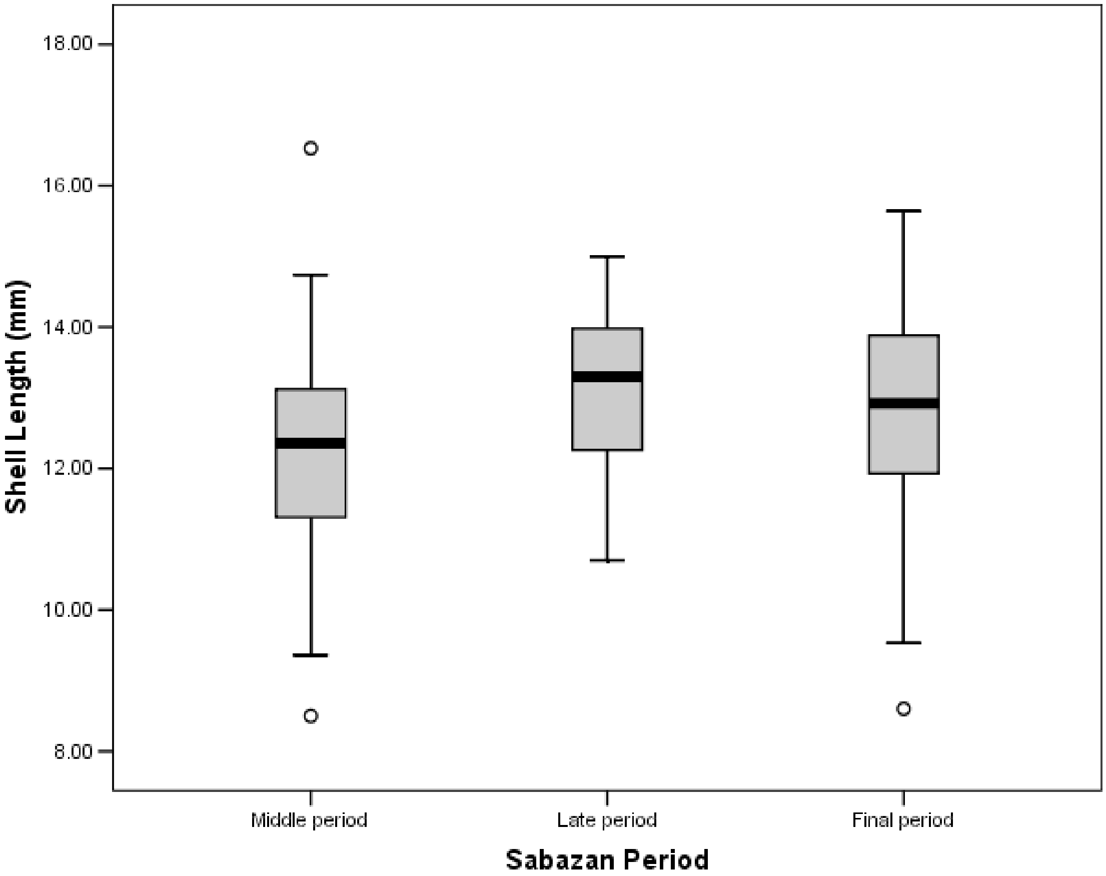


Figure 7.2 Box plot for length measurements on *Nerita tessellata* from the Middle, Late, and Final occupation periods at Sabazan. Circles are minor outliers, see text for explanation.

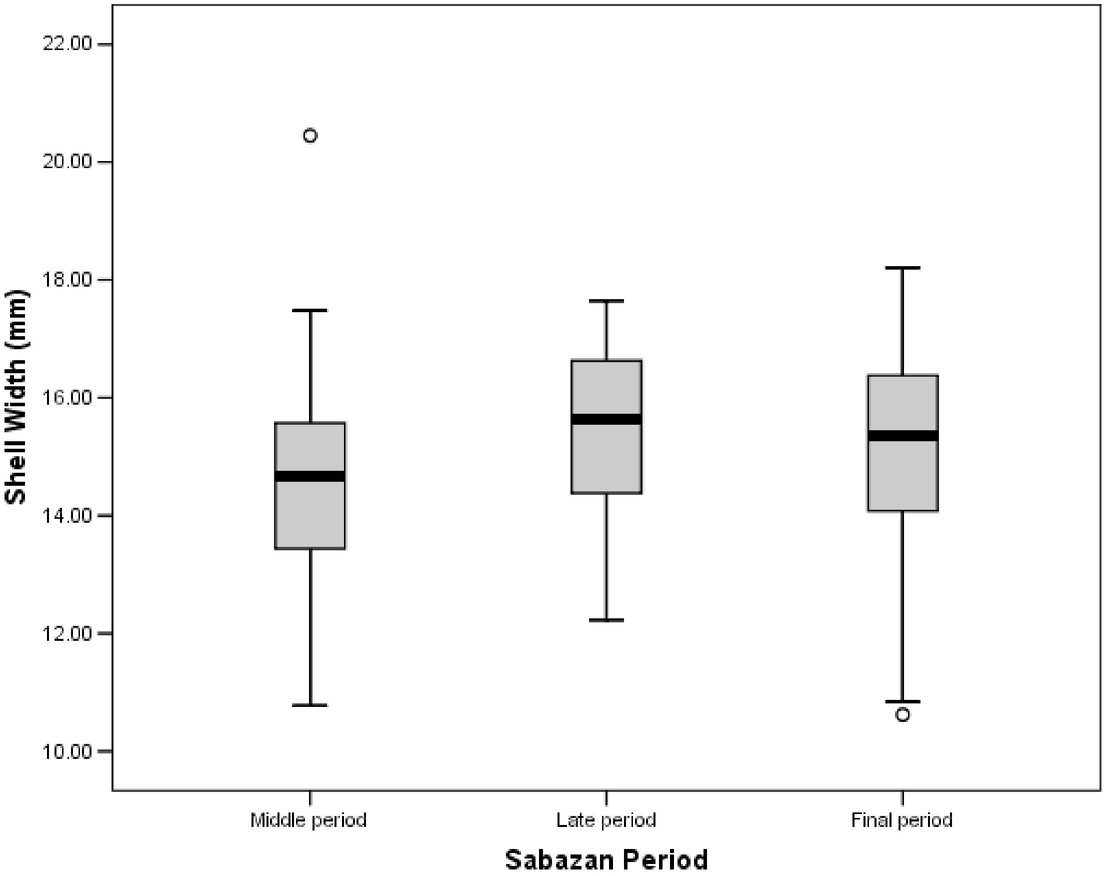


Figure 7.3 Box plot for width measurements on *Nerita tessellata* from the Middle, Late, and Final occupation periods at Sabazan. Circle is a minor outlier, see text for explanation.

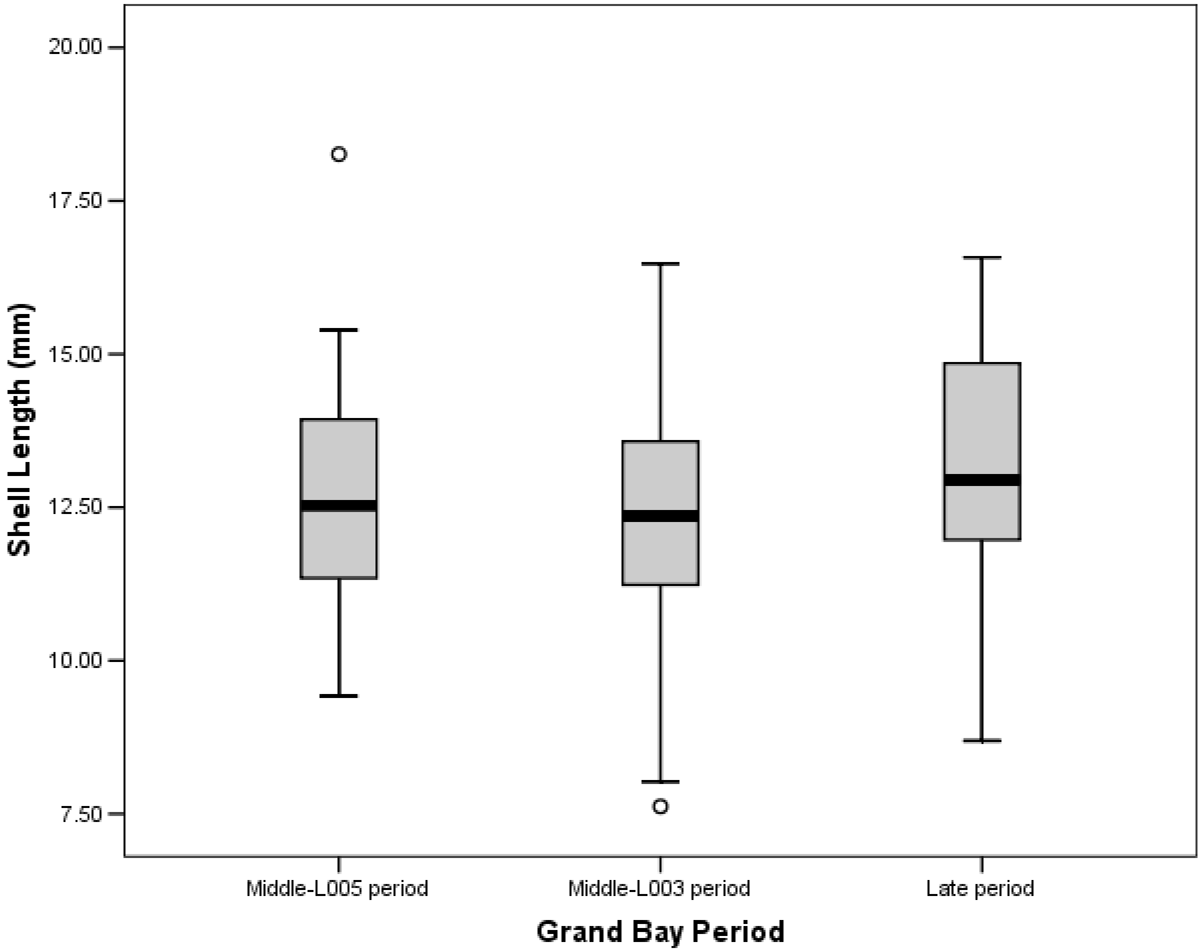


Figure 7.4 Box plot for length measurements on *Nerita tessellata* from the Middle-L005, Middle-L003, and Late occupation periods at Grand Bay. Circles are minor outliers, see text for explanation.

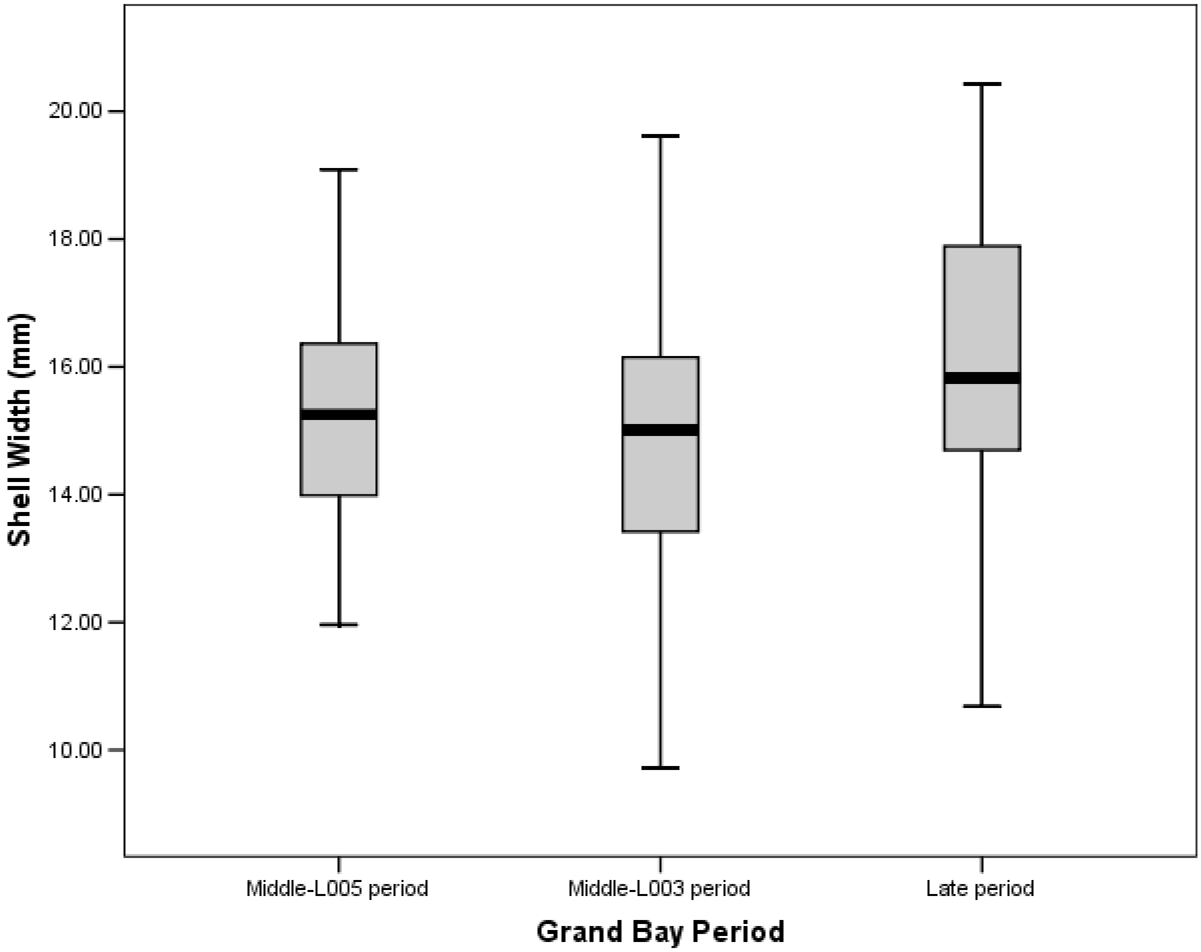


Figure 7.5 Box plot for width measurements on *Nerita tessellata* from the Middle-L005, Middle-L003, and Late occupation periods at Grand Bay.

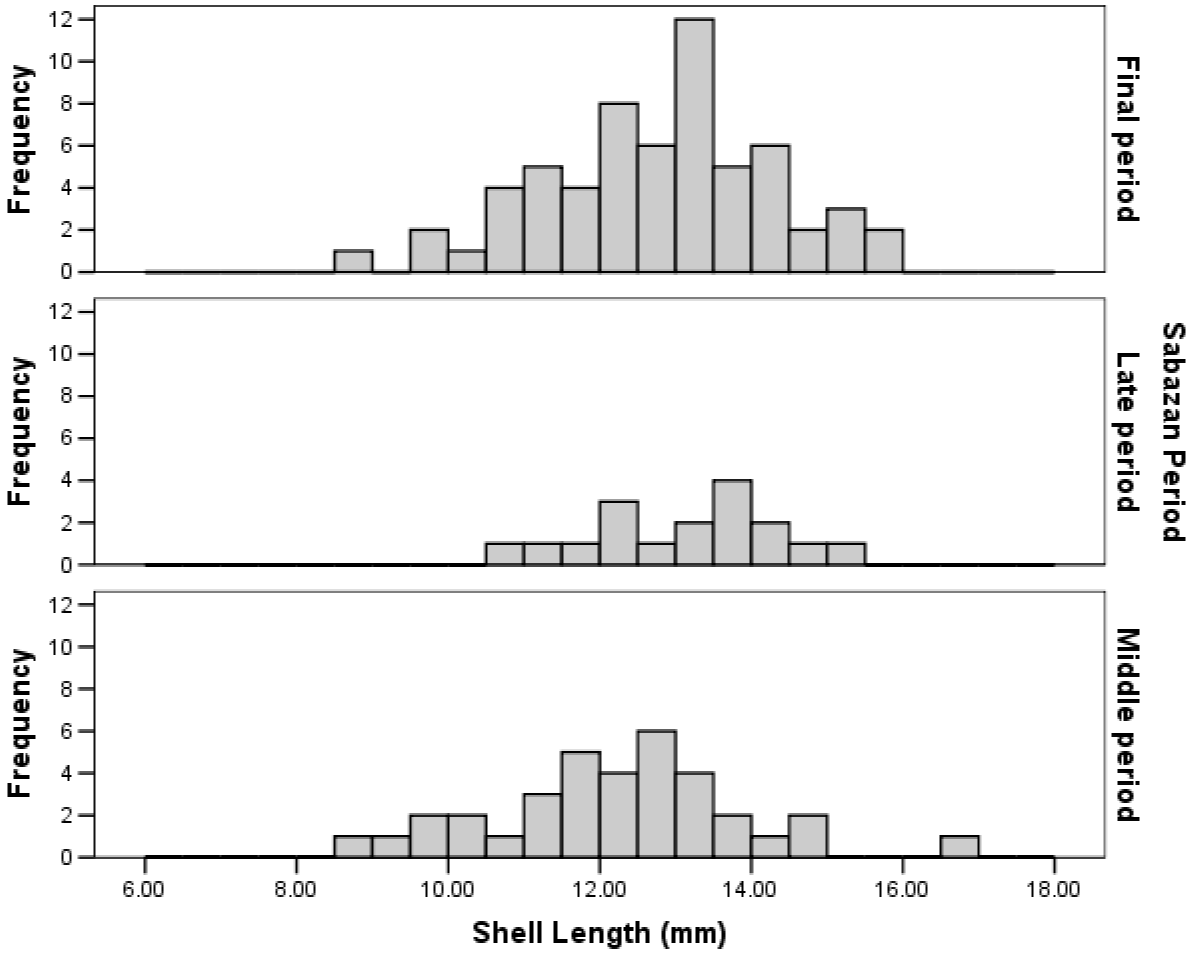


Figure 7.6 Size frequency histograms for *Nerita tessellata* shell length during the Middle, Late, and Final periods at Sabazan.

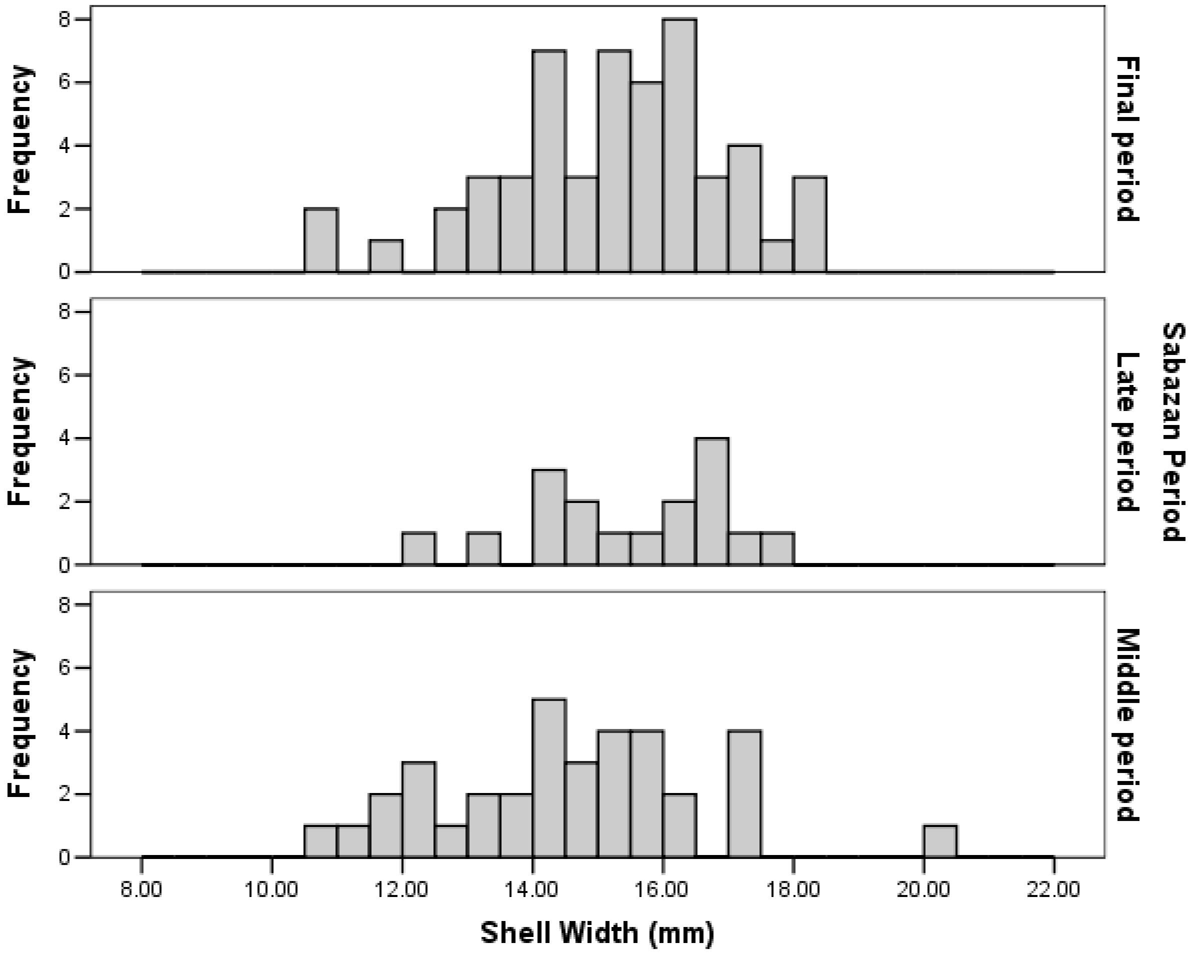


Figure 7.7 Size frequency histograms for *Nerita tessellata* shell width during the Middle, Late, and Final periods at Sabazan.

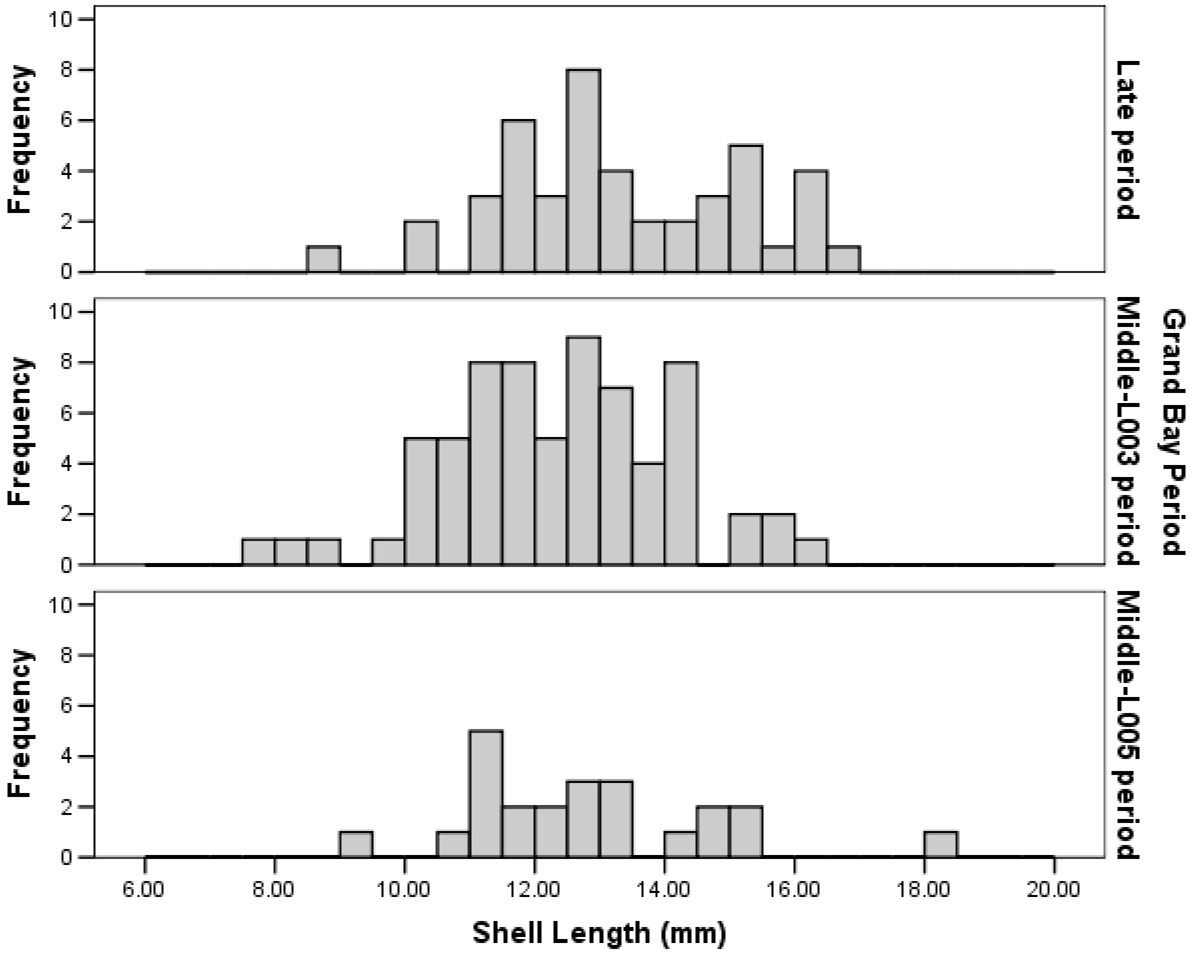


Figure 7.8 Size frequency histograms for *Nerita tessellata* shell length during the Middle-L005, Middle-L003, and Late periods at Grand Bay.

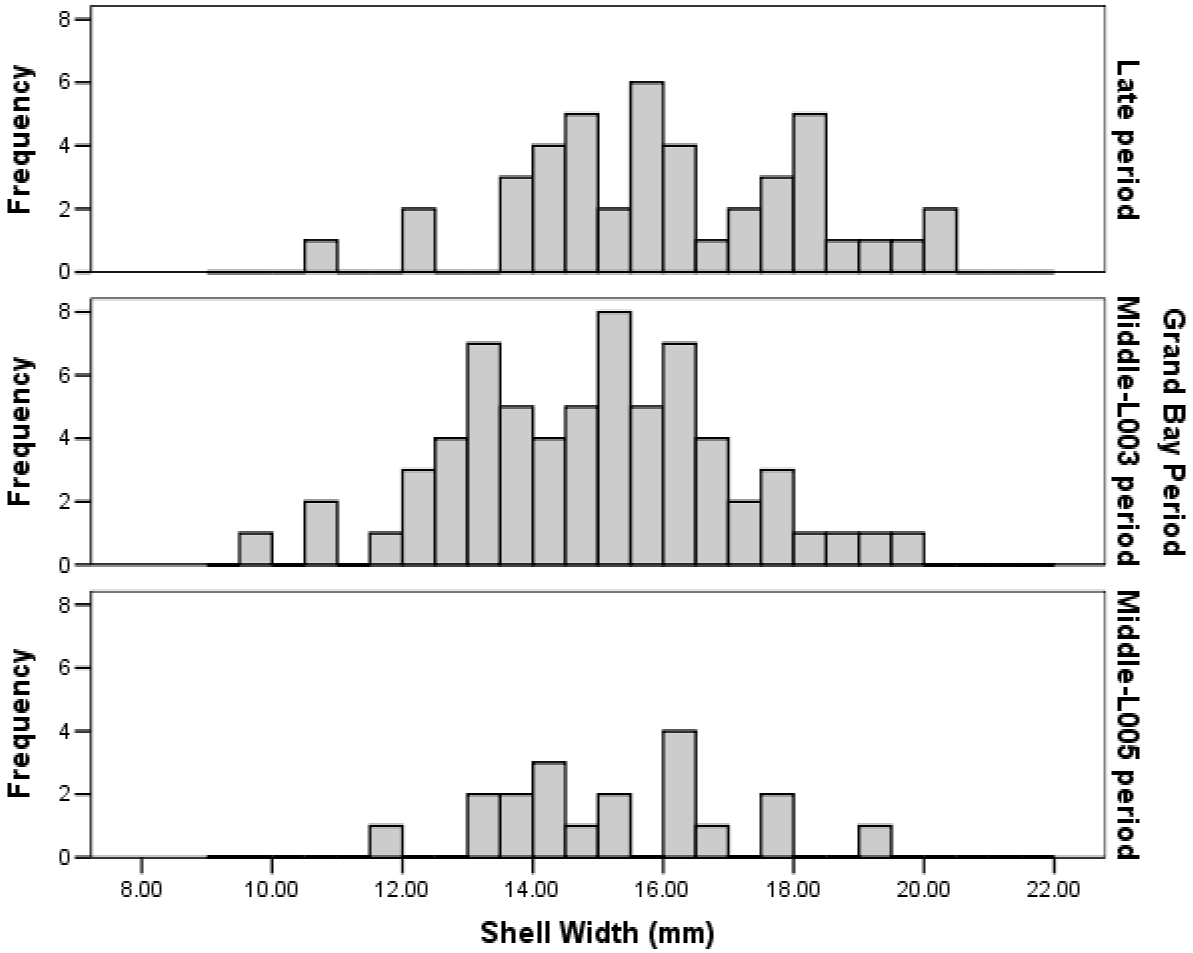


Figure 7.9 Size frequency histograms for *Nerita tessellata* shell width during the Middle-L005, Middle-L003, and Late periods at Grand Bay.

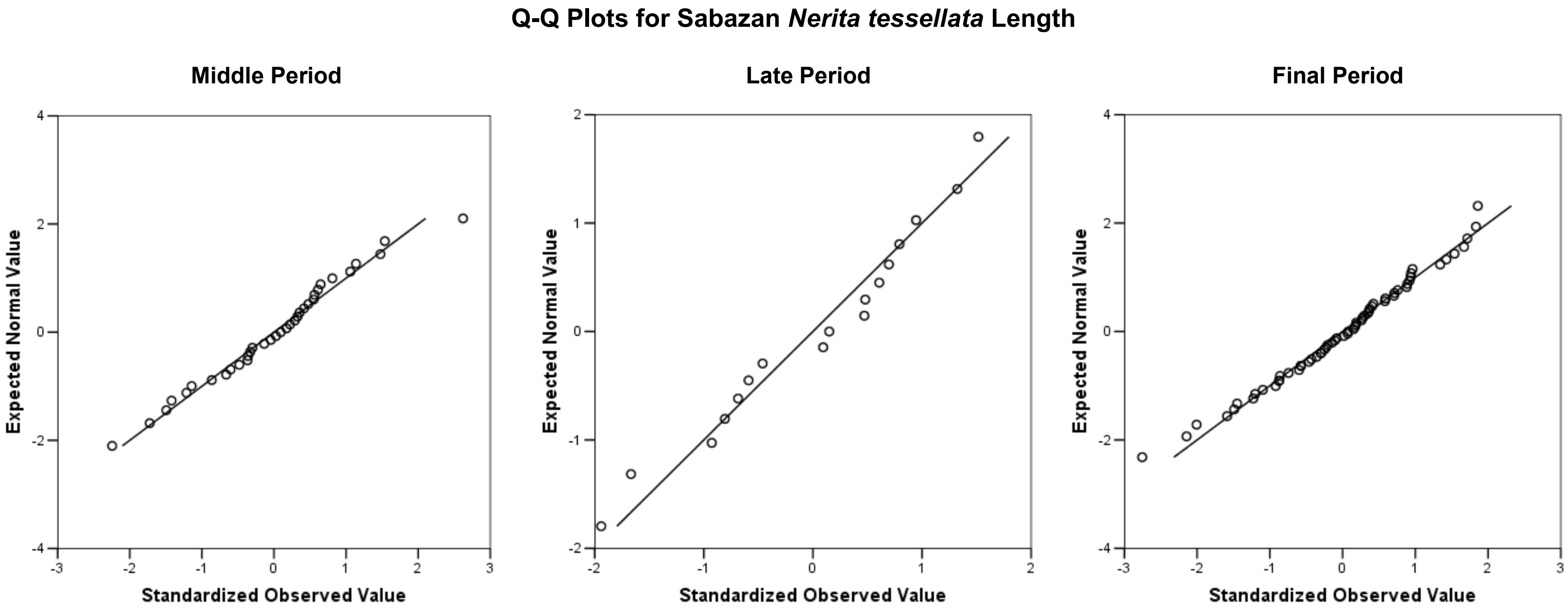


Figure 7.10 Normal Q-Q plots for *Nerita tessellata* length at Sabazan for the Middle, Late, and Final periods.

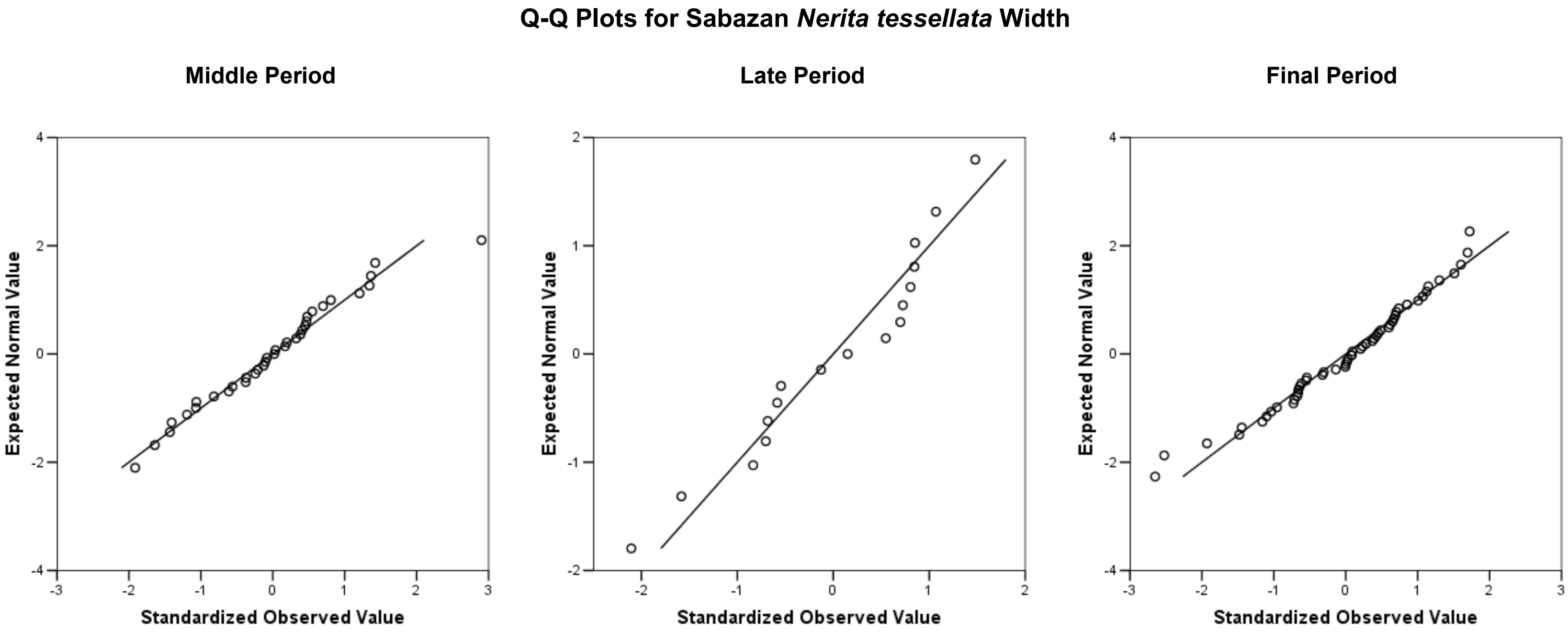


Figure 7.11 Normal Q-Q plots for *Nerita tessellata* width at Sabazan for the Middle, Late, and Final periods.

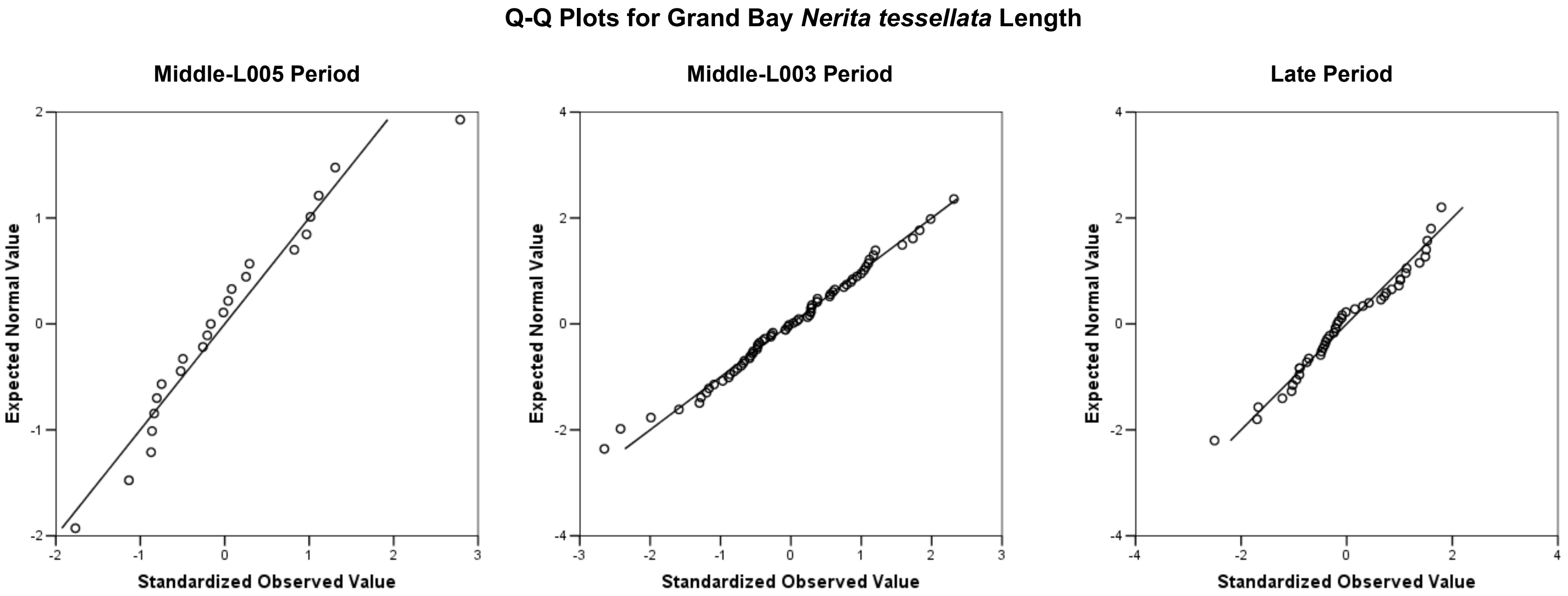


Figure 7.12 Normal Q-Q plots for *Nerita tessellata* length at Grand Bay for the Middle-L005, Middle-L003, and Late periods.

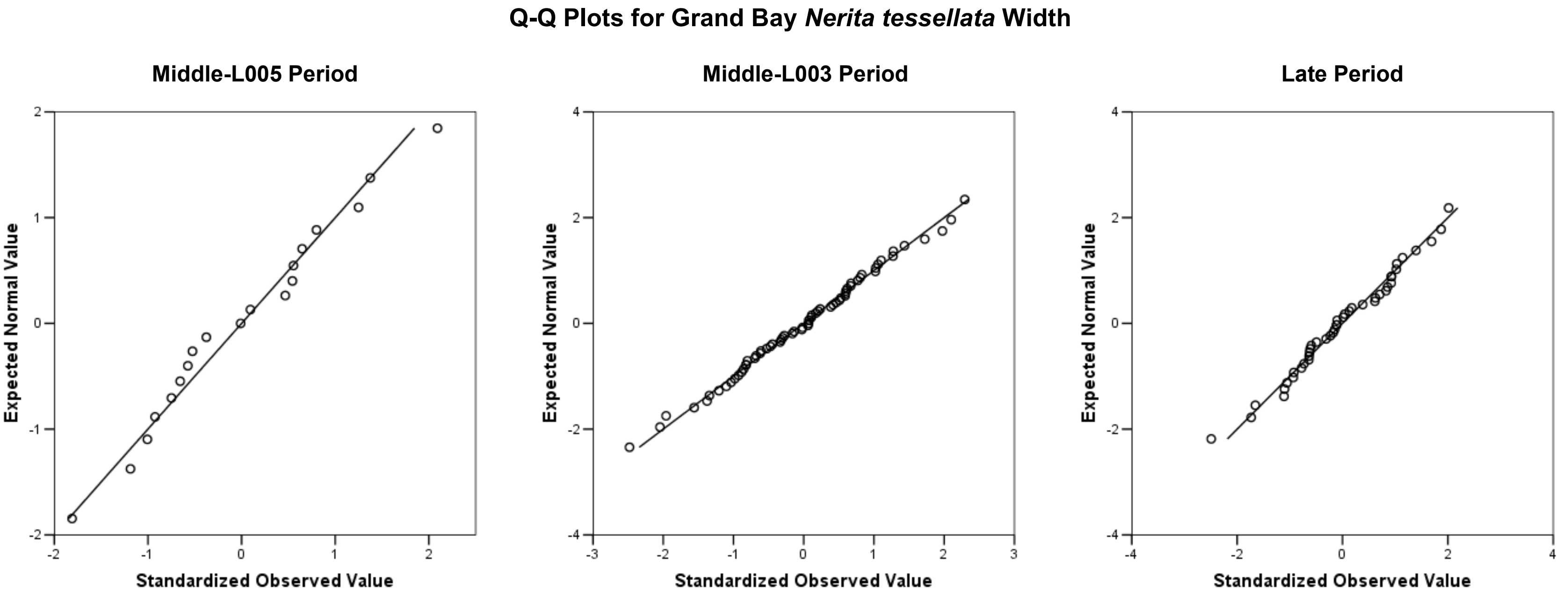


Figure 7.13 Normal Q-Q plots for *Nerita tessellata* width at Grand Bay for the Middle-L005, Middle-L003, and Late periods.

Table 7.1 Descriptive statistics for *Nerita tessellata* length and width measurements from Sabazan and Grand Bay. NISP and MNI counts include specimens identified with a cf. designation. Only shells securely identified to *Nerita tessellata* were measured.

Descriptive Statistics for *Nerita tessellata* Measurements (mm)

						95% Confidence										
		NISP	MNI	Sample n	Mean	Lower Bound	Upper Bound	Median	Variance	Std. Deviation	Minimum	Maximum	Range	Inter-quartile Range	Skewness	Kurtosis
Sabazan																
Shell Length	Final Period	105	72	61	12.84	12.42	13.26	12.92	2.331	1.527	8.60	15.64	7.04	1.78	-0.397	0.458
	Late Period	34	24	17	13.11	12.47	13.75	13.30	1.547	1.244	10.70	15.00	4.30	1.86	-0.422	-0.608
	Middle Period	97	56	35	12.20	11.64	12.77	12.36	2.722	1.650	8.50	16.53	8.03	1.92	0.058	0.567
Shell Width	Final Period	105	72	53	15.22	14.74	15.70	15.36	3.012	1.736	10.62	18.21	7.59	2.33	-0.550	0.259
	Late Period	34	24	17	15.41	14.64	16.19	15.64	2.287	1.512	12.23	17.65	5.42	2.30	-0.554	-0.450
	Middle Period	97	56	35	14.62	13.93	15.31	14.66	4.041	2.010	10.77	20.45	9.68	2.19	0.411	0.888
Grand Bay																
Shell Length	Late Period	206	149	45	13.29	12.71	13.87	12.90	3.526	1.878	8.69	16.58	7.89	3.20	-0.079	-0.538
	Middle-L003 Period	114	93	68	12.35	11.90	12.80	12.30	3.316	1.821	7.62	16.48	8.86	2.57	-0.154	0.095
	Middle-L005 Period	36	29	23	12.52	11.76	13.29	12.53	2.544	1.595	9.42	15.39	5.97	2.19	0.118	-0.543
Shell Width	Late Period	206	149	43	16.07	15.41	16.74	15.83	4.682	2.164	10.68	20.43	9.75	3.23	-0.064	-0.189
	Middle-L003 Period	114	93	65	14.86	14.35	15.38	15.01	4.301	2.074	9.72	19.62	9.90	2.89	-0.020	-0.044
	Middle-L005 Period	36	29	19	15.27	14.39	16.15	15.25	3.338	1.827	11.96	19.09	7.13	2.55	0.273	-0.380

Table 7.2 *Nerita tessellata* absolute and standardized absolute abundance by NISP and MNI. See text for explanation of standardization procedure.

Nerita tessellata Quantification Standardized by Volume

Site	Period	Approx. volume of sample matrix (m$^{3)}$	NISP	MNI	NISP per 0.1 m^3	MNI per 0.1 m^3
Sabazan	Final	0.1	105	72	105.0	72.0
	Late	0.2	34	24	17.0	12.0
	Middle	0.35	97	56	27.7	16.0
	Early	0.05	5	5	10.0	10.0
Grand Bay	Late	1	206	149	20.6	14.9
	Middle-L003	0.2	114	93	57.0	46.5
	Middle-L005	0.3	36	29	12.0	9.7
	Early	0.5	5	4	1.0	0.8

Table 7.3 Shapiro-Wilk tests of normality for *Nerita tessellata* length and width datasets at Sabazan and Grand Bay.

Shapiro-Wilk Tests of Normality

		Statistic	df	*p*
Sabazan				
Shell Length	Final Period	0.975	53	0.330
	Late Period	0.958	17	0.600
	Middle Period	0.986	35	0.931
Shell Width	Final Period	0.971	53	0.215
	Late Period	0.937	17	0.280
	Middle Period	0.973	35	0.531
Grand Bay				
Shell Length	Late Period	0.966	43	0.222
	Middle-L003 Period	0.991	65	0.911
	Middle-L005 Period	0.968	19	0.727
Shell Width	Late Period	0.984	43	0.788
	Middle-L003 Period	0.994	65	0.987
	Middle-L005 Period	0.979	19	0.931

Table 7.4 Analysis of variance results for mean *Nerita tessellata* shell length and width between periods at Sabazan and Grand Bay.

ANOVA Results for *Nerita tessellata* Mean Length and Width

			Sum of Squares	df	Mean Square	F	*p*
Sabazan							
	Length	Between Groups	12.033	2	6.016	2.575	0.081
		Within groups	256.985	110	2.336		
		Total	269.018	112			
	Width	Between Groups	8.222	2	4.111	1.726	0.183
		Within groups	262.025	110	2.382		
		Total	270.247	112			
Grand Bay							
	Length	Between Groups	24.174	2	12.087	3.618	0.030
		Within groups	444.288	133	3.341		
		Total	468.463	135			
	Width	Between Groups	37.789	2	18.895	4.404	0.014
		Within groups	532.002	124	4.290		
		Total	569.792	126			

Table 7.5 Post hoc tests for *Nerita tessellata* mean shell length and width at Sabazan and Grand Bay. Statistically significant pairwise comparisons indicated in bold print.

Post Hoc Pariwise Comparisons for *Nerita tessellata* Mean Shell Length and Width

								95% Confidence Interval	
		Test	Period	Pair	Mean Difference	Std. Error	*p*	Lower Bound	Upper Bound
Sabazan									
	Length	Tukey-Kramer	Middle period	Late period	-0.910	0.452	0.114	-1.983	0.164
				Final period	-0.600	0.324	0.158	-1.370	0.170
			Late period	Middle period	0.910	0.452	0.114	-0.164	1.983
				Final period	0.310	0.419	0.741	-0.686	1.306
			Final period	Middle period	0.600	0.324	0.158	-0.170	1.370
				Late period	-0.310	0.419	0.741	-1.306	0.686
		Scheffe	Middle period	Late period	-0.910	0.452	0.137	-2.031	0.212
				Final period	-0.600	0.324	0.185	-1.404	0.204
			Late period	Middle period	0.910	0.452	0.137	-0.212	2.031
				Final period	0.310	0.419	0.762	-0.730	1.350
			Final period	Middle period	0.600	0.324	0.185	-0.204	1.404
				Late period	-0.310	0.419	0.762	-1.350	0.730
	Width	Tukey-Kramer	Middle period	Late period	-0.722	0.456	0.257	-1.806	0.362
				Final period	-0.519	0.327	0.256	-1.297	0.258
			Late period	Middle period	0.722	0.456	0.257	-0.362	1.806
				Final period	0.203	0.423	0.881	-0.802	1.209
			Final period	Middle period	0.519	0.327	0.256	-0.258	1.297
				Late period	-0.203	0.423	0.881	-1.209	0.802
		Scheffe	Middle period	Late period	-0.722	0.456	0.290	-1.855	0.410
				Final period	-0.519	0.327	0.288	-1.331	0.293
			Late period	Middle period	0.722	0.456	0.290	-0.410	1.855
				Final period	0.203	0.423	0.891	-0.847	1.254
			Final period	Middle period	0.519	0.327	0.288	-0.293	1.331
				Late period	-0.203	0.423	0.891	-1.254	0.847
Grand Bay									
	Length	Tukey-Kramer	Middle-L005 period	Middle-L003 period	0.502	0.441	0.492	-0.543	1.547
				Late period	-0.436	0.468	0.621	-1.547	0.674
			Middle-L003 period	Middl-L005 period	-0.502	0.441	0.492	-1.547	0.543
				Late period	-0.939	0.351	**0.023**	-1.771	-0.106
			Late period	Middl-L005 period	0.436	0.468	0.621	-0.674	1.547
				Middle-L003 period	0.939	0.351	**0.023**	0.106	1.771
		Scheffe	Middle-L005 period	Middle-L003 period	0.502	0.441	0.524	-0.589	1.594
				Late period	-0.436	0.468	0.649	-1.596	0.723
			Middle-L003 period	Middl-L005 period	-0.502	0.441	0.524	-1.594	0.589
				Late period	-0.939	0.351	**0.031**	-1.808	-0.069
			Late period	Middl-L005 period	0.436	0.468	0.649	-0.723	1.596
				Middle-L003 period	0.939	0.351	**0.031**	0.069	1.808
	Width	Tukey-Kramer	Middle-L005 period	Middle-L003 period	0.404	0.540	0.736	-0.878	1.685
				Late period	-0.803	0.571	0.340	-2.157	0.550
			Middle-L003 period	Middl-L005 period	-0.404	0.540	0.736	-1.685	0.878
				Late period	-1.207	0.407	**0.010**	-2.173	-0.241
			Late period	Middl-L005 period	0.803	0.571	0.340	-0.550	2.157
				Middle-L003 period	1.207	0.407	**0.010**	0.241	2.173
		Scheffe	Middle-L005 period	Middle-L003 period	0.404	0.540	0.757	-0.935	1.742
				Late period	-0.803	0.571	0.374	-2.217	0.611
			Middle-L003 period	Middl-L005 period	-0.404	0.540	0.757	-1.742	0.935
				Late period	-1.207	0.407	**0.014**	-2.216	-0.198
			Late period	Middl-L005 period	0.803	0.571	0.374	-0.611	2.217
				Middle-L003 period	1.207	0.407	**0.014**	0.198	2.216

Chapter 8

MULTIPLE FORAGING OPTIMA AND FORAGING EFFICIENCY ON PREHISTORIC CARRIACOU: EVALUATION AND SYNTHESIS OF EVIDENCE FROM SABAZAN AND GRAND BAY

The conch was silent, a gleaming tusk….

\- William Golding, *Lord of the Flies*

8.1 Synthesis: Resource Exploitation at Sabazan and Grand Bay

This investigation reveals marked similarities between the two study sites, Sabazan and Grand Bay. Marine and terrestrial habitat patches were exploited at similar rates, and both sites exhibit an increasing reliance on rocky intertidal species, particularly nerites, as well as an apparent increase in conch harvest. Like other Lesser Antillean sites during the Ceramic Age, marine resources comprise the majority of protein-based subsistence. Fishing and the collection of molluscs from the intertidal zone and shallow water reef flat formed the basis of a lifeway oriented toward the sea. Undoubtedly residents of Grand Bay and Sabazan engaged in horticulture and foraged wild plant resources, but the relative impermanence and indirect nature of aspects of this record mean that, at present, the degree to which plant resources contributed to diet is unknown. Archaeobatanical research to address this question is underway. Relevant to this discussion are stable isotope studies on the skeletal remains of individuals from Grand Bay that indicate islanders had a diet high in marine-based protein (Krigbaum et al. 2013). This is discussed further below.

The use of terrestrial fauna is a consistent, but small component of resource exploitation at both Sabazan and Grand Bay. The majority of mammalian taxa exploited are species that ultimately originate from the South American mainland: opossum, agouti, peccary, guinea pig and armadillo. However, of these, only agouti and opossum are found with any kind of regularity at both sites, and even then their dietary significance is nominal in comparison to marine resources.

At both sites, the most noteworthy trend is the increasing emphasis on nerite exploitation. This is reflected in declining evenness values which point to resource collection focused increasingly on just a handful of invertebrate species. At Sabazan, this trend is associated with a decline in the relative importance of fishing. Since the overall level of fish exploitation at Grand Bay is not statistically distinguishable from Sabazan during the Late period, ca. AD 1000 – 1250, it is possible that similar developments in fishing may have occurred at this site as well (Table 6.6). From a foraging theory perspective, increased reliance on smaller-bodied molluscan taxa that require more effort to collect and process when compared to larger bodied fish, such as parrotfish, jacks, groupers, and tunas, represents a shift to lower-return rate resources. This may signal a decline in foraging efficiency potentially brought on by human predation pressure (Allen 2012; Langejans et al. 2012). Such conclusions are premature, however, without first assessing indicators of changing foraging efficiency for higher ranked taxa, the effects of technology, including mass capture, on prey return rates, and the role of environmental factors as causal mechanisms of change.

While it is clear from the evidence presented here that the patterns of foraging at Sabazan and Grand Bay were broadly similar, and may have even been similar in terms of their long-term effects on local ecology, it is also evident that the sites differed from each other in a few, but significant, ways. The size of the tuna catch at Sabazan, for instance, has no parallel at Grand Bay, at least for the Late period, where pelagic fishing was focused on smaller, net-caught species such as herrings. Such considerations return us to the original purpose of this investigation: determining whether evidence exists for multiple foraging optima (MFO) at these two sites.

In this chapter I consider the comparability of foraging strategies employed at Sabazan and Grand Bay, and offer an explanation for the differential zooarchaeological patterning between the sites. Following this, I evaluate the temporal trends evident at each site from the perspective of changing foraging efficiency. For the latter discussion, I focus in particular on Sabazan, where a larger component of the vertebrate and invertebrate assemblages has been analyzed.

8.2 Comparative Foraging at Sabazan and Grand Bay: Evidence for Multiple Optima

Previously, it was noted that MFO may be detected in cases where significant zooarchaeological differences exist between sites located in identical, or virtually identical, environmental settings *and* where these differences can not be assigned to minor environmental or cultural variations. The key zooarchaeological differences between Sabazan and Grand Bay can be summarized rather succinctly based on the statistically significant findings presented earlier.

8.2.1 Comparative Assessment of Prey

With regard to fishing during the Late period, ca AD 1000 – 1150/1250, inshore fish, especially jacks and the bigeye scad, are relied upon much more at Grand Bay than at Sabazan. Parrotfish are a top ranking taxon at both sites. However, parrotfish are emphasized more heavily among reef fish at Sabazan, while coral reef fishing at Grand Bay is more equitably distributed over several taxa. This is reflected in the statistically significant greater abundance of grunts at Grand Bay compared to Sabazan. Finally, while levels of pelagic fishing do not differ between the sites, tunas are significantly less abundant at Grand Bay, with herrings instead the dominant taxon from this habitat patch. Terrestrial vertebrates were exploited at relatively low frequencies at both sites and, at least by MNI, there do not appear to be any major differences in the degree of dietary contribution by these taxa.

Class-based faunal comparisons at Sabazan for the period between ca. AD 750/800 – 1400 indicate a decline in the relative importance of fish and an increase in gastropods (Table 5.18). Because only the Late period component of Grand Bay's vertebrate assemblage has been analyzed, comparison of temporal trends for fish between the sites is not possible. However, within invertebrate classes, evidence suggests gastropods probably increase significantly at Grand Bay over the span of Early to Late occupation, ca. AD 650 – 1250 (Table 5.28). While crabs decline at Sabazan, this change is not significant. Several specific crab and bivalve taxa exhibit differences in relative abundance between the two sites at different points in time, but generally these involve taxa of lesser importance (Table 6.4).

Among the most important invertebrate taxa—nerites, turbans/top snails, chitons and conchs—the differences between two sites are limited. Conchs and nerites each increase over time at both locations beginning around AD 800. The spike in nerite abundance during the Middle-L003 phase at Grand Bay is anomalous, but nerite numbers in the subsequent Late period are consistent with an overall trend for an increase in this taxon at both sites (Table 5.26, Table 6.4). Chiton exploitation is regular and steady at both Sabazan and Grand Bay, and at both locations *Chiton tuberculatus* replaces *Acanthopleura granulata* after about AD 800 – 1000 as the major species collected. Chitons are generally somewhat more abundant at Grand Bay than Sabazan, but this difference is only statistically significant during the Middle-L005/Middle period. Lastly, slipper snails (*Crepidula* sp.) were typically more important at Grand Bay than Sabazan, but their relatively greater abundance is significant for just one period, the Late period. As previously mentioned, Grand Bay *Crepidula* specimens appear to have been generally larger than those from Sabazan based on qualitative observations. This may reflect size differences in the local populations available for harvest that made Grand Bay slipper snails a more attractive resource.

In general then, for the taxa of greatest importance, the zooarchaeological differences are limited and tend to be more pronounced for fishing as opposed to mollusc collection. But, as previously discussed, indices of diversity and evenness, along with richness counts (which may be compared at the family level) point to differences between the sites that require explanation.

Shannon-Weiner diversity and evenness measures cannot reveal (in)consistencies in the specific taxa exploited at each site, however. Therefore, to assess the degree of taxonomic overlap between the two study sites, I employed the Morisita-Horn similarity index (Magurran 1988:95-96, 2004:174-175) which takes into account both the taxa present and their abundance and is particularly sensitive to the abundances of the most prevalent taxa. The Morisita-Horn index is scaled so that for sites of absolute similarity, the index returns a value of 1.0. I also employed a second similarity index, the Jaccard index (Magurran 1988:95), which is based simply on the presence or absence of taxa irrespective of their abundance. It too is scaled to 1.0. By comparing the set of species exploited at Sabazan to that of Grand Bay, the Jaccard index provides a simple measure of taxonomic correspondence between the assemblages. The Morisita-Horn index goes beyond this by giving primacy to those taxa which are most important at each site and reflecting the degree to which these are equally abundant. This may serve to filter out some of the "noise" from non-dietary and rare species, as well as provide an additional "depth" dimension to diet breadth.

When the two indices are employed in concert, the Jaccard index will indicate the degree to which taxon-specific diet breadth overlaps between the two sites for a given period. Any differential between it and the Morisita-Horn index will reflect the extent to which the same taxa are emphasized at each site. If the Morisita-Horn is lower than the Jaccard index, this indicates that while the specific taxa exploited at each site are similar, the greater part of exploitation is focused on different taxa. If the Morisita-Horn index is higher, this suggests that while specific taxa exploited at each site are not a perfect match, the greater proportion of resource acquisition is focused on the same set of taxa. For these assessments, I compare assemblages based on MNI and family-level taxonomic designations using the same data structure employed earlier to calculate diversity and evenness indices (Table 5.7, Table 5.22).

The Morisita-Horn indices for the invertebrate comparisons by period are all quite high, approaching, 1.0, with the exception of the Early period where the small size of the Sabazan sample is probably an issue (Table 8.1). The values for the Jaccard index, however, are all substantially lower than their Morisita-Horn counterparts and actually decline slightly over time. Together, these data indicate an imperfect overlap in the invertebrate taxa targeted at each site, but high degree of similarity in the taxa most emphasized and their relative contributions to the assemblages of each site.

The Morisita–Horn index for the Late period vertebrate assemblages is lower than that of the invertebrate assemblage. In addition, the degree of departure from the Jaccard index is also much smaller, suggesting that there is less similarity between the two sites for vertebrate exploitation than for invertebrate exploitation. Comparable results are obtained for the combined invertebrate and invertebrate samples. The Morisita-Horn index suggests some, but not a high degree of similarity (i.e., close to 1.0) in taxonomic composition and abundance for the assemblage as a whole. The Jaccard index reflects the same fact for diet breadth, and again, there is less departure between the two indices than in general for the invertebrate assemblage. Overall, the indices indicate that diet breadth overlaps but is not identical. However, where the most important taxa at each site are concerned, the assemblages are much more similar, and in the case of invertebrate exploitation, virtually identical.

8.2.2 Comparative Assessment of Patches

I employ the Morisita-Horn index to assess similarity between habitat patch use at Sabazan and Grand Bay during the Late period. Here, habitats essentially become the targeted “prey”, and since the same set of five habitats—rocky intertidal, inshore/shallow waters, coral reef, pelagic, and terrestrial—is fixed across both sites, the Morisita-Horn index will only detect differences in levels of exploitation between these habitats. Chi square tests previously indicated that these were not dissimilar between sites, at least for the Late period (Table 6.8). But where the chi square statistic indicates the probability of the observed patterning occurring by chance, the

Morisita-Horn index provides a measure of the strength of similarities or differences between sites. Following from the MVT (Charnov 1976), levels of disparity detected here may reflect differences between sites for in-patch residence time or return-rates.

As expected, the index is extremely high, with a value approaching 1.0, reflecting virtually identical levels of exploitation within the five major habitats surrounding the sites (Table 8.2). I performed the same test focusing exclusively on the major habitats reflected in the fish sample: inshore/shallow water, coral reef, and pelagic (Table 8.2). Although still relatively high, the index for fish habitats during the Late period, ca. AD 1000 – 1150/1250, is somewhat lower than that for all habitats in the assemblage as a whole. This is consistent with statistically significant differences detected between levels of inshore/shallow water fishing at Grand Bay and Sabazan (Table 6.9), and is in keeping with the lower Morisita-Horn index value for vertebrate assemblages in comparison to invertebrate assemblages during the Late period. Since the available data suggest that the major differences between Sabazan and Grand Bay, both in terms of prey and patches exploited, lie within the fish assemblage, this is where I focus my assessment of evidence for multiple foraging optima.

8.2.3 Evidence for Multiple Foraging Optima

Previously, I noted that observed differences in the foraging strategies of two groups could be attributed to different optima if lack of correspondence between ecological, technological, and social variables do not account for the phenomenon. The results of this investigation do not appear to indicate the possibility of MFO. Instead, the major differences between the sites seem to correlate with differences in habitat/patch availability. For example, in conjunction with higher levels of fishing in this environmental patch, the shallow water bay system at Grand Bay is much larger than that of Sabazan—more than six times greater as measured by the area encompassed by headlands on either end of the bays. Similarly, the relative abundance of tuna at Sabazan may relate to the greater accessibility of open pelagic waters at this site, which can be reached by clearing the edge of the barrier/fringing reefs about a half kilometer from shore (Figure 4.10).

I test this proposed explanation by relying on the prey and patch choice models to establish a set of assumptions and empirical predictions, derived with reference to the earlier theoretical discussion (see Chapter 2).

1. All else being equal, within a given habitat patch, larger prey will be ranked higher than smaller prey because of greater handling and processing costs associated with the latter.

2. All else being equal, more distant/less accessible patches will be ranked lower than nearby patches because of the cost of added travel time for more distant patches.

In light of these assumptions, I predict:

1. In comparison to Sabazan, a greater abundance at Grand Bay of small, shallow water fish relative to small pelagic fish. This is because foragers are expected to target small fish close to shore before exploiting similarly small, but more distant fish that require more effort to access.

2. In comparison to Sabazan, a greater abundance at Grand Bay of large pelagic fish relative to small pelagic fish. This is because with increasing distance from a central place, foraging should be increasingly restricted to larger prey to maximize return rates.

To test these two predictions, I employ two abundance indices, the small shallow water fish (SSWF) index and the large pelagic fish (LPF) index. As previously noted, abundance indices (AI) have been widely applied by zooarchaeologists to detect changes in foraging efficiency (Allen 2002, 2012; Bayham 1979, 1982; Betts and Friesen 2006; Broughton 1994, 1997, 1999; Cannon 2000, 2003; Morrison and Hunt 2007; Morrison and Cochrane 2008; see Ugan and Bright 2001 for a critique). Because of the different sampling approaches employed for the 6.4 mm and 1.6 mm components from Sabazan (i.e., the 6.4 mm and 1.6 mm screened subsamples represent differing proportions of the whole; see section 5.2.1), NISP values for this site were first standardized against excavated volume to permit appropriate comparison with Grand Bay. The SSWF and the LPF indices are both calculated using NISP values as follows:

$$\text{SSWF Index} = \frac{\Sigma\ \text{NISP small shallow water fish}}{\Sigma\ (\text{NISP small shallow water fish} + \text{NISP small pelagic fish})}$$

$$\text{LPF Index} = \frac{\Sigma\ \text{NISP large pelagic fish}}{\Sigma\ (\text{NISP large pelagic fish} + \text{NISP small pelagic fish})}$$

The SSWF and LPF indices are scaled so that as they approach 1.0, small shallow water fish and large pelagic fish, respectively, predominate in the assemblage. Small shallow water fish incorporated into the SSWF index are *S. crumenophthalmus*, Mullidae, and Ostraciidae. Small pelagic fish are *Trachurus lathami,* Exocoetidae, Hemiramphidae, Belonidae, and Clupeidae. Clupeids, in fact, include herring species (e.g., *Harengula* spp.) that school closer to shore along sandy beaches, in lagoons, and over reefs, as well as those that occur up to the edge of the continental shelf (e.g., *Sardinella* spp.) (Froese and Pauly 2013; Smith 1997). In this study, however, I follow Newsom and Wing (2004) in treating herrings as pelagic fish to allow for appropriate comparison with prior zooarchaeological work in the Caribbean. Similarly, while I have treated Hemiramphidae and Belonidae as pelagic species, also following Newsom and Wing (2004), these families include some inshore species as well as juvenile (small) members that can be found in shallow waters close to shore (Banford 2010; Froese and Pauly 2013; McBride and Thurman 2003; Smith 1997) (Table 5.20 and Table 5.29). All species of tuna/mackerel (Scombridae) are treated as large pelagic fish. Unfortunately, because lower level species designations are not always possible for the remains of some fish families incorporated into these indices, a degree of uncertainty is necessarily associated with this exercise.

SSWF and LPF index values indicate that neither prediction is met (Table 8.3). At Sabazan, small shallow water fish are relatively more abundant among combined small shallow water and pelagic fish than at Grand Bay. Similarly, at Sabazan, large pelagic fish constitute a slightly larger component of the overall pelagic fish assemblage than at Grand Bay.

There are a couple of possible explanations for these unexpected results. Return rates for the respective taxonomic categories may not actually conform to the assumptions outlined above. In particular, the use of nets for mass capture of small schooling fish such as the bigeye scad and herrings may have meant that these species yielded a much higher return rate on a par with, or perhaps even greater than, that for large fish such as tuna (Cannon 2000; Grayson and Cannon 1999; Jones 2004b, 2006; Kaplan and Hill 1992; Madsen and Schmitt 1998). Based on ethnohistoric descriptions, modern analogues, and experimental data, fishing gear/methods probably in use in the pre-Columbian Caribbean include hook-and-line techniques, seine nets, gill nets, basketry traps, weirs, and fish poison, the last derived from several possible plant species (Baldeo 2011; Keegan 1986; LeFebvre 2005, 2007; Wing and Reitz 1982; Newsom and Wing 2004:209). As previously mentioned, fishhooks recovered from both Grand Bay and Sabazan indicate hook-and-line technology was undoubtedly in use at the study sites.

In her analysis of fishing at Grand Bay, LeFebvre (2005, 2007) found that 90% of measurable non-caudal fish vertebrae were less than 5 mm, and, based on allometric regression of atli measurements, more than 90% of the biomass contribution came from fish weighing ≤ 200 g each. She concluded that Grand Bay foragers specifically targeted small-sized fish using nets. Since researchers have questioned whether mass capture truly raises the return rates of small prey sufficiently to alter their ranking, given that they frequently have high processing costs, consideration of other causes for the patterning observed in this study is warranted (Ugan 2005; Lupo and Schmitt 2005).

One alternative explanation for the failure of the predictions made here may rest with the fish habitat assignments themselves. Clupeids form a sizeable component (by NISP) of the small fish assemblage, particularly at Grand Bay. As discussed above, some species may be found quite close to shore around reefs and in lagoons. If herring specimens from Grand Bay and Sabazan belong to these species, then the relative exploitation of inshore and pelagic habitats will be wrongly characterized in this study, and given the relative abundance of this family in the fish assemblage, may skew results. To test this alternative, I recalculated the SSWF and LPF indices, treating clupeids as inshore/shallow water taxa. The resulting index values conform to the predictions above (Table 8.4). At Grand Bay, small shallow water fish are relatively more abundant among combined small inshore and offshore fish than at Sabazan. And, also at Grand Bay, a greater proportion of all pelagic fish are large taxa (Scombridae). These findings are consistent with foraging theory expectations. Additional investigation is needed, however, to confirm which clupeid genera or species are present at the sites before firm conclusions may be drawn. Importantly, if the herring species present are not offshore pelagics, this may alter previous characterizations of habitat patch-based exploitation by Sabazan and Grand Bay residents, and, possibly, related statistical assessments and interpretations.

Despite these complications, I conclude that, at present, there is insufficient evidence to indicate the existence of multiple foraging optima at Grand Bay and Sabazan. The strongest disparities between the two sites align with those precise differences in ecological variables that were discussed earlier in this thesis as potential analytic complications (see Chapter 4). I argue that the zooarchaeological patterning encountered in this study is best explained by modest, but important habitat differences. Specifically, the greater abundance of inshore fish taxa at Grand Bay corresponds to the much larger size of the bay here. Modern ecological data indicate the presence of a significantly larger area of well-developed sand flats and seagrass habitat that, if present a millennium ago, would have supported the small schooling carangids, juvenile fish, and conch that are abundant at Grand Bay (Figure 4.9).

The large quantity of tuna at Sabazan is likely related the shorter distance to open water habitat, which presumably lowered the travel time/handling costs associated with exploiting this patch (Figure 4.10). The tuna taxa present at Sabazan are mostly *Auxis* spp., *Thunnus* sp., and

Katsuwonus pelamis. *Auxis* are small tunas (maximum fork length 50 – 65 cm) that prefer coastal waters around islands (Collette 2002; Froese and Pauly 2013). Because the blackfin tuna (*Thunnus atlanticus*) frequently schools with the skipjack (*K. pelamis*), the *Thunnus* remains from Sabazan may belong to this species (Collette 2002; Taquet et al. 2002). Based on comparative skeletal material, most of the *K. pelamis*, *Thunnus,* and *Auxis* specimens at Sabazan represent fish ranging in size from about 30 – 75 cm in total length and between roughly 1.5 – 4.2 kg. Presumably tuna were caught uing a hook and line, but the rarity of fishhooks in the assemblages of both sites, as well as the Caribbean in general, makes it difficult to assess the level of technological specialization associated with this activity.

Skipjack and blackfin are both highly migratory oceanic fish that will, at certain times of the year, move in over the continental shelf, coming near islands and sometimes relatively close to shore (Collette 2002; Taquet et al. 2002; Vieira et al. 2005). Sabazan residents may have taken advantage of this behavior and the relatively easy access afforded by site location to acquire these species during these periods. Wing and Wing (2001) have argued similarly to explain Nevis's strong, stable prehistoric tuna fishery. Grenada's modern fishery targets seasonally available migratory coastal pelagics, including blackfin, yellowfin (*T. albacares*), and albacore tuna (*T. alalunga*) between October and July (Baldeo 2011).

Finally, as noted in Chapter 6, during the Late period at Sabazan, the MNI-based relative abundance of parrotfish is significantly greater than at Grand Bay. At the latter site, coral reef-based fishing is more equitably distributed over several taxa, such as grunts, surgeonfish, and snappers. It is not clear why this is the case. However, scarid relative abundance during the Late period is the highest recorded for any time at Sabazan and represents a significant increase over the preceding Middle period, ca. AD 750/800 – 1000. During Sabazan's Middle and Final periods, parrotfish relative abundances are actually similar to that of Grand Bay's Late period (Table 5.12, Table 5.24). In addition, during the Late period at Sabazan, carangids, which are top-ranked, decrease significantly. Varying levels of exploitation for top ranking taxa may relate to changes in foraging efficiency. I address the topic of changing foraging efficiency and evidence for anthropogenic environmental impacts in the remainder of this chapter.

8.3 Foraging Efficiency and Evidence for Anthropogenic Environmental Impacts on Prehistoric Carriacou

Certain zooarchaeological trends at Sabazan and Grand Bay suggest possible resource depression brought on by human predation pressure. The relative decline of fishing at Sabazan and the increase in gastropod exploitation at both sites are consistent with diet breadth expansion due to depletion of higher ranking marine vertebrate resources. I explore the potential for exploitation depression initiated by Carriacou's prehistoric residents, focusing on the site of Sabazan after AD 750, where broader analytic coverage of both the vertebrate and invertebrate assemblages offers the ability to test several zooarchaeological indicators of anthropogenic environmental impacts.

8.3.1 Indices of Declining Foraging Efficiency

In a prehistoric foraging context, molluscs are often considered to have been low-ranked resources due to their relatively small size and high handling costs (Braje and Erlandson 2009; MacArthur and Pianka 1966; Ugan 2005). A considerable degree of research and discussion has challenged just how marginal molluscan resources truly were to coastal foragers in the past (Claassen 1998; Daniels 2009; Erlandson 1988, 2001; Erlandson and Fitzpatrick 2006; Erlandson et al. 2007; Jerardino and Marean 2010; Marean et al. 2007; Parkington 2004; Waselkov 1987). Nevertheless, their increase in the archaeological record relative to larger vertebrate resources is often heralded as an indicator of declining foraging efficiency and evidence for anthropogenic human impacts consistent with foraging theory predictions (Blick 2007; Newsom and Wing 2004; but see Erlandson et al. 2009).

I examine this possibility for Sabazan based on two indices of foraging efficiency that quantify the relative proportions of fish and gastropods in the assemblage and the relative proportions large and small fish within the fish assemblage. In employing these abundance indices below, I make no assumptions about prey capture methods (i.e., use of mass capture, etc.), but instead rely on body size as a proxy for return rates (Broughton et al. 2011). This allows me to rank large fish more highly than small fish, and collective fish more highly than collective gastropods.

Earlier statistical tests indicated a significant change in fish and gastropod abundance between the Middle and Final occupation at Sabazan (Table 5.18). To more fully explore this relationship I employed a fish index to quantify changes in fish abundance relative to that of gastropods (excluding conchs) based on MNI data in Table 5.8. The fish index is calculated as follows:

$$\text{Fish Index} \quad = \quad \frac{\Sigma \text{ MNI fish}}{\Sigma \text{ (MNI fish + MNI gastropods)}}$$

The index values across the Middle, Late, and Final periods indicate a sequential decline in the relative amount of fish based on MNI (Figure 8.1, Table 8.5). A Conchran-Armitage test for linear trends among proportions (see Zar 1999:565-68; Cannon 2001b, 2003) indicates that this temporal reduction in fish relative abundance is significant. While these results point to a switch from higher ranking to lower ranking prey, suggesting an overall decline in foraging efficiency at Sabazan, additional evidence is required to demonstrate that the increase in gastropods over time is due to specific changes in energetic returns from the fish catch.

Based on the assumption that foragers will preferentially target larger, higher ranking fish over small, lower ranking fish, I employed a large fish (LF) index to explore the potential for declining foraging efficiency within fishing. Previous studies have demonstrated that the average size and biomass of fish decrease with increased predation pressure as people "fish through" larger bodied taxa and turn increasingly to smaller species (Blick 2007; Hardt 2009; Morrison and Addison 2009; Pauly et al. 1998, 2000; Quitmyer and Reitz 2006; Reitz 2004; Reitz et al. 2009; Steadman and Jones 2006; Wing 2001; Wing and Wing 2001). The LF index will reflect this phenomenon if present at Sabazan. The index is calculated as follows:

$$\text{LF Index} = \frac{\Sigma \text{ MNI large fish}}{\Sigma \text{ (MNI large fish + MNI small fish)}}$$

Because of their indeterminate growth, many fish species exhibit a considerable size range. For this reason, family and genus level identifications do not necessarily correlate meaningfully with mass/length in a manner that would make them appropriate for use in this index as an indicator of size. For example, some juvenile species of carangid may be only 10 cm total length, while other mature species can reach over 1 m (Smith 1997). Since in the course of analysis fish size was taken into account when calculating MNIs, for Sabazan it is possible to compare the MNI values of the smallest fish to the MNI of larger fish even within a single species. I have used this approach here, defining small fish as those with anterior vertebral widths under ca. 3 mm, for which all skeletal remains (except a fused neurocranium) are too small to be captured in the 6.4 mm screen mesh. These fish would likely have been caught with nets or fine gauge traps. Large fish are all those which lie above this size threshold. The index employs standardized MNI values (per 10 cm^3) to correct for differences in sampling protocols between 6.4 and 1.6 mm screen fractions.

The LF index shows only a very slight decline over time at Sabazan (Figure 8.1, Table 8.6). Because original MNI values have been standardized, a Cochran-Armitage test of linear trend is not appropriate here. However, since the proportion by which large fish have decreased in the assemblage is only about 2 % in ca. 600 years, and because the raw MNI values indicate an even smaller change in large fish proportion over time, I conclude that large fish relative abundance remains fairly stable over the course of occupation at Sabazan. While it appears that fishing does decline relative to gastropod exploitation at the site, this trend is not driven by declining energetic returns for large fish.

One remaining possibility is that the depletion of nearshore fish resources forced Sabazan residents to pursue fish further offshore, and that declines in foraging efficiency for fishing may take this form at the site. As discussed above and in previous chapters, all else being equal exploitation of prey in more distant patches is expected as return rates decline in more proximate habitat patches. This phenomenon has previously been detected in the pre-Columbian zooarchaeological record primarily as an increase in the presence of pelagic fish (Newsom and

Wing 2004; Wing and Wing 2001). Previous chi square tests for changing levels of exploitation between major habitat patches at Sabazan do not support this scenario (Table 5.14). Instead, declines in inshore fishing are compensated for by a relative increase in coral reef fish—consistent with the Late period spike in parrotfish relative abundance—but levels of pelagic fishing remain unaltered. In addition, tests of overall faunal exploitation (excluding conch) across all habitats indicated relative declines in both inshore and coral reef exploitation, the latter of which is represented exclusively by fish (Table 5.21).

These changes may still be consistent with patch shifts brought on by exploitation depression, however. Rather than rely more heavily on offshore fish, residents may have turned instead to exploitation of intertidal and shallow water invertebrate resources. If this is the case, then nearshore fish assemblages should show evidence for declines in foraging efficiency in the form of an increase in the relative abundance of small, lower ranked fish from inshore waters and coral reefs. To test this possibility I employ the same procedure used to create the dataset for the LF index. The large nearshore fish (LNSF) index groups coral reef and inshore fish into a single nearshore category (excluding herrings) and is calculated as follows:

$$\text{LNSF Index} = \frac{\Sigma \text{ MNI large nearshore fish}}{\Sigma \text{ (MNI large nearshore fish + MNI small nearshore fish)}}$$

The resulting index for the proportion of large nearshore fish in the assemblage reveals minor fluctuations of about 2% over the span of occupation, with index values for the Final period slightly higher than those of the preceding Late period and almost equal to those of the Middle period (Figure 8.1, Table 8.7)[5]. These results do not support a model for the incorporation of smaller fish into diet as encounter rates with larger inshore and coral reef fish decline.

The size-based analyses pursued here are coarse-grained, and it may be that the two size classes, large and small, are too broad capture variation over time. Additional studies based on allometric reconstructions of fish size or biomass may offer further insights by providing finer-grained data (Blick 2007; LeFebvre 2005; Longnecker 2011; Reitz et al. 1987, 2009; Reitz and Wing 2008; Seymour 2004; Wing and Wing 2001; Zohar et al. 1997). At present, however, there is insufficient evidence to conclude that the relative increase in exploitation of gastropods such as conchs and nerites after ca. AD 800 at Sabazan is related to anthropogenic exploitation depression of fish.

8.3.2 Explaining Temporal Trends in Foraging at Sabazan

The results of foraging efficiency investigation and the earlier size analysis of tessellated nerites together suggest that overall resource use at Sabazan, and possibly also at Grand Bay, was sustainable over more than a millennium of occupation. The trend for increasing exploitation of seemingly lower ranking nerites and conchs does not fit a resource depression model, but requires explanation nonetheless. Possible causal mechanisms involve culturally specific variables, such as changes in food production, as well as broad environmental factors, like changing climate. I do not consider technological enhancements to be relevant here as most

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[5] Including Clupeidae as nearshore taxa does not alter the results. Recalculated LNSF values with clupeids are: Middle period = 0.065, Late period = 0.042, Final period = 0.053.

gastropods may be easily collected from littoral and sublittoral areas with limited technology (Bird 1997; De Boer 2002).

In their analysis of fish remains from the archaeological site of Chelechol ra Orrak, Palau, Fitzpatrick et al. (2011) posited that declines in fishing after ca. 1400 – 1250 BP may have been related to settlement changes coupled with increasing agricultural production. Very little is known about pre-Columbian agriculture on Carriacou. In general, however, horticultural/agricultural production for the Ceramic Age Caribbean is commonly understood (or presumed) to have been well-developed, at least for the Greater Antilles, and variously included crops such as sweet potato, maize, and manioc (Berman and Pearsall 2008; deFrance and Newsom 2005; Lane et al. 2008; Mickelburgh and Pagán-Jiménez 2012; Newsom and Pearsall 2003; Newsom and Wing 2004). It is possible that subsistence activities on Carriacou shifted toward the terrestrial environment with an increasing reliance on cultivation over time, imposing new opportunity costs that could have limited foraging activities, including fishing (Tucker 2006).

Evidence for agricultural intensification should be reflected in geoarchaeological and palynological records that signal increased rates of erosion, charcoal influx, and pollen counts for cultigens, all markers which are associated with land clearance and cultivation. These records have not yet been investigated for Carriacou, but evidence from elsewhere in the Caribbean illustrates how such data can be used to reconstruct human paleoecology and landscape changes associated with agricultural activities. For instance, in a study of two archaeological sites dating to the 9th and 15th centuries from Bluefields Bay, Jamaica, Keegan et al. (2003) found changes in bay ecology later in prehistory that arose from increased sediment loads within the rivers flowing into the bay, something the authors attributed to agricultural activities coupled with increased precipitation. Over time, siltation changed the bay from one of freely circulating, high salinity waters supporting sea grass communities and molluscs such as *E. gigas*, to one of low turbidity, low salinity habitat marked by muddy substrates, the development of mangal, and an increase in taxa favouring these conditions, such as lucinid clams. On prehistoric Cairracou, agricultural intensification with resultant erosion and eutrophication could potentially have had a similar impact by silting and smothering the reef, altering the ecological communities in Sabazan Bay to the detriment of fish populations. Available evidence does not support this scenario, however. For instance, *E. gigas*, which increases in archaeological abundance over time at both Sabazan and Grand Bay, prefers clear, well-circulating waters and seagrass substrates which are not expected to be favored under this model. In addition, transport mechanisms for bay siltation are limited as Carriacou lacks rivers. In fact, the island today is shrinking in part because land progradation into the sea is limited, although other factors, such as sea level rise, play a role (Hendry 1993).

If increased emphasis was placed on terrestrial resources at Sabazan, it is not reflected in the temporal changes of the zooarchaeological record, where levels of terrestrial exploitation are actually lower by the end of site occupation (Table 5.21). In addition, an increase in rice rats that is often associated with the augmentation of ecotone habitats through agricultural and settlement expansion is contraindicated for Sabazan (Grouard 2004; Wing 1995, 2008) (Table 5.14). Terrestrial mammals, in general, played a relatively minor dietary role at Sabazan and Grand Bay. Although, it is possible their cultural significance may have rested in their symbolic value as, for example, a marker of status-mediated consumption, similar to prehistoric commensal taxa in other island regions (Deagan 2004; Giovas et al. 2012; Kirch and O'Day 2003). In accordance with signaling theory, the currency assumptions and rankings for animals like agouti and guinea pig, may need to be reconsidered for behavioral ecology based studies of pre-Columbian foraging in the Caribbean (Bliege Bird and Smith 2005; Lupo 2007; Lupo and Schmitt 2005). Additional, more robust lines of evidence are required first, however, in order to confirm a symbolic and/or ritual role for prehistorically introduced Caribbean mammals (see discussions in Curet and Pestle 2010; deFrance 2009, 2010, 2013; LeFebvre and deFrance in review).

A recent study of stable isotopes conducted on the skeletal remains of 14 individuals from Grand Bay indicates bone collagen values relatively low in $\delta^{15}N$ and high in $\delta^{13}C$ (Krigbaum et al. 2013). While consumption of C_4 plants, such as maize, may produce this signature, Keegan and DeNiro (1988) demonstrated that similarly depleted $\delta^{15}N$ values may result from dietary dependence on shallow water marine species, including *Nerita* spp., where local environments are affected by atmospheric N_2 fixation by blue-green algae. Based on Carriacou's extensive reef system coupled with the zooarchaeological abundance of marine taxa, Krigbaum et al. (2013) concluded that their results were most parsimoniously explained by a strong reliance on food resources from shallow water and reef-based ecosystems.

Broad environmental changes that could account for the observed faunal patterning would be expected to impact Grand Bay and Sabazan in a similar manner. Since the trend for increasing nerite and conch exploitation is seen at both sites, the role of climate change deserves careful consideration. Increasing aridification in the Caribbean is documented for the period after 3200 BP based on oxygen isotope data from sediment cores of Lake Miragoane, Haiti (Hodell et al. 1991). Multi-proxy indicators from sediment cores of the Cariaco Basin, Venezuela, indicate alternating arid and moist-humid regimes during this period (Haug et al. 2003; Tedesco and Thunell 2003). Based on comparative assessment of circum-Caribbean records, Malaizé et al. (2011) found conflicting climate signals for a given period depending on record locality and suggested that location with respect to the Intertropical Convergence Zone and the North Atlantic Oscillation influenced the specific impact of climate changes for islands in the Caribbean over the last several millennia.

As such, local records probably more reliably indicate Carriacou's paleoclimate. The most local available come from Grenada. Here, multi-proxy records from Lake Etang and Lake Antoine point to an increase in effective moisture in the immediate area after ca. 3200 BP (Fritz et al. 2011; McAndrews and Ramcharan 2003). The Lake Antoine record subsequently indicates enhanced aridity in the Late Holocene, between 1600 – 1400 cal. BP, and again between 1200 – 800 cal. BP (Fritz et al. 2011). Carriacou's prehistoric occupation lies within this period of variably increasing aridity. The foraging shifts evident in Sabazan and Grand Bay's zooarchaeological record occur either as marked changes between the Middle and Late periods, ca. AD 800 – 1200, or as gradual transformations within that last 600 years of occupation at Sabazan, ca. AD 800 – 1400. The decline in fishing and increase in nerite and conch collection on Carriacou during these centuries coincide with the Medieval Warm Period (MWP), ca. AD 900 – 1300. Circum-Caribbean paleoclimate records for the MWP document warmer sea surface temperatures (SST) and possible increased frequency of hurricanes and major storms (Gischler et al. 2008; Malaizé et al. 2011; Richey et al. 2007).

The size increase observed for *N. tessellata* at Grand Bay may have resulted from more favorable growth conditions promoted by warmer temperatures during the MWP, consistent with research by Kolipinski (1964), who found a positive correlation between growth rate and SST in *Nerita*. Interestingly, a size increase is also documented for a large sample of tessellated (n = 2700) nerites from the Coconut Walk site on Nevis during the same time frame, AD 890 – 1440, concurrent with increased exploitation of this species (Giovas et al. 2013). This explanation for nerite size increase should be treated as tentative, however, since the same effect is not seen at Sabazan.

The impact of changing MWP precipitation and SST regimes on Carriacou's reef system is unknown, but theoretically could have had deleterious effects. Climate warming in the modern era is associated with pronounced ENSO events in the Pacific (although these may have been less frequent during the MWP) (Cobb et al. 2003), warmer SSTs, and increased strength and frequency of tropical cyclones, all of which have contributed to significant coral bleaching episodes and reef die-off in the Caribbean, as well as globally (Booth and Beretta 2002; Eakin et al. 2010; Emanuel 2005; Gill et al. 2006; Glynn 1990; Goldenberg et al. 2001; Saunders and Lea 2008). Temperatures in the Caribbean during the MWP would have been similar to or slightly warmer than today. The impacts of modern climate warming on reefs, however, are exacerbated by the effects of eutrophication, commercial fishing, and coastal development which would not have been present prehistorically. Reef communities in the past, therefore, may have been more resilient. Future planned research involving climate proxy data from Sabazan's zooarchaeological record will help to clarify the effect of climate change on Carriacou's paleoenvironment during the Late Holocene.

At present, there are insufficient data to say for certain what caused the observed trends in Carriacou's zooarchaeological record. The fact that similar processes seem to occur at both sites and that some of these occur on other islands contemporaneously (i.e., nerite size increase on Nevis), suggests changes may be driven by broader causal mechanisms, although this is not conclusive. Importantly, many of the zooarchaeological trends in Lesser Antillean sites taken to signify anthropogenic environmental impacts do not occur at Sabazan. The evidence here indicates that prehistoric foraging at Sabazan was sustainable, and in as much as it is possible to say, probably was also for Grand Bay. Viewed through a foraging theory lens, the record reveals patterns of resource exploitation that were strongly similar between sites, with the existing differences and temporal trends in foraging best explained by variations in environment across space and time.

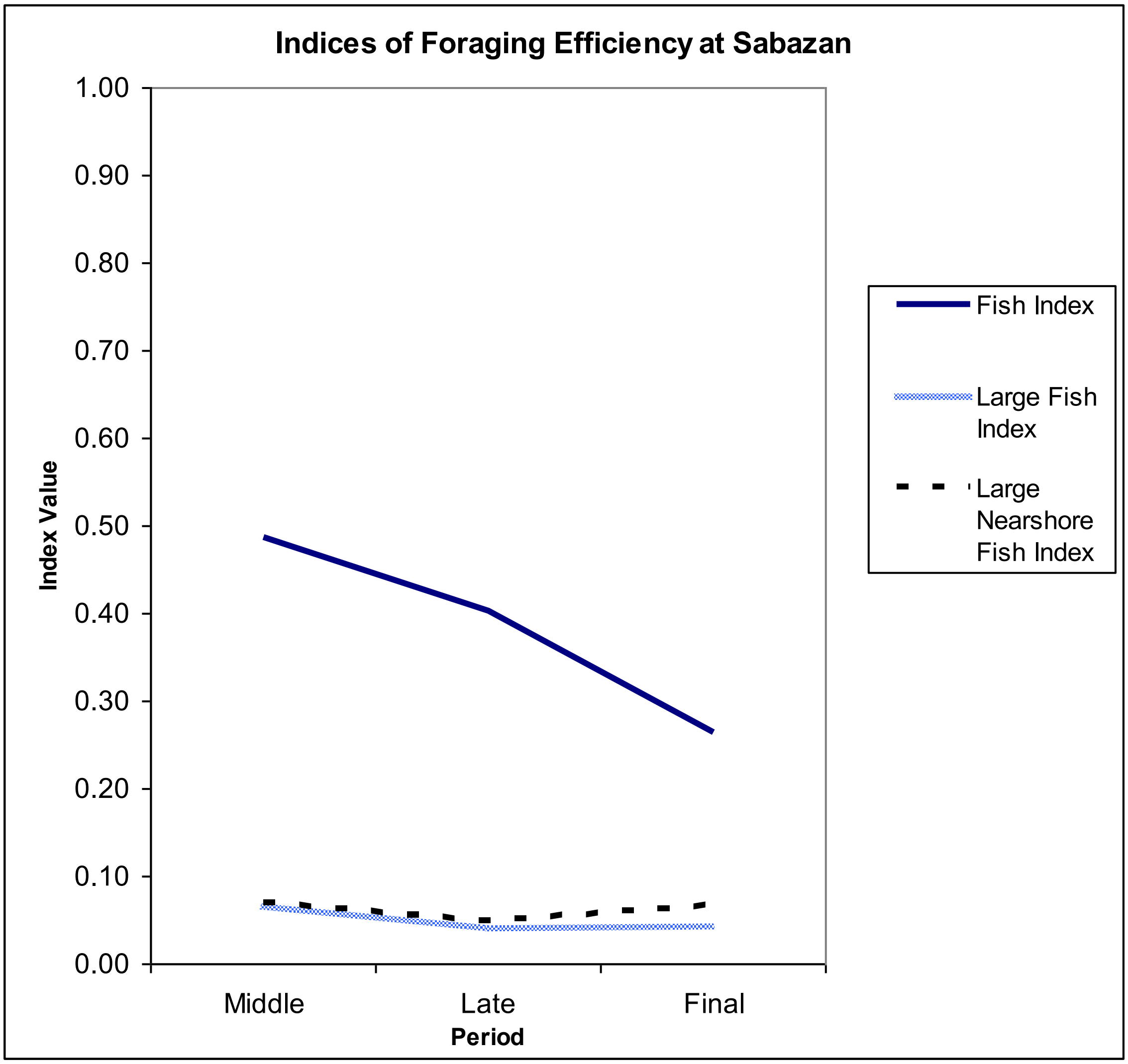

Figure 8.1 Indices of foraging efficiency at Sabazan.

Table 8.1 Similarity indices for faunal exploitation at Grand Bay and Sabazan.

		Similarity Indices					
		Grand Bay		Sabazan			
		Ntaxa	MNI	Ntaxa	MNI	Morisita-Horn Index	Jaccard Index
Invertebrate							
	Early Period	27	94	9	17	0.530	0.333
	Middle-L005/ Middle Period	19	118	26	171	0.926	0.607
	Middle-L003/ Middle Period	20	158	26	171	0.879	0.533
	Late Period	32	559	15	64	0.910	0.469
Vertebrate							
	Late Period	25	120	24	119	0.777	0.690
Invertebrate and Vertebrate							
	Late Period	57	679	39	183	0.616	0.574

Table 8.2 Morisita-Horn index for similarity of habitat exploitation for the Late period at Grand Bay and Sabazan.

Similarity Index for Habitat Exploitation

	Grand Bay		Sabazan		
	NHabitats	MNI	NHabitats	MNI	Morisita-Horn Index
All Habitat Patches					
Late Period	5	223	5	101	0.984
Fish Habitat Patches					
Late Period	3	104	3	102	0.950

Table 8.3 Small shallow water fish (SSWF) and large pelagic fish (LPF) indices for the Late period at Grand Bay and Sabazan.

Abundance Indices		
	Grand Bay	Sabazan
Small shallow water fish NISP	38	22
Small pelagic fish NISP	361	50
SSWF Index	0.095	0.306
Large pelagic fish NISP	39	$1.30/10cm^3$
Small pelagic fish NISP	361	$9.551/10cm^3$
LPF Index	0.098	0.120

Table 8.4 Small shallow water fish (SSWF) and large pelagic fish (LPF) indices with herrings treated as a shallow water taxon.

Abundance Indices	Grand Bay	Sabazan
Small shallow water fish NISP (including clupeids)	369	58
Small pelagic fish NISP	361	50
SSWF Index	0.925	0.806
Large pelagic fish NISP	39	1.30/10cm^3
Small pelagic fish NISP (excluding clupeids)	30	2.67/10cm^3
LPF Index	0.565	0.327

Table 8.5 Fish index for Sabazan with results for Conchran's test of linear trends among proportions.

Sabazan Fish Index

	Fish MNI	Gastropod MNI	Total Fish and Gastropod MNI	Fish Index
Final period	33	92	125	0.264
Late period	31	46	77	0.403
Middle period	106	112	218	0.486
Total	170	250	420	

Cochran-Armitage Test	
$\chi^2 = 16.29$	$p < 0.001$
$\chi^2_{\text{trend}} = 16.09$	$p < 0.001$
Departure from linearity: $\chi^2 = 0.19$	$p = 0.659$

Table 8.6 Large fish index for Sabazan; *standardized as MNI/$10cm^3$.

Sabazan Large Fish Index

Period	Large Fish MNI (quarter of unit)	*Stndrd. Large Fish MNI	Small Fish MNI	*Stndrd. Small Fish MNI	Large Fish Index
Final	17	0.39	32	8.51	0.044
Late	10	0.20	25	4.78	0.040
Middle	49	0.26	106	3.72	0.065
Total	76		163		

Table 8.7 Large nearshore (coral reef and shallow water) fish index for Sabazan; *standardized as MNI/10cm^3.

Sabazan Large Nearshore Fish Index

Period	Large Nearshore Fish MNI (quarter of unit)	*Stndrd. Large Nearshore Fish MNI	Small Nearshore Fish MNI	*Stndrd. Small Nearshore Fish MNI	Large Nearshore Fish Index
Final	13	0.30	16	4.25	0.065
Late	8	0.16	17	3.25	0.047
Middle	38	0.20	78	2.74	0.068
Total	59		111		

Chapter 9

PRE-COLUMBIAN FORAGING AT SABAZAN AND GRAND BAY: CONCLUSIONS

The great shroud of the sea rolled on as it rolled five thousand years ago.

- Herman Melville, *Moby Dick*

9.1 Pre- Columbian Foraging on Carriacou in Comparative Perspective

Sixteen hundred years ago, a group of people with origins in mainland South America settled a small island in the southern Caribbean Sea. Looking out over the Atlantic Ocean, they established villages on the coast, villages which today are represented by the archaeological sites of Sabazan and Grand Bay. At these settlements, islanders went about the daily rhythms of life. They built houses, buried their dead, engaged in a rich socio-religious and symbolic life, hunted and fished, cultivated crops, and exchanged goods with neighbors, travelling perhaps as far as South America to do so. Terrestrial resources were part of their economy, but it was the sea that formed the basis of their lifeway for a millennium.

The role of the marine environment in subsistence, as least for the protein component of diet, is well documented by archaeological midden remains at Sabazan and Grand Bay as well as evidence from stable isotopes of human remains (Krigbaum et al. 2013). In this respect, prehistoric Carriacou is much like other Ceramic Age sites in the Lesser Antilles. Just as the results of this study indicate that subtle differences underlie broad similarities between Sabazan and Grand Bay, it is also the case that differences exist between Carriacou's record of resource use and the general patterns seen elsewhere in Lesser Antilles and Caribbean as a whole.

Fishing at Sabazan and Grand Bay illustrates this point. The results of this study and previous research (LeFebvre 2005, 2007) indicate that, collectively, coral reef taxa represent the largest component of the Sabazan and Grand Bay fish assemblages, in keeping with evidence for the importance of species such as parrotfish, grunts, groupers, and surgeonfish at other Lesser Antillean sites (Newsom and Wing 2004). At many of these same sites, however, there is a decline in coral reef fishing over time with concomitant shifts toward inshore and pelagic fishing (Blick 2007, 2012; Wing 2001; Wing and Wing 2001). Consistent with foraging theory expectations, these declines are measured as decreases in fish biomass, mean fish size, and mean trophic level. They are taken to indicate a pattern of overfishing of larger, aggressive piscivores with increasing reliance on smaller bodied, lower trophic level herbivores such as surgeonfish, smaller net-caught species, or more difficult to acquire pelagic species (Allen 2002; Blick 2007, 2012; Morrison and Addison 2009; Reitz 2004, Reitz et al. 2009; Wing 2001; Wing and Wing 2001).

Anticipated increases in inshore/shallow water and pelagic fish are not apparent at Sabazan over time. Pelagic fishing is relatively stable, and inshore fishing actually declines somewhat over the course of occupation. Unfortunately, it not possible to gauge temporal trends in fishing patch selection for Grand Bay since vertebrate remains from earlier deposits at this site have not been analyzed. Prey and patch switching in response to the depletion of nearshore fish are typically employed to explain an increase in pelagic species, especially tuna, in later Ceramic Age site deposits (Wing 2001; Wing and Wing 2001). However, the record for tuna fishing at Sabazan shows only minor fluctuations and levels of exploitation are consistently high through time with tuna always a top ranking fish taxon. While scombrids are found at many Ceramic Age sites in the Lesser Antilles (Newsom and Wing 2004), the abundance with which they occur at Sabazan (24% NISP, 9% MNI) is less typical. Fewer sites exhibit similarly high levels of tuna exploitation, among them the post-Saladoid component of Heywoods on Barbados (Drewett et al. 1993; Newsom and Wing 2004), Sandy Ground and Barnes Bay on Anguilla (Carder et al. 2007; Carder and Crock 2012), and the Golden Grove site on Tobago (Steadman and Jones 2006).

Pelagic and tuna fishing aside, one of the most profound differences between Carriacou's fish assemblages and those of the Lesser Antilles in general involves coral reef exploitation. At Sabazan, as a proportion of the overall catch, coral reef taxa increase over time, as do carnivorous reef dwellers such as snappers, groupers, and grunts. Representation of coral reef fish is similarly high at the end of occupation at Grand Bay. In addition, measures of foraging efficiency employed in this research for the Sabazan site (i.e., the large fish and large nearshore fish indices) failed to detect specific trends in taxonomic composition and fish size consistent with human predation pressure on fisheries.

Based on the data presented here, therefore, Carriacou constitutes an exception to a general pattern of depletion of coral reef fish stocks by prehistoric foragers. Although relatively few have been documented, cases for long-term stability in fishing and resource sustainability are found elsewhere in the Caribbean, including sites on Anguilla (Carder et al. 2007, 2012), San Salvador (Whyte et al. 2005), and Guadeloupe (Grouard 2001). Importantly, these cases together serve as a cautionary warning that anthropogenic environmental impacts in the past are not universal and cannot be assumed, not even for small insular ecosystems (e.g., Baisre 2010; Carder et al. 2012; see also Grayson 2001). The results of the tessellated nerite size analysis, in which snail size increases with increasing exploitation, bear this point out and are echoed by similar findings from Nevis in the northern Lesser Antilles (Giovas et al. 2013) as well as other island and coastal regions (Giovas et al. 2010; Leach and Davidson 2001; see also McCoy 2008 and Thackar 2011 for molluscan size increases in general). The final effect of human activities on ecological communities is the product of complex interactions between multiple living systems, the biology and life history of the species within these systems, various abiotic factors (e.g., climate, geology, oceanic hydrography), and historically particular events (hurricanes, volcanic eruptions, timing and distribution of exotic species introductions). In reconstructing anthropogenic paleolandscapes, archaeologists are probably still in the nascent stages of understanding and, more importantly, *being able to document* the complexity of these processes.

While it is true that fishing at Sabazan, and probably Grand Bay, was sustainable over the duration of occupation, fishing as a subsistence activity gradually declined after AD 800. The cause of this decline is not understood. Because it is accompanied by an increase in the exploitation of lower-ranking gastropod resources, it is tempting interpret this shift as evidence for exploitation depression. But again, specific indicators for intensifying predation pressure on fish are lacking at Sabazan, and taxonomic proportion alone cannot be relied upon as evidence for anthropogenic impacts. Importantly, the trend for declining fish abundance is not driven simply by increases in the relative abundance of gastropods. Absolute numbers of fish at Sabazan fall in the Late (AD 1000 – 1150) and Final (AD 1250 – 1400) periods. A reduction in the importance of fishing has been recorded from various locations in the Pacific where it has been variously ascribed to climate change (e.g., the “AD 1300 Event”) (Nunn 1999, 2000; Ono and Intoh 2011), technological shifts, or allocation of energy to other economic pursuits, such as agriculture (Allen 2002; Fitzpatrick et al. 2011).

Decreases in the fish catch at Sabazan correlate with the onset of the Medieval Warm Period around AD 800. In addition, the synchronicity of certain zooarchaeological patterns at both sites—for example, the increasing abundance of conchs and nerites, the shift in chiton exploitation from *A. granulata* to *C. tuberculatus*—suggests that broader causal mechanisms, like climate change, were at play. Precisely if and how Carriacou's marine environments were impacted by changing climate and what effect his may have had on human subsistence practices, however, requires further investigation.

Complicating this assessment is the fact that changes in foraging also coincide or slightly post-date evidence for settlement expansion and population increase at both archaeological sites beginning after ca. AD 700. While this research has established negative evidence for resource depression in fish and nerites specifically, impacts on other taxa remain undetermined, and the cases for these should be evaluated based on their own merits. Exploitation depression triggered by mounting predation pressure from a growing population may account for some of the zooarchaeological patterning not explored in greater depth in this study.

In particular, while the shift from exploitation of fuzzy chiton to West Indian chiton around AD 800 corresponds to changes in climate, the ecology and behaviour of these species also make this shift consistent with prey switching in response to resource depression. *Acanathopleura granulata* lives on exposed rocks in the intertidal zone and is more easily collected than *C. tuberculatus*, which occupies the same rocky intertidal habitat, but is only found submerged below the water line (up to ca. 40 cm) (Glynn 1970). Serrand and Bonnissent (2005) believed that accessibility explained the exclusive presence of fuzzy chitons at the Orient Bay site on St. Martin, even though West Indian chitons were also available in the surrounding environment. While this may be the case, it is worth noting that shallow water submersion does not appear to have inhibited the collection of other molluscan taxa, such as Strombidae spp. and *C. pica*. In keeping with foraging theory expectations and the body size proxy, however, *A. granulata* attains a greater size and average mass than *C. tuberculatus* (Glynn 1970; Slieker 2000), and this difference instead may explain preferential targeting of fuzzy chiton. At Sabazan and Grand Bay, increasing reliance on *C. tuberculatus* could have come about due to depletion of larger *A. granulata* individuals.

Further investigation is needed to clarify whether prey switching among chitons is driven by human foraging pressure or other variables, such as increasing aridification of the climate. The equifinality of this situation illustrates the difficulty of assigning zooarchaeological trends to a single cause, but also raises the question of whether it is always appropriate to do so. It is possible that some or many of the findings of this study are driven by multiple causal mechanisms acting in concert.

The increasing reliance on lower-ranking molluscan taxa observed for Grand Bay and Sabazan after AD 800 is consistent with trends seen elsewhere in the Caribbean during the later Ceramic Age (Serrand 2008; Wing 2001). In the case of Carriacou, however, this phenomenon lacks any obvious cause since foraging efficiency measures indicate stable energetic returns from fishing. Also in need of explanation is the apparent synchronous onset of intensified exploitation of conchs and nerites. This pattern is inconsistent with foraging theory models which predict that lower ranking, small nerites should only be incorporated into the diet only after encounter rates with higher ranking, large conchs decline. Possibly, the temporal divisions employed in this research are not sufficiently fine-grained to detect the sequential intensification of these resources. However, since conch exploitation remains consistently elevated at both sites during the latter half of occupation (with the exception of the anomalous L003 deposits at Grand Bay), at least in terms of relative abundance, conch encounter rates do not appear to have declined over time.

A study of queen conch mean size undertaken at both sites to explore the issue of resource depression was inconclusive because the majority of complete shells suitable for measurement belonged to juveniles. Intact adult shells were relatively scarce due, at least in part, to the fracture and removal of shell portions for the purpose of tool and ornament manufacture (Lozano 2008, unpublished report). Preferential selection of adult shells for raw material, especially the characteristic flared lip found only in mature snails, is widely reported for the Caribbean in both Preceramic and Ceramic Age contexts (Bonnissent et al. 2001; Keegan 1981; Nokkert 2002b; Serrand 1999; Serrand and Bonnissent 2005; O'Day and Keegan 2001). In fact, conch tool replication studies have found that the most desirable properties for conch shell as a raw material are found in specimens that are fresh (i.e., recently dead) and mature, but not excessively old (del Rosarrio Curet 1982).

As discussed in Chapter 5, estimation of conch dietary contribution is made problematic because of issues of selective retention of shells for raw material, fragmentation from industrial use, and selective transport. In ethnoarchaeological studies of Meriam foragers, Bird et al. (2002) found that 90% of shellfish diet came from large tridacnid clams which were significantly underrepresented in household waste accumulations due to field processing of the shell. As a consequence smaller taxa, especially nerites, which were not processed in the field, came to dominate household waste assemblages, giving an exaggerated impression of their dietary importance.

It is probable that Grand Bay and Sabazan's faunal assemblages, and pre-Columbian Caribbean assemblages in general, are biased in this respect. This bias cannot explain the increase in conchs over time at the two study sites, however, unless foragers simply stopped field processing conchs, a situation which seems unlikely. It is reasonable to conclude, therefore, that Sabazan and Grand Bay's inhabitants relied more heavily on conch meat than zooarchaeological remains indicate, and that this reliance increased during the latter period of site occupation.

The importance of top-ranking, but smaller, nerites and chitons may be exaggerated with respect to conch and perhaps the West Indian top snail as well. At a maximum length of nearly 14 cm (Rosenberg 2009), *C. pica* is large enough to have potentially been field processed. Conch, nerite, chitons, and possibly top snails, together constitute the bulk of invertebrate resource exploitation at Grand Bay and Sabazan. Other archaeological sites in the Lesser Antilles exhibit a comparable focus on this set of taxa, for instance, at the Archaic site of Orient Bay on St. Martin (Serrand and Bonnissent 2005) and the Ceramic Age site of Hichman's (GE-5) site on Nevis (Nokkert 2002b). In her review of Ceramic Age mollusc exploitation, however, Serrand (2008) characterized the Late Saladoid and post-Saladoid as a period during which exploitation of bivalves, such as *Donax* spp., increases markedly. In contrast, earlier Saladoid sites emphasized the collection of land invertebrates (e.g., terrestrial crabs), and gastropods from the rocky intertidal areas and shallow sea grass beds. She linked these shifts to the duration of site occupation and the necessity of pursuing less accessible (i.e., infaunal) resources as more easily acquired invertebrate taxa became scarce. In this respect, the Sabazan and Grand Bay invertebrate assemblages, with their focus on rocky intertidal species and conchs, are similar to invertebrate assemblages from the earlier Ceramic Age. But the study sites depart substantially from these other sites in the relatively minor overall importance of terrestrial crabs and the lack of convincing evidence for prey switching consistent with a 'crab-shell dichotomy'. Although the crab-shell dichotomy is a phenomenon primarily associated with the Greater Antilles, because it is now interpreted within the framework of anthropogenic environmental impacts, rather than as a historically particular event, it has the potential to be encountered elsewhere in the Caribbean. The fact that crabs were not ever relied upon heavily on prehistoric Carriacou is an interesting point of fact, made more so because the reasons for this indifference remain unknown.

Overall, the zooarchaeological assemblages of Sabazan and Grand Bay reflect a foraging emphasis on marine resources with a shift over time toward increasing exploitation of several large *or* easily acquired molluscan taxa, especially queen conch and nerites snails. At Sabazan, these changes are associated with increased targeting of coral reef fish at the same time that fishing as a subsistence practice declines overall. Pelagic fish, especially tuna, remain a consistent and important component of the fish-based diet at this site for at least six hundred years. While the precise cause has yet to be determined, this study indicates that the decline in fishing observed at Sabazan is not consistent with resource depression due to predation pressure or ‘fishing through’ stocks. At both Sabazan and Grand Bay, the collection of nerites, which maintain or increase in mean size over several hundred years of intensifying exploitation, appears also to have been a sustainable practice. Importantly, in the instances where tests of foraging efficiency were employed to detect signs of resource depression consistent with patterning observed elsewhere in the prehistoric Caribbean, these indicators were not found. The evidence presented here, therefore, suggests that much of the resource exploitation undertaken by pre-Columbian foragers on Carriacou was sustainable over the course of a millennium. In conjunction with similar findings for other sites in the prehistoric Caribbean, this study indicates the necessity of recognizing potential variability in the ecological outcomes of long-term human-environment interactions and the importance of documenting the temporal and spatial distribution associated with it.

9.2 Multiple Foraging Optima and the Comparability of Archaeological Sites

Through a paired site analysis, this dissertation has explored evidence for multiple foraging optima in a context where cultural, environmental, and temporal variables were matched between study locales. In light of the comparability of the sites, it is not surprising that the patterns of resource exploitation documented at Sabazan and Grand Bay are broadly similar. The two sites exhibit strong correspondences in taxonomic composition, the degree to which particular habitat patches were foraged, which prey were most heavily exploited, the presence of introduced mammals, and temporal trends in invertebrate resource use, specifically the increase in nerites and conchs. These results are keeping with those of Carder and Crock (2012) who showed that for five pre-Columbian sites on Anguilla, those which had the greatest levels of proportional similarity in fish assemblages were also those with the most similar environmental structure.

Yet, disparities between the faunal assemblages of Grand Bay and Sabazan do exist. The results of this research indicate the most significant zooarchaeological differences between the sites relate to fishing, particularly the greater emphasis on inshore/shallow water fish at Grand Bay and the pronounced abundance of tunas at Sabazan. Rather than substantiate the existence of multiple foraging optima, however, these differences are better explained by variation in the structure of habitats surrounding the sites. These findings are consistent with other studies highlighting the role of local environmental variability in shaping taxonomic composition and abundance in West Indian zooarchaeological assemblages (e.g., Grouard 2002; Nokkert 1999).

At first glance, the greater bay area encompassing the Grand Bay site and the closer proximity of Sabazan to the outer reef edge and open pelagic waters beyond may not seem consequential. From a fishing perspective, however, it appears to have significantly impacted forager behavior by affecting patch-based return rates. Environmental structure, more than any other potential variable—for example, differential availability of boats or fishing gear[6]—appears to have been the mechanism shaping disparities in resource use between the sites. Further confirmation of this assessment may be obtained by clarifying the habitat preference of the clupeid species exploited at the sites and whether this conforms to foraging theory predictions for sequential habitat patch use.

While this research did not identify multiple foraging optima, the results do call attention to ways in which relatively minor environmental differences can alter foraging patterns and long-term human-environment interactions. They point to the importance of refining analytic models to incorporate these types of considerations. In reaching this conclusion, it is not my intent to advance environmental determinism. Instead, I hope to underscore the subtle complexities that may not be captured by current, coarse-grained modeling of human paleoecology. For instance, although purely speculative at this stage, it is difficult not to wonder if the high-returns of abundant tuna at Sabazan help explain why occupation here lasted nearly two centuries longer than at Grand Bay. Rather than viewed as the result of deterministic environmental constraints, this scenario may instead be evaluated in terms of adaptive choices made by islanders in

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[6] Large pelagic fish like tuna were most likely caught using hooks for which evidence has been encountered at Sabazan and Grand Bay (see Chapter 4). While it is possible that differences between sites existed in boating technology or access to boats, the presence of pelagic taxa in both assemblages indicates a correspondence in at least basic sea faring capabilities. Ethnohisotric and archaeological evidence point to the use of simple dugout or platform canoes without sails in the prehistoric Caribbean (Callaghan 2001, 2003; Callaghan and Schwabe 2001; Fitzpatrick et al. in press).

response to the emerging challenges posed by sociocultural developments, landscape history, and dynamic ecological relationships.

By employing prey and patch models in this research, I have attempted to link standard ecological hallmarks employed to demonstrate resource depression in the prehistoric Caribbean to an explicit foraging theory framework. My aim in doing so has been to increase the predictive and explanatory power of studies such as this one, thereby opening up further avenues for research. Within this study, incorporation of foraging theory models has permitted the identification of zooarchaeological patterning that will require closer scrutiny and additional investigation to explain. Among these are prey switching in chiton, the simultaneous increase in low- and high-ranking gastropod species, and the reduction in fishing and corresponding intensification of gastropod collection in the absence of foraging efficiency declines. Pursuit of these and similar issues touched upon in this research may not only generate productive new lines of inquiry for cases where similar trends have been observed, but not yet explained, but may also help to develop and refine theoretical models used to understand human foraging behavior in the past.

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APPENDIX A

Sabazan Zooarchaeological Sample Information

Sabazan sample provenience, weight, and subsampling regimen.

Provenience							Samples Analysed									
							6.4mm Screen Fraction					1.6 mm Screen Fraction				
Trench	Square	Layer	Level	Planum	Stratum	Avg Depth (cm below datum)	Field Find No.	Weight of Original Sample (g)	Proportion of Original Sample Subsampled	Vertebrate Component Analyzed	Invertebrate Component Analyzed	Field Find No.	Weight of Original Sample (g)	Weight of Subsample (g)	Vertebrate Component Analyzed	Invertebrate Component Analyzed
1	1	2	1	2	2	6.5 - 17.0	0707CSZ000006	4500.0	Quarter	Yes						
1	1	2	2	3	2	17.0 - 23.0	0707CSZ000026	1723.2	Quarter	Yes						
1	1	2	3	4	2	23.0 - 33.5	0707CSZ000041	2111.7	Quarter	Yes						
1	1	2	4	5	2	32.0 - 39.0	0707CSZ000057	329.6	Quarter	Yes						
1	1	3	1	6	4	33.5 - 37.5	0707CSZ000053	786.1	Quarter	Yes						
1	1	3	2	8	4	38.5 - 47.5	0707CSZ000075	981.1	Quarter	Yes						
1	1	4	1	9	5	47.5 - 57.5	0707CSZ000091	587.9	Quarter	Yes						
1	1	4	2	10	5	57.5 - 61.0	0707CSZ000109	435.4	Quarter	Yes						
1	1	5	1	11	6	61.0 - 71.5	0707CSZ000116	84.0	Quarter	Yes						
1	1	5	2	12	6	70.0 - 74.5	0707CSZ000136	20.3	Quarter	Yes						
1	1	5	3	13	6	74.5 - 80.5	0707CSZ000175	9.9	Quarter	Yes (no vertebrate material)						
1	1	5	4	14	6	81.0 - 86.0	0707CSZ000195	9.7	Quarter	Yes						
1	1	5	5	15	6	86.0 - 89.0	0707CSZ000222	4.4	Quarter	Yes						
1	1	Feat. A	1	7	(within Stratum 4)		0707CSZ000081	73.4	Quarter	Yes						
2	1	2	1	2	2	12.0 - 21.0	0707CSZ000013	1052.9	Quarter	Yes		0707CSZ000011	5255.0	100.0	Yes	
2	1	2	2	3	2	21.0 - 29.5	0707CSZ000023	1101.0	Quarter	Yes	Yes	0707CSZ000024	4051.8	100.0	Yes	Yes
2	1	3	1	4	3	29.5 - 39.5	0707CSZ000035	755.5	Quarter	Yes	Yes	0707CSZ000036	4367.2	100.0	Yes	Yes
2	1	3	2	5	3	39.5 - 50.0	0707CSZ000046	458.0	Total	Yes		0707CSZ000047	3273.6	100.0	Yes	
2	1	3A	1	6	3A	50.0 - 60.5	0707CSZ000063	580.2	Total	Yes	Yes	0707CSZ000064	3455.6	100.0	Yes	Yes
2	1	3A	2	7	3A	60.5 - 70.5	0707CSZ000085	789.4	Total	Yes		0707CSZ000086	2840.8	100.0	Yes	
2	1	3A	3	8	3A	70.5 - 80.5	0707CSZ000100	567.0	Quarter	Yes		0707CSZ000101	3114.2	100.0	Yes	
2	1	3A	4	9	3A	80.5 - 91.0	0707CSZ000113	1177.5	Quarter	Yes	Yes	0707CSZ000114	3025.0	100.0	Yes	Yes
2	1	3A	5	10	3A	91.0 - 96.5	0707CSZ000126	348.0	Quarter	Yes		0707CSZ000127	870.2	100.0	Yes	
2	1	3A	6	11	3A	93.0 - 99.0	0707CSZ000133	1274.0	Quarter	Yes		0707CSZ000135	2567.6	100.0	Yes	
2	1	4	1	12	8	99.0 - 101.5	0707CSZ000162	455.8	Quarter	Yes	Yes	0707CSZ000164	1174.6	100.0	Yes	Yes
2	1	5	1	13	9	101.5 - 112.0	0707CSZ000166	506.0	Quarter	Yes		0707CSZ000168	3599.8	100.0	Yes	
2	1	5	2	14	9	112.0 - 122.5	0707CSZ000213	851.4	Quarter	Yes	Yes	0707CSZ000215	2844.2	100.0	Yes	Yes
2	1	5	3	15	9	122.5 - 126.0	0707CSZ000239	143.1	Quarter	Yes		0707CSZ000241	497.0	100.0	Yes	
2	1	Feat. B	1	1		N/A						0707CSZ000179	803.0	100.0	Yes	
2	1	Feat. C	1	1		N/A						0707CSZ000187	26.2	100.0	Yes	
Coastal Profile Column		L11	N/A	N/A	L11		03CAR000234	–	All screened sediments	Yes (no vertebrate material)	Yes	03CAR000234	–	100.0	Yes	Yes
Coastal Profile Column		L14	N/A	N/A	L14		03CAR000235	–	All screened sediments	Yes	Yes	03CAR000235	–	100.0	Yes	Yes

APPENDIX B

Sabazan Fish Element and Taxonomic Identifications

Lower level taxonomic fish identifications made based on specific element; cf. designations excluded from list where secure identifications are present. Some identifications aided by species checklists delimited by geographic range based on FishBase (Froese and Pauly 2013).

Fish Element	Lower Level Taxonomic Identifications Based on Element
Articluar	Sparisoma sp.
	Carangidae
	Haemulidae
	Labridae
	cf. *Holocentrus* sp.
	Lutjanidae
	Scarus sp.
	Sparisoma sp.
	Scombridae
	Thunnini
	Serranidae
Articular/Dentary	Balistidae
Basihyal	*Katsuwonis pelamis*
Basioccipital	Haemulidae
	Labridae
	Scaridae
	Scarus sp.
	Sparisoma sp.
Basipterygium	Haemulidae
	Holocentridae
	Lutjanidae
	Mullidae
	Scaridae
	Thunnini
Buckler	*Acanthurus* sp.
Burr	Diodontidae
Ceratobranchial - 5	Carangidae
	cf. *Haemulon* sp.
	Haemulidae
	Serranidae
Ceratohyal	Carangidae
	Haemulidae
	Lutjanidae
	Epinephelus sp.
	Serranidae
Cleithrum	*Acanthurus* sp.
	Balistidae
	Haemulidae
	Holocentridae
	Scaridae
	Serranidae

Fish Element	Lower Level Taxonomic Identifications Based on Element
Coracoid	Scombridae
	Thunnini
Dental plate	Myliobatidae
Dentary	*Acanthurus* sp.
	Balistidae
	Carangidae
	Haemulidae
	cf. *Haemulon* sp.
	Labridae
	cf. *Bodianus* sp.
	cf. *Halichoeres* sp.
	Lutjanidae
	Mullidae
	Scaridae
	Scarus sp.
	Sparisoma sp.
	Scombridae
	Thunnini
	Thunnus sp.
	Serranidae
Entopterygoid/Mesopterygoid	*Sparisoma* sp.
Epibranchial - 4	cf. *Halichoeres* sp.
	Scaridae
	Scarus sp.
	Sparisoma sp.
Epihyal	Haemulidae
	cf. *Haemulon* sp.
	Holocentridae
	Labridae
	Lutjanidae
	Serranidae
Epiotic	Serranidae
	Epinephelus sp.
Ethmoid	Balistidae
Exoccipital	Carangidae
	Serranidae
Frontal	Holocentridae
	Scaridae
	Acanthurus sp.
	Anisotremus sp.
	Holocentridae
	Labridae/Scaridae
	Scaridae
Hyoid Arch (Ceratohyal/Epihyal/Hypohyal)	Labridae
Hyomandibular	*Acanthurus* sp.
	Balistidae
	Selar crumenophthalmus
	Haemulidae
	cf. *Haemulon* sp.

Fish Element	Lower Level Taxonomic Identifications Based on Element
Hyomandibular continued	Holocentridae
	Labridae
	Scaridae
	Scombridae
	Auxis sp.
	Thunnini
Hypobranchial	Serranidae
Hypohyal - Dorsal	*Selar crumenophthalmus*
	Haemulidae
	Serranidae
	Epinephelinae
Hypohyal - Ventral	*Selar crumenophthalmus*
	Malacanthidae
	Thunnini
Hypural 1 and 2	Scaridae
Interhyal	Serranidae
Maxilla	*Acanthurus* sp.
	Carangidae
	cf. *Caranx* sp.
	Selar crumenophthalmus
	Haemulidae
	Holocentridae
	Halichoeres sp.
	Labridae
	Lutjanidae
	Scaridae
	Scarus sp.
	Sparisoma sp.
	Katsuwonus pelamis
	Thunnini
	Serranidae
Neurocranium	*Epinephelus* sp.
Opercle	*Acanthurus* sp.
	Holocentridae
	Lutjanidae
	cf. *Mugil* sp.
	Pomacentridae
	Scaridae
	Thunnini
	Serranidae
	Epinephelus sp.
Palatine	cf. *Haemulon* sp.
	Lutjanidae
	Scarus sp.
	Sparisoma sp.
	Serranidae
Parasphenoid	Balistidae
	Haemulidae

Fish Element	Lower Level Taxonomic Identifications Based on Element
Pectoral Ray - First	*Acanthurus* sp.
	Haemulidae
	Scaridae
	Scarus sp.
	Serranidae
Pelvic	Balistidae
Pharyngeal Grinder - Upper	*Halichoeres* sp.
	Cryptotomus roseus
	Cryptotomus roseus / *Nicholsina usta*
	Scaridae
	Scarus sp.
	Sparisoma sp.
Pharyngobranchial - 2 (Upper Pharyngeal)	cf. Halichoeres sp.
Pharyngeal Grinder - Lower	*Halichoeres* sp.
	Scaridae
	Scarus sp.
	Sparisoma sp.
Post-temporal	Balistidae
	Haemulidae
	Holocentridae
	Scaridae
	Scarus sp.
	cf. *Epinephelus* sp.
	Haemulidae
	Serranidae
Prefrontal	Epinephelinae
Premaxilla	Balistidae
	cf. *Caranx* sp.
	Selar crumenophthalmus
	Diodontidae
	Haemulidae
	cf. *Haemulon* sp.
	Labridae
	Scaridae
	Scarus sp.
	Sparisoma sp.
	Scombridae
	Auxis sp.
	Thunnini
	Serranidae
Preopercle	*Acanthurus* sp.
	Balistidae
	Holocentridae
	Scaridae
	Thunnini
	Serranidae
Pterygiophore - Dorsal First	*Acanthurus* sp.
Pterygiophore - Ventral First	*Acanthurus* sp.
	Carangidae

Fish Element	Lower Level Taxonomic Identifications Based on Element
Quadrate	*Acanthurus* sp.
	Balistidae
	Carangidae
	Haemulidae
	cf. *Haemulon* sp.
	Holocentridae
	Labridae
	cf. *Ocyurus chrysurus*
	Lutjanidae
	Scarus sp.
	Sparisoma sp.
	Thunnini
	Serranidae
Scale	Ostraciidae
Scapula	*Acanthurus* sp.
	Balistidae
	Carangidae
	Haemulidae
	Holocentridae
	Lutjanidae
	Scaridae
	Auxis sp./ *Katsuwonus pelamis*
	Euthynnus sp.
	Thunnus sp.
	Serranidae
	Epinephelinae
Scute	Carangidae
	Holocentridae
Spine - First Dorsal	Balistidae
Spine - Second Dorsal	Balistidae
Spine	Balistidae
Supracleithrum	Acanthurus sp.
	Haemulidae
	Bodianus sp.
	Lutjanidae
	Scaridae
	Auxis sp./ *Katsuwonus pelamis*
	cf. *Katsuwonus pelamis*
	Serranidae
Tooth	*Acanthurus* sp.
	Balistidae
	Scaridae
	Sphyraena sp.
Vertebra - Atlas	*Acanthurus* sp.
	Belonidae
	cf. Carangidae
	Selar crumenophthalmus
	Trachurus lathami
	cf. Pomacentridae

Fish Element	Lower Level Taxonomic Identifications Based on Element
Vertebra - Atlas Continued	Clupeidae
	Haemulidae
	Lutjanidae
	Mullidae
	Scaridae
	Scarus sp.
	Sparisoma sp.
	Auxis sp.
	Katsuwonus pelamis
	Epinephelinae
	Epinephelus sp.
Vertebra - Anterior (All vertebrae anterior to first vertebra with closed haemal arch; excludes atlas)	*Acanthurus* sp.
	Balistidae
	Belonidae
	cf. *Strongylura* sp.
	Carangidae
	Caranx sp.
	cf. *Trachurus lathami*
	Selar crumenophthalmus
	Chaetodontidae
	Clupeidae
	Exocoetidae
	Exocoetoidea
	Haemulidae
	Hemiramphidae
	Holocentridae
	Labridae
	cf. *Halichoeres* sp.
	cf. *Bodianus* sp.
	Lutjanidae
	cf. *Ocyurus chrysurus*
	Lutjanidae
	Mullidae
	Pomacentridae
	Scaridae
	Scarus sp.
	Sparisoma sp.
	Cynoscion sp.
	Scombridae
	Auxis sp.
	Katsuwonus pelamis
	Katsuwonus pelamis/*Euthynnus alleteratus*
	Thunnus sp.
	Thunnini
	Serranidae
	cf. *Cephalopholis fulva*
	cf. *Epinephelus* sp.
	Epinephelinae
	Mycteroperca sp.

Fish Element	Lower Level Taxonomic Identifications Based on Element
Vertebra - Anterior Continued	Taxon B
	Taxon C
Posterior Vertebra (All vertebrae including and posterior to first vertebra with closed haemal arch; exlcudes final three caudal vertebrae)	*Acanthurus* sp.
	Balistidae
	Belonidae
	Carangidae
	cf. *Elagatis bipinnulata*
	Selar crumenophthalmus
	Clupeidae
	Engraulidae/Clupeidae
	Exocoetidae
	Exocoetoidea
	cf. Haemulidae
	Hemiramphidae
	Labridae
	Labroidei
	Lutjanidae/Serranidae
	Mullidae
	Pomacentridae
	Scaridae
	Auxis sp.
	Katsuwonus pelamis
	Katsuwonus pelamis/Euthynnus alleteratus
	Thunnus sp.
	Thunnini
	Serranidae
	Taxon B
Vertebra - Antepenultimate	*Acanthurus* sp.
Vertebra - Penultimate/Antepenultimate	cf. Lutjanidae/Serranidae
	Thunnini
Vertebra - Penultimate	*Acanthurus* sp.
	Balistidae
Vertebra - Ultimate (Urostyle)	*Acanthurus* sp.
	Balistidae
	Carangidae
	Haemulidae
	Hemiramphidae
	Holocentridae
	Labridae
	Scaridae
	Thunnini
	Serranidae
Vomer	*Acanthurus* sp.
	Haemulidae
	cf. *Holocentrus* sp.
	Lutjanidae
	Scarus sp.
	Sparisoma sp.
	Thunnini
	Serranidae

APPENDIX C

Sabazan Vertebrate and Invertebrate Zooarchaeological Data by Provenience

Sabazan faunal assemblage. “Quarter” refers to a 25 % subsample; “Full and Quarter” indicates some specimens derive from a 25% sample, others from a fully analyzed sample, with NISP for fully analyzed sample provided in the far right column;“100g PSA” refers to a 100g subsample per sample analyzed.

Class	Family		Taxon	Trench	Square	Stratum	Layer	Fraction	NISP	MNI	Weight (g)	Sampling Proportion From Which Specimens Derive	NISP From "Full Sample"
Elasmobranchii													
	Myliobatidae												
		Trench 1	Myliobatidae	1	1	5	4	6.4 mm	1	1	2.82	Quarter	
Actinoptergii													
	Acanthuridae												
		Trench 1	*Acanthurus* sp.	1	1	2	2	6.4 mm	49	4	9.04	Quarter	
			cf. Acanthuridae	1	1	2	2	6.4 mm	2	–	0.45	Quarter	
			Acanthurus sp.	1	1	4	3	6.4 mm	29	2	5.17	Quarter	
			Acanthurus sp.	1	1	5	4	6.4 mm	11	2	2.48	Quarter	
			Acanthurus sp.	1	1	6	5	6.4 mm	1	1	0.13	Quarter	
			Acanthurus sp.	1	1	Feat A	Feat A	6.4 mm	1	1	0.10	Quarter	
		Trench 2	*Acanthurus* sp.	2	1	2	2	6.4 mm	7	1	1.08	Quarter	
			Acanthurus sp.	2	1	2	2	1.6 mm	7	1	1.25	100g PSA	
			Acanthurus sp.	2	1	3	3	6.4 mm	30	1	5.31	Full and Quarter	16
			Acanthurus sp.	2	1	3	3	1.6 mm	10	1	0.40	100g PSA	
			Acanthurus sp.	2	1	3A	3A	6.4 mm	104	6	20.22	Full and Quarter	82
			Acanthurus sp.	2	1	3A	3A	1.6 mm	39	–	1.19	100g PSA	
			cf. Acanthuridae	2	1	3A	3A	1.6 mm	1	–	0.03	100g PSA	
			Acanthurus sp.	2	1	8	4	6.4 mm	1	1	0.19	Quarter	
			Acanthurus sp.	2	1	8	4	1.6 mm	6	1	0.14	100g PSA	
			Acanthurus sp.	2	1	9	5	6.4 mm	2	1	0.27	Quarter	
			Acanthurus sp.	2	1	9	5	1.6 mm	5	1	0.17	100g PSA	
			Acanthurus sp.	2	1	Feat B	Feat B	1.6 mm	1	1	0.05	100g PSA	
			Acanthurus sp.	2	1	Feat C	Feat C	1.6 mm	3	1	0.07	Full	
	Acanthuridae or Pomacanthidae												
		Trench 2	Acanthuridae or Pomacanthidae	2	1	3A	3A	6.4 mm	1	–	0.05	Full	1
	Balistidae												
		Trench 1	Balistidae	1	1	2	2	6.4 mm	3	1	0.81	Quarter	
			Balistidae	1	1	4	3	6.4 mm	7	1	2.64	Quarter	
			Balistidae	1	1	5	4	6.4 mm	1	1	0.29	Quarter	
		Trench 2	Balistidae	2	1	2	2	6.4 mm	3	2	0.81	Quarter	
			Balistidae	2	1	3	3	6.4 mm	4	2	1.19	Full and Quarter	3
			Balistidae	2	1	3A	3A	6.4 mm	20	3	14.72	Full and Quarter	13
			Balistidae	2	1	3A	3A	1.6 mm	1	1	0.01	100g PSA	
			Balistidae	2	1	9	5	1.6 mm	1	–	1.17	100g PSA	
			Balistidae	2	1	Feat C	Feat C	1.6 mm	1	1	0.02	Full	
	Belonidae												
		Trench 2	Belonidae	2	1	2	2	6.4 mm	1	1	0.12	Quarter	
			Belonidae	2	1	2	2	1.6 mm	1	1	<0.01	100g PSA	
			cf. *Strongylura* sp.	2	1	3A	3A	1.6 mm	2	1	0.01	100g PSA	
			Belonidae	2	1	3A	3A	6.4 mm	2	1	0.43	Quarter	
			Belonidae	2	1	3A	3A	1.6 mm	2	–	0.01	100g PSA	
	Carangidae												
		Trench 1	*Caranx* sp.	1	1	2	2	6.4 mm	1	1	0.15	Quarter	
			cf. *Elagatis bipinnulata*	1	1	2	2	6.4 mm	1	1	0.34	Quarter	
			Carangidae	1	1	2	2	6.4 mm	7	–	1.47	Quarter	
			cf. Carangidae	1	1	2	2	6.4 mm	3	–	1.18	Quarter	
			Carangidae	1	1	5	4	6.4 mm	2	1	0.27	Quarter	
			Carangidae	1	1	Feat A	Feat A	6.4 mm	1	1	0.09	Quarter	
		Trench 2	*Caranx* sp.	2	1	2	2	6.4 mm	1	1	0.58	Quarter	
			Selar crumenophthalmus	2	1	2	2	1.6 mm	13	6	0.08	100g PSA	
			Trachurus lathami	2	1	2	2	1.6 mm	9	9	0.05	100g PSA	
			cf. *Trachurus lathami*/*Selar crumenophthalmus*	2	1	2	2	1.6 mm	5	–	0.01	100g PSA	
			Carangidae	2	1	2	2	6.4 mm	1	–	0.33	Quarter	
			Carangidae	2	1	2	2	1.6 mm	17	–	0.12	100g PSA	
			Selar crumenophthalmus	2	1	3	3	1.6 mm	11	6	0.03	100g PSA	
			cf. *Selar crumenophthalmus*	2	1	3	3	1.6 mm	5	–	0.01	100g PSA	
			Trachurus lathami	2	1	3	3	1.6 mm	1	1	<0.01	100g PSA	
			cf. *Trachurus lathami*	2	1	3	3	1.6 mm	2	2	<0.01	100g PSA	
			cf. *Trachurus lathami*/*Selar crumenophthalmus*	2	1	3	3	1.6 mm	2	–	<0.01	100g PSA	
			Carangidae	2	1	3	3	6.4 mm	2	1	0.68	Full and Quarter	1
			Carangidae	2	1	3	3	1.6 mm	15	–	0.07	100g PSA	
			Caranx sp.	2	1	3A	3A	6.4 mm	1	1	0.64	Full	1
			cf. *Caranx* sp.	2	1	3A	3A	6.4 mm	4	1	3.70	Full	4
			Selar crumenophthalmus	2	1	3A	3A	6.4 mm	2	1	0.13	Full	2
			Selar crumenophthalmus	2	1	3A	3A	1.6 mm	50	32	0.26	100g PSA	
			cf. *Selar crumenophthalmus*	2	1	3A	3A	6.4 mm	1	–	0.13	Full	1
			cf. *Selar crumenophthalmus*	2	1	3A	3A	1.6 mm	38	–	0.24	100g PSA	
			cf. *Trachurus lathami*	2	1	3A	3A	1.6 mm	8	4	0.02	100g PSA	
			cf. *Trachurus lathami*/*Selar crumenophthalmus*	2	1	3A	3A	6.4 mm	6	–	0.40	Full and Quarter	5
			cf. *Trachurus lathami*/*Selar crumenophthalmus*	2	1	3A	3A	1.6 mm	34	–	0.13	100g PSA	

Class	Family	Taxon	Trench	Square	Stratum	Layer	Fraction	NISP	MNI	Weight (g)	Sampling Proportion From Which Specimens Derive	NISP From "Full Sample"
		Carangidae	2	1	3A	3A	6.4 mm	30	1	4.66	Full and Quarter	21
		Carangidae	2	1	3A	3A	1.6 mm	165	–	1.22	100g PSA	
		cf. Carangidae	2	1	3A	3A	1.6 mm	2	–	0.01	100g PSA	
		Selar crumenophthalmus	2	1	8	4	1.6 mm	14	10	0.11	100g PSA	
		cf. *Selar crumenophthalmus*	2	1	8	4	1.6 mm	8	–	0.07	100g PSA	
		cf. *Trachurus lathami*	2	1	8	4	1.6 mm	5	5	<0.01	100g PSA	
		cf. *Trachurus lathami*/*Selar crumenophthalmus*	2	1	8	4	1.6 mm	19	–	0.12	100g PSA	
		Carangidae	2	1	8	4	1.6 mm	11	–	0.07	100g PSA	
		Selar crumenophthalmus	2	1	9	5	1.6 mm	5	3	0.03	100g PSA	
		cf. *Selar crumenophthalmus*	2	1	9	5	1.6 mm	1	–	<0.01	100g PSA	
		cf. *Trachurus lathami*	2	1	9	5	1.6 mm	2	1	<0.01	100g PSA	
		cf. *Trachurus lathami*/*Selar crumenophthalmus*	2	1	9	5	1.6 mm	4	–	<0.01	100g PSA	
		Carangidae	2	1	9	5	1.6 mm	7	–	0.07	100g PSA	
		cf. *Selar crumenophthalmus*	2	1	Feat B	Feat B	1.6 mm	1	1	<0.01	100g PSA	
		cf. *Trachurus lathami*/*Selar crumenophthalmus*	2	1	Feat B	Feat B	1.6 mm	1	–	<0.01	100g PSA	
		Carangidae	2	1	Feat B	Feat B	1.6 mm	6	1	0.04	100g PSA	
		cf. *Selar crumenophthalmus*	2	1	Feat C	Feat C	1.6 mm	1	1	<0.01	Full	
		cf. *Trachurus lathami*/*Selar crumenophthalmus*	2	1	Feat C	Feat C	1.6 mm	2	–	<0.01	Full	
	Coastal Profile Column	Carangidae	Coastal column	Coastal column	Layer 11	Layer 11	1.6 mm	1	1	<0.01	100g PSA	
		Selar crumenophthalmus	Coastal column	Coastal column	Layer 14	Layer 14	1.6 mm	2	1	0.01	100g PSA	
		cf. *Trachurus lathami*/*Selar crumenophthalmus*	Coastal column	Coastal column	Layer 14	Layer 14	1.6 mm	2	1	<0.01	100g PSA	
		Carangidae	Coastal column	Coastal column	Layer 14	Layer 14	1.6 mm	6	–	0.02	100g PSA	
	Chaetodontidae											
	Trench 2	Chaetodontidae	2	1	2	2	1.6 mm	1	1	0.03	100g PSA	
	Clupeidae											
	Trench 2	Clupeidae	2	1	2	2	1.6 mm	31	4	0.05	100g PSA	
		Clupeidae	2	1	3	3	1.6 mm	36	2	0.09	100g PSA	
		Clupeidae	2	1	3A	3A	1.6 mm	87	2	0.21	100g PSA	
		Clupeidae	2	1	8	4	1.6 mm	13	1	0.02	100g PSA	
		Clupeidae	2	1	9	5	1.6 mm	16	1	0.05	100g PSA	
		Clupeidae	2	1	Feat B	Feat B	1.6 mm	2	1	<0.01	100g PSA	
		Clupeidae	2	1	Feat C	Feat C	1.6 mm	7	1	0.02	Full	
	Coastal Profile Column	Clupeidae	Coastal column	Coastal column	Layer 14	Layer 14	1.6 mm	2	1	<0.01	100g PSA	
	Clupeidae/Engraulidae											
	Trench 2	Clupeidae/Engraulidae	2	1	2	2	1.6 mm	2	–	<0.01	100g PSA	
		Clupeidae/Engraulidae	2	1	3	3	1.6 mm	4	–	0.01	100g PSA	
		Clupeidae/Engraulidae	2	1	3A	3A	1.6 mm	3	–	0.01	100g PSA	
		Clupeidae/Engraulidae	2	1	Feat B	Feat B	1.6 mm	1	–	<0.01	100g PSA	
		Clupeidae/Engraulidae	2	1	Feat C	Feat C	1.6 mm	1	–	<0.01	Full	
	Diodontidae											
	Trench 1	Diodontidae	1	1	2	2	6.4 mm	1	1	0.55	Quarter	
	Trench 2	Diodontidae	2	1	3A	3A	6.4 mm	2	1	1.21	Full and Quarter	1
		Diodontidae	2	1	8	4	6.4 mm	1	1	24.07	Quarter	
	Exocoetidae											
	Trench 1	Exocoetidae	1	1	2	2	6.4 mm	2	1	0.16	Quarter	
	Trench 2	Exocoetidae	2	1	2	2	1.6 mm	2	1	0.03	100g PSA	
		cf. Exocoetidae	2	1	2	2	1.6 mm	2	–	0.01	100g PSA	
		Exocoetidae	2	1	3	3	1.6 mm	4	1	0.03	100g PSA	
		Exocoetidae	2	1	9	5	1.6 mm	1	1	0.02	100g PSA	
		Exocoetidae	2	1	3A	3A	1.6 mm	3	2	0.12	100g PSA	
		cf. Exocoetidae	2	1	3A	3A	1.6 mm	1	–	0.06	100g PSA	
	Exocoetoidea											
	Trench 2	Exocoetoidea	2	1	3	3	1.6 mm	1	–	0.01	100g PSA	
		Exocoetoidea	2	1	3A	3A	1.6 mm	3	–	0.02	100g PSA	
		Exocoetoidea	2	1	Feat C	Feat C	1.6 mm	1	–	<0.01	Full	
	Haemulidae											
	Trench 1	Haemulidae	1	1	2	2	6.4 mm	15	2	2.30	Quarter	
		Haemulidae	1	1	4	3	6.4 mm	8	1	2.05	Quarter	
		Haemulidae	1	1	5	4	6.4 mm	4	1	0.70	Quarter	
		cf. Haemulidae	1	1	5	4	6.4 mm	1	–	0.09	Quarter	
		cf. *Haemulon*	1	1	Feat A	Feat A	6.4 mm	1	1	0.15	Quarter	
	Trench 2	cf. *Haemulon* sp.	2	1	2	2	6.4 mm	1	1	0.15	Quarter	
		cf. *Haemulon* sp.	2	1	2	2	1.6 mm	1	–	0.13	100g PSA	
		Haemulidae	2	1	2	2	6.4 mm	3	–	0.55	Quarter	
		Haemulidae	2	1	2	2	1.6 mm	10	2	0.15	100g PSA	
		cf. Haemulidae	2	1	2	2	1.6 mm	1	1	0.01	100g PSA	
		cf. *Haemulon* sp.	2	1	3	3	6.4 mm	2	1	0.36	Full	2
		Haemulidae	2	1	3	3	6.4 mm	6	–	0.87	Full and Quarter	1
		Haemulidae	2	1	3	3	1.6 mm	2	1	0.02	100g PSA	
		Anisotremus sp.	2	1	3A	3A	6.4 mm	1	1	0.15	Quarter	
		cf. *Haemulon* sp.	2	1	3A	3A	6.4 mm	18	3	5.29	Full and Quarter	17
		cf. *Haemulon* sp.	2	1	3A	3A	1.6 mm	1	–	<0.01	100g PSA	
		Haemulidae	2	1	3A	3A	6.4 mm	21	–	4.39	Full and Quarter	17

Class	Family	Taxon	Trench	Square	Stratum	Layer	Fraction	NISP	MNI	Weight (g)	Sampling Proportion From Which Specimens Derive	NISP From "Full Sample"
		Haemulidae	2	1	3A	3A	1.6 mm	16	1	0.46	100g PSA	
		cf. Haemulidae	2	1	3A	3A	1.6 mm	4	–	0.05	100g PSA	
		Haemulidae	2	1	8	4	6.4 mm	1	1	0.08	Quarter	
		Haemulidae	2	1	8	4	1.6 mm	2	1	0.03	100g PSA	
		Haemulidae	2	1	9	5	6.4 mm	1	1	0.32	Quarter	
		Haemulidae	2	1	9	5	1.6 mm	1	1	<0.01	100g PSA	
	Coastal Profile Column	Haemulidae	Coastal column	Coastal column	Layer 14	Layer 14	1.6 mm	1	1	<0.01	100g PSA	
		cf. Haemulidae	Coastal column	Coastal column	Layer 14	Layer 14	1.6 mm	1	–	<0.01	100g PSA	
	Hemiramphidae											
	Trench 2	Hemiramphidae	2	1	3	3	1.6 mm	6	1	0.02	100g PSA	
		Hemiramphidae	2	1	3A	3A	1.6 mm	28	1	0.19	100g PSA	
		Hemiramphidae	2	1	8	4	1.6 mm	2	1	0.01	100g PSA	
		Hemiramphidae	2	1	9	5	1.6 mm	1	1	<0.01	100g PSA	
		cf. Hemiramphidae	2	1	9	5	1.6 mm	1	–	<0.01	100g PSA	
		Hemiramphidae	2	1	Feat B	Feat B	1.6 mm	1	1	<0.01	100g PSA	
		Hemiramphidae	2	1	Feat C	Feat C	1.6 mm	1	1	<0.01	Full	
	Coastal Profile Column	Hemiramphidae	Coastal column	Coastal column	Layer 14	Layer 14	1.6 mm	1	1	<0.01	100g PSA	
	Holocentridae											
	Trench 1	Holocentridae	1	1	2	2	6.4 mm	6	1	0.78	Quarter	
		Holocentridae	1	1	4	3	6.4 mm	1	1	0.14	Quarter	
		Holocentridae	1	1	5	4	6.4 mm	1	1	0.05	Quarter	
	Trench 2	Holocentridae	2	1	3	3	1.6 mm	1	1	0.03	100g PSA	
		cf. *Holocentrus* sp.	2	1	3A	3A	6.4 mm	1	1	0.27	Full	1
		cf. *Holocentrus* sp.	2	1	3A	3A	1.6 mm	1	–	0.03	100g PSA	
		Holocentridae	2	1	3A	3A	6.4 mm	7	–	1.39	Full and Quarter	4
		Holocentridae	2	1	3A	3A	1.6 mm	12	2	0.26	100g PSA	
		cf. Holocentridae	2	1	3A	3A	6.4 mm	1	–	0.02	Quarter	
		Holocentridae	2	1	8	4	6.4 mm	3	1	0.78	Quarter	
		Holocentridae	2	1	8	4	1.6 mm	1	–	0.04	100g PSA	
	Labridae											
	Trench 1	*Halichoeres* sp.	1	1	2	2	6.4 mm	1	1	0.16	Quarter	
		Labridae	1	1	2	2	6.4 mm	1	–	0.27	Quarter	
		cf. Labridae	1	1	2	2	6.4 mm	1	–	0.14	Quarter	
		Halichoeres sp.	1	1	4	3	6.4 mm	2	1	0.99	Quarter	
		Labridae	1	1	4	3	6.4 mm	3	–	1.03	Quarter	
		Labridae	1	1	5	4	6.4 mm	1	1	0.18	Quarter	
	Trench 2	cf. *Halichoeres* sp.	2	1	2	2	6.4 mm	1	1	0.16	Quarter	
		Labridae	2	1	2	2	1.6 mm	1	1	<0.01	100g PSA	
		Bodianus sp.	2	1	3	3	1.6 mm	1	1	0.03	100g PSA	
		cf. *Halichoeres* sp.	2	1	3	3	6.4 mm	1	1	0.44	Quarter	
		Labridae	2	1	3	3	1.6 mm	2	1	0.01	100g PSA	
		Halichoeres sp.	2	1	3A	3A	6.4 mm	1	1	0.18	Quarter	
		cf. *Halichoeres* sp.	2	1	3A	3A	6.4 mm	7	1	4.03	Full	7
		cf. *Bodianus* sp.	2	1	3A	3A	6.4 mm	3	1	1.10	Full and Quarter	2
		Labridae	2	1	3A	3A	6.4 mm	6	–	1.44	Full and Quarter	5
		Labridae	2	1	3A	3A	1.6 mm	10	2	0.21	100g PSA	
		Labridae	2	1	8	4	1.6 mm	1	1	<0.01	100g PSA	
	Labroidei											
	Trench 1	Labroidei	1	1	2	2	6.4 mm	1	–	0.14	Quarter	
		Labroidei	1	1	5	4	6.4 mm	1	–	0.16	Quarter	
		cf. Labroidei	1	1	5	4	6.4 mm	1	–	0.09	Quarter	
	Trench 2	Labroidei	2	1	3A	3A	6.4 mm	3	–	0.69	Full and Quarter	2
	Lutjanidae											
	Trench 1	Lutjanidae	1	1	2	2	6.4 mm	7	2	1.79	Quarter	
		cf. Lutjanidae	1	1	2	2	6.4 mm	1	–	0.15	Quarter	
		Lutjanidae	1	1	4	3	6.4 mm	2	1	0.46	Quarter	
		Lutjanidae	1	1	5	4	6.4 mm	2	1	0.56	Quarter	
	Trench 2	Lutjanidae	2	1	2	2	6.4 mm	1	1	0.04	Quarter	
		Lutjanidae	2	1	3	3	6.4 mm	1	1	0.66	Full	1
		Lutjanidae	2	1	3	3	1.6 mm	1	–	0.04	100g PSA	
		cf. Lutjanidae	2	1	3	3	6.4 mm	1	1	0.14	Full	1
		cf. Lutjanidae	2	1	3	3	1.6 mm	1	1	<0.01	100g PSA	
		cf. *Ocyurus chrysurus*	2	1	3A	3A	1.6 mm	1	1	0.12	100g PSA	
		Lutjanidae	2	1	3A	3A	6.4 mm	3	1	0.72	Quarter	
		Lutjanidae	2	1	3A	3A	1.6 mm	6	–	0.25	100g PSA	
		cf. Lutjanidae	2	1	3A	3A	6.4 mm	1	–	0.53	Full	1
		Lutjanidae	2	1	8	4	1.6 mm	3	1	0.09	100g PSA	
		Lutjanidae	2	1	9	5	6.4 mm	1	1	0.38	Quarter	
	Lutjanidae/Serranidae											
	Trench 1	Lutjanidae/Serranidae	1	1	2	2	6.4 mm	2	–	0.40	Quarter	
		Lutjanidae/Serranidae	1	1	4	3	6.4 mm	2	–	2.18	Quarter	
		cf. Lutjanidae/Serranidae	1	1	4	3	6.4 mm	1	–	0.15	Quarter	

Class	Family	Taxon	Trench	Square	Stratum	Layer	Fraction	NISP	MNI	Weight (g)	Sampling Proportion From Which Specimens Derive	NISP From "Full Sample"
	Trench 2	Lutjanidae/Serranidae	2	1	3	3	6.4 mm	6	–	1.98	Full and Quarter	5
		Lutjanidae/Serranidae	2	1	3A	3A	6.4 mm	1	–	0.52	Full	1
		cf. Lutjanidae/Serranidae	2	1	3A	3A	1.6 mm	1	–	0.02	100g PSA	
	Malacanthidae											
	Trench 2	Malacanthidae	2	1	3A	3A	1.6 mm	1	1	0.02	100g PSA	
	Mugilidae											
	Trench 2	cf. *Mugil* sp.	2	1	3A	3A	6.4 mm	1	1	0.06	Full	1
	Mullidae											
	Trench 2	cf. Mullidae	2	1	2	2	1.6 mm	2	1	<0.01	100g PSA	
		Mullidae	2	1	3	3	1.6 mm	1	1	0.03	100g PSA	
		cf. Mullidae	2	1	3	3	1.6 mm	4	–	0.01	100g PSA	
		Mullidae	2	1	3A	3A	1.6 mm	5	1	0.05	100g PSA	
		cf. Mullidae	2	1	3A	3A	1.6 mm	19	2	0.04	100g PSA	
		cf. Mullidae	2	1	9	5	1.6 mm	1	1	<0.01	100g PSA	
		cf. Mullidae	2	1	Feat B	Feat B	1.6 mm	1	1	<0.01	100g PSA	
	Ostraciidae											
	Trench 2	Ostraciidae	2	1	2	2	1.6 mm	2	1	<0.01	100g PSA	
		Ostraciidae	2	1	3	3	1.6 mm	1	1	<0.01	100g PSA	
		Ostraciidae	2	1	3A	3A	1.6 mm	1	1	0.02	100g PSA	
	Pomacentridae											
	Trench 1	Pomacentridae	1	1	2	2	6.4 mm	1	1	0.06	Quarter	
	Trench 2	Pomacentridae	2	1	2	2	1.6 mm	3	1	<0.01	100g PSA	
		cf. Pomacentridae	2	1	2	2	1.6 mm	1	–	<0.01	100g PSA	
		Pomacentridae	2	1	3	3	1.6 mm	3	1	<0.01	100g PSA	
		cf. Pomacentridae	2	1	3	3	1.6 mm	1	–	<0.01	100g PSA	
		Pomacentridae	2	1	3A	3A	1.6 mm	35	4	0.03	100g PSA	
		cf. Pomacentridae	2	1	3A	3A	1.6 mm	5	1	<0.01	100g PSA	
		Pomacentridae	2	1	8	4	1.6 mm	1	1	<0.01	100g PSA	
	Coastal Profile Column	Pomacentridae	Coastal column	Coastal column	Layer 14	Layer 14	1.6 mm	1	1	<0.01	100g PSA	
	Scaridae											
	Trench 1	*Scarus* sp.	1	1	2	2	6.4 mm	9	2	2.40	Quarter	
		cf. *Scarus* sp.	1	1	2	2	6.4 mm	2	–	0.53	Quarter	
		Sparisoma sp.	1	1	2	2	6.4 mm	32	4	13.81	Quarter	
		cf. *Sparisoma* sp.	1	1	2	2	6.4 mm	3	–	1.14	Quarter	
		Scaridae	1	1	2	2	6.4 mm	35	–	7.96	Quarter	
		Scarus sp.	1	1	4	3	6.4 mm	5	3	9.95	Quarter	
		cf. *Scarus* sp.	1	1	4	3	6.4 mm	1	–	0.71	Quarter	
		Sparisoma sp.	1	1	4	3	6.4 mm	29	9	19.76	Quarter	
		Scaridae	1	1	4	3	6.4 mm	27	–	7.35	Quarter	
		Scarus sp.	1	1	5	4	6.4 mm	5	4	1.77	Quarter	
		Sparisoma sp.	1	1	5	4	6.4 mm	16	6	5.20	Quarter	
		Scaridae	1	1	5	4	6.4 mm	10	–	2.28	Quarter	
		Sparisoma sp.	1	1	6	5	6.4 mm	2	1	0.56	Quarter	
		Scaridae	1	1	6	5	6.4 mm	3	1	5.98	Quarter	
		Scarus sp.	1	1	Feat A	Feat A	6.4 mm	1	1	0.82	Quarter	
		Sparisoma sp.	1	1	Feat A	Feat A	6.4 mm	2	1	3.07	Quarter	
		Scaridae	1	1	Feat A	Feat A	6.4 mm	4	1	1.20	Quarter	
	Trench 2	*Scarus* sp.	2	1	2	2	6.4 mm	1	1	0.26	Quarter	
		Scarus sp.	2	1	2	2	1.6 mm	2	–	0.13	100g PSA	
		Sparisoma sp.	2	1	2	2	6.4 mm	9	3	3.53	Quarter	
		Scaridae	2	1	2	2	6.4 mm	10	–	4.09	Quarter	
		Scaridae	2	1	2	2	1.6 mm	8	–	0.31	100g PSA	
		cf. Scaridae	2	1	2	2	1.6 mm	1	1	<0.01	100g PSA	
		Scarus sp.	2	1	3	3	1.6 mm	1	1	0.04	100g PSA	
		Sparisoma sp.	2	1	3	3	6.4 mm	15	3	9.70	Full and Quarter	9
		Sparisoma sp.	2	1	3	3	1.6 mm	2	–	0.19	100g PSA	
		cf. *Sparisoma* sp.	2	1	3	3	6.4 mm	1	–	0.60	Full	1
		cf. *Sparisoma* sp.	2	1	3	3	1.6 mm	1	–	0.03	100g PSA	
		Cryptotomus roseus/*Nicholsina usta*	2	1	3	3	1.6 mm	1	1	<0.01	100g PSA	
		Scaridae	2	1	3	3	6.4 mm	16	–	4.30	Full and Quarter	8
		Scaridae	2	1	3	3	1.6 mm	17	–	0.34	100g PSA	
		Scarus sp.	2	1	3A	3A	6.4 mm	31	4	9.14	Full and Quarter	27
		Scarus sp.	2	1	3A	3A	1.6 mm	12	–	0.56	100g PSA	
		cf. *Scarus* sp.	2	1	3A	3A	6.4 mm	1	–	0.09	Quarter	
		Sparisoma sp.	2	1	3A	3A	6.4 mm	146	18	75.84	Full and Quarter	105
		Sparisoma sp.	2	1	3A	3A	1.6 mm	16	1	0.59	100g PSA	
		cf. *Sparisoma* sp.	2	1	3A	3A	6.4 mm	1	–	0.11	Full	1
		cf. *Sparisoma* sp.	2	1	3A	3A	1.6 mm	1	–	0.07	100g PSA	
		Cryptotomus roseus	2	1	3A	3A	1.6 mm	1	1	<0.01	100g PSA	
		Cryptotomus roseus/*Nicholsina usta*	2	1	3A	3A	1.6 mm	1	1	0.02	100g PSA	
		Scaridae	2	1	3A	3A	6.4 mm	99	–	19.10	Full and Quarter	71
		Scaridae	2	1	3A	3A	1.6 mm	44	–	1.03	100g PSA	
		cf. Scaridae	2	1	3A	3A	1.6 mm	1	–	0.07	100g PSA	
		Scarus sp.	2	1	8	4	6.4 mm	3	1	2.46	Quarter	
		Scarus sp.	2	1	8	4	1.6 mm	1	–	0.06	100g PSA	
		Sparisoma sp.	2	1	8	4	6.4 mm	3	1	0.62	Quarter	

Class	Family	Taxon	Trench	Square	Stratum	Layer	Fraction	NISP	MNI	Weight (g)	Sampling Proportion From Which Specimens Derive	NISP From "Full Sample"
		Sparisoma sp.	2	1	8	4	1.6 mm	1	–	0.06	100g PSA	
		Scaridae	2	1	8	4	6.4 mm	1	–	0.15	Quarter	
		Scaridae	2	1	8	4	1.6 mm	7	–	0.30	100g PSA	
		Scarus sp.	2	1	9	5	6.4 mm	1	1	0.49	Quarter	
		Sparisoma sp.	2	1	9	5	6.4 mm	1	1	0.16	Quarter	
		Sparisoma sp.	2	1	9	5	1.6 mm	3	–	0.18	100g PSA	
		Scaridae	2	1	9	5	6.4 mm	4	–	1.36	Quarter	
		Scaridae	2	1	9	5	1.6 mm	2	–	0.06	100g PSA	
		Scarus sp.	2	1	Feat B	Feat B	1.6 mm	1	1	0.05	100g PSA	
		Scaridae	2	1	Feat B	Feat B	1.6 mm	2	–	0.04	100g PSA	
		Scaridae	2	1	Feat C	Feat C	1.6 mm	1	1	<0.01	Full	
	Coastal Profile Column	Scaridae	Coastal column	Coastal column	Layer 11	Layer 11	1.6 mm	1	1	0.03	100g PSA	
		Scarus sp.	Coastal column	Coastal column	Layer 14	Layer 14	1.6 mm	1	1	0.04	100g PSA	
		Sparisoma sp.	Coastal column	Coastal column	Layer 14	Layer 14	6.4 mm	5	2	1.67	Full	
		Sparisoma sp.	Coastal column	Coastal column	Layer 14	Layer 14	1.6 mm	2	–	0.15	100g PSA	
		Scaridae	Coastal column	Coastal column	Layer 14	Layer 14	6.4 mm	3	–	0.15	Full	
		Scaridae	Coastal column	Coastal column	Layer 14	Layer 14	1.6 mm	2	–	<0.01	100g PSA	
	Sciaenidae											
	Trench 1	cf. *Cynoscion* sp.	1	1	Feat A	Feat A	6.4 mm	1	1	0.27	Quarter	
	Trench 2	*Cynoscion* sp.	2	1	3A	3A	6.4 mm	1	1	0.06	Full	1
	Scombridae											
	Trench 1	*Katsuwonus pelamis*	1	1	2	2	6.4 mm	9	1	3.90	Quarter	
		Auxis sp.	1	1	2	2	6.4 mm	14	1	2.37	Quarter	
		Thunnus sp.	1	1	2	2	6.4 mm	5	1	1.92	Quarter	
		Auxis sp./ *Katsuwonus pelamis*	1	1	2	2	6.4 mm	1	–	0.12	Quarter	
		Katsuwonus pelamis/*Euthynnus alleteratus*	1	1	2	2	6.4 mm	10	–	4.01	Quarter	
		Thunnus sp./*Katsuwonus pelamis*	1	1	2	2	6.4 mm	3	–	1.39	Quarter	
		Thunnini	1	1	2	2	6.4 mm	23	–	8.58	Quarter	
		Katsuwonus pelamis	1	1	4	3	6.4 mm	8	1	4.33	Quarter	
		Auxis sp.	1	1	4	3	6.4 mm	8	1	2.06	Quarter	
		cf. *Auxis* sp.	1	1	4	3	6.4 mm	2	–	1.33	Quarter	
		Thunnus sp.	1	1	4	3	6.4 mm	6	1	2.46	Quarter	
		Auxis sp./ *Katsuwonus pelamis*	1	1	4	3	6.4 mm	3	–	0.81	Quarter	
		Katsuwonus pelamis/*Euthynnus alleteratus*	1	1	4	3	6.4 mm	10	–	3.59	Quarter	
		Thunnini	1	1	4	3	6.4 mm	35	1	10.82	Quarter	
		Katsuwonus pelamis	1	1	5	4	6.4 mm	3	1	1.01	Quarter	
		cf. *Katsuwonus pelamis*	1	1	5	4	6.4 mm	1	–	0.15	Quarter	
		Auxis sp.	1	1	5	4	6.4 mm	8	1	1.75	Quarter	
		Thunnus sp.	1	1	5	4	6.4 mm	9	1	2.88	Quarter	
		cf. *Thunnus* sp.	1	1	5	4	6.4 mm	1	–	0.84	Quarter	
		Auxis sp./ *Katsuwonus pelamis*	1	1	5	4	6.4 mm	2	–	0.36	Quarter	
		Katsuwonus pelamis/*Euthynnus alleteratus*	1	1	5	4	6.4 mm	1	–	0.16	Quarter	
		Thunnus sp./*Katsuwonus pelamis*	1	1	5	4	6.4 mm	3	–	1.91	Quarter	
		Thunnini	1	1	5	4	6.4 mm	23	–	7.95	Quarter	
		cf. Scombridae	1	1	5	4	6.4 mm	1	–	0.07	Quarter	
		Thunnini	1	1	6	5	6.4 mm	1	1	0.46	Quarter	
		Katsuwonus pelamis	1	1	Feat A	Feat A	6.4 mm	1	1	0.36	Quarter	
		Thunnini	1	1	Feat A	Feat A	6.4 mm	1	–	0.16	Quarter	
	Trench 2	*Katsuwonus pelamis*	2	1	2	2	6.4 mm	3	1	0.89	Quarter	
		Auxis sp.	2	1	2	2	6.4 mm	18	1	2.82	Quarter	
		Thunnus sp.	2	1	2	2	6.4 mm	1	1	0.54	Quarter	
		cf. *Thunnus* sp.	2	1	2	2	6.4 mm	1	–	1.04	Quarter	
		Thunnus sp./*Katsuwonus pelamis*	2	1	2	2	6.4 mm	6	–	3.08	Quarter	
		Thunnini	2	1	2	2	6.4 mm	14	–	3.08	Quarter	
		Thunnini	2	1	2	2	1.6 mm	2	–	0.14	100g PSA	
		Scombridae	2	1	2	2	6.4 mm	1	–	0.03	Quarter	
		Katsuwonus pelamis	2	1	3	3	6.4 mm	1	1	0.38	Full	1
		Auxis sp.	2	1	3	3	6.4 mm	7	1	1.18	Full and Quarter	5
		Thunnus sp.	2	1	3	3	6.4 mm	1	1	0.30	Quarter	
		Katsuwonus pelamis/*Euthynnus alleteratus*	2	1	3	3	6.4 mm	4	–	1.42	Full and Quarter	2
		Thunnus sp./*Katsuwonus pelamis*	2	1	3	3	6.4 mm	2	–	0.48	Full and Quarter	1
		Thunnini	2	1	3	3	6.4 mm	24	–	7.30	Full and Quarter	14
		Thunnini	2	1	3	3	1.6 mm	1	–	0.07	100g PSA	
		Scombridae	2	1	3	3	6.4 mm	2	–	0.30	Full	2
		Katsuwonus pelamis	2	1	3A	3A	6.4 mm	52	5	28.79	Full and Quarter	46
		cf. *Katsuwonus pelamis*	2	1	3A	3A	6.4 mm	6	–	3.44	Full	6
		Auxis sp.	2	1	3A	3A	6.4 mm	122	4	28.97	Full and Quarter	110
		cf. *Auxis* sp.	2	1	3A	3A	6.4 mm	1	–	0.52	Full	1
		Euthynnus sp.	2	1	3A	3A	6.4 mm	2	1	0.34	Full	2
		Thunnus sp.	2	1	3A	3A	6.4 mm	25	3	9.05	Full and Quarter	14
		cf. *Thunnus* sp.	2	1	3A	3A	6.4 mm	1	–	0.31	Quarter	
		Auxis sp./ *Katsuwonus pelamis*	2	1	3A	3A	6.4 mm	7	–	7.10	Full and Quarter	5
		Auxis sp./ *Katsuwonus pelamis*	2	1	3A	3A	1.6 mm	1	–	0.16	100g PSA	
		Katsuwonus pelamis/*Euthynnus alleteratus*	2	1	3A	3A	6.4 mm	52	–	21.55	Full and Quarter	49
		Thunnus sp./*Katsuwonus pelamis*	2	1	3A	3A	6.4 mm	10	–	4.62	Full and Quarter	9
		Thunnini	2	1	3A	3A	6.4 mm	154	–	54.40	Full and Quarter	129
		Thunnini	2	1	3A	3A	1.6 mm	8	–	0.42	100g PSA	
		cf. Thunnini	2	1	3A	3A	1.6 mm	1	–	0.03	100g PSA	
		Scombridae	2	1	3A	3A	6.4 mm	5	–	1.11	Full and Quarter	4

Class	Family	Taxon	Trench	Square	Stratum	Layer	Fraction	NISP	MNI	Weight (g)	Sampling Proportion From Which Specimens Derive	NISP From "Full Sample"
		Katsuwonus pelamis	2	1	8	4	6.4 mm	1	1	0.73	Quarter	
		Katsuwonus pelamis / *Euthynnus alleteratus*	2	1	8	4	6.4 mm	1	–	0.24	Quarter	
		Thunnini	2	1	8	4	1.6 mm	1	–	0.08	100g PSA	
		Thunnini	2	1	8	4	6.4 mm	1	–	1.11	Quarter	
		Katsuwonus pelamis	2	1	9	5	6.4 mm	1	1	0.25	Quarter	
		cf. *Katsuwonus pelamis*	2	1	9	5	6.4 mm	1	–	2.63	Quarter	
		Auxis sp.	2	1	9	5	6.4 mm	3	1	0.76	Quarter	
		Thunnus sp.	2	1	9	5	6.4 mm	4	1	1.33	Quarter	
		Katsuwonus pelamis / *Euthynnus alleteratus*	2	1	9	5	6.4 mm	1	–	0.28	Quarter	
		Thunnini	2	1	9	5	6.4 mm	4	–	1.19	Quarter	
	Serranidae											
	Trench 1	*Epinephelus* sp.	1	1	2	2	6.4 mm	1	1	0.27	Quarter	
		Epinephelinae	1	1	2	2	6.4 mm	1	1	0.15	Quarter	
		Serranidae	1	1	2	2	6.4 mm	24	1	14.43	Quarter	
		Epinephelus sp.	1	1	4	3	6.4 mm	1	–	4.14	Quarter	
		Epinephelinae	1	1	4	3	6.4 mm	1	1	0.12	Quarter	
		Serranidae	1	1	4	3	6.4 mm	11	–	10.84	Quarter	
		cf. Serranidae	1	1	4	3	6.4 mm	2	–	0.28	Quarter	
		Epinephelus sp.	1	1	5	4	6.4 mm	1	1	0.17	Quarter	
		cf. *Epinephelus* sp.	1	1	5	4	6.4 mm	1	–	0.18	Quarter	
		Serranidae	1	1	5	4	6.4 mm	4	–	1.19	Quarter	
		Serranidae	1	1	6	5	6.4 mm	1	1	0.20	Quarter	
		Serranidae	1	1	Feat A	Feat A	6.4 mm	1	1	0.26	Quarter	
	Trench 2	*Epinephelus* sp.	2	1	2	2	6.4 mm	1	1	0.51	Quarter	
		Epinephelus sp.	2	1	2	2	1.6 mm	1	–	0.09	100g PSA	
		Mycteroperca sp.	2	1	2	2	6.4 mm	1	1	0.27	Quarter	
		cf. Epinephelinae	2	1	2	2	1.6 mm	1	–	<0.01	100g PSA	
		Serranidae	2	1	2	2	6.4 mm	4	–	0.99	Quarter	
		Serranidae	2	1	2	2	1.6 mm	3	–	0.05	100g PSA	
		cf. Serranidae	2	1	2	2	6.4 mm	1	–	0.38	Quarter	
		Serranidae	2	1	3	3	6.4 mm	13	1	3.88	Full and Quarter	10
		Serranidae	2	1	3	3	1.6 mm	2	–	0.09	100g PSA	
		cf. Serranidae	2	1	3	3	1.6 mm	1	–	0.04	100g PSA	
		cf. *Epinephelus* sp.	2	1	3A	3A	6.4 mm	1	1	0.31	Quarter	
		Epinephelinae	2	1	3A	3A	6.4 mm	4	–	0.77	Full and Quarter	2
		Epinephelinae	2	1	3A	3A	1.6 mm	4	1	0.38	100g PSA	
		Serranidae	2	1	3A	3A	6.4 mm	54	1	25.28	Full and Quarter	43
		Serranidae	2	1	3A	3A	1.6 mm	21	2	1.26	100g PSA	
		cf. Serranidae	2	1	3A	3A	6.4 mm	1	–	0.03	Quarter	
		Epinephelinae	2	1	8	4	1.6 mm	1	1	0.07	100g PSA	
		Serranidae	2	1	8	4	6.4 mm	5	–	2.09	Quarter	
		Serranidae	2	1	8	4	1.6 mm	3	1	0.17	100g PSA	
		cf. Serranidae	2	1	8	4	6.4 mm	1	–	0.16	Quarter	
		Serranidae	2	1	9	5	6.4 mm	1	1	0.08	Quarter	
		Serranidae	2	1	9	5	1.6 mm	2	–	0.06	100g PSA	
		cf. Serranidae	2	1	9	5	6.4 mm	1	–	0.40	Quarter	
		Epinephelinae	2	1	Feat B	Feat B	1.6 mm	1	1	0.09	100g PSA	
		cf. Serranidae	2	1	Feat B	Feat B	1.6 mm	1	–	0.05	100g PSA	
		Serranidae	2	1	Feat C	Feat C	1.6 mm	1	1	0.01	Full	
	Coastal Profile Column	cf. *Cephalopholis fulva*	Coastal column	Coastal column	Layer 14	Layer 14	6.4 mm	1	1	0.11	Full	
	Sphyraenidae											
	Trench 2	*Sphyraena* sp.	2	1	9	5	6.4 mm	1	1	0.29	Quarter	
	Trench 2	Taxon B	2	1	3A	3A	1.6 mm	15	2	0.01	100g PSA	
		Taxon B	2	1	8	4	1.6 mm	2	1	<0.01	100g PSA	
	Trench 2	Taxon C	2	1	2	2	1.6 mm	1	1	<0.01	100g PSA	
		Taxon C	2	1	3	3	1.6 mm	3	1	<0.01	100g PSA	
		Taxon C	2	1	3A	3A	1.6 mm	16	2	0.02	100g PSA	
		Taxon C	2	1	8	4	1.6 mm	2	1	<0.01	100g PSA	
		Taxon C	2	1	9	5	1.6 mm	1	1	<0.01	100g PSA	
		Taxon C	2	1	Feat C	Feat C	1.6 mm	2	1	<0.01	Full	
	Tetraodontiformes											
	Trench 2	Tetraodontiformes	2	1	3	3	6.4 mm	1	–	0.33	Full	1
		cf. Tetraodontiformes	2	1	3A	3A	6.4 mm	1	–	0.58	Quarter	
	Trench 1	Indeterminate Actinopterygii	1	1	2	2	6.4 mm	279	–	45.88	Quarter	
		Indeterminate Actinopterygii	1	1	4	3	6.4 mm	153	–	27.34	Quarter	
		Indeterminate Actinopterygii	1	1	5	4	6.4 mm	75	–	10.33	Quarter	
		Indeterminate Actinopterygii	1	1	6	5	6.4 mm	2	–	0.29	Quarter	
		Indeterminate Actinopterygii	1	1	Feat A	Feat A	6.4 mm	4	–	0.34	Quarter	
	Trench 2	Indeterminate Actinopterygii	2	1	2	2	6.4 mm	70	–	10.72	Quarter	
		Indeterminate Actinopterygii	2	1	3	3	6.4 mm	110	–	19.13	Full and Quarter	82
		Indeterminate Actinopterygii	2	1	3A	3A	6.4 mm	1121	–	158.14	Full and Quarter	905
		Indeterminate Actinopterygii	2	1	8	4	6.4 mm	14	–	1.66	Quarter	
		Indeterminate Actinopterygii	2	1	9	5	6.4 mm	46	–	6.59	Quarter	
	Coastal Profile Column	Indeterminate Actinopterygii	Coastal column	Coastal column	Layer 14	Layer 14	6.4 mm	16	–	0.73	Full	
Total Actinopterygii and Chondrichthyes								5043	392	995.9		

Class	Family	Taxon	Trench	Square	Stratum	Layer	Fraction	NISP	MNI	Weight (g)	Sampling Proportion From Which Specimens Derive	NISP From "Full Sample"
Aves												
	Columbidae											
	Trench 1	Columbidae	1	1	2	2	6.4 mm	2	1	0.17	Quarter	
		Columbidae	1	1	4	3	6.4 mm	1	1	0.26	Quarter	
	Trench 2	Columbidae	2	1	2	2	6.4 mm	1	1	0.14	Quarter	
		Columbidae	2	1	8	4	6.4 mm	1	1	0.29	Quarter	
		cf. Columbidae	2	1	8	4	6.4 mm	1	–	0.13	Quarter	
		Columbidae	2	1	9	5	6.4 mm	1	1	0.27	Quarter	
	Laridae											
	Trench 2	cf. Laridae	2	1	3A	3A	6.4 mm	1	1	0.37	Full	1
	Trench 1	Indeterminate Aves	1	1	4	3	6.4 mm	4	–	5.08	Quarter	
	Trench 2	Indeterminate Aves	2	1	3	3	1.6 mm	2	1	<0.01	100g PSA	
		Indeterminate Aves	2	1	3A	3A	6.4 mm	4	–	0.79	Full and Quarter	1
		Indeterminate Aves	2	1	3A	3A	1.6 mm	9	–	0.22	100g PSA	
		Indeterminate Aves	2	1	9	5	6.4 mm	2	–	0.12	Quarter	
Total Aves								29	7	7.8		
Mammalia												
	Dasyproctidae											
	Trench 1	*Dasyprocta* sp.	1	1	2	2	6.4 mm	22	3	15.00	Quarter	
		cf. *Dasyprocta* sp.	1	1	2	2	6.4 mm	1	–	0.33	Quarter	
		Dasyprocta sp.	1	1	4	3	6.4 mm	7	1	8.20	Quarter	
		Dasyprocta sp.	1	1	5	4	6.4 mm	7	1	4.90	Quarter	
	Trench 2	*Dasyprocta* sp.	2	1	2	2	6.4 mm	4	1	0.71	Quarter	
		Dasyprocta sp.	2	1	3	3	6.4 mm	4	1	1.26	Full and Quarter	3
		cf. *Dasyprocta* sp.	2	1	3	3	6.4 mm	1	–	0.17	Full	1
		Dasyprocta sp.	2	1	8	4	1.6 mm	2	1	0.10	100g PSA	
		Dasyprocta sp.	2	1	9	5	6.4 mm	2	1	2.94	Quarter	
		Dasyprocta sp.	2	1	9	5	1.6 mm	1	–	0.15	100g PSA	
		Dasyprocta sp.	2	1	3A	3A	6.4 mm	47	3	22.90	Full and Quarter	38
		cf. *Dasyprocta* sp.	2	1	3A	3A	6.4 mm	3	–	0.76	Full	3
		Dasyprocta sp.	2	1	3A	3A	1.6 mm	6	–	0.73	100g PSA	
		cf. *Dasyprocta* sp.	2	1	3A	3A	1.6 mm	2	–	0.31	100g PSA	
	Coastal Profile Column	*Dasyprocta* sp.	Coastal column	Coastal column	Layer 14	Layer 14	1.6 mm	1	1	0.10	100g PSA	
	Dasypodidae											
	Trench 2	*Dasypus* sp.	2	1	3A	3A	6.4 mm	2	1	0.32	Full	2
	Didelphidae											
	Trench 1	*Didelphis* sp.	1	1	2	2	6.4 mm	37	2	12.66	Quarter	
		Didelphis sp.	1	1	4	3	6.4 mm	4	1	2.52	Quarter	
		Didelphis sp.	1	1	5	4	6.4 mm	4	1	1.18	Quarter	
		Didelphis sp.	1	1	6	5	6.4 mm	1	1	0.87	Quarter	
	Trench 2	*Didelphis* sp.	2	1	2	2	6.4 mm	2	1	1.21	Quarter	
		Didelphis sp.	2	1	2	2	1.6 mm	1	–	0.02	100g PSA	
		Didelphis sp.	2	1	3	3	6.4 mm	8	2	6.82	Full and Quarter	6
		Didelphis sp.	2	1	3A	3A	6.4 mm	20	3	23.95	Full and Quarter	12
		Didelphis sp.	2	1	3A	3A	1.6 mm	1	–	0.05	100g PSA	
		Didelphis sp.	2	1	8	4	6.4 mm	4	1	1.80	Quarter	
		Didelphis sp.	2	1	9	5	6.4 mm	2	1	0.31	Quarter	
		cf. *Didelphis* sp.	2	1	9	5	1.6 mm	1	–	0.10	100g PSA	
	Coastal Profile Column	*Didelphis* sp.	Coastal column	Coastal column	Layer 14	Layer 14	1.6 mm	1	1	–	100g PSA	
	Cricetidae											
	Trench 1	Oryzomyini	1	1	2	2	1.6 mm	2	1	0.01	100g PSA	
		Oryzomyini	1	1	6	5	1.6 mm	1	1	<0.01	100g PSA	
	Trench 2	Oryzomyini	2	1	2	2	1.6 mm	1	1	<0.01	100g PSA	
		Oryzomyini	2	1	3	3	1.6 mm	4	1	0.14	100g PSA	
		Oryzomyini	2	1	3A	3A	6.4 mm	10	3	1.56	Full and Quarter	9
		Oryzomyini	2	1	3A	3A	1.6 mm	36	1	0.58	100g PSA	
		Oryzomyini	2	1	8	4	1.6 mm	3	1	0.04	100g PSA	
		Oryzomyini	2	1	9	5	1.6 mm	14	1	0.27	100g PSA	
		Oryzomyini	2	1	Feat B	Feat B	1.6 mm	1	1	< 0.01	100g PSA	
		Oryzomyini	2	1	Feat C	Feat C	1.6 mm	1	1	< 0.01	Full	
	Coastal Profile Column	Oryzomyini	Coastal column	Coastal column	Layer 14	Layer 14	6.4 mm	5	2	0.27	Full	
		Oryzomyini	Coastal column	Coastal column	Layer 14	Layer 14	1.6 mm A	8	–	0.05	100g PSA	
		cf. Oryzomyini	Coastal column	Coastal column	Layer 14	Layer 14	1.6 mm A	1	–	< 0.01	100g PSA	
	Trench 1	Medium mammal	1	1	2	2	6.4 mm	19	–	2.66	Quarter	
		Medium mammal	1	1	4	3	6.4 mm	1	–	0.41	Quarter	
		Medium mammal	1	1	5	4	6.4 mm	1	–	0.11	Quarter	

Class	Family		Taxon	Trench	Square	Stratum	Layer	Fraction	NISP	MNI	Weight (g)	Sampling Proportion From Which Specimens Derive	NISP From "Full Sample"
		Trench 2	Medium mammal	2	1	2	2	1.6 mm	4	–	0.38	100g PSA	
			Medium mammal	2	1	3	3	6.4 mm	4	–	0.51	Full	4
			Medium mammal	2	1	3	2	1.6 mm	6	–	0.27	100g PSA	
			Medium mammal	2	1	3A	3A	6.4 mm	26	–	6.54	Full and Quarter	22
			Medium mammal	2	1	3A	3A	1.6 mm	6	–	0.38	100g PSA	
			Medium mammal	2	1	8	4	1.6 mm	4	–	0.32	100g PSA	
			Medium mammal	2	1	9	5	6.4 mm	1	–	0.22	Quarter	
			Medium mammal	2	1	9	5	1.6 mm	2	–	0.17	100g PSA	
			Medium mammal	2	1	Feat C	Feat C	1.6 mm	2	–	0.11	Full	
		Trench 2	Small mammal	2	1	2	2	1.6 mm	2	–	0.08	100g PSA	
			Small mammal	2	1	3	3	6.4 mm	1	–	0.07	Full	1
			Small mammal	2	1	3	3	1.6 mm	2	–	0.01	100g PSA	
			Small mammal	2	1	3A	3A	6.4 mm	1	–	0.19	Full	1
			Small mammal	2	1	3A	3A	1.6 mm	6	–	0.03	100g PSA	
		Trench 2	Indeterminate Mammalia	2	1	2	2	6.4 mm	4	–	0.36	Quarter	
			Indeterminate Mammalia	2	1	3A	3A	6.4 mm	2	–	0.08	Full	2
			Indeterminate Mammalia	2	1	3A	3A	1.6 mm	1	–	<0.01	100g PSA	
			Indeterminate Mammalia	2	1	9	5	6.4 mm	2	–	0.05	Quarter	
Total Mammalia									382	42	126.3		
Reptilia													
	Iguanidae												
		Trench 1	Iguanidae	1	1	2	2	6.4 mm	7	1	1.80	Quarter	
			cf. Iguanidae	1	1	2	2	6.4 mm	1	–	0.18	Quarter	
			Iguanidae	1	1	4	3	6.4 mm	2	1	2.18	Quarter	
		Trench 2	Iguanidae	2	1	2	2	6.4 mm	2	–	0.82	Quarter	
			Iguana sp.	2	1	2	2	1.6 mm	1	1	0.06	100g PSA	
			cf. Iguanidae	2	1	2	2	6.4 mm	1	–	0.45	Quarter	
			Iguanidae	2	1	3	3	6.4 mm	1	1	0.38	Quarter	
			Iguanidae	2	1	3A	3A	6.4 mm	3	–	2.34	Full	3
			Iguana sp.	2	1	3A	3A	6.4 mm	1	1	0.05	Quarter	
			cf. Iguanidae	2	1	3A	3A	6.4 mm	3	–	0.53	Full and Quarter	2
			cf. Iguanidae	2	1	3A	3A	1.6 mm	2	–	0.07	100g PSA	
		Trench 1	Lacertilia	1	1	2	2	6.4 mm	1	–	0.15	Quarter	
		Trench 2	Lacertilia	2	1	3	3	1.6 mm	1	–	<0.01	100g PSA	
			Lacertilia	2	1	3A	3A	1.6 mm	4	–	0.06	100g PSA	
		Coastal Profile Column	Lacertilia	Coastal column	Coastal column	Layer 14	Layer 14	1.6 mm	1	1	0.01	100g PSA	
	Cheloniidae												
		Trench 1	Cheloniidae	1	1	2	2	6.4 mm	156	1	98.65	Quarter	
			Cheloniidae	1	1	4	3	6.4 mm	14	1	8.43	Quarter	
			Cheloniidae	1	1	5	4	6.4 mm	8	1	8.35	Quarter	
			Cheloniidae	1	1	6	5	6.4 mm	2	1	1.13	Quarter	
		Trench 2	Cheloniidae	2	1	2	2	6.4 mm	56	1	28.27	Quarter	
			Cheloniidae	2	1	2	2	1.6 mm	7	–	0.47	100g PSA	
			Cheloniidae	2	1	3	3	6.4 mm	30	1	15.95	Full and Quarter	20
			Cheloniidae	2	1	3	3	1.6 mm	4	–	0.21	100g PSA	
			Cheloniidae	2	1	3A	3A	6.4 mm	44	1	125.00	Full and Quarter	29
			Cheloniidae	2	1	3A	3A	1.6 mm	8	–	0.83	100g PSA	
			Cheloniidae	2	1	8	4	6.4 mm	2	1	2.13	Quarter	
			Cheloniidae	2	1	8	4	1.6 mm	4	–	0.40	100g PSA	
			Cheloniidae	2	1	9	5	6.4 mm	19	1	7.25	Quarter	
			Cheloniidae	2	1	9	5	1.6 mm	14	–	0.83	100g PSA	
	Colubridae												
		Trench 2	Colubridae	2	1	3A	3A	6.4 mm	1	1	0.24	Full	1
		Trench 1	Serpentes	1	1	2	2	6.4 mm	2	1	0.25	Quarter	
			Serpentes	1	1	5	4	6.4 mm	1	1	0.21	Quarter	
		Trench 2	Serpentes	2	1	3A	3A	6.4 mm	1	–	0.16	Full	1
			Serpentes	2	1	3A	3A	1.6 mm	1	–	0.01	100g PSA	
		Coastal Profile Column	Serpentes	Coastal column	Coastal column	Layer 14	Layer 14	1.6 mm	3	1	0.04	100g PSA	
		Trench 2	Squamata	2	1	3	3	1.6 mm	2	–	0.13	100g PSA	
			Squamata	2	1	3A	3A	6.4 mm	1	–	0.18	Full	1
			Squamata	2	1	3A	3A	1.6 mm	1	–	0.01	100g PSA	
			Squamata	2	1	9	5	6.4 mm	1	1	0.11	Quarter	
		Trench 1	Indeterminate Reptilia	1	1	2	2	6.4 mm	2	–	0.33	Quarter	
			Indeterminate Reptilia	1	1	5	4	6.4 mm	1	–	0.18	Quarter	

Class	Family		Taxon	Trench	Square	Stratum	Layer	Fraction	NISP	MNI	Weight (g)	Sampling Proportion From Which Specimens Derive	NISP From "Full Sample"
		Trench 2	Indeterminate Reptilia	2	1	2	2	1.6 mm	2	–	0.06	100g PSA	
			Indeterminate Reptilia	2	1	3	3	1.6 mm	1	–	0.02	100g PSA	
Total Reptilia									419	20	308.9		
Amphibia													
		Trench 2	Indeterminate Amphibia	2	1	3A	3A	1.6 mm	1	1	0.07	100g PSA	
Amphibia/Reptilia													
		Trench 2	Indeterminate Amphibia/Reptilia	2	1	3A	3A	1.6 mm	1	–	<0.01	100g PSA	
		Trench 1	Indeterminate Vertebrata	1	1	2	2	6.4 mm	27	–	6.29	Quarter	
			Indeterminate Vertebrata	1	1	2	2	6.4 mm	3	–	0.38	Quarter	
			Indeterminate Vertebrata	1	1	4	3	6.4 mm	5	–	0.71	Quarter	
			Indeterminate Vertebrata	1	1	5	4	6.4 mm	3	–	0.23	Quarter	
		Trench 2	Indeterminate Vertebrata	2	1	2	2	6.4 mm	7		0.75	Quarter	
			Indeterminate Vertebrata	2	1	2	2	6.4 mm	1	–	0.30	Quarter	
			Indeterminate Vertebrata	2	1	3	3	6.4 mm	4	–	0.86	Full and Quarter	1
			Indeterminate Vertebrata	2	1	3A	3A	6.4 mm	25	–	3.02	Full and Quarter	19
			Indeterminate Vertebrata	2	1	3A	3A	6.4 mm	1	–	0.08	Full	1
			Indeterminate Vertebrata	2	1	8	4	6.4 mm	2	–	0.08	Quarter	
			Indeterminate Vertebrata	2	1	9	5	6.4 mm	11	–	1.34	Quarter	
		Coastal Profile Column	Indeterminate Vertebrata	2005 Col	2005 Co	Layer 14	Layer 14	6.4 mm	6	–	0.27	Full	
Total Vertebrata									5970	462	1453.3		
		Trench 2	Echinoidea	2	1	2	2	6.4 mm	53	3	7.13	Quarter	
			Echinoidea	2	1	2	2	1.6 mm	543	3	9.29	100g PSA	
			Echinoidea	2	1	3	3	6.4 mm	21	4	3.51	Quarter	
			Echinoidea	2	1	3	3	1.6 mm	307	–	3.89	100g PSA	
			Echinoidea	2	1	3A	3A	6.4 mm	37	3	5.08	Full and Quarter	18
			Echinoidea	2	1	3A	3A	1.6 mm	163	1	2.53	100g PSA	
			Echinoidea	2	1	8	4	6.4 mm	1	1	0.30	Quarter	
			Echinoidea	2	1	8	4	1.6 mm	94	2	1.08	100g PSA	
			Echinoidea	2	1	9	5	6.4 mm	8	1	0.63	Quarter	
			Echinoidea	2	1	9	5	1.6 mm	26	–	0.35	100g PSA	
		Coastal Profile Column	Echinoidea	Coastal column	Coastal column		Layer 11	1.6 mm	4	1	0.08	100g PSA	
			Echinoidea	Coastal column	Coastal column		Layer 14	1.6 mm	13	1	0.16	100g PSA	
Total Echinoidea									1270	20	34.0		
Bivalvia													
	Arcidae												
		Trench 2	Arcidae	2	1	3A	3A	1.6 mm	1	1	<0.01	100g PSA	
	Cardiidae												
		Trench 2	*Americardia media*	2	1	2	2	6.4 mm	1	1	0.31	Quarter	
			Cardiidae	2	1	2	2	6.4 mm	1	–	0.28	Quarter	
			Americardia media	2	1	3A	3A	6.4 mm	4	3	4.82	Full and Quarter	3
			Cardiidae	2	1	3A	3A	6.4 mm	1	–	0.15	Full and Quarter	1
	Donacidae												
		Trench 2	*Donax denticulatus*	2	1	2	2	6.4 mm	3	3	0.84	Quarter	
			Donax sp.	2	1	2	2	6.4 mm	2	1	0.23	Quarter	
			Donax sp.	2	1	3	3	6.4 mm	1	1	0.21	Quarter	
			Donax sp.	2	1	3A	3A	6.4 mm	1	1	0.16	Quarter	
	Mytilidae												
		Trench 2	*Brachidontes* or *Ischadium* sp.	2	1	2	2	6.4 mm	3	1	0.28	Quarter	
			Brachidontes or *Ischadium* sp.	2	1	2	2	1.6 mm	2	–	0.01	100g PSA	
			Brachidontes or *Ischadium* sp.	2	1	3	3	6.4 mm	1	1	0.08	Quarter	
			Brachidontes or *Ischadium* sp.	2	1	3	3	1.6 mm	3	–	0.03	100g PSA	
			Brachidontes sp.	2	1	3A	3A	6.4 mm	44	7	8.34	Full and Quarter	37
			Brachidontes sp.	2	1	3A	3A	1.6 mm	5	–	0.09	100g PSA	
			Brachidontes sp.	2	1	8	4	1.6 mm	3	1	0.06	100g PSA	
	Lucinidae												
		Trench 2	Codakia sp.	2	1	2	2	6.4 mm	5	1	1.28	Quarter	
			cf. *Codakia orbicularis*	2	1	3	3	6.4 mm	1	–	0.38	Quarter	
			Codakia orbicularis	2	1	3	3	6.4 mm	1	1	7.29	Quarter	
			Codakia orbicularis	2	1	3A	3A	6.4 mm	4	2	5.98	Full and Quarter	4
	Psammobiidae												
		Trench 2	cf. *Asaphis deflorata*	2	1	9	5	6.4 mm	1	1	0.04	Quarter	
		Coastal Profile Column	cf. *Asaphis deflorata*	Coastal column	Coastal column		Layer 14	6.4 mm	1	1	0.10	Full	1

Class	Family	Taxon	Trench	Square	Stratum	Layer	Fraction	NISP	MNI	Weight (g)	Sampling Proportion From Which Specimens Derive	NISP From "Full Sample"
	Tellinidae											
	Trench 2	Tellinidae	2	1	3A	3A	6.4 mm	1	1	0.46	Quarter	
		Arcopagia fausta	2	1	8	4	6.4 mm	1	1	5.87	Quarter	
	Veneridae											
	Trench 2	*Chione cancellata*	2	1	2	2	6.4 mm	1	1	0.64	Quarter	
	Plicatulidae											
	Trench 2	*Plicatula gibbosa*	2	1	3A	3A	6.4 mm	2	2	4.02	Full	2
	Trench 2	Indeterminate Bivalve	2	1	2	2	6.4 mm	7	–	3.28	Quarter	
		Indeterminate Bivalve	2	1	2	2	1.6 mm	4	–	0.26	100g PSA	
		Indeterminate Bivalve	2	1	3	3	1.6 mm	3	–	0.08	100g PSA	
		Indeterminate Bivalve	2	1	3A	3A	6.4 mm	7	–	3.98	Full and Quarter	6
		Indeterminate Bivalve	2	1	3A	3A	1.6 mm	4	–	0.15	100g PSA	
		Indeterminate Bivalve	2	1	9	5	6.4 mm	1	–	0.27	Quarter	
		Indeterminate Bivalve	2	1	9	5	1.6 mm	1	–	0.01	100g PSA	
	Coastal Profile Column	Indeterminate Bivalve	Coastal column	Coastal column		Layer 14	6.4 mm	3	–	0.73	Full	
Total Bivalvia								124	32	50.7		
Gastropoda												
	Bullidae											
	Trench 2	*Bulla striata*	2	1	3A	3A	6.4 mm	3	2	2.04	Full and Quarter	2
	Calyptraeidae											
	Trench 2	*Crepidula maculosa*	2	1	3A	3A	6.4 mm	1	1	0.57	Full	1
		Crepidula maculosa	2	1	3A	3A	1.6 mm	1	1	0.01	100g PSA	
		Crepidula maculosa	2	1	8	4	6.4 mm	1	1	0.25	Quarter	
		Crepidula maculosa	2	1	8	4	1.6 mm	4	4	0.11	100g PSA	
	Cassidae											
	Trench 2	Cassidae sp.	2	1	3A	3A	6.4 mm	1	1	1.11	Full	1
		cf. *Cassis* sp.	2	1	3A	3A	6.4 mm	1	1	100.47	Full	1
	Collumbellidae											
	Trench 2	*Columbella mercatoria*	2	1	2	2	6.4 mm	1	1	0.70	Quarter	
		Columbella mercatoria	2	1	3A	3A	6.4 mm	1	1	0.46	Full	1
	Fissurellidae sp.											
	Trench 2	Fissurellidae	2	1	3A	3A	6.4 mm	2	1	0.57	Full and Quarter	2
	Littorinidae											
	Trench 2	*Cenchritis muricata*	2	1	2	2	1.6 mm	1	1	0.12	100g PSA	
		Cenchritis muricata	2	1	3	3	6.4 mm	1	1	0.14	Quarter	
		Cenchritis muricata	2	1	3A	3A	6.4 mm	1	1	0.27	Full	1
		Cenchritis muricata	2	1	9	5	6.4 mm	1	1	0.91	Quarter	
	Coastal Profile Column	*Cenchritis muricata*	Coastal column	Coastal column		Layer 14	6.4 mm	1	1	0.76	Full	
	Strophocheilidae											
	Trench 2	*Megalobulimus* sp.	2	1	2	2	6.4 mm	2	1	3.25	Quarter	
		Megalobulimus sp.	2	1	3	3	6.4 mm	1	1	0.39	Quarter	
		Megalobulimus sp.	2	1	3A	3A	6.4 mm	5	1	2.22	Full and Quarter	2
	Muricidae											
	Trench 2	*Plicopurpura patula*	2	1	3	3	6.4 mm	1	1	0.29	Quarter	
		Mancinella deltoidea	2	1	3A	3A	6.4 mm	2	2	5.42	Quarter	
		Plicopurpura patula	2	1	3A	3A	6.4 mm	1	1	37.42	Quarter	
		Stramonita rustica	2	1	3A	3A	6.4 mm	1	1	1.76	Full	1
		Stramonita haemastoma/rustica	2	1	8	4	6.4 mm	1	1	1.14	Quarter	
	Neritidae											
	Trench 2	*Nerita* sp.	2	1	2	2	6.4 mm	4	–	0.82	Quarter	
		Nerita sp.	2	1	2	2	1.6 mm	29	–	0.83	100g PSA	
		Nerita peloronta/versicolor	2	1	2	2	6.4 mm	1	–	0.09	Quarter	
		Nerita tessellata	2	1	2	2	6.4 mm	87	70	71.34	Quarter	
		Nerita tessellata	2	1	2	2	1.6 mm	18	2	1.14	100g PSA	
		Nerita versicolor	2	1	2	2	6.4 mm	6	5	4.63	Quarter	
		Nerita versicolor	2	1	2	2	1.6 mm	2	–	0.07	100g PSA	
		Nerita sp.	2	1	3	3	6.4 mm	4	–	0.95	Quarter	
		Nerita sp.	2	1	3	3	1.6 mm	15	–	0.46	100g PSA	
		Nerita peloronta/versicolor	2	1	3	3	1.6 mm	1	–	0.06	100g PSA	
		Nerita tessellata	2	1	3	3	6.4 mm	27	24	21.53	Quarter	
		Nerita tessellata	2	1	3	3	1.6 mm	7	–	0.34	100g PSA	
		Nerita versicolor	2	1	3	3	6.4 mm	4	3	2.28	Quarter	
		Nerita sp.	2	1	3A	3A	6.4 mm	7	–	1.99	Full and Quarter	2
		Nerita sp.	2	1	3A	3A	1.6 mm	13	–	0.37	100g PSA	
		Nerita peloronta/versicolor	2	1	3A	3A	6.4 mm	2	–	0.85	Full and Quarter	1
		Nerita peloronta/versicolor	2	1	3A	3A	1.6 mm	2	–	0.14	100g PSA	
		Nerita tessellata	2	1	3A	3A	6.4 mm	71	46	38.77	Full and Quarter	55
		Nerita tessellata	2	1	3A	3A	1.6 mm	9	–	0.54	100g PSA	

Class	Family	Taxon	Trench	Square	Stratum	Layer	Fraction	NISP	MNI	Weight (g)	Sampling Proportion From Which Specimens Derive	NISP From "Full Sample"
		Nerita versicolor	2	1	3A	3A	6.4 mm	14	10	10.80	Full and Quarter	8
		Nerita versicolor	2	1	3A	3A	1.6 mm	3	–	0.24	100g PSA	
		Nerita sp.	2	1	8	4	6.4 mm	1	–	0.14	Quarter	
		Nerita sp.	2	1	8	4	1.6 mm	6	–	0.10	100g PSA	
		Nerita peloronta/versicolor	2	1	8	4	6.4 mm	1	1	0.31	Quarter	
		Nerita peloronta/versicolor	2	1	8	4	1.6 mm	1	–	0.02	100g PSA	
		Nerita tessellata	2	1	8	4	6.4 mm	6	6	4.84	Quarter	
		Nerita tessellata	2	1	8	4	1.6 mm	5	1	0.27	100g PSA	
		Nerita sp.	2	1	9	5	1.6 mm	1	–	0.11	100g PSA	
		Nerita tessellata	2	1	9	5	6.4 mm	4	3	1.69	Quarter	
		Nerita tessellata	2	1	9	5	1.6 mm	2	–	0.11	100g PSA	
		Nerita versicolor	2	1	9	5	6.4 mm	1	1	0.56	Quarter	
	Coastal Profile Column	*Nerita* sp.	Coastal column	Coastal column		Layer 11	6.4 mm	1	1	0.19	Full	
		Nerita sp.	Coastal column	Coastal column		Layer 14	6.4 mm	1	–	0.10	Full	
		Nerita tessellata	Coastal column	Coastal column		Layer 14	6.4 mm	5	5	1.77	Full	
		Nerita versicolor	Coastal column	Coastal column		Layer 14	6.4 mm	1	1	1.43	Full	
	Olividae											
	Trench 2	Olivellinae	2	1	3A	3A	6.4 mm	1	1	0.53	Full	1
	Orthalicidae											
	Trench 2	*Orthalicus undatus*	2	1	2	2	1.6 mm	6	1	0.02	100g PSA	
		Orthalicus undatus	2	1	3	3	6.4 mm	1	1	0.04	Quarter	
		Orthalicus undatus	2	1	3	3	1.6 mm	2	–	0.01	100g PSA	
		Orthalicus undatus	2	1	8	4	1.6 mm	4	1	0.07	100g PSA	
		cf. *Orthalicus undatus*	2	1	3A	3A	6.4 mm	1	1	0.58	Full	1
		Orthalicus undatus	2	1	3A	3A	6.4 mm	6	1	0.60	Full and Quarter	5
		Orthalicus undatus	2	1	3A	3A	1.6 mm	2	–	<0.01	100g PSA	
		cf. *Orthalicus undatus*	2	1	9	5	6.4 mm	1	1	0.28	Quarter	
		Orthalicus undatus	2	1	9	5	6.4 mm	4	2	1.33	Quarter	
		Orthalicus undatus	2	1	9	5	1.6 mm	2	–	0.02	100g PSA	
	Coastal Profile Column	*Orthalicus undatus*	Coastal column	Coastal column		Layer 11	6.4 mm	2	1	0.01	Full	
		Orthalicus undatus	Coastal column	Coastal column		Layer 11	1.6 mm	7	–	0.09	100g PSA	
		Orthalicus undatus	Coastal column	Coastal column		Layer 14	6.4 mm	7	1	0.34	Full	
		Orthalicus undatus	Coastal column	Coastal column		Layer 14	1.6 mm	6	–	0.05	100g PSA	
	Planaxidae											
	Trench 2	*Angiola lineata*	2	1	2	2	1.6 mm	1	1	0.06	100g PSA	
		Supplanaxis nucleus	2	1	2	2	6.4 mm	5	5	0.97	Quarter	
		Supplanaxis nucleus	2	1	3	3	6.4 mm	6	6	1.72	Quarter	
		Supplanaxis nucleus	2	1	3A	3A	6.4 mm	1	1	0.28	Full	1
	Pleurodontidae											
	Trench 2	*Pleurodonte* sp.	2	1	2	2	1.6 mm	1	1	0.02	100g PSA	
		Pleurodonte sp.	2	1	3	3	6.4 mm	1	1	0.02	Quarter	
		Pleurodonte sp.	2	1	3	3	1.6 mm	1	–	0.01	100g PSA	
		Pleurodonte aff. *perplexa*	2	1	3A	3A	6.4 mm	1	1	0.13	Quarter	
		Pleurodonte aff. *perplexa*	2	1	9	5	6.4 mm	1	1	0.70	Quarter	
		Pleurodonte sp.	2	1	9	5	6.4 mm	1	1	0.11	Quarter	
	Coastal Profile Column	*Pleurodonte* sp.	Coastal column	Coastal column		Layer 11	1.6 mm	3	1	0.03	100g PSA	
		Pleurodonte sp.	Coastal column	Coastal column		Layer 14	6.4 mm	2	–	0.20	Full	
		Pleurodonte aff. *perplexa*	Coastal column	Coastal column		Layer 14	6.4 mm	2	2	0.27	Full	
		cf. *Pleurodonte* sp.	Coastal column	Coastal column		Layer 14	1.6 mm	1	–	<0.01	100g PSA	
	Turbinidae											
	Trench 2	*Cittarium pica*	2	1	2	2	6.4 mm	18	1	44.64	Quarter	
		Cittarium pica	2	1	2	2	1.6 mm	16	–	0.79	100g PSA	
		Cittarium pica nacre	2	1	2	2	6.4 mm	9	–	1.30	Quarter	
		Cittarium pica nacre	2	1	2	2	1.6 mm	48	–	1.12	100g PSA	
		Tegula excavata	2	1	2	2	6.4 mm	6	3	2.44	Quarter	
		Cittarium pica	2	1	3	3	6.4 mm	19	2	54.46	Quarter	
		Cittarium pica	2	1	3	3	1.6 mm	12	–	0.47	100g PSA	
		Cittarium pica nacre	2	1	3	3	6.4 mm	10	–	4.19	Quarter	
		Cittarium pica nacre	2	1	3	3	1.6 mm	22	–	0.45	100g PSA	
		Tegula excavata	2	1	3	3	6.4 mm	3	2	2.10	Quarter	
		Cittarium pica	2	1	3A	3A	6.4 mm	34	5	212.56	Full and Quarter	22
		Cittarium pica	2	1	3A	3A	1.6 mm	8	–	0.57	100g PSA	
		Cittarium pica nacre	2	1	3A	3A	6.4 mm	33	–	13.09	Full and Quarter	22
		Cittarium pica nacre	2	1	3A	3A	1.6 mm	16	–	0.60	100g PSA	
		Lithopoma caelatum	2	1	3A	3A	6.4 mm	1	1	2.39	Quarter	
		Tegula excavata	2	1	3A	3A	6.4 mm	1	1	0.34	Full	1
		Tegula excavata	2	1	3A	3A	1.6 mm	2	–	0.08	100g PSA	
		Cittarium pica	2	1	8	4	6.4 mm	3	2	43.82	Quarter	
		Cittarium pica	2	1	8	4	1.6 mm	4	–	0.25	100g PSA	

Class	Family	Taxon	Trench	Square	Stratum	Layer	Fraction	NISP	MNI	Weight (g)	Sampling Proportion From Which Specimens Derive	NISP From "Full Sample"
		Cittarium pica nacre	2	1	8	4	6.4 mm	3	–	1.40	Quarter	
		Cittarium pica nacre	2	1	8	4	1.6 mm	4	–	0.13	100g PSA	
		Cittarium pica	2	1	9	5	6.4 mm	11	1	7.94	Quarter	
		Cittarium pica	2	1	9	5	1.6 mm	3	–	0.10	100g PSA	
		Cittarium pica nacre	2	1	9	5	6.4 mm	4	–	1.16	Quarter	
		Cittarium pica nacre	2	1	9	5	1.6 mm	5	–	0.01	100g PSA	
	Coastal Profile Column	*Cittarium pica*	Coastal column	Coastal column		Layer 11	6.4 mm	2	1	2.40	Full	
		Cittarium pica	Coastal column	Coastal column		Layer 11	1.6 mm	2	–	0.06	100g PSA	
		Cittarium pica nacre	Coastal column	Coastal column		Layer 11	1.6 mm	1	–	0.08	100g PSA	
		Cittarium pica	Coastal column	Coastal column		Layer 14	6.4 mm	25	2	28.54	Full	
		Cittarium pica	Coastal column	Coastal column		Layer 14	1.6 mm	11	–	0.32	100g PSA	
		Cittarium pica nacre	Coastal column	Coastal column		Layer 14	6.4 mm	35	–	19.67	Full	
		Cittarium pica nacre	Coastal column	Coastal column		Layer 14	1.6 mm	21	–	0.24	100g PSA	
	Vermetidae/Turritellidae											
	Trench 2	Vermetidae/Turritellidae	2	1	3A	3A	6.4 mm	1	1	0.94	Full	1
	Trench 2	Indeterminate Gastropoda	2	1	2	2	6.4 mm	12	–	2.56	Quarter	
		Indeterminate Gastropoda	2	1	2	2	1.6 mm	7	–	0.39	100g PSA	
		Indeterminate Gastropoda	2	1	3	3	6.4 mm	3	–	2.12	Quarter	
		Indeterminate Gastropoda	2	1	3	3	1.6 mm	3	–	0.07	100g PSA	
		Indeterminate Gastropoda	2	1	3A	3A	6.4 mm	14	–	7.85	Full and Quarter	11
		Indeterminate Gastropoda	2	1	3A	3A	1.6 mm	23	1	1.09	100g PSA	
		Indeterminate Gastropoda	2	1	8	4	1.6 mm	10	–	0.33	100g PSA	
		Indeterminate Gastropoda	2	1	9	5	6.4 mm	13	–	4.05	Quarter	
		Indeterminate Gastropoda	2	1	9	5	1.6 mm	10	–	0.63	100g PSA	
	Coastal Profile Column	Indeterminate Gastropoda	Coastal column	Coastal column		Layer 11	6.4 mm	1	–	0.27	Full	
		Indeterminate Gastropoda	Coastal column	Coastal column		Layer 11	1.6 mm	5	–	0.14	100g PSA	
		Indeterminate Gastropoda	Coastal column	Coastal column		Layer 14	6.4 mm	5	–	1.71	Full	
		Indeterminate Gastropoda	Coastal column	Coastal column		Layer 14	1.6 mm	12	–	0.09	100g PSA	
	Trench 2	Indeterminate terrestrial Gastropoda	2	1	2	2	6.4 mm	1	–	0.14	Quarter	
		Indeterminate terrestrial Gastropoda	2	1	3	3	6.4 mm	1	–	0.86	Quarter	
	Coastal Profile Column	Indeterminate terrestrial Gastropoda	Coastal column	Coastal column		Layer 11	6.4 mm	2	–	0.12	Full	
		Indeterminate terrestrial Gastropoda	Coastal column	Coastal column		Layer 14	6.4 mm	6	–	0.25	Full	
Total Gastropoda								599	54	479.3		
Polyplacophora												
	Chitonidae											
	Trench 2	*Acanthopleura granulata*	2	1	2	2	6.4 mm	33	5	31.34	Quarter	
		Acanthopleura granulata	2	1	2	2	1.6 mm	1	–	0.07	100g PSA	
		Chiton marmoratus	2	1	2	2	6.4 mm	13	2	7.10	Quarter	
		Chiton marmoratus	2	1	2	2	1.6 mm	1	–	0.08	100g PSA	
		Chiton tuberculatus	2	1	2	2	6.4 mm	55	6	19.38	Quarter	
		Chiton tuberculatus	2	1	2	2	1.6 mm	9	–	0.45	100g PSA	
		Acanthopleura granulata	2	1	3	3	6.4 mm	11	2	10.96	Quarter	
		Chiton marmoratus	2	1	3	3	6.4 mm	7	2	4.26	Quarter	
		Chiton tuberculatus	2	1	3	3	6.4 mm	19	4	8.50	Quarter	
		Chiton tuberculatus	2	1	3	3	1.6 mm	7	–	0.16	100g PSA	
		Acanthopleura granulata	2	1	3A	3A	6.4 mm	70	9	59.99	Full and Quarter	39
		Chiton marmoratus	2	1	3A	3A	6.4 mm	15	2	8.49	Full and Quarter	9
		Chiton tuberculatus	2	1	3A	3A	6.4 mm	35	4	15.09	Full and Quarter	26
		Chiton tuberculatus	2	1	3A	3A	1.6 mm	1	–	0.08	100g PSA	
		Acanthopleura granulata	2	1	8	4	6.4 mm	4	1	3.96	Quarter	
		Acanthopleura granulata	2	1	8	4	1.6 mm	1	–	0.12	100g PSA	
		Chiton tuberculatus	2	1	8	4	1.6 mm	4	1	0.39	100g PSA	
		Acanthopleura granulata	2	1	9	5	6.4 mm	4	1	3.27	Quarter	
		Acanthopleura granulata	2	1	9	5	1.6 mm	1	–	0.24	100g PSA	
		Chiton marmoratus	2	1	9	5	6.4 mm	1	1	0.27	Quarter	
		Chiton tuberculatus	2	1	9	5	6.4 mm	4	1	1.55	Quarter	
	Coastal Profile Column	*Acanthopleura granulata*	Coastal column	Coastal column		Layer 14	6.4 mm	4	2	3.09	Full	
	Trench 2	Indeterminate Polyplacophora	2	1	2	2	6.4 mm	2	–	1.01	Quarter	
		Indeterminate Polyplacophora	2	1	2	2	1.6 mm	4	–	0.35	100g PSA	
Total Polyplacophora								306	43	180.2		

Class	Family	Taxon	Trench	Square	Stratum	Layer	Fraction	NISP	MNI	Weight (g)	Sampling Proportion From Which Specimens Derive	NISP From "Full Sample"
Malacostraca: Order Decapoda												
	Gecarcinidae											
	Trench 2	*Cardisoma guanhumi*	2	1	2	2	6.4 mm	8	2	3.78	Quarter	
		Gecarcinus sp.	2	1	3	3	1.6 mm	1	1	0.08	100g PSA	
		Gecarcinidae	2	1	3	3	6.4 mm	1	–	0.41	Quarter	
		Cardisoma guanhumi	2	1	3A	3A	6.4 mm	22	4	9.33	Full and Quarter	17
		Cardisoma guanhumi	2	1	3A	3A	1.6 mm	2	–	0.08	100g PSA	
		Gecarcinus sp.	2	1	3A	3A	6.4 mm	5	2	1.23	Full and Quarter	1
		Cardisoma guanhumi	2	1	8	4	6.4 mm	1	1	1.16	Quarter	
		Cardisoma guanhumi	2	1	8	4	1.6 mm	1	–	0.17	100g PSA	
		Gecarcinus sp.	2	1	8	4	6.4 mm	2	1	1.15	Quarter	
		Gecarcinus sp.	2	1	8	4	1.6 mm	2	1	0.31	100g PSA	
		Gecarcinidae	2	1	8	4	1.6 mm	2	–	0.05	100g PSA	
		Cardisoma guanhumi	2	1	9	5	6.4 mm	3	1	1.75	Quarter	
		Gecarcinus sp.	2	1	9	5	6.4 mm	3	2	1.41	Quarter	
	Coastal Profile Column	*Cardisoma guanhumi*	Coastal column	Coastal column		Layer 14	6.4 mm	1	1	0.42	Full	
	Portunidae											
	Trench 2	Portunidae	2	1	2	2	1.6 mm	1	1	0.07	100g PSA	
		Portunidae	2	1	3	3	6.4 mm	2	1	1.45	Quarter	
	Trench 2	Decapoda	2	1	2	2	6.4 mm	22	–	3.92	Quarter	
		Decapoda	2	1	2	2	1.6 mm	116	–	2.12	100g PSA	
		Decapoda	2	1	3	3	6.4 mm	13	–	2.91	Quarter	
		Decapoda	2	1	3	3	1.6 mm	289	–	2.52	100g PSA	
		Decapoda	2	1	3A	3A	6.4 mm	79	–	15.58	Full and Quarter	54
		Decapoda	2	1	3A	3A	1.6 mm	219	–	3.32	100g PSA	
		Decapoda	2	1	8	4	6.4 mm	4	–	0.23	Quarter	
		Decapoda	2	1	8	4	1.6 mm	218	–	1.53	100g PSA	
		Decapoda	2	1	9	5	6.4 mm	7	–	1.92	Quarter	
		Decapoda	2	1	9	5	1.6 mm	44	–	0.43	100g PSA	
	Coastal Profile Column	Decapoda	Coastal column	Coastal column		Layer 11	1.6 mm	3	1	0.06	100g PSA	
		Decapoda	Coastal column	Coastal column		Layer 14	1.6 mm	18	–	0.22	100g PSA	
Total Malacostraca (Decapoda)								1089	19	57.6		
Maxillopoda												
	Trench 2	Cirripedia	2	1	9	5	6.4 mm	1	1	0.28	Quarter	
	Trench 2	Indeterminate Mollusca	2	1	2	2	6.4 mm	7	–	1.34	Quarter	
		Indeterminate Mollusca	2	1	2	2	1.6 mm	253	–	7.18	100g PSA	
		Indeterminate Mollusca	2	1	3	3	6.4 mm	5	–	1.20	Quarter	
		Indeterminate Mollusca	2	1	3	3	1.6 mm	430	–	5.28	100g PSA	
		Indeterminate Mollusca	2	1	3A	3A	6.4 mm	32	–	8.06	Full and Quarter	27
		Indeterminate Mollusca	2	1	3A	3A	1.6 mm	240	–	4.55	100g PSA	
		Indeterminate Mollusca	2	1	8	4	1.6 mm	217	–	2.85	100g PSA	
		Indeterminate Mollusca	2	1	9	5	6.4 mm	41	–	10.36	Quarter	
		Indeterminate Mollusca	2	1	9	5	1.6 mm	162	–	4.41	100g PSA	
	Coastal Profile Column	Indeterminate Mollusca	Coastal column	Coastal column		Layer 11	6.4 mm	3	–	1.00	Full	
		Indeterminate Mollusca	Coastal column	Coastal column		Layer 11	1.6 mm	42	–	0.62	100g PSA	
		Indeterminate Mollusca	Coastal column	Coastal column		Layer 14	6.4 mm	12	–	0.84	Full	
		Indeterminate Mollusca	Coastal column	Coastal column		Layer 14	1.6 mm	126	–	1.60	100g PSA	
	Trench 2	Indeterminate Invertebrata	2	1	9	5	1.6 mm	1	–	0.07	100g PSA	
		Indeterminate Invertebrata	2	1	3A	3A	1.6 mm	2	–	0.01	100g PSA	
		Indeterminate Invertebrata	2	1	9	5	1.6 mm	1	–	<0.01	100g PSA	
Total Invertebrata								4963	169	851.5		
Total Assemblage								10933	631	2304.8		

APPENDIX D

Grand Bay Invertebrate Zooarchaeological Data by Provenience

The Grand Bay invertebrate faunal assemblage. “Quarter” refers to a 25 x 25 cm quadrant of an excavated 1x 1m unit; “100g PSA” refers to a 100g subsample per sample analyzed.

Class	Family	Taxon	Trench	Stratum/ Layer	Fraction	NISP	MNI	Weight (g)	Sampling Proportion From Which Specimens Derive
Echinoidea									
	Trench 415	Echinoidea	415	L002	6.4 mm	197	4	20.06	Quarter
		Echinoidea	415	L005	6.4 mm	8	1	1.04	Quarter
		Echinoidea	415	L006	6.4 mm	4	1	0.23	Quarter
	Trench 446	Echinoidea	446	L002	1.6 mm	132	1	2.03	100g PSA
		Echinoidea	446	L003	6.4 mm	48	2	5.93	Quarter
		Echinoidea	446	L003	1.6 mm	109	1	1.66	100g PSA
		Echinoidea	446	L005	1.6 mm	34	1	0.64	100g PSA
		Echinoidea	446	L006	1.6 mm	20	1	0.30	100g PSA
Total Echinoidea						552	12	31.9	
Bivalvia									
	Cardiidae								
	Trench 446	*Laevicardium* cf. *serratum*	446	L006	6.4 mm	1	1	0.83	Quarter
	Donacidae								
	Trench 415	*Donax denticulatus*	415	L002	6.4 mm	3	3	1.05	Quarter
		Donax denticulatus	415	L005	6.4 mm	2	2	0.96	Quarter
	Isognomonidae								
	Trench 446	*Isognomon alatus*	446	L006	6.4 mm	2	1	1.45	Quarter
	Lucinidae								
	Trench 415	*Codakia orbicularis*	415	L002	6.4 mm	3	2	6.67	Quarter
		cf. *Codakia orbicularis*	415	L002	6.4 mm	2	–	1.59	Quarter
		Codakia orbicularis	415	L005	6.4 mm	7	1	13.17	Quarter
		Codakia orbicularis	415	L006	6.4 mm	2	1	0.63	Quarter
		Lucinidae	415	L006	6.4 mm	1	–	0.05	Quarter
	Trench 446	*Codakia orbicularis*	446	L002	6.4 mm	2	1	15.10	Quarter
		Codakia orbicularis	446	L003	6.4 mm	3	1	2.36	Quarter
		Codakia orbicularis	446	L006	6.4 mm	1	1	1.77	Quarter
	Mytilidae								
	Trench 415	*Brachidontes exustus*	415	L002	6.4 mm	3	1	0.40	Quarter
		Brachidontes sp.	415	L002	6.4 mm	24	5	5.70	Quarter
		Brachidontes/*Ischadium* sp.	415	L005	6.4 mm	2	1	0.21	Quarter
		Brachidontes/*Ischadium* sp.	415	L006	6.4 mm	2	1	0.15	Quarter
	Trench 446	Mytilidae	446	L003	1.6 mm	1	1	<0.01	100g PSA
		Mytilidae	446	L005	1.6 mm	3	1	0.04	100g PSA
		Mytilidae	446	L006	1.6 mm	3	1	0.01	100g PSA
	Pectinidae								
	Trench 446	Pectinidae	446	L003	6.4 mm	1	1	3.83	Quarter
	Plicatulidae								
	Trench 415	*Plicatula gibbosa*	415	L002	6.4 mm	2	1	4.43	Quarter
	Psammobiidae								
	Trench 415	*Asaphis deflorata*	415	L002	6.4 mm	5	2	9.30	Quarter
		cf. *Asaphis deflorata*	415	L002	6.4 mm	5	1	1.08	Quarter
		Asaphis deflorata	415	L005	6.4 mm	18	4	19.06	Quarter
		cf. *Asaphis deflorata*	415	L005	6.4 mm	14	–	5.04	Quarter
		Asaphis deflorata	415	L006	6.4 mm	19	5	10.62	Quarter
		cf. *Asaphis deflorata*	415	L006	6.4 mm	22	–	5.52	Quarter
	Trench 446	cf. *Asaphis deflorata*	446	L002	6.4 mm	1	1	0.29	Quarter
		Asaphis deflorata	446	L003	6.4 mm	1	1	2.60	Quarter
		cf. *Asaphis deflorata*	446	L003	6.4 mm	1	–	0.97	Quarter
		Asaphis deflorata	446	L005	6.4 mm	5	3	15.36	Quarter
		Asaphis deflorata	446	L006	6.4 mm	8	3	6.96	Quarter
		cf. *Asaphis deflorata*	446	L006	6.4 mm	6	–	2.49	Quarter

Class	Family	Taxon	Trench	Stratum/ Layer	Fraction	NISP	MNI	Weight (g)	Sampling Proportion From Which Specimens Derive
		cf. *Asaphis deflorata*	446	L006	1.6 mm	1	–	0.10	100g PSA
	Tellinidae								
	Trench 415	*Tellinella listeri*	415	L002	6.4 mm	1	1	0.18	Quarter
		Tellinidae	415	L006	6.4 mm	1	1	0.52	Quarter
	Trench 446	*Tellina* sp.	446	L002	6.4 mm	1	1	10.55	Quarter
		Tellinidae	446	L003	6.4 mm	1	1	0.44	Quarter
		Arcopagia fausta	446	L006	6.4 mm	1	1	0.62	Quarter
	Veneridae								
	Trench 415	*Chione cancellata*	415	L002	6.4 mm	3	2	1.97	Quarter
		cf. *Timoclea pygmaea*	415	L002	6.4 mm	1	1	0.06	Quarter
	Trench 415	Indeterminate Bivalvia	415	L002	6.4 mm	16	–	8.63	Quarter
		Indeterminate Bivalvia	415	L005	6.4 mm	5	–	1.99	Quarter
		Indeterminate Bivalvia	415	L006	6.4 mm	18	–	15.49	Quarter
	Trench 446	Indeterminate Bivalvia	446	L002	6.4 mm	1	–	0.25	Quarter
		Indeterminate Bivalvia	446	L002	1.6 mm	2	–	0.11	100g PSA
		Indeterminate Bivalvia	446	L003	6.4 mm	15	–	7.36	Quarter
		Indeterminate Bivalvia	446	L003	1.6 mm	3	–	0.13	100g PSA
		Indeterminate Bivalvia	446	L005	6.4 mm	2	–	1.56	Quarter
		Indeterminate Bivalvia	446	L006	6.4 mm	20	–	16.36	Quarter
		Indeterminate Bivalvia	446	L006	1.6 mm	19	–	0.48	100g PSA
Total Bivalvia						286	55	206.5	
Gastropoda									
	Batillariidae								
	Trench 446	*Batillaria minima*	446	L006	1.6 mm	1	1	<0.01	100g PSA
	Buccinidae								
	Trench 446	*Engoniophos unicinctus*	446	L003	6.4 mm	1	1	0.60	Quarter
	Bullidae								
	Trench 415	*Bulla striata*	415	L002	6.4 mm	2	2	2.39	Quarter
		cf. *Bulla striata*	415	L002	6.4 mm	1	–	0.67	Quarter
		Bulla striata	415	L005	6.4 mm	1	1	0.26	Quarter
		Bulla striata	415	L006	6.4 mm	4	4	5.70	Quarter
	Trench 446	*Bulla striata*	446	L003	6.4 mm	2	2	2.54	Quarter
		cf. *Bulla striata*	446	L005	6.4 mm	1	1	0.23	Quarter
	Trench 561	*Bulla striata*	561	L002	6.4 mm	1	1	1.20	Quarter
	Calyptraeidae								
	Trench 415	*Crepidula maculosa*	415	L002	6.4 mm	34	33	11.08	Quarter
		Crepidula sp.	415	L002	6.4 mm	2	2	0.30	Quarter
		Crepidula maculosa	415	L005	6.4 mm	9	9	2.35	Quarter
		Crepidula maculosa	415	L006	6.4 mm	6	5	1.12	Quarter
	Trench 446	*Crepidula maculosa*	446	L002	6.4 mm	7	7	3.69	Quarter
		Crepidula maculosa	446	L003	6.4 mm	7	7	2.50	Quarter
		Crepidula maculosa	446	L005	6.4 mm	1	1	0.19	Quarter
		Crepidula maculosa	446	L006	6.4 mm	6	6	1.29	Quarter
		Crepidula maculosa	446	L006	1.6 mm	5	3	0.10	100g PSA
	Trench 561	*Crepidula maculosa*	561	L002	6.4 mm	1	1	0.10	Quarter
	Cassidae								
	Trench 415	*Cassis* sp.	415	L002	6.4 mm	1	1	2.20	Quarter
	Cerithiidae and Batillariidae								
	Trench 415	*Cerithium lutosum*	415	L005	6.4 mm	1	1	0.24	Quarter
		Cerithium lutosum	415	L006	6.4 mm	1	1	0.08	Quarter
	Trench 446	*Cerithium lutosum*/*Batillaria minima*	446	L002	1.6 mm	1	1	<0.01	100g PSA
		Cerithium lutosum	446	L005	1.6 mm	2	2	0.12	100g PSA
		Cerithium lutosum/*Batillaria minima*	446	L005	1.6 mm	3	3	0.01	100g PSA
		Cerithium lutosum	446	L006	1.6 mm	1	1	0.14	100g PSA
		Cerithium lutosum/*Batillaria minima*	446	L006	1.6 mm	14	13	0.04	100g PSA

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	Collumbellidae								
	Trench 446	*Columbella mercatoria*	446	L006	6.4 mm	1	1	0.42	Quarter
	Cypraeidae								
	Trench 561	Cypraeidae	561	L002	6.4 mm	1	1	4.60	Quarter
	Fasciolariidae								
	Trench 415	*Leucozonia nassa*	415	L002	6.4 mm	1	1	3.26	Quarter
		Leucozonia sp.	415	L002	6.4 mm	1	1	1.08	Quarter
	Fissurellidae								
	Trench 415	*Fissurella barbadensis*	415	L002	6.4 mm	2	2	4.14	Quarter
		Fissurella nodosa	415	L002	6.4 mm	1	1	4.27	Quarter
		Fissurella/*Diadora* sp.	415	L002	6.4 mm	2	2	0.79	Quarter
		Fissurellidae	415	L005	6.4 mm	1	1	0.26	Quarter
	Trench 446	*Fissurella* sp.	446	L006	6.4 mm	2	2	3.26	Quarter
	Littorinidae								
	Trench 415	*Cenchritis muricata*	415	L002	6.4 mm	9	9	10.08	Quarter
		Echinolittorina tuberculata	415	L002	6.4 mm	1	1	0.11	Quarter
		Echinolittorina ziczac	415	L002	6.4 mm	2	2	1.06	Quarter
		Echinolittorina sp.	415	L002	6.4 mm	1	1	0.17	Quarter
		Littoraria sp.	415	L002	6.4 mm	1	1	0.39	Quarter
		Littorinidae	415	L002	6.4 mm	2	1	0.36	Quarter
		Cenchritis muricata	415	L005	6.4 mm	2	2	1.66	Quarter
		Echinolittorina ziczac	415	L005	6.4 mm	1	1	0.43	Quarter
		Cenchritis muricata	415	L006	6.4 mm	2	2	1.95	Quarter
		Littorinidae	415	L006	6.4 mm	1	1	0.51	Quarter
	Trench 446	*Cenchritis muricata*	446	L002	6.4 mm	4	4	5.70	Quarter
		Cenchritis muricata	446	L003	6.4 mm	1	1	0.50	Quarter
		Cenchritis muricata	446	L006	6.4 mm	1	1	0.13	Quarter
	Trench 561	*Cenchritis muricata*	561	L002	6.4 mm	1	1	0.30	Quarter
	Lottiidae								
	Trench 415	*Tectura antillarum*	415	L002	6.4 mm	1	1	0.10	Quarter
	Marginellidae								
	Trench 446	Marginellidae	446	L002	1.6 mm	1	1	<0.01	100g PSA
		Marginellidae	446	L005	1.6 mm	1	1	0.02	100g PSA
	Strophocheilidae								
	Trench 415	*Megalobulimus* sp.	415	L002	6.4 mm	3	1	2.00	Quarter
		cf. *Megalobulimus* sp.	415	L002	6.4 mm	1	–	0.24	Quarter
	Modulidae								
	Trench 415	*Modulus modulus*	415	L006	6.4 mm	1	1	0.45	Quarter
	Muricidae								
	Trench 415	*Plicopurpura patula*	415	L002	6.4 mm	1	1	0.15	Quarter
		Stramonita haemastoma/*rustica*	415	L002	6.4 mm	2	2	1.90	Quarter
		Muricidae	415	L002	6.4 mm	1	1	0.21	Quarter
		Plicopurpura patula	415	L005	6.4 mm	1	1	1.72	Quarter
	Trench 446	*Stramonita haemastoma*/*rustica*	446	L002	6.4 mm	4	4	11.15	Quarter
		Stramonita haemastoma/*rustica*	446	L003	6.4 mm	1	1	3.36	Quarter
	Trench 561	*Plicopurpura patula*	561	L002	6.4 mm	1	1	1.00	Quarter
	Nassariidae								
	Trench 415	*Nassarius polygonatus*	415	L002	6.4 mm	1	1	0.53	Quarter
		Nassarius polygonatus	415	L006	6.4 mm	1	1	0.28	Quarter
	Trench 446	*Nassarius polygonatus*	446	L003	6.4 mm	1	1	0.30	Quarter
	Naticidae								
	Trench 446	*Naticarius* cf. *canrena*	446	L002	6.4 mm	1	1	3.00	Quarter

Class	Family	Taxon	Trench	Stratum/ Layer	Fraction	NISP	MNI	Weight (g)	Sampling Proportion From Which Specimens Derive
	Neritidae								
	Trench 415	*Nerita peloronta*	415	L002	6.4 mm	2	2	4.87	Quarter
		Nerita tessellata	415	L002	6.4 mm	142	100	93.38	Quarter
		Nerita cf. *tessellata*	415	L002	6.4 mm	1	–	0.70	Quarter
		Nerita versicolor	415	L002	6.4 mm	45	34	41.20	Quarter
		Nerita versicolor or *peloronta*	415	L002	6.4 mm	5	–	1.19	Quarter
		Nerita sp.	415	L002	6.4 mm	9	–	1.20	Quarter
		cf. *Nerita* sp.	415	L002	6.4 mm	1	–	0.20	Quarter
		Nerita tessellata	415	L005	6.4 mm	33	28	26.44	Quarter
		Nerita versicolor	415	L005	6.4 mm	9	8	12.02	Quarter
		Nerita sp.	415	L005	6.4 mm	4	–	0.76	Quarter
		Nerita tessellata	415	L006	6.4 mm	4	3	0.91	Quarter
		Nerita versicolor	415	L006	6.4 mm	2	1	0.72	Quarter
		Nerita tessellata or *fulgurans*	415	L006	6.4 mm	1	1	0.57	Quarter
		Nerita versicolor or *peloronta*	415	L006	6.4 mm	1	–	0.42	Quarter
		Nerita sp.	415	L006	6.4 mm	2	–	0.37	Quarter
	Trench 446	*Nerita peloronta*	446	L002	6.4 mm	1	1	4.30	Quarter
		Nerita tessellata	446	L002	6.4 mm	33	30	29.10	Quarter
		Nerita tessellata	446	L002	1.6 mm	7	1	0.54	100g PSA
		Nerita cf. *tessellata*	446	L002	6.4 mm	2	–	0.30	Quarter
		Nerita versicolor	446	L002	6.4 mm	6	6	20.98	Quarter
		Nerita cf. *versicolor*	446	L002	6.4 mm	2	2	2.70	Quarter
		Nerita sp.	446	L002	6.4 mm	2	–	1.18	Quarter
		Nerita sp.	446	L002	1.6 mm	4	–	0.13	100g PSA
		Nerita tessellata	446	L003	6.4 mm	110	93	69.95	Quarter
		Nerita tessellata	446	L003	1.6 mm	4	–	0.23	100g PSA
		Nerita versicolor	446	L003	6.4 mm	10	9	8.25	Quarter
		Nerita versicolor	446	L003	1.6 mm	1	–	0.11	100g PSA
		Nerita sp.	446	L003	6.4 mm	16	–	2.60	Quarter
		Nerita sp.	446	L003	1.6 mm	1	–	0.09	100g PSA
		Netritidae	446	L003	1.6 mm	2	2	0.02	100g PSA
		Nerita tessellata	446	L005	1.6 mm	3	1	0.18	100g PSA
		Nerita versicolor	446	L005	1.6 mm	2	1	0.08	100g PSA
		Nerita cf. *versicolor*	446	L005	1.6 mm	1	–	0.14	100g PSA
		Nerita sp.	446	L005	1.6 mm	6	–	0.21	100g PSA
		Nerita tessellata	446	L006	6.4 mm	1	1	0.10	Quarter
		Smaragdia viridis	446	L006	1.6 mm	1	1	<0.01	100g PSA
	Trench 561	*Nerita peloronta*	561	L002	6.4 mm	1	1	0.20	Quarter
		Nerita tessellata	561	L002	6.4 mm	21	18	11.80	Quarter
		Nerita versicolor	561	L002	6.4 mm	4	3	2.70	Quarter
	Olividae								
	Trench 415								
		Oliva sp.	415	L002	6.4 mm	2	2	5.35	Quarter
		cf. *Oliva* sp.	415	L002	6.4 mm	1	1	1.00	Quarter
		Olivella sp.	415	L005	6.4 mm	1	1	0.04	Quarter
		Oliva sp.	415	L006	6.4 mm	1	1	2.00	Quarter
	Trench 446	*Oliva* sp.	446	L003	6.4 mm	1	1	0.26	Quarter
		Olivella sp.	446	L006	1.6 mm	1	1	<0.01	100g PSA
	Orthalicidae								
	Trench 415	*Orthalicus undatus*	415	L002	6.4 mm	88	13	25.34	Quarter
		Orthalicidae	415	L002	6.4 mm	2	–	0.25	Quarter
		Orthalicus undatus	415	L005	6.4 mm	14	4	1.97	Quarter
		Orthalicus undatus	415	L006	6.4 mm	7	1	0.66	Quarter
	Trench 446	*Orthalicus undatus*	446	L002	6.4 mm	3	2	4.63	Quarter
		Orthalicus undatus	446	L002	1.6 mm	1	–	0.02	100g PSA
		Orthalicus undatus	446	L003	6.4 mm	6	1	0.70	Quarter
		Orthalicus undatus	446	L003	1.6 mm	1	–	<0.01	100g PSA
		Orthalicus undatus	446	L005	6.4 mm	1	1	0.62	Quarter
		Orthalicus undatus	446	L005	1.6 mm	7	1	0.04	100g PSA
		Orthalicus undatus	446	L006	6.4 mm	2	1	0.17	Quarter
	Trench 561	*Orthalicus undatus*	561	L002	6.4 mm	2	2	1.70	Quarter
	Phasianellidae								
	Trench 446	*Eulithidium* sp.	446	L003	1.6 mm	1	1	<0.01	100g PSA
		Eulithidium bellum	446	L006	1.6 mm	1	1	<.01	100g PSA
		Eulithidium sp.	446	L006	1.6 mm	2	2	<.01	100g PSA

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	Planaxidae								
	Trench 415	*Supplanaxis nucleus*	415	L002	6.4 mm	1	1	0.48	Quarter
	Trench 446	*Supplanaxis nucleus*	446	L002	6.4 mm	1	1	0.60	Quarter
		Supplanaxis nucleus	446	L003	6.4 mm	3	3	1.00	Quarter
	Pleurodontidae								
	Trench 415	*Pleurodonte* aff. *perplexa*	415	L002	6.4 mm	15	13	6.84	Quarter
		Pleurodonte sp.	415	L002	6.4 mm	23	–	2.81	Quarter
		Pleurodonte aff. *perplexa*	415	L005	6.4 mm	1	1	1.38	Quarter
	Trench 446	*Pleurodonte* sp.	446	L002	1.6 mm	2	1	0.02	100g PSA
		Pleurodonte sp.	446	L003	1.6 mm	1	1	<0.01	100g PSA
		Camaenidae	446	L003	6.4 mm	1	–	0.18	Quarter
		Pleurodonte sp.	446	L006	6.4 mm	1	1	0.09	Quarter
	Ranellidae								
	Trench 415	*Cymatium nicobaricum*	415	L002	6.4 mm	1	1	1.30	Quarter
		Cymatium sp.	415	L002	6.4 mm	1	1	0.41	Quarter
	Turbinidae								
	Trench 415	*Cittarium pica*	415	L002	6.4 mm	149	23	1257.56	Quarter
		Cittarium pica nacre	415	L002	6.4 mm	12	–	3.88	Quarter
		Lithopoma caelatum	415	L002	6.4 mm	1	1	14.88	Quarter
		Turbo castanea	415	L002	6.4 mm	1	1	1.40	Quarter
		Lithopoma tuber	415	L002	6.4 mm	4	1	3.14	Quarter
		Lithopoma sp.	415	L002	6.4 mm	1	–	0.86	Quarter
		Tegula excavata	415	L002	6.4 mm	10	9	13.07	Quarter
		Tegula sp.	415	L002	6.4 mm	1	1	0.16	Quarter
		Cittarium pica	415	L005	6.4 mm	53	5	426.24	Quarter
		Tegula excavata	415	L005	6.4 mm	7	2	1.73	Quarter
		Cittarium pica	415	L006	6.4 mm	21	5	320.96	Quarter
		Lithopoma caelatum	415	L006	6.4 mm	1	1	1.04	Quarter
	Trench 446	*Cittarium pica*	446	L002	6.4 mm	66	30	1605.37	Quarter
		Cittarium pica	446	L002	1.6 mm	7	–	0.29	100g PSA
		Cittarium pica nacre	446	L002	1.6 mm	14	–	0.17	100g PSA
		Lithopoma caelatum	446	L002	6.4 mm	2	2	16.10	Quarter
		Lithopoma tuber	446	L002	6.4 mm	5	2	10.50	Quarter
		Tegula excavata	446	L002	6.4 mm	11	3	3.60	Quarter
		Cittarium pica	446	L003	6.4 mm	19	4	46.00	Quarter
		Cittarium pica	446	L003	1.6 mm	7	–	0.33	100g PSA
		Cittarium pica nacre	446	L003	6.4 mm	45	–	8.72	Quarter
		Cittarium pica nacre	446	L003	1.6 mm	13	–	0.22	100g PSA
		Lithopoma caelatum	446	L003	6.4 mm	1	1	0.50	Quarter
		Lithopoma tuber	446	L003	6.4 mm	1	1	3.61	Quarter
		Tegula excavata	446	L003	6.4 mm	1	1	0.08	Quarter
		Cittarium pica	446	L005	6.4 mm	7	3	326.50	Quarter
		Cittarium pica	446	L005	1.6 mm	9	–	0.24	100g PSA
		Cittarium pica nacre	446	L005	1.6 mm	19	–	0.54	100g PSA
		Cittarium pica nacre	446	L005	1.6 mm	16	–	0.23	100g PSA
		Lithopoma tectum	446	L005	6.4 mm	1	1	34.73	Quarter
		Cittarium pica	446	L006	6.4 mm	15	3	307.46	Quarter
		Cittarium pica	446	L006	1.6 mm	29	–	1.30	100g PSA
		Cittarium pica nacre	446	L006	6.4 mm	7	–	0.21	Quarter
		Cittarium pica nacre	446	L006	1.6 mm	50	–	0.89	100g PSA
	Trench 561	*Cittarium pica*	561	L002	6.4 mm	17	3	43.94	Quarter
	Turridae								
	Trench 415	Turridae	415	L002	6.4 mm	1	1	0.06	Quarter
	Trench 446	Turridae	446	L002	1.6 mm	1	1	<0.01	100g PSA
		Turridae	446	L006	1.6 mm	1	1	<0.01	100g PSA
	Trench 415	Indeterminate Gastropoda	415	L002	6.4 mm	103	–	49.36	Quarter
		Indeterminate Gastropoda	415	L005	6.4 mm	2	–	0.45	Quarter
		Indeterminate Gastropoda	415	L006	6.4 mm	10	–	2.91	Quarter
	Trench 446	Indeterminate Gastropoda	446	L002	6.4 mm	61	–	24.10	Quarter
		Indeterminate Gastropoda	446	L002	1.6 mm	9	1	0.14	100g PSA

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		Indeterminate Gastropoda	446	L003	6.4 mm	27	–	9.13	Quarter
		Indeterminate Gastropoda	446	L003	1.6 mm	14	–	0.26	100g PSA
		Indeterminate Gastropoda	446	L005	1.6 mm	29	–	0.54	100g PSA
		Indeterminate Gastropoda	446	L006	6.4 mm	3	–	2.51	Quarter
		Indeterminate Gastropoda	446	L006	1.6 mm	69	–	1.09	100g PSA
	Trench 561	Indeterminate Gastropoda	561	L002	6.4 mm	3	–	1.38	Quarter
	Trench 415	Indeterminate terrestrial Gastropoda	415	L002	6.4 mm	8	1	4.23	Quarter
		Indeterminate terrestrial Gastropoda	415	L006	6.4 mm	1	–	0.02	Quarter
	Trench 446	Indeterminate terrestrial Gastropoda	446	L002	1.6 mm	4	–	0.03	100g PSA
		Indeterminate terrestrial Gastropoda	446	L005	1.6 mm	1	–	0.02	100g PSA
		Indeterminate terrestrial Gastropoda	446	L006	1.6 mm	1	–	<0.01	100g PSA
Total Gastropoda						1849	686	5064.4	
Polyplacophora									
	Chitonidae								
	Trench 415	*Acanthopleura granulata*	415	L002	6.4 mm	79	9	81.16	Quarter
		Chiton marmoratus	415	L002	6.4 mm	43	10	29.76	Quarter
		Chiton tuberculatus	415	L002	6.4 mm	519	58	293.72	Quarter
		Chiton cf. *tuberculatus*	415	L002	6.4 mm	1	–	0.20	Quarter
		Acanthopleura granulata	415	L005	6.4 mm	49	7	55.69	Quarter
		Chiton marmoratus	415	L005	6.4 mm	5	1	5.37	Quarter
		Chiton tuberculatus	415	L005	6.4 mm	75	13	48.19	Quarter
		Acanthopleura granulata	415	L006	6.4 mm	27	4	43.77	Quarter
		cf. *Acanthopleura granulata*	415	L006	6.4 mm	1	–	0.30	Quarter
		Chiton tuberculatus	415	L006	6.4 mm	32	4	18.40	Quarter
	Trench 446	*Acanthopleura granulata*	446	L002	6.4 mm	27	5	55.80	Quarter
		Acanthopleura granulata	446	L002	1.6 mm	1	–	0.13	100g PSA
		Chiton marmoratus	446	L002	6.4 mm	17	3	17.60	Quarter
		Chiton tuberculatus	446	L002	6.4 mm	188	30	127.25	Quarter
		Chiton tuberculatus	446	L002	1.6 mm	8	–	0.60	100g PSA
		Chiton cf. *tuberculatus*	446	L002	6.4 mm	2	1	0.45	Quarter
		Acanthopleura granulata	446	L003	6.4 mm	15	2	24.36	Quarter
		Chiton marmoratus	446	L003	6.4 mm	25	3	15.56	Quarter
		Chiton squamosus	446	L003	6.4 mm	1	1	0.31	Quarter
		Chiton tuberculatus	446	L003	6.4 mm	123	11	59.88	Quarter
		Chiton tuberculatus	446	L003	1.6 mm	4	1	0.28	100g PSA
		Chiton viridis	446	L003	6.4 mm	5	1	1.11	Quarter
		Acanthopleura granulata	446	L005	6.4 mm	2	2	1.67	Quarter
		Chiton tuberculatus	446	L005	1.6 mm	4	1	0.27	100g PSA
		Acanthopleura granulata	446	L006	6.4 mm	19	3	12.11	Quarter
		Acanthopleura granulata	446	L006	1.6 mm	3	1	0.26	100g PSA
		Chiton tuberculatus	446	L006	6.4 mm	15	4	6.00	Quarter
		Chiton tuberculatus	446	L006	1.6 mm	5	–	0.23	100g PSA
	Trench 561	*Acanthopleura granulata*	561	L002	6.4 mm	4	1	4.60	Quarter
		Chiton marmoratus	561	L002	6.4 mm	4	2	3.00	Quarter
		Chiton tuberculatus	561	L002	6.4 mm	15	2	3.90	Quarter
	Trench 415	Indeterminate Polyplacophora	415	L002	6.4 mm	3	–	1.13	Quarter
		Indeterminate Polyplacophora	415	L006	6.4 mm	1	–	0.21	Quarter
	Trench 446	Indeterminate Polyplacophora	446	L002	6.4 mm	2	–	1.50	Quarter
		Indeterminate Polyplacophora	446	L003	1.6 mm	2	–	0.17	100g PSA
		Indeterminate Polyplacophora	446	L003	6.4 mm	2	–	0.47	Quarter
		Indeterminate Polyplacophora	446	L006	1.6 mm	1	–	0.02	100g PSA
Total Polyplacophora						1329	180	915.4	
Malacostraca: Order Decapoda									
	Gecarcinidae								
	Trench 415	*Cardisoma guanhumi*	415	L002	6.4 mm	13	2	10.58	Quarter
		Gecarcinus sp.	415	L002	6.4 mm	6	1	1.52	Quarter
		Gecarcinidae	415	L002	6.4 mm	18	1	8.56	Quarter
		Cardisoma guanhumi	415	L005	6.4 mm	3	1	3.70	Quarter
		Gecarcinidae	415	L005	6.4 mm	2	–	0.76	Quarter
		Cardisoma guanhumi	415	L006	6.4 mm	5	1	3.99	Quarter

Class	Family		Taxon	Trench	Stratum/ Layer	Fraction	NISP	MNI	Weight (g)	Sampling Proportion From Which Specimens Derive
		Trench 446	*Cardisoma guanhumi*	446	L002	6.4 mm	1	1	1.78	Quarter
			Cardisoma guanhumi	446	L002	1.6 mm	1	–	<0.01	100g PSA
			Cardisoma guanhumi	446	L005	6.4 mm	1	1	1.55	Quarter
			Cardisoma guanhumi	446	L006	1.6 mm	1	1	0.02	100g PSA
			Gecarcinus sp.	446	L006	1.6 mm	2	1	0.37	100g PSA
	Portunidae									
		Trench 415	Portunidae	415	L002	6.4 mm	6	2	1.06	Quarter
			cf. Portunidae	415	L002	6.4 mm	6	1	0.96	Quarter
	Grapsidae									
		Trench 446	*Grapsus grapsus*	446	L006	6.4 mm	1	1	0.55	Quarter
		Trench 415	Decapoda	415	L002	6.4 mm	180	–	31.09	Quarter
			Decapoda	415	L005	6.4 mm	18	1	6.51	Quarter
			Decapoda	415	L006	6.4 mm	26	2	5.83	Quarter
		Trench 446	Decapoda	446	L002	6.4 mm	1	–	0.12	Quarter
			Decapoda	446	L002	1.6 mm	132	–	1.69	100g PSA
			Decapoda	446	L003	6.4 mm	65	1	12.87	Quarter
			Decapoda	446	L003	1.6 mm	94	–	0.91	100g PSA
			Decapoda	446	L005	1.6 mm	46	–	1.02	100g PSA
			Decapoda	446	L006	6.4 mm	4	–	1.20	Quarter
			Decapoda	446	L006	1.6 mm	186	–	2.87	100g PSA
Total Malacostraca (Decapoda)							818	18	99.5	
Maxillopoda										
		Trench 415	Cirripedia	415	L006	6.4 mm	1	1	1.48	Quarter
		Trench 415	Indeterminate Mollusca	415	L002	6.4 mm	299	–	74.53	Quarter
			Indeterminate Mollusca	415	L005	6.4 mm	91	–	26.45	Quarter
			Indeterminate Mollusca	415	L006	6.4 mm	92	–	28.62	Quarter
		Trench 446	Indeterminate Mollusca	446	L002	6.4 mm	4	–	0.65	Quarter
			Indeterminate Mollusca	446	L002	1.6 mm	237	–	3.81	100g PSA
			Indeterminate Mollusca	446	L003	6.4 mm	34	–	6.07	Quarter
			Indeterminate Mollusca	446	L003	1.6 mm	203	–	3.15	100g PSA
			Indeterminate Mollusca	446	L005	1.6 mm	260	–	4.98	100g PSA
			Indeterminate Mollusca	446	L006	6.4 mm	42	–	13.49	Quarter
			Indeterminate Mollusca	446	L006	1.6 mm	544	–	8.70	100g PSA
		Trench 561	Indeterminate Mollusca	561	L002	6.4 mm	2	–	0.50	Quarter
		Trench 415	Indeterminate Invertebrata	415	L002	6.4 mm	3	–	1.10	Quarter
		Trench 446	Indeterminate Invertebrata	446	L002	1.6 mm	4	–	0.16	100g PSA
			Indeterminate Invertebrata	446	L003	1.6 mm	7	–	0.06	100g PSA
			Indeterminate Invertebrata	446	L006	1.6 mm	3	–	0.01	100g PSA
Total Invertebrata							6660	952	6491.4	