Comparative Analysis of the Faunal Remains from British Royal Engineer and Enslaved African Occupations at Brimstone Hill Fortress, St. Kitts, West Indies

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Abstract

During the 17th through 19th centuries, economic interests favoring sugarcane production and export over domestic animal husbandry, necessitated an import-based subsistence strategy in many Caribbean colonies. British military stationed on the island of St. Kitts also adopted this practice of provisioning its soldiers and the enslaved Africans who served at Brimstone Hill Fortress. Comparative analysis of the faunal materials recovered at BSH 3 Terrace 1 (Royal Engineers Officer's quarters) and Terrace 3 (enslaved Africans' occupation) show that military personnel and enslaved Africans alike supplemented their rations (i.e. salted fish or barreled pork or beef) with locally obtained foods (i.e. fresh fish and birds). Though Europeans and Africans utilized the same food species, they did so in unique ways. Data gathered from archaeofaunal identifications, skeletal part frequencies, and stable carbon isotope analysis reveal that British diets included fairly even amounts of mammals, birds, and fish, while enslaved Africans relied more heavily on fish and preserved meats. At both sites, low utility elements from caprine indicate that sheep (*Ovis*) and goats (*Capra*) were raised locally and slaughtered on the island. This interpretation is less clear for cattle (*Bos*) and swine (*Sus*). Fresh-caught fish and birds supplemented the other available sources of protein on St. Kitts such as imported barreled and salted meats. Without materials collected from screens smaller than one-quarter inch, the contribution of these food sources would have been difficult to detect or entirely overlooked. Clearly these interpretations demonstrate the difficulty of adequately sampling the complete faunal community present at a site using only one-quarter inch screen. Likewise, the faunal specimens recovered using screens smaller than one-quarter inch revealed specific cultural practices (e.g. marine zones exploited and fishing methods) that may have been missed without the use of these finer screens. For example, the archaeological fish community reveals consumption patterns indicative of different fishing strategies. This analysis illustrates the potential shortcomings of zooarchaeological research that does not use small screens to recover faunal materials. Further, the faunal material from the Brimstone Hill Site enhances our understanding of the role of this particular military provisioning strategy in the success of European colonization in the Caribbean.

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Chapter 1: Introduction and Objectives

In Diaspora literature of both North America and the Caribbean, the traditional view of the enslaved African diet has been one of marginal nutrition in which deficiencies in vitamins, protein, and caloric intake were commonplace (Varney 2003; Farnsworth 2001; Morgan 1995; Beckles and Shepherd 1991; Kiple and Kiple 1980). Brimstone Hill (BSH) Fortress on the island of St. Kitts (officially part the Federation of St. Christopher and Nevis) in the West Indies offers an ideal opportunity to test this hypothesis. Both excellent preservation and known occupation dates for adjacent habitation areas attributed to enslaved Africans and members of the British military provide good context for a comparative dietary analysis. This thesis seeks to understand subsistence options available and choices made within the island's specific colonial military context by members of this distinctive multi-ethnic community through analysis of human food refuse.

Sugar and sugar by-products were ventral to the economy of the British West Indies during the seventeenth and eighteenth centuries (Higman 2011). Indeed, these Caribbean islands were highly productive. When compared with the large continental colonies, the tiny Caribbean islands produced enormous wealth for Britain (Pulsipher 1986). Consider, for instance, that in 1700 English Barbados, Jamaica, Antigua, Nevis, and Montserrat collectively exported 25,000 tons of sugar and sugar-based products while Brazil was responsible for producing 22,000 tons. (St. Kitts' production was disrupted during this period by French raids.) Only ten substantial exporters globally existed in 1700, and more than half of them were Caribbean island colonies (Higman 2011:103).

Typical of Caribbean colonies during this period, sugar cane production and processing formed the foundation of St. Kitts' economy, as evidenced by the fact that sugar-based products constituted ninety-seven percent of St. Kitts' domestic exports between 1771 and 1775 (Richardson 1997; Sheridan 1984). So profitable was the production of sugar, molasses, and rum that some islands developed sugar monoculture systems (Dunn 2000). Through innovative manuring and intensive cultivation techniques, St. Kitts (and neighboring Nevis) greatly out-produced most other West Indies sugar islands. The island's size, strategic location, and productivity made it one of Britain's most important and prized New World colonies, earning St. Kitts the nickname "Gem of the Caribbean" and Brimstone Hill Fortress the moniker "Gibraltar of the West Indies" (Schroedl and Ahlman 2002).

As the sugar industry grew, so did international rivalry over the West Indian colonies (Knight 1970). From an economic standpoint, then, military protection was extremely important for maintaining possession of the island. For its defense, military installations ranging in size from "small redoubts and batteries to large fortresses" were distributed across the island (Schroedl and Ahlman 2000). British military personnel used Brimstone Hill Fortress, the largest of these installations, to defend holdings on the island from 1690-1853 (with the exception of a brief period of French occupation in 1782). Throughout this period the colonial Kittitian government required plantation owners to supply enslaved African labor for the construction, maintenance, and armament of this 40 acre installation (Ahlman 1997; Schroedl 1997). The British military, in turn, took responsibility for provisioning their conscripted workforce (Klippel 2001).

Limited zooarchaeological evidence for subsistence practices and patterns exists for the historic Caribbean. Gibson's (2007) work at the French plantation, Habitation la Mahaudière, on Guadeloupe, for example, revealed that slave diet there consisted of a variety of pork, goat, chicken, beef, fish, and shellfish sources of protein. She and Peggy Brunache (dissertation forthcoming) also identified wild species such as cane toad, agouti, rat, and mongoose. They concluded that a combination of planter-distributed rations and local exploitation of primarily marine resources explained the diets of this plantation's occupants (Gibson 2007).

St. Kitts offers a valuable contribution to subsistence studies in the Caribbean and historical archaeological studies overall. This is especially true with respect to the institution of slavery. Other African slave sites in the Caribbean include excavations on Jamaica (Armstrong 1985 and 1990), Cuba (La Rosa 2003), Montserrat (Pulsipher 1982 and Goodwin 1979; Howson 1995), Saint Eustatius (Heath 1988, 1999), the Virgin Islands (Armstrong 2003), the Bahamas (Wilkie and Farnsworth 2005), and Barbados (Handler and Lange 1978). These studies often investigate issues of ethnicity and Africanisms, focusing on social interactions of slaves and planters (see also Finamore's [1995] work in Belize) and slaves' resistance to the dominant (i.e. European) culture. Many also reveal interesting subsistence practices that blend African, European, and Caribbean traditions in the utilization of local and imported food sources.

In contrast to the many Caribbean plantation and urban sites previously studied, the military installation at Brimstone Hill Fortress offers unique insight into the way that military rules and regulations influenced interactions between enslaved Africans and their European captors. In particular, this site will help identify and explain coping mechanisms with which enslaved Africans responded to the “daily drudgeries of fort life” under the oppression of the British military regime (Ahlman 1997).

The analysis of faunal remains from archaeological sites can reveal much about the types and proportions of animals consumed. Examination of this portion of the material culture of the British colonial military installation on Brimstone Hill can produce information on this specific historic social setting’s influence on the island’s occupational history, settlement, and agricultural practices. Because foodways can function to signal identity by highlighting differences and reinforcing social boundaries, faunal analysis can also provide insight into questions of socioeconomic status and racial differences (Franklin 2002:102). The primary goals of this study are two-fold. First, I will identify subsistence patterns and demonstrate Africans’ and Europeans’ different access to and utilization of food resources evident in the Brimstone Hill (Site 3) faunal assemblages. Second, I will demonstrate the importance of fine screening, a field technique essential to this analysis (and therefore others), without which one would have an incomplete data set that skews archaeological interpretation of faunal material.

Chapter 2: Background

Slave ships transported nearly two million Africans to the British Caribbean during the Atlantic slave trade era (Curtin 1972). Between 1680 and 1688 alone, the Royal African Company supplied 46,396 slaves to the British West Indies. They averaged annually 5,155 slaves (Williams 1970). Between 1721 and 1730, St. Kitts planters imported 10,358 slaves, and by the 1780s, the island of St. Kitts held 360 slaves per square mile (Richardson 1983:62). Yet throughout the Caribbean, land was at a premium due to the sugar monoculture technique prominent throughout the region during this time (Curtin 1972; Sheridan 1972; Williams 1970). As a result, the intensity of sugar monoculture in the British West Indies from the seventeenth to the nineteenth centuries necessitated the provisioning of both European colonists and enslaved people via shipments from Europe and North America. During this period the bulk of British West Indies staple food was imported (Watters 2001:83).

Even where space allowed for subsistence agriculture, sugar monoculture was so profitable that planters on many islands, including St. Kitts, preferred to import foodstuffs at very high prices rather than produce it themselves. Rather than devote land and labor to local food production (and thus detract from their sugar profit), Kittitian planters opted to provision their slaves with imported foodstuffs. These provisions usually included some form of meal (usually corn based) and/or rice and preserved meat such as salted fish or barreled pork or beef (Higman 1984; Varney 2003:15). Specifically on St. Kitts, slaves were legally entitled to 1.25 lbs. of "herring, shad, mackerel, or other salt provisions, or double the quantity (2.5 lbs.) of fresh fish or other provisions" (Edwards 1966:178). Generally six to eight imported herring comprised the weekly food allowance in eighteenth-century St. Kitts. Contrast that amount with an 1806 document which lists the barreled herring allowance for slaves on Jamaica at a scant 19.6 grams of protein per day. One can contrast that amount with a late 20th century study by Sheridan (1984:163) who calculates the daily minimum requirement of protein for a 150lb man to be 70g. Clearly enslaved Africans' dietary experiences varied greatly from island to island.

Under the direction of the colonial Kittitian government, the British military often was responsible for feeding slave laborers provided by plantation owners at Brimstone Hill (Buckley 1979). African laborers generally ate two meals per day consisting of homegrown vegetables, imported fish, and some type of bread. Cane juice or rum was commonly drunk (Richardson 1983:102). While records indicate that items such as "Irish beef, salted ham, bacon, pickled salmon, sturgeon, and oysters" (Smith 1745:222) were all imported, the military extensively utilized three protein sources: barreled beef, barreled pork, and imported salt cod and provided African soldiers and laborers 3/4 the rations given British soldiers (Klippel 2002). These rations included flour, peas, and rice in addition to specified amounts of beef, pork, or fish. Even tobacco and alcohol rations were allotted. Whites and blacks alike then supplemented this basic diet with what fruits, vegetables, and meats they could obtain locally through barter or purchase (Schroedl and Ahlman 2002).

St. Kitts's unique foodways were influenced by these military and plantation provisioning systems as well as access to the island's natural resources. To their predominantly vegetable diets, Caribbean slaves sometimes added available resources such as "fish, crabs, ducks, pork, the odd alligator, and grubs" (Morgan 1995:43). Slave-related faunal assemblages from North America often contain a wide variety of wild game and fish. Accordingly, Wilkie and Farnsworth documented heavy reliance on raccoon at Clifton Plantation in the Bahamas (Wilkie

2004:216). This species is not present on the island of St. Kitts. In fact, this island's biogeography offers little in the way of palatable land animals, though previous zooarchaeological investigation on the island reveals that Africans did consume two species of mollusks (Klippel 2002). The paucity of indigenous terrestrial fauna, then, makes reliance on aquatic resources and perhaps native birds likely for both Europeans and Africans at Brimstone Hill Fortress.

Considerable legislation proffering guidelines attempted to ensure adequate slave provisioning. Leeward Islands slave laws specified weekly food allotments that owners were required to provide their slaves. "Ideally, Caribbean slaves received an allotment of a little less than a half pound of animal protein daily, either dried beef or salted fish, and approximately a pint of cereal" (such as cornmeal or rice) that would equal approximately "a third of the daily calorie requirement" according to Kiple and Kiple (1980:174), who estimate that an adult male laborer would require at least 3,000-4,000 calories per day when harvesting sugar.

In 1793 the St. Kitts government first enacted its own legislation requiring the allotment of sufficient land for provisioning grounds (Edwards 1966; Klippel 2001:1191). Kittitian planters generally allowed more food crop cultivation than their Nevis counterparts, who preferred to maintain their laborers' dependence on provisions (Richardson 1983:78,138-139). Typically, Planters utilizing the provision ground system typically supplied their enslaved workforce "only rations of salted or pickled fish, imported from North America" (Higman 1984:204). In one example, slaves newly arrived at Jamaica's Thistlewood plantation received:

> "a salted herring a day and a quart of flour a week, together with an occasional six ears of corn to individual slaves, such as Dublin and Marina, who were "really in want." In early August, he [the overseer] noted that the newcomers "complain very much of hunger, not without reason," and he doled out more ears of corn. By

> mid-August, he had stepped up the allocation of flour to two quarts a week, although it sometimes fell short at one and a half quarts. In the early New Year, shad replaced herring for a while, and five or ten ears of corn every few days often substituted for the allocations of flour. Recent arrivals sometimes received spoiled food: plantains "about to rot," "a bit of bad salt beef," "a piece of salt pork spoiled with long keeping," and "some peas which the ants had almost eaten" (Morgan 1995:68).

As this passage suggests, African slaves routinely received foodstuffs of lesser quality than the free Europeans (Morgan 1995; Kiple and Kiple 1980). During the colonial era, the same low quality meat supplied to southern markets in North America and sold for consumption aboard ships at sea made its way to the plantations of the West Indies (Klippel 2002). Instead of firm, bright, and plump stall-fed beef that was properly cured, slave laborers often received dark and shriveled grass-fed beef that was “tasteless, juiceless, [and] without heart or substance” (De Voe 1975). Likewise in the fishing industry, larger and more valuable cod were shipped to North America’s Gulf Coast region, while smaller fish and those damaged in the salting process (e.g. sun “burnt”) were shipped to the West Indies (O’Leary 1996:285-286). Such refuse, termed “West Indies Cod” commonly provided an inexpensive protein source for plantation labor forces (Klippel 2002).

Interestingly, one record in the government archives reports guidelines put forth by Kittitian Governor General William Matthews in 1733 for stockpiling emergency rations at Brimstone Hill Fortress for use during times of siege. In these writings, he encouraged planters to supply one barrel of beef per white male and family and one barrel of beef per each two slaves that would be brought to the fortress during time of crisis. If their owners did not provide “Negroes beef,” those slaves would not be admitted to the fort in the event of hostilities. Matthews further requested that barreled beef be replenished yearly due to spoilage, and that barreled herring be replenished biannually. He suggests that, "expired stores should be fed to the Negroes" (Klippel 2002). That "slaves allegedly preferred it that way" (Kiple and Kiple 1980:176) is likely an historical inaccuracy.

Both insufficient quantities and qualities of foodstuffs meant that enslaved Africans often experienced nutritional deficiencies (Morgan 1995:68). Their diets were generally so poor that acute malnutrition made them susceptible to additional health problems such as vitamin deficient diseases and pathogenic invasions (Kiple and Kiple 1980). Many Caribbean slaves were probably deficient in calcium and vitamin A. Vitamin A, for example, is fat soluble, so a low-fat diet would decrease the body's absorption of this nutrient; the reported rancidity of slaves' fish and meat allotments conveyed a further "destructive effect on fat-soluble vitamins" (Kiple and Kiple 1980:176). Also, the dried beef and salted fish provisions would have provided significantly less (approximately "20g of fat if a beef-corn diet and only 3g if fish-rice") fat than the "safe minimum" of 80-125 g calculated by Kiple and Kiple (1980:176).

Certain food preparation techniques further diminished enslaved Africans' nutrition. The dietary effects on other water-soluble vitamins like thiamine and B1 were similarly less than optimal, especially "in the case of low-fat diets… [where] carbohydrates replace fat as the major energy source." In this situation, available thiamine is further reduced as the body uses it to metabolize carbohydrates. Complicating this affect was the fact that "the process of pickling, salting, and drying beef or fish treats thiamine poorly. Both alkaline solutions and prolonged dehydration have a destructive effect on [it]" (Kiple and Kiple 1980:176). Since heat is very destructive to thiamine, cooking further degrades these nutrients in prepared foods. Up to 85% of thiamine can leach out of meat "during boiling, the standard method of cooking on most West Indian plantations" (Kiple and Kiple 1980:176).

"The expense of maintaining the slave population placed a heavy economic burden on [the plantation owner]. Goods imported for consumption were always expensive and their supply was often irregular, while both land and time for provision cultivation emerged almost naturally from the conditions of sugar production and the plantation landscape itself. The planters perceived it in their interest to spend as little money, time, or energy as possible on slave maintenance" (Tomich 1990:304). To solve the problem of feeding their slaves, owners had two choices: "use the slaves to produce as much as possible of their own diet… or else to import all of what they ate" (Mintz and Hall 19790:319). The first option was sometimes preferable since warfare often disturbed merchant shipping in the eighteenth century, causing food shortages and high costs for imported foods (both of which also reduced sugar production and profits) (Mintz and Hall 1979:319).

Therefore, "a system by which the enslaved were made largely responsible for producing their own food" developed. This system, commonly referred to as the provision ground system, was particularly associated with Jamaica but existed in other Caribbean colonies where conditions were appropriate. It was designed to reduce the planter's costs of supervising labor and to minimize expenditure on the purchase of local or imported foodstuffs. Under the provisioning ground system, "the planter allocated a defined area of land to be used by the enslaved people to cultivate particularly staple carbohydrate crops such as tubers (yams, cocoyams, and cassava) and the plantain, its green fruit eaten roasted or boiled" (Pulsipher 1986:108). In these areas planters encouraged slaves to grow their own food. They preferred this practice to rationing (Tomich 1990:307). To reduce production costs, Martinique planters pressed their slaves to use their own "free time" to produce food for themselves (Tomich 1990:304). Slave efforts in these provision gardens not only translated into savings to the plantation owners, but profited the slaves themselves (Mintz 1995:18). Slaves were given ground to work to provide for a portion of their own consumption needs. This reduced their masters' expenses. He only had to provide "a fixed weekly ration of salt meat or fish" (Tomich 1990). Slaves worked their provisioning grounds "on public holidays, Sundays, and on infrequent weekdays" (Morgan 1995:42).

Though provision grounds were often the foundation of slaves' diet, they were not always sufficient. Enslaved Africans may have even amended their diets on occasion with meat "that came their way either licitly or illicitly [e.g.] (cowskin was a popular dish, made from hide boiled to a jelly, with yams, cocos, ochro, and other vegetables)" (Morgan 1995). In some instances slaves even resorted to eating rats and insects caught in the cane fields (De Voe 1975). Morgan (1995:43) describes " grubs in Cotton Trees, mahogany trees, [etc.] …a Kind of worms cald Machackow's [macaca], by Some Bagoobah's [buga-boo], Negroes fry them and Eat them, they are said to look extremely well when dress'd."

Though little land was designated for subsistence agriculture, the majority of what land was utilized in this manner was often limited to poor mountainous slopes ill-suited for sugar cane cultivation. On steep islands such as St. Kitts and Nevis, sugar cultivation was concentrated in flatter coastal areas. Sugar estates on these islands often possessed "a sea frontage, with cane fields extended to almost the 1,000 foot contour, and provision grounds occupied the more rugged inland" (Higman 1984: 208). "Generally speaking where land was flat and fertile the cane was planted; where it was not, food was grown for the slaves and the dependence on food imports was considerably reduced. Thus, throughout the archipelago as a whole, the flat or gently sloping islands (e.g. Barbados, Antigua, St. Kitts, were almost entirely planted in sugar, whereas in the mountainous islands (e.g. Grenada, St. Vincent, Jamaica) planters, limited by the topography of their sugar cultivation, had at their disposal relatively extensive areas which might be allotted to the growing of food crops" (Mintz and Hall 1970:319-320). For these geographic reasons the Leeward islands (except mountainous Montserrat) and Barbados relied more heavily on food imports (Mintz and Hall 1970).

Location, soil, and weather conditions all made mountainous land better suited for local food production than for sugar cane production (Mintz and Hall 1970), so livestock pastures and food crop cultivation were routinely located inland and upland of the cane fields (Higman 2011). In these marginal "gutside plots," slaves were often expected to maintain livestock and small garden plots for supplementation of their imported provisioned diets and as insurance against lean times (Klippel 2002). Since they rarely received sufficient calories in the form of rations, Caribbean slaves depended significantly upon their provisioning gardens. Usually described as "starchy" and "protein poor," the basic diets thus provided "would have met most of their nutritional needs" (Kiple and Kiple 1980:174). Because local crops were vulnerable to drought, hurricane, and insects, however, they were not the most reliable source of dietary supplementation (Cox 1984). In many cases, "chaotic… food production and frequent food shortages prevented the masters from dispensing altogether with the distribution of rations" (Tomich 1990:306). Food shortages were common on St. Kitts and neighboring Nevis. Drought and flood constantly threatened the slaves' marginally fertile provision grounds, perpetually necessitating the importation of corn and salt fish from British North America. Intended or not, this unavoidable dependence on external food sources allowed planters to maintain control of this aspect of their slaves' lives.

In addition to imported and wild-caught foods, the food resources available to the St. Kitts inhabitants came from a variety of domestic sources. Wool-less sheep and goats were raised locally for meat, as were rabbit, pork, veal, and domestic fowl such as ducks, geese, guineas, chickens, and turkey. Slaves did not necessarily consume all of the animals that they raised (Sheridan 1984:163). Circumstances allowing, slaves were allowed to visit local marketplaces where they could purchase items such as: greens, green beans, cassava, milk, eggs, fresh fish, small stock, fresh butter, and fruits (Richardson 1983:14, 68). The items sold there were often the surplus of husbandry and horticulture efforts conducted by slaves on their own time. Wilkie and Farnsworth (2004:219) report that in the Bahamas slaves did not eat their own fowl or pigs, but instead used them for barter or to generate cash income. Late eighteenth-century accounts from Jamaica report that slaves sold "pigs, goats, fish, poultry, eggs, and milk" (Mintz and Hall 19790:327). Jamaica was actually known to export many crops, food, and livestock (Beckles and Shepherd 1991:88). In this manner, Jamaica was able to reduce "its dependence on foreign sources… [more] than did any other islands in the British Caribbean" (Beckles and Shepherd 1991:118).

Similarly, Kittitian slaves likely sold a portion of the plants and animals they raised for cash for other necessities. Enslaved Africans engaged in informal economic activity through their work keeping provisioning grounds and house gardens and by participating in Sunday markets. These efforts compensated for insufficient provisioning by planters (Gibson 2007).

These slave markets were also “an important feature of the economic and social life of Martinique (Tomich 1990:314). “The Sunday market was as much a social event as an occasion for exchanging goods. Slaves went to town to attend mass, meet friends from other parts of the island, drink tafia, smoke, eat roast corn, exchange news and gossip, and perhaps dance, sing, or gamble” (Tomich 1990). Indeed, “Market day… became an important social and economic institution” (Mintz and Hall 1979:320) as “the colorful and bustling markets punctuated the drudgery and isolation of plantation life” (Tomich 1990:314-315).

Of course, the degree to which slaves were allowed provisioning grounds or animal husbandry for their own consumption or for trade varied among islands, plantations, and individual slaves (Richardson 1997). In Jamaica, for example, laws in place as early as 1678 required provision of cultivation grounds for slaves (Higman 1984). (Consequently, the 1751 calculation of 100 square feet of garden space per slave at the Jamaican Thistlewood plantation likely exceeded West Indian standards at that time [Morgan 1995:42] due to the longer history of the provisioning ground system on that island). The initial Slave Act of 1788 further bolstered planters’ cooperation with enslaved persons’ horticultural efforts. Slave efforts in these provision gardens not only translated into savings to the plantation owners, but profited the slaves themselves. In fact, on Jamaica and St. Domingue, slaves sold their produce at market, and their participation in the regional food economy actually came to meet the food needs of much of the free population of the island (Mintz 1995; Beckles and Shepherd 1991). Similarly, on Martinique, food produced by slaves was important for feeding the rest of the population as the colony “came to rely on the produce of the slave gardens for a substantial portion of its food” (Tomich 1990:307, 314).

Chapter 3: Brimstone Hill Sites

A monument of British colonial power, the Brimstone Hill Fortress rests nearly 800 ft. (approximately 240 m) above sea level overlooking the western coast of St. Kitts (Schroedl and Ahlman 2002). Archaeological investigations at this site began in 1996. Since then, excavations have been conducted at six different locations throughout the fort. Brimstone Hill 1 (BSH 1) was a site of lime-based mortar production during the 1780s and 1790s (Figure 1). It consists of a well, lime kiln, and lime storage building as well as two buildings of unknown purpose all situated at the northwestern base of the Hill, 200 m from the Park's entrance. Although several slave huts appear on a 1791 watercolor map attributed to Lt. James Lee, field workers unearthed no archaeological evidence of additional structures at BSH 1 (Schroedl 1997).

Brimstone Hill 2 (BSH 2) lies 60 meters below Brimstone Hill's summit and encompasses the remains of four buildings found below the defensive stone curtain wall connecting the Orillon and Magazine bastions (Schroedl 1997, 2000) (Figure 1). Designated as hospital, kitchen and workshop buildings on the 1791 map, these structures were likely post and timber construction and doubled as the African artificers' workspace and occupation areas. Excavated over the 1997-1999 field seasons (Schroedl 2000:2) and identified as the location of bone button manufacturing (see Klippel 1997 and 1998 for further discussion), BSH 2 has yielded artifacts such as Afro-Caribbean wares (storage and cooking pots and jars) and X-incised European ceramic sherds indicating that the "use, occupation, and/ or waste disposal by slaves" occurred in this area (Schroedl and Ahlman 2002). The recovery of other items attributed to religious and ideological significance such as smoothed ceramic and glass disks and blue glass beads further indicates long-term occupation by slaves (Ahlman 1997).

Though X-incised colonoware pottery has been recovered from numerous African American occupation areas in the Caribbean and on 17th-19th century plantation sites throughout the Southern states of North America including: South Carolina, Kentucky, Maryland, and Virginia (e.g. Leone 2005; Rivera 2005; Ruppel *et al.* 2003; Galke 2000; L. Jones 2000; Neuwirth and Cochran 2000; Ferguson 1999; Leone and Fry 1999; Russell 1997; Young 1997; Young 1996; Logan 1995; Adams 1994; Orser 1994; Ferguson 1992), it is difficult to draw conclusions about the nature of these markings. Fennell (2007) discusses the possible connection between these cross marks on American made colonoware pottery and elements of the BaKongo religion of west central Africa, but he cautions that since such cross motifs were common among diverse Native American, African American, and European American religions, it is difficult to attribute them directly to slaves. However, Schroedl and Ahlman (2002) contend that such marks signified personal and cultural identity in the Brimstone Hill community.

Brimstone Hill 3 (BSH 3) lies to the north of BSH 2 and above the curtain wall separating these two major terraces (Figure 1). In 1998 four test pits were excavated and a controlled surface collection was conducted at BSH 3 (Schroedl 2000). This building complex included both office space and residential areas (BSH 3 Terrace 1) that were utilized by the Royal Engineers stationed there (Schroedl 1998:3, personal communication) (Figure 2). Recovered artifacts include European refuse and thus contrast with material from previous excavations (from BSH 2, in particular) that focused primarily on enslaved African contexts (Schroedl 1997; Klippel 1997, 2001). Yet ample historical documentation and archaeological evidence indicates that Africans did indeed live and work in these adjoining areas (BSH 3 Terrace 3) (Figure 2).

Chapter 4: Methods of Recovery and Identification

Brimstone Hill deposits generally consist of a matrix of loose, very fine loam and sandy loam sediments (Schroedl 1998:3-4). Highly erosive and fragile elements such as otoliths and articulated fish bones, as well as the abundance of fish scales, attest to the excellent preservation at BSH 3. The faunal assemblages used in this research were recovered from Terraces 1 and 3 at BSH 3. According to a 1791 engineer's map of the Fort, Terrace 3 was a building complex occupied by enslaved Africans. Recovered artifacts compare favorably with material from previous excavations at BSH 2 that have focused on enslaved African contexts. Items unearthed include both Afro-Caribbean pottery and European ceramics etched with designs often found in Africa and enslaved contexts in North America (Camp 2007; Schroedl and Ahlman 2002; Klippel 2001; Schroedl 1997).

Deposits from the terraces at BSH 3 were hand excavated during the 2005 and 2006 field seasons. Both university students and local residents of St. Kitts (including paid employees and volunteers) performed troweling and sifting duties on-site. In order to record three-dimensional proveniences of the artifacts, fieldworkers established site numbers and metric grids (based on north and west coordinates) for each of the excavation areas. Also, an individual datum was established for each site (i.e. for each terrace) and set at the arbitrary elevation of 100.0 m (Schroedl 1997, 1998).

Each area was excavated in 1 by 1 meter squares and in arbitrary 10 cm levels using trowels, dustpans, and 1/4 inch hardware cloth. A total of $10.1 m^3$ were excavated at Terrace 1, and $21.6 m^3$ were excavated at Terrace 3. All material recovered at the site was dry-screened through one-quarter-inch (6.4 mm) mesh screen. Artifacts were cleaned with plain water and brushes, tagged, bagged, and logged in Excel® files (Schroedl 1997).

For the purpose of zooarchaeological investigation, the retrieved sediments of several arbitrarily selected units were further sieved through consecutive one-eighth inch (3 mm) and one-sixteenth inch (1.5 mm) meshes (Newsome and Wing 2004); these included 29 levels ($2.9m^3$) from Terrace 1 and 95 levels ($9.5m^3$) from Terrace 3. Sieving took place in the field, and all areas were backfilled upon completion of excavation. All faunal material recovered was catalogued, bagged, and transported back to the United States for identification using the University of Tennessee's Zooarchaeology Laboratory facilities and comparative collection.

This comparative collection proved invaluable for the purpose of identifying taxon, element, side, portion, and, in some instances, sex of the bones and bone fragments recovered. These parameters were entered into two Excel spreadsheets, one for each site (Terrace 1 and Terrace 3) (see Appendices 1 and 2). Also recorded were observations of butchering patterns (e.g. saw, chop, and cut marks) and heat damage (e.g. burning or calcification). Abundant root etching was observed but not recorded, and the occasional instances of rodent or carnivore damage were recorded in "notes" appearing in the final column of the spreadsheets.

Based on morphological and histological evidence, the faunal material was initially sorted into Classes: Mammalia, Aves, Reptilia, Amphibia, and Osteoichtyes. Bones that were too fragmented to be identified to class level were counted and listed as Unidentified. No weight measurements were made for this study. Each class of bones was then further assessed for identification to the family, genus, or species level(s) and the Number of Individual Specimens Present (NISP) for each taxa was recorded.

Both NISP and the Minimum Number of Individuals (MNI) can be used to quantify faunal remains and to evaluate the relative importance of different animals in the diet (Reitz and Wing 1998; Morales *et al.* 1994; Kent 1993; Tchernov 1993; Reitz and Zierden 1991; Zeider 1991; Bunn *et al.* 1988; Maltby 1985; Grayson 1984; Gilbert and Singer 1982; Grayson 1979; Gilbert and Steinfeld 1977; Payne 1975; Grayson 1973; Thomas 1971; Shotwell 1955). However, taking into consideration the size of the samples derived from BSH 3 and the various factors that led to their initial deposition, it was decided that NISP would be the more appropriate tool by which to evaluate the relative abundance of various animals within the recovered faunal assemblage.

NISP is "that number of individuals which are necessary to account for all of the skeletal elements (specimens) found in the site" (Shotwell 1955:272). Attributed to Payne (1975), the "NISP" acronym refers to the same calculation as NR (the Number of Remains) described by Morales *et al.* (1994) and TNF (the Total Number of Fragments) used by Gilbert and Steinfeld (1977). These all similarly measure abundance.

NISP assumes that, for all elements of all taxa: both cultural and non-cultural transformation is uniform, that the rate of recovery is constant, and that all taxa have the same opportunity to be counted (Reitz and Wing 1998). While it is true that screen size can skew NISP, numerous archaeologists believe that NISP is a good tool of analysis and use this calculation in their work (Gilbert and Singer 1982; Maltby 1985; Tchernov 1993; and Thomas 1971).

The size of an adequate sample to overcome sampling bias is debatable. Perhaps 30-50 specimens are sufficient; certainly sampling effects increase as sample size decreases. Grayson

(1979) finds Shotwell's (1958) approach insufficiently conservative for its failure to examine the relationship between MNI and E (the number of specimens) as it shifts across sample sizes because, an exaggeration of minimum numbers occurs in both very small and larger sample sizes (Grayson 1979).

Cultural practices such as transportation, butchering, cooking, and discard of food, as well as non-subsistence uses of elements (e.g. bone button manufacture in the example of St. Kitts) affect NISP calculations (Kent 1993; Bunn *et al.* 1988). Other interpretive problems arise due to the fact that different taxa possess variable numbers of identifiable elements and may experience differential preservation, leading many critics of NISP to argue that it is a better tool to use for intra-class comparisons than for comparisons spanning broad taxonomic boundaries.

The Minimum Number of Individuals (MNI) (also known as MIND and NMI) is also affected by the same aforementioned first- and second-order changes that affect NISP (Bunn *et al.* 1998; Gilbert and Singer 1982; Maltby 1994; Bartram *et al.* 1991; Reitz and Zierden 1991; Zeder 1991). As with NISP, preparation and distribution of food complicate the correlation between an excavated faunal assemblage's calculated MNI and the number of individual animals that were actually present at the site. MNI can also be affected by the way that archaeological proveniences are treated during analysis. Whether a researcher follows natural stratigraphy or decides to use arbitrary metric levels initially determines how data from those proveniences are aggregated for analysis. Once in the lab, sample size (to which MNI often correlates), influences the decision of which taxonomic level MNI is calculated for (Reitz and Wing 1998). Indeed, for MNI to work well, one must have a sufficiently large sample size. Payne (1972) explained how MNI tends to exaggerate the abundance of rarer taxa in an assemblage. The necessity for age, sex, and size measurements as well as identifications for estimation of MNI makes calculating MNI more difficult than calculating NISP (Grayson 1979).

Though Grayson asserted that "field procedures, taphonomic analysis, and statistical manipulation can overcome the weakness of specimen count for estimating relative frequencies" (1979:200), he criticized MNI calculations for their inherent difficulty in accounting for the relationship between MNI and E. And rightly so, because different investigators calculate MNI differently and use different definitions of it. According to Grayson (1984, 1979), most attempts to address these problems with MNI calculations are only partially successful.

As shown, "the number of identifiable elements in each animal, site formation processes, recovery techniques, and laboratory procedures" all affect both MNI and NISP (Reitz and Wing 1998:192). NISP was determined to be the more appropriate measure of abundance for the Brimstone Hill Fortress faunal collections for two of reasons: 1) food preparation was a leading cause of modifications to these bones, and 2) difficulty arose in deriving a representative or meaningful MNI due to the size of the samples available for analysis; the St. Kitts assemblages contained sample sizes too small (see Appendices 1 and 2 where it is obvious that several taxa are represented by less than 10 specimens). Because there was no MNI, it was also impossible to determine the amount of meat (i.e. meat weights) that those animal bones likely represent.

Mammal identifications proved relatively easier than other classes of animals since island biogeography and historical circumstance greatly restricted likely species to imported or unintentionally introduced domestic and commensal species. The greatest difficulty arose in distinguishing between sheep (*Ovis aries*) and goats (*Capra hirca*). To this end, Boessneck (1970) and to a lesser extent Payne (1985) provide guidelines for osteological differentiation of the two wherever possible. Otherwise, indistinguishable sheep and goat elements were grouped collectively as Caprinae to make clear that they were at least discernable from Suidae or bovines.

In some cases fragmentary, eroded, or juvenile mammal bones were found that lacked adequate landmarks to make specific identification, but intact enough to indicate the general size of the animal from which it came. Incomplete elements such as long-bone diaphyses, vertebral or rib fragments, metapodials, or irregular bones (i.e. tarsals or carpals) were graded into Small, Medium, and Large mammal categories listed in the "notes" column on the Excel spreadsheets. Here, "Small Mammal" generally indicates some sort of rodent-sized organism while "Large Mammal" is reserved for cattle or horse-sized bones (though admittedly very large pigs could fit into this category). The identifier "Medium Mammal" mostly indicates bones that fall within the size parameters of either caprines or suids, as felids and canids were typically discernable to at least the family level. Obviously too arbitrary and non-specific for quantification purposes, these three size categories exist only as additional remarks intended to enhance general knowledge of the overall nature of the assemblage. For statistical purposes, all mammal bone fragments incapable of being assigned to more specific taxonomic classification were assessed inclusively as "Unidentified Mammal."

As with mammals, the avian portion of the assemblage was relatively easy to identify as the majority of recovered bird bones fit the size grade of domestic fowl. Distinction between guinea fowl (Numididae) and domestic chicken (Gallidae) was made according to guidelines set forth by MacDonald (1992), who describes osteomorphological differences on eight skeletal elements. Here there is no attempt at osteometric separation of the two families. Instead, all elements not certainly attributed to *Numidea* were identified as *Gallus* by default. Admittedly, it is highly likely that this category includes intermingled elements from both families. Remaining bird bones were identified using the comparative collection specimens and cross-referencing three guides: Avian Osteoarchaeology: North America (Gilbert et al. 1978), Birds of the West Indies (Bond 1993), and A Field Guide to Birds of Britain and Europe (Peterson et al. 1993) for confirmation of geographic distributions.

Reptile and amphibian identifications were made using Peterson's Field Guide to Reptiles and Amphibians of Eastern and Central North America (Conant and Collins 1991) and Fish, Amphibian, and Reptile Remains From Archaeological Sites Part I: Southeastern and Southwestern United States (Olsen 1968). Sea turtles were entirely represented by carapace fragments, whereas skinks were mostly identified by mandibles and long bones. The unique morphology and dentition of skink mandibular fragments rendered them particularly easy to distinguish from the general assemblage. Many of their long bones were found while sorting and counting fish spines, ribs, and rays under the microscope, which reinforces the need for meticulous scrutiny of the fine screen portions of zooarchaeological materials (see Chapter 7 for further discussion).

Specific fish identifications were based primarily on cranial elements including the: articular, ceratohyle, cleithrum, dentary, hyomandibular, maxilla, operculum, pharyngeal, premaxilla, post-temporal, prevomer, quadrate, and scapula (Wheeler and Jones 1989). These elements were compared with a Caribbean Synoptic Collection (pulled from UT's Comparative Collection) created as a quick-reference for siding elements and narrowing down taxonomic search parameters. Once family or genus similarities were determined, field guides (Smith 1997, Robins and Ray 1986) were employed to determine the degree of confidence to which identifications could be established. Based on the total number of genera in a given family or species in a given genus (and discounting those whose geographic distributions made them improbable candidates) versus the number of specimens available for comparison, identifications were either confirmed or relegated to less specific classifications. Olson's and Peterson's field guides also assisted in identifications. Robinson's and Ray's (1986) Atlantic Coast Fishes proved an extremely useful complement to the identification of fish.

In addition to cranial elements, distinct features on Clupidae vertebrae could be attributed to discrete families and possibly size graded to distinguish locally caught pilchards from imported herring specimens (Klippel et al. 2011). All other vertebra were noted as "tropical fish" and tallied in Unidentified Fish counts, as were scales and nondescript bony elements histologically identified as belonging to fish. Fragments of spines, ribs, and rays of fins or tails were labeled as "Spines, Ribs, and Rays" in the elements column and were counted as Unidentified Fish.

Chapter 5: Results

A list of common and scientific names of the species discussed is included in Table 1. Tables 2 and 3 contain complete lists of all faunal materials recovered at Brimstone Hill Terrace 1 and Terrace 3, respectively. Non-descript elements such as bird egg shell fragments and fish scales, spines, ribs, and rays were counted separately and appear as separate numbers at the ends of the bird and fish totals. For each animal class listed, the “indeterminate” category includes bone fragments that could not be identified to a more specific taxonomic level. Similarly, the “Indeterminate” count given at the end of each table accounts for all faunal materials that were too fragmented or otherwise degraded (i.e. weather damaged or otherwise taphonomically altered) to be identified as anything other than unknown vertebrate remains. Each “identifiable” total equals the class total minus its indeterminate portion. Percentages in the far right column derive from dividing each line by the identifiable total.

Terrace 1 Assemblage

Of the 10,757 skeletal elements recovered at Terrace 1 (the British Engineers’ Quarters), 4,972 (46.2%) were identified to a taxonomic level of class or below. This identifiable portion is presented in Table 4. Even discounting the 1,815 elements attributed to fish of unknown taxa (i.e. scales, spines, ribs, rays, and other unknown fragments), fish nevertheless make up a significantly large portion of the Terrace 1 assemblage (41.3% of the total identified specimens). All of the families identified belong to locally available, tropical and sub-tropical fishes (Table 5). The most abundant type identified was Belonidae followed by Serranidae, Lutjanidae, and Clupidae. Also present were members of the following families: Sparidae, Holocentridae, Scaridae, Carangidae, and Haemulidae. Diodontidae, Sphyraenidae, and Acanthuridae were each represented by a single specimen. No Gadidae were recovered at this site.

Mammal bones and teeth comprise 38.2% (NISP=1,906) of the Terrace 1 faunal assemblage (Table 2). Four hundred nineteen skeletal elements (22.0%) were identifiable to family or below and are presented in Table 6. Rodents are the largest group represented. Of these, rats outnumbered mice 129 to 41 (74.6% and 23.7% of rodents, respectively). Caprines were the second most abundant group. While only five of these bones could be positively attributed to the specific genus *Capra*, the caprine category surely includes commingled elements from both domestic goat (*C. circa)* and sheep (*Ovis aries*). There were twice as many pigs (NISP=51) as cattle (NISP=25). Rabbits (NISP= 14) contribute 3.3% to the total, and cats (NISP= 13) add 3.1%. Two unidentifiable Artyodactyla elements contribute another 0.5% to the total mammals.

Of the 979 bird bones recovered (Table 2), 568 (58.0 %) could not be attributed to specific taxa. Of the 411 elements that were identified, 393 (95.6%) were attributed to *Gallus gallus* (domestic chicken) (Table 7). Only six bones could be definitively identified as *Numidea meleagris* (guinea fowl). Also present were at least three different kinds of Anatids and six Columbidae specimens, the latter of which included at least one *Columba* species. Columbidae were likely indigenous, whereas the others could potentially represent domestic imports. In addition to these skeletal elements, 303 egg shell fragments were recovered (Table 2).

Reptiles and amphibians comprised 0.5% and 0.4% respectively of the Terrace 1 assemblage. Half of the 24 reptile elements recovered could be identified to class or below (Table 8). Of these, 7 elements (58.3%) belonged to *Anolis* species (i.e. iguanian lizards), 4 (or

33.3%) were from the order Squamata (lizards), and one carapace fragment belonged to Chelonidae (turtles)**.** All 20 of the amphibian elements belonged to indigenous *Anura* species (frogs).

Terrace 3 Assemblage

The faunal assemblage recovered at Terrace 3 (the enslaved Africans' occupation) included 16,786 skeletal elements (see Table 3 for a complete listing), 9,883 (58.9%) of which were identifiable to a taxonomic level of class or below (Table 9). This assemblage differs significantly from the Terrace 1 assemblage in several ways. Here, only 14.8% (NISP= 1,461) of the identifiable portion were fish remains, and a scant 225 (15.4%) of these could be attributed to more specific taxonomic categories (Table 10). Groupers and jacks were the most abundant type, with representatives of the family Serranidae totaling 119 (52.9% of the identifiable fish assemblage). Belonidae contributed an additional 13.3%, followed by Lutjanidae at 10.2%, and Gadidae at 6.7%. No specimens from the latter family were found at Terrace 1. Of the remaining fish assemblage, 9 specimens (4.0%) belonged to Sparidae, 8 (3.6%) each to Clupidae and Holocentridae, 5 (2.2%) Haemulidae, 3 (1.3%) Scaridae, 2 (0.9%) each Sphyranidae and Diodontidae, and a single specimen of Carangidae. Unlike at Terrace 1, no members of the family Acanthuridae were observed.

In contrast to the Terrace 1 assemblage, the vast majority (78.2%) of bones identified at Terrace 3 belonged to the class Mammalia (Table 3). Of the 7,727 specimens recovered, 830 (62.1%) could be attributed to specific genera (Table 11). Caprines (NISP= 417) were by far the most common. They made up 50.3% of the identifiable mammals, and both *Capra hirca* and *Ovis aries* were positively identified. Domestic pigs (*Sus scrofa*) were the next most common species present (NISP= 143), and cattle (*Bos tarus*) were a close third with 130 elements contributing 15.7% of the mammal assemblage. One hundred six rodent elements added another 12.9% to the total mammal assemblage, and rats, both brown (*Rattus norvegicus*) and black (*R. rattus*), outnumbered mice (*Mus musculus*) 84 to 19. As at Terrace 1, domestic rabbits (*Oryctolgaus cunniculus*) and cats were present in small numbers. Twenty-one rabbit bones accounted for 2.5%, and 13 cat bones made up the remaining 1.6% of the Terrace 3 mammal assemblage.

Only 5.9% (NISP= 579) of the skeletal remains at Terrace 3 belonged to Aves. Most (NISP=421) were too fragmented to classify beyond family. One hundred fifty-six (i.e. 98.7%) of the 158 elements whose taxa could be determined belonged to domestic chicken (*Gallus gallus*) (Table 12). Only one (element) was determined to be guinea fowl (*Numidea meleagris*). Less than 1% of the bird bones recovered belonged to any other families. Only a single distal radius (see Appendix 2) belonged to Anatidae. In addition to these skeletal elements, 2,885 egg shell fragments were recovered (Table 3).

Reptiles (presented alongside amphibians in Table 13) made up 0.7% of the total assemblage at Terrace 3. Of these 71 elements, 40 (59.7%) were Chelonidae carapace fragments. All of the turtle remains showed evidence of button manufacturing, making it unclear whether or not they were consumed as meat (see Klippel and Schroedl 1999 for discussion). Most of the remaining reptile assemblage belonged to Iguanidae, with the majority of those specimens representing *Anlois* species (iguanian lizards) of some sort. In addition to these reptile elements, forty-six amphibian bones (all *Anura* species, i.e. toads and frogs) contributed 0.5% to the total Terrace 3 assemblage.

Chapter 6: Discussion

While some evidence from the Lesser Antilles prior to emancipation in 1834 suggests that slaves were typically poorly fed in terms of the amount of food available (Klippel 2002; Morgan 1995; Beckles and Shepherd 1991; Higman 1984; Kiple and Kiple 1980; De Voe 1975), comparison of the Terrace 1 and Terrace 3 faunal assemblages recovered at Brimstone Hill Fortress show that enslaved African laborers consumed many of the same animal products as did their European overseers. Varney (2003) describes differences in dietary patterns observed among Caribbean islands with respect to the colonizing country, and both assemblages from BSH 3 adhere to the British pattern of greater consumption of animal products (meat, dairy, and eggs) than would be observed on French colonies (Varney 2003). Both British officers and the enslaved Africans follow this pattern at BSH 3. However, several interesting differences occur in the degree to which each group relied on the different animal classes. Figure 3 shows that fish and avian resources comprised far greater proportions (41.2% and 19.6%, respectively) of the Royal Engineers' diets, whereas Africans consumed considerably more meat from mammals (78.1% of the NISP).

Some differences in the overall class comparisons (Figure 3) become less apparent when bones that could not be identified below the taxonomic level of class are excluded from the counts (Figure 4). The exclusion of significant amounts of bird and fish bone fragments reduces the difference between the relative proportions that each of these classes contributes to the Terrace 1 and Terrace 3 assemblage. On the other hand, this shift increases the apparent contributions of reptiles, amphibians, and mammals to the totals. The refined data set presented in Figure 4 shows the relative proportions of the bones identified to family or more specific taxonomic category because these counts are incorporated into the following discussion of individual vertebrate classes (Figures 5 through 21). Nevertheless, it is important to keep in mind the contributions of those less identifiable fragments included in Figure 3, as they indicate an even greater reliance on fish and avian resources than can be addressed with respect to the actual family or genera of the specimens present.

Mammal Assemblage

Mammals, which constitute 38.0% of the Terrace 1 assemblage and 62.6% of the Terrace 3 assemblage (Figure 4), include only domestic and commensal species; no indigenous mammals were identified in the faunal material from either site. Mice and rats inhabited both the Engineers' quarters on Terrace 1 and the enslaved Africans' occupations on Terrace 3, although, interestingly, there were more than three times as many rodents recovered at the upper terrace (Terrace 1). Since none of the rodent bones analyzed bore modifications such as cut marks or evidence of burning, it is inconclusive whether the presence of these common commensals indicates that they were consumed in any significant quantities by either Europeans or Africans. It is also unlikely that domestic cats (*Felis domesticus*) were consumed in great quantity, if at all, by either population. Therefore, the removal of these genera from the analysis of the mammal assemblages helps focus attention on the differences in the relative proportions of the remaining species, which both observed osteological modifications and historical documentation confirm were used primarily for food.

With the removal of cats and rodents from the analysis, it becomes apparent that caprines, both sheep (*Ovis aries*) and goats (*Capra hirca*), dominate the two mammal assemblages

(Figures 5 and 6). This faunal category comprises 61% of the Terrace 1 assemblage and 59% of the Terrace 3 assemblage. Pigs (*Sus scrofa*) are similarly equally represented, making up 22% of the Terrace 1 assemblage and 20% of the Terrace 3 assemblage. Rabbits (*Oryctolagus cunniculus*) are twice as prevalent at Terrace 1 as at Terrace 3. Terrace 3 had considerably more cattle (*Bos tarus*) bones (18% versus 11% at Terrace 1). Cattle were valued for the many services they provided: as a food source, for the power they supplied to turn the cane mills, and for the manure they supplied to the fields (Edwards 1966; Merrill 1958). Some beef was produced on the island, and it is entirely reasonable that the mill cattle also were butchered once they outlived their usefulness as work animals. Yet it is known from previous work at BSH 2 (also occupied by enslaved Africans) that the number of low utility limb bones and the carbon isotope signatures of those bones confirmed that slaves received some barreled beef shipped from the United Kingdom or North America (Klippel 2002). Since it is possible that the *Bos* elements recovered at BSH 3 Terrace 3 could either reflect historically documented use of barreled beef or locally raised and slaughtered meat, the distribution of skeletal elements was examined for patterns indicative of local versus distant butchery.

A hierarchy of value can be attributed to different parts of the carcass of most domestic animals, and skeletal part frequencies can be affected by differential transport from primary butchery sites to areas of consumption and ultimately disposal (Binford 1978). Fifty percent of the bovine skeleton is made up of bones of high utility (i.e. high nutritional value) found in the axial and upper limb sections of the body. Upper limb and axial portions provide more meat and are usually more tender and tastier. These portions, therefore, are usually associated with high status (Klippel 2001). The remaining half of the bovine skeleton is low utility feet and cranial elements, which offer lower nutritional value. Lower utility elements would be less economic to transport across long distances, making high utility elements more abundant in assemblages that have been moved appreciable distances from their site of butchery (Klippel 2002; Binford 1978). Ninety percent of the cattle remains from BSH 2 come from high utility portions (Klippel 2002). Similarly, the Terrace 3 assemblage from BSH 3 contains 97.2% high utility cattle bones (Table 14, Figure 7). This contrasts dramatically with the Terrace 1 assemblage, where high utility elements only account for 56.0% of those cattle remains, and seems to support the conclusions that 1) enslaved Africans were consuming more beef than were the British officers and 2) that much of this meat was salted, not fresh.

Interestingly, stable carbon isotope analyses of 3 of 4 *Bos* bones from the enslaved Africans' occupation on BSH 3 Terrace 3 have values suggesting that these bones came from animals that were grazed on temperate C^3 grasses (characteristic of England, for example) (Table 15). Alternatively, stable carbon isotope analyses of 10 *Bos* bones from Brimstone Hill Fortress 5, an area consisting of enlisted men's barracks and other structures (Roller 2009), found that 6 of the tested specimens had stable carbon isotope ratios indicative of animals grazed on temperate C^3 grasses (Table 16), whereas only 4 of them had stable carbon isotope signatures consistent with animals raised locally on tropical C^4 grasses (Roller 2009). It is the unique ways in which different kinds of plants photosynthesize that make it possible to distinguish between their stable carbon isotope signatures.

Photosynthesis involves a series of reactions that synthesizes simple sugars from atmospheric carbon dioxide and the hydrogen ions released from water molecules. This process effectively converts the inorganic carbon dioxide molecule into usable organic compounds such as glucose (Biggs et al. 2010; Campbell et al. 2006; Purves et al. 1998). Plants regulate the amount of water and gasses (primarily carbon dioxide and oxygen) that pass through their tissues by opening and closing their stomata (plant cell pores) resulting in alternative processes of photosynthesis (Biggs et al. 2010). Not all plants use identical metabolic processes to convert light energy into chemical energy. Alternative photosynthetic pathways evolved to meet the demands of different environments. Xeric conditions, for example, can negatively impact a plants' ability to photosynthesize. Plants in hot, dry environments that are subject to excessive water loss, therefore, have evolved alternative photosynthesis pathways to maximize energy conversion in these extreme climates (Biggs et al. 2010; Campbell et al. 2006; Purves et al. 1998). The organic compounds produced by these different photosynthetic pathways can become incorporated into the tissues of animals and humans who eat them. Each photosynthetic pathway leaves a traceable chemical signature that shows up in animal tissues such as the skeletons of vertebrates recovered in archaeological excavations (Newsome and Wing 2004; Varney 2003; Stokes 1998; Ambrose and Norr 1993; van Klinken 1991; Keegan and DeNiro 1988).

Two distinct chemical pathways by which plants sustain themselves are C_3 and C_4 photosynthesis (Biggs *et al.* 2010; Campbell et al. 2006; Purves et al. 1998). A third photosynthetic pathway that is similar to C_4 photosynthesis, crassulacean acid metabolism (CAM photosynthesis), occurs in water-conserving plants (family Crassulaceae) that live in desserts, salt marshes and other environments where access to water is limited. Because CAM plants (primarily succulents, cacti, orchids, and pineapple) (Campbell et al. 2006) are not routinely consumed by the domestic mammals were present on St. Kitts, this version of photosynthesis is not discussed here.

C_3, C_4, and CAM plants "all eventually use the Calvin cycle [i.e. dark reactions] to make sugar from CO_2" (Campbell et al. 2006:118), but in C_3 plants atmospheric CO_2 directly enters this metabolic pathway to produce a three-carbon compound that is called 3-phospho[14C]glycerate or 3-PGA. These kinds of plants are widely distributed in many ecosystems, and they get their name from that first organic compound produced (Campbell et al. 2006). Because insufficient water can decrease a plant's ability to convert light energy into chemical energy, plants that live in hot, dry environments and are subject to excessive water loss have developed a different strategy (Campbell et al. 2006; Purves et al. 1998). By closing their stomata, C4 plants effectively reduce water loss. Unfortunately, this action also reduces gas exchanging capacity; carbon dioxide is prevented from entering the leaf, and oxygen cannot leave it. These conditions instigate a process called photorespiration in which neither sugar nor ATP is produced. This detrimental process can actually result in the loss of "as much as 50% of the carbon fixed by the Calvin cycle" and significantly hinder plant growth (Campbell et al. 2006; Purves et al.1998).

For this reason, C_4 and CAM plants have anatomical and physiological adaptations that bypass photorespiration. Using specialized chemical reactions and specialized leaf anatomy (Campbell et al. 2006; Purves et al. 1998), C_4 plants such as sugarcane and corn initially transform atmospheric "carbon dioxide into four-carbon compounds instead of three-carbon molecules" (Biggs et al. 2010). When the stomata of these C4 plants remain closed during the heat of the day, these four-carbon compounds are moved into special cells where the carbon dioxide can then enter the Calvin cycle (Biggs et al. 2010). This simultaneously enhances carbon dioxide uptake and minimizes water loss (Biggs et al. 2010), yet the plant can continue synthesizing sugars via photosynthesis using the enzyme rubisco, which has a high affinity for CO_2 that allows it "to fix carbon even when the CO_2 concentration in the leaf is low" (Campbell et al. 2006). In this manner, C_4 plants isolate the steps of the Calvin cycle to avoid photorespiration and significantly enhance their overall photosynthetic yield. It is that initial CO_2 fixation step that allows C_4 plants to "very effectively optimize photosynthesis under conditions that inhibit the photosynthesis of C_3 plants" (e.g. when CO_2 are low and temperatures are high) (Purves et al.1998).

Since C3 and C4 pathways produces unique carbon molecules during the Calvin cycle of photosynthesis, the different carbon isotope signatures deposited in animal remains can be traced back to the plants which produced them and thus indicate the environments in which they lived (Varney 2003). On colonial plantations on Jamaica, for example, guinea grass (*Panicum maximum*) was used as cattle fodder (Knight 1970), and it is a tropical C4 variety (Tan 2001). The importance of different photosynthetic pathways in zooarchaeology is that the unique products have carbon signatures that are distinguishable in organisms that consume plant tissues. Much research (e.g. Stokes 1998; Ambrose and Norr (1993); van Klinken (1991); and Keegan and DeNiro 1988) has examined carbon isotope signatures in human bone collagen and carbonate, and the same methods can be applied to domestic mammals (Newsome and Wing 2004; Varney 2003).

Unlike bovids, suid skeletons contain 67% low utility bones, complicating the ability to compare pig skeletal part frequencies to those of cattle. However, suid heads, which were considered more nutritious than bovid heads, were routinely packed into inferior grades of barreled pork labeled "Prime of Cargo" during the early nineteenth century. Legs were also included in this grade of meat (Klippel 2002), making it possible to include these elements in the high utility category for analysis of the Brimstone Hill Fortress faunal material. When cranial elements are considered high utility, the suid skeleton becomes more equally divided between high and low utility elements. Using this method of classification, Klippel (2002) found 68% of the pig remains from BSH 2 to be elements of high utility, and he used this evidence, along with a surprising paucity of foot bones, to demonstrate the importation of barreled pork to Brimstone Hill Fortress. Both European and enslaved African use of pork also seems to emphasize preserved cuts at BSH 3, because the two faunal assemblages from Terrace 1 and Terrace 3 are heavily skewed towards high utility elements (87.8% and 97.2%, respectively) (Table 14, Figure 7).

For cattle and pigs alike, the prevalence of long bones and cranial elements from these species does not necessarily support the conclusion that they were locally raised and slaughtered, because historical records and archaeological evidence document the presence of these elements in low-quality barreled provisions (Klippel 2001). While marrow bones caused barreled meat to spoil, some archaeological evidence indicates that long bones were occasionally included in barreled salt beef (Klippel 2001). Therefore, the stable carbon isotope analyses provide complementary evidence that beef was, at least, in part imported from elsewhere.

Sheep and goats, on the other hand, were raised and slaughtered locally, as seen by the more even distribution of low and high utility elements of their skeletons (Figure 7). At Terrace 1, the distribution of caprine bones is 34.3% high utility and 65.7% low utility elements (Table 14). It is unclear why low utility elements outnumber high utility elements in this manner. At Terrace 3, the difference is 40.3% high utility and 59.7% low utility. Such high incidences of low utility elements from caprine strongly suggest that sheep and goats were grazed locally and slaughtered on the island and that these carcasses were not transported appreciable distances. Previous stable carbon isotope analyses (Klippel 2002) concur that caprines were raised locally, unlike some of the cattle that were raised on temperate C3 grasses in a more northern climate (e.g. Great Britain or North America) (Roller 2009).

Interestingly, no agouti (*Dasyprocta leporine*) or mongoose remains were found. (Mongooses were first brought from Jamaica to St. Kitts in 1884 [Woods and Sergile 1954].) Agouti were intentionally introduced in the Caribbean sometime during the Ceramic age (Newsome and Wing 2004), and one specimen was recovered in a St. Kitts burial (Goodwin 1976), so they did inhabit the island at one point. However, no remains from this species were recovered at Brimstone Hill Fortress. Westerman (1953) suggests that this species may have been extirpated from the Lesser Antilles as a result of land clearing and the introduction of European animals. Likewise, cori (i.e. guinea pig) and hutía (*Isolobodon portoricensis*) (Newsome and Wing 2004) were also absent in the Brimstone Hill faunal assemblages.

Avian Assemblage

In addition to domesticated livestock, both the British and enslaved Africans relied heavily on domestic fowl (Gallidae) in their diets (Figures 8 and 9). It is likely that most of these specimens belong to chickens (*Gallus gallus*), though more guinea fowl (*Numidea gallapova*) than were positively identified could be commingled with them, as the two are not always easily differentiated osteologically (see MacDonald 1992 for further discussion). It is interesting to find zooarchaeological evidence of guinea fowl, which are known to have been present on the island according to an 1808 letter penned by 25th Regiment Infantry Captain John Hawtrey (Hawtrey 1903).

The Engineers did enjoy a slightly greater diversity of birds, with the inclusion of slightly more Numididae and Anatidae. The Terrace 1 assemblage also includes several Columbidae (Figure 8), likely native doves or pigeons, which were not found in the Terrace 3 assemblage (Figure 9). These latter specimens could have been hunted with firearms and may, in fact, demonstrate differential opportunities of British military officers and enslaved Africans to access this wild food resource.

Fish Assemblage

Marine resources obviously contribute significantly to the diets of island dwellers who are capable of obtaining them. Though observed differences in the numbers and types of fishes consumed by Europeans and Africans living on St. Kitts during the occupation of BSH 3 possibly suggest specific ethnic or socioeconomic preferences, they almost certainly reflect the abilities of each group to access them either directly by fishing or indirectly by purchase or barter with fishermen. Fish constitute an appreciable 41.2% of all archaeofaunal refuse recovered at Terrace 1 (Figure 3) despite the high rate of fragmentation that excludes many specimens from subsequent analyses (compare with Figure 4, where fish make up 21.8% of the identified material). This effect is less pronounced at Terrace 3, where the relative proportion of fish in the overall assemblage only shifts from 14.9% when considered at the class level of identification (Figure 3) to 17.0% when evaluated at the family level (Figure 4).

Two distinct fishing methods (pot and net) likely account for the majority of tropical fish remains uncovered at Brimstone Hill. Pot fishing involved the use of a rowboat to set and check sieve-like traps placed in shallow waters around coral reefs; such ventures would require the coordinated efforts of a three or four-man crew (Klippel 2002). Reef-dwelling fishes were caught in this manner (Klippel 2002). Pelagic species such as needlefish (Belonidae) and barracuda (Sphyraenidae), on the other hand, would require different methods of capture. Net fishing, which depended on skilled fishermen taking several boats out into the open waters, was used to harvest these epipelagic fishes (Klippel 2002).

Both the Engineers and the enslaved Africans consumed a variety of fishes (Figures 10 and 11), many of which are locally available reef types (Wing 1973). The differences observed in their food refuse may be explained by the methods through which Europeans and Africans obtained their fishes. Certainly, the great number of Serranidae observed in the Terrace 3 assemblage (Figure 11) could have been caught using traps. The capture of Belonidae, which are more prevalent in the Terrace 1 assemblage (Figure 10), however, required the coordinated efforts of multiple boats and skilled anglers (Klippel 2002). Lack of these skills and/or equipment may have limited slaves' access to these pelagic fishes. It is possible that socioeconomic constraints limited enslaved Africans' access to the markets where these fish were sold. Houndfish (Belonidae), while edible, were considered rough and so were not valued as a preferred food source (Robins 1986). Perhaps their greater prevalence in the British officers' assemblage (42% versus 13% of the Africans' fish remains) (Figures 10 and 11) is a function of greater purchasing power instead of a specific preference for this species. Certainly fresh fish of any kind would have been preferable to the alternative salted or dried rations available.

Rather than consider the remaining families of fishes individually (since the differences in their numbers are negligible), they have been grouped according to ecological habitat, a prime factor influencing capture techniques. Figures 12 and 13 include as reef fishes: parrotfish (Scaridae), squirrelfish (Holocentridae), snapper (Lutjanidae), grouper (Serranidae), triggerfish (Balistidae), and jack (Carangidae). The only pelagic species observed at this site were needlefishes (Belonidae) and barracuda (Sphyraenidae) (Wing 1973). As explained below, codfish (Gadidae) and appropriately sized herring (Clupeidae) are counted under saltfish. Clupids that were indistinguishable as either imported saltfish or locally available pilchards were listed separately. When sorted into these categories, a couple of interesting trends emerge. The Terrace 1 fish assemblage sorts fairly evenly between reef (49.2%) and pelagic (42.9%) fishes (Figure 12), while the Terrace 3 assemblage is skewed heavily towards reef fishes (75.6% compared to only 14.2% pelagic species) (Figure 13). Secondly, cod bones were found only at Terrace 3 (Figure 13). Codfish were represented primarily by caudal vertebra and specific post-cranial elements, whereas tropical fish remains included many skeletal elements of the cranium and vertebral column. This skeletal element distribution, combined with the known biogeographic distribution of Atlantic cod (*Gadus morhua*), suggests that these specimens represent imported saltfish remains (Klippel 2002).

Reptile and Amphibian Assemblage

Though reptiles and amphibians make up less than 10% of either the BSH 3 assemblages (Figure 3), it seems plausible that they were a slightly more important resource to the enslaved Africans on Terrace 3, where they represent 8.5% of the faunal material (versus 2.9% of the Terrace 1 assemblage) (Figure 4). An initial comparison of the animals identified shows that sea turtles (Chelonidae) were ten times more prevalent at Terrace 3 (Figures 14 and 15). However, a cursory skeletal element analysis (see Appendices 1 and 2) of these bones revealed that they were all carapace pieces. Further, many of these fragments possessed cut marks indicative of bone button manufacturing, a known occupation of enslaved Africans at BSH 2 (see Klippel and Price 2007; Klippel and Schroedl 1999 for discussion). It is reasonable, then, to interpret this faunal material as remnant of raw materials imported for the manufacture of buttons instead of fleshed turtles transported for consumption. Therefore, this family has been omitted from consideration in Figures 16 and 17 in order to emphasize the differences among the remaining reptiles and amphibians.

Interestingly, frogs (Order Anura) are the only group represented with any degree of consistency between terraces 1 and 3 (Figures 16 and 17). They make up the bulk of this portion of the faunal assemblage at 64.5% and 63.0%, respectively. From the numerous contemporary sources listing frogs (likely *Leptodactylsu fallux* or other spp.) as “mountain chicken” in various modern Caribbean dishes (Ackerson 2010, Daltry 2002, Anguilla Travel Guide 2000, Schwartz and Henderson 1991), it is not beyond the realm of possibility that these bones belong to animals consumed as food.

Mostly nonspecific Squamata elements account for the majority of the reptile assemblage from Terrace 1 (Figure 16). *Anolis* (small lizard) specimens are slightly more prevalent at Terrace 3 (Figure 17). Combined with the greater number of specimens from members of the Iguanidae family, the Terrace 3 assemblage affords a slightly more specific profile of the kinds of reptiles and amphibians present. It should be noted, though, that to this day these small lizards and skinks occupy the island in great numbers and frequent human habitations with impunity.

Also, given the lack of direct modifications to any of these bones, it is impossible to use their presence to definitively argue for their consumption by humans.

The results presented in Figures 8 through 13 have been combined to show how these animals contributed to the overall diets of the Royal Engineers and enslaved Africans occupying the sites where they were excavated. As previously discussed, likely commensals (i.e. cats, rats, lizards, and frigs) and non-edible portions of turtle have been omitted to show the differences in the groups of animals most likely eaten. Categorized by taxonomic class, diet at the Royal Engineers' occupation consisted of 39% birds, 36% mammals, and 25% fish (Figure 18). Comparison with the faunal assemblage from the enslaved Africans' occupation suggests that they consumed considerably more mammals and half as many birds. Their diet included 51% mammals, 34% fish, and only 15% birds (Figure 19).

The data presented in Figures 18 and 19 were further refined to show more specific analysis of the utilization of these animals at the two sites.

Figures 20 and 21 show the specific animals consumed at each terrace, considering mammal species individually and grouping species of birds and fish into families or orders. It is apparent that the British Engineers (Figure 20) relied heavily on fresh meats, such as chickens (37%), locally slaughtered caprines (20%), and locally caught tropical fishes (16%). Their diet also included a fair amount of pork (11%) and houndfish (10%). Beef (*Bos*, 3%) was only slightly more abundant than rabbit (*Oryctolagus*, 1%).

Enslaved Africans occupying Terrace 3 at Brimstone Hill experienced a diet rather different than their European counterparts (Figure 21). Caprines (30%) and tropical fishes (24%)

made up the bulk of the animal portion of their diet. Chicken (15%), pork (13%), and houndfish (10%) were also important food sources, followed by tropical reef fishes (24%) and domestic fowl (Galliformes, 15%). Only 7% of the faunal remains observed at Terrace 3 were from cattle. Rabbits (*Oryctolagus,* 1%) and Anatids (<1%) were consumed in very small amounts. No Columbids were observed in the Terrace 3 assemblage.

Chapter 7: Screening Bias

A logical and predictable pattern of taxonomic class distortion arises from consideration of the overall skeletal size of birds, mammals, and fish, the three taxonomic classes most often associated with cultural assemblages (Roth et al. 1980). Both physical and cultural factors contribute to taxonomic class distortions in archaeological material (Roth et al. 1980). However, numerous studies (see Casteel 1972; Davis 1987; James 1997; Lyman 1994; Nagaoka 2005; Payne 1975; Reitz and Wing 1998; Roth et al. 1980; Vale and Gargett 2002; Versteeg and Schinkel 1992; Zohar and Belmaker 2005) demonstrate the potential for screen size in particular to significantly bias skeletal element recovery and thus calculations of taxonomic abundance and richness. Payne (1975), for example, noted a lack of smaller bones in many published faunal reports and conducted sieving experiments at Sitagroi in Greece to show that many small bones actually present in the assemblage were not being recovered using standard field techniques (i.e. screening through one-quarter-inch mesh). Similarly, James (1997) found that nearly 75% of the faunal assemblage at the Maniopa Road Site in southern Arizona was lost through one-quarter-inch screens. In these studies and others it has been well documented that this method cannot adequately recover small animal bones from archaeological deposits.

Another common methodological problem afflicting zooarchaeological studies, as explained by Davis (1987) is a bias favoring easily recognizable elements (such as long bones and mandibles in mammals). More often, these elements are larger and possess diagnostic features that aid in identification. Elements retrieved in fine screen are less likely to meet either of these criteria. Therefore, the contribution of sieving through successively smaller screen may actually diminish for some species as the elements recovered become smaller, more fragmented, and less recognizable. On the other hand, small bodied animals may pass entirely through quarter-inch screen and thus be under-represented or completely unrepresented in conclusions based on faunal material derived solely from quarter-inch screens. Sensibly, knowledge of a site's location and function and familiarity with the potential faunal community assist zooarchaeologists in determining how best to sample and interpret each faunal assemblage.

Of particular concern at island sites like St. Kitts, for example, is the fact that fish bone is particularly susceptible to screening bias. Fish are unique in that their bones are more delicate and vulnerable to decay than other vertebrates, and they rarely preserve in acidic sediments (Lyman 1994). They are also generally smaller, and their bones more difficult to recover using traditional excavation techniques. Multiple studies have shown that small fish bones may be lost without the use of 0.5-2 mm mesh (Lyman 1994); at the Zebree site, Roth et al. (1980) sought to quantify the amount of skeletal elements lost through standard one-quarter-inch mesh and to determine a correction factor or "constant of recovery" to adjust for the underrepresentation of small-sized bones. They concluded that "in none of the approaches to calculating relative faunal abundance does one-quarter-inch mesh account for as much as two-thirds of the total recovered fish (1908:9)." James (1997) estimates that sieving with one-quarter-inch screen recovers only 10% of the fish bones at the Pueblo Grande site. Casteel (1972) concludes that all fish bones in the sites he examined could have been lost through one-quarter-inch mesh. In none of these examples did the "industry standard" use of one-quarter-inch mesh effectively recover small fish bones.

Since the use of one-quarter-inch screen to recover fish bone cannot produce an adequate representation of the total fish community present at a site, several attempts to address the problem have been presented. Thomas (1969) was the first to suggest the use of nested screens in one-quarter, one-eighth, and one-sixteenth inch mesh (Roth et al. 1980; Vale and Gargett 2002).

Similarly, Versteeg and Schinkel (1992) found that the most productive method for the recovery of vertebrate remains at the Golden Rock Site on nearby St. Eustatius was the use of 2.8 mm mesh screen. Although Vale and Gargett (2002) claimed that the use of 3 mm sieves did not increase the richness observed in a fish bone assemblage from an Aboriginal Australian shell midden, Zohar and Belmaker (2005:636) reexamined their data using a statistical method called "the equivalent alpha diversity method for abundification" and reached the opposite conclusion, emphasizing the fact that the importance of the use of fine screening cannot be over-stressed. They criticized certain shortfalls of Vale and Gargett's initial study, such as small sample size, inadequate sampling methods, and poor analytical methodology.

The faunal material from Terraces 1 and 3 of the Brimstone Hill Fortress complex was examined to address the issue of screen-size based recovery bias on skeletal elements and to assess the utility of fine screening at the Brimstone Hill sites. The following data demonstrate the effect of differential recovery on zooarchaeological interpretations of these assemblages.

Twenty-nine of the 101 levels excavated at Terrace 1 were fine screened (Table 17). By determining for each species the proportion of skeletal elements captured in the quarter-inch screen versus the fine screen (e.g. the eighth- and sixteenth inch screens combined), it was possible to calculate a rate of recovery for both screen portions of the assemblage. This rate could then be applied to the quarter-inch material from the remaining 72 units to produce an expected NISP. This number (Table 18) predicts the NISP present in the portion of the Terrace 1 assemblage that was not fine-screened. Though this method does not address intra-site variations (i.e. different rates of recovery among the individual units), it does facilitate the most realistic NISP calculations based on the available data.

Not surprisingly, in the Terrace 1 example most of *Bos* elements were caught in the larger screen (Figure 22). The majority of caprines was also caught in the quarter-inch screen, yet suids were slightly more numerous in the fine screen fraction. Quarter-inch screen also did a good job of capturing *Oryctolagus* and three tropical fishes (*Epinephelus, Haemulon,* and *Lutjanus* spp.), as well as the majority of domestic fowl (i.e. Galliformes). Testudines were the only reptile or amphibian adequately represented by the quarter-inch portion of the Terrace 1 assemblage. As expected, skeletal elements from the remaining fishes and other small-bodied animals were much more abundant in the fine screen portion.

Many of these recovery rates are mirrored in the Terrace 3 assemblage (Figure 23). Here the majority of skeletal elements from *Bos*, Galliformes, and three species of fishes (*Epinephelus, Lutjanus,* and *Gadus*) were caught in the quarter-inch screen. Suids, again, sorted fairly evenly between the two screen sizes but, unlike at Terrace 1, many more caprine elements from the Terrace 3 assemblage were recovered in the larger screen. The majority of Testudines also came from the quarter-inch screen. *Felis* and *Oryctolagus*, on the other hand, were more abundant in the fine screen, as were rodents and the remaining tropical fishes (Figure 23).

From the data presented, it is apparent that quarter-inch screen captures significant portions of certain species' skeletal remains better than others. By plotting the predicted NISPs derived in Tables 18-19, it is easy to see where the skeletal elements from each species are found (Figures 22 and 23). At neither Terrace 1 nor 3 does the fine screen portion of the faunal assemblage account for as much as half of the total fish population. In fact, for all fishes at

Terrace 3, the rate of recovery using quarter-inch screen is at or below 10% (Figure 23). Though between 30% and 40% of Belonidae and other tropical fishes were caught in the larger screen size at Terrace 1 (Figure 22), Clupidae were less well represented in the larger fraction. At both sites, then, omission of the fine screen portion has the potential to fail to reveal the presence of *Clupea* spp. (i.e. salted herring). The same cannot be said of salted cod, at least from this Brimstone Hill assemblage, since *Gadus* spp. skeletal elements were only found at Terrace 3 (Table 10), and only in the quarter-inch screen.

As with the fishes, no lizards (Order Squamata) or frogs (Order Anura) were well represented by quarter-inch captures at either Terrace 1 (Figure 22) or Terrace 3 (Figure 23). Of all the reptiles and amphibians identified, only the Order Testudinata was more abundant in this larger fraction. In general, birds were relatively better represented in the quarter-inch screen samples than were fish, reptiles, or amphibians. Over 40% of Galliformes were found in quarter-inch screen at Terrace 3, and nearly 60% of the skeletal elements from these domestic fowl were recovered in the large fraction of the Terrace 1 assemblage. Due to the very small sample sizes, it is difficult to generalize about the distributions of Anatidae and Columbidae specimens (Figures 24 and 25, refer also to Tables 18 and 19 for actual NISPs).

The observed recovery rates of mammals appear to correlate with body size; at both Terrace 1 (Figure 22) and Terrace 3 (Figure 23) the majority of *Bos* elements were recovered in quarter-inch screen. More than half of the caprine elements were also found in the larger screen, but *Sus* remains sorted very differently at each site. Approximately two thirds of the pig skeletal elements at Terrace 1 and nearly half of those from Terrace 3 came from the fine screen portion. Perhaps the inclusion of numerous Caprinae and Suidae tooth fragments (which are readily identifiable even when highly fragmented) account for these anomalies. Surprisingly, at least three-fourths of *Oryctolagus* remains were recovered by quarter-inch screens at both terraces. Cats were significantly less well represented in the large fraction of these assemblages and, rather expectedly, rodents were the least represented mammal in the quarter-inch screen capture from either terrace.

Taking into account the recovery biases present, reanalysis of the faunal materials from Brimstone Hill Fortress leads to quite different interpretations than were initially drawn (Figures 18 through 21). The expected populations of each animal class, calculated from the NISPs present in the portion of the excavated materials that were fine screened, are presented in Figures 24 through 33. The small sample sizes available for all birds except chickens complicated calculation of their expected numbers at both Terrace 1 (Figure 24) and Terrace 3 (Figure 25), resulting in little change between these and their relative proportions in the excavated materials (Figures 8 and 9); chickens still dominate the avian assemblage, accounting for 95% of all birds at the Engineers' quarters (Figure 24) and nearly 100% at the enslaved Africans' area (Figure 25). Mammals, however, change considerably. At Terrace 1, the expected relative proportions are 72% caprines, 17% *Sus*, 6% *Bos*, and 5% *Oryctolagus* (Figure 26), whereas the Terrace 3 assemblage should include 60% caprine, 25% *Sus*, 15% *Bos*, and <1% *Oryctolagus* (Figure 27). The expected relative proportions of reptiles and amphibians are: 63% *Anura*, 34% Squamata, and 3% Testudinata at Terrace 1 (Figure 28), and 43% Testudinata, 38% *Anura*, and 19% Squamata at Terrace 3 (Figure 29). Fish are expected to consist of 60% reef species and 40% pelagic species at Terrace 1 (Figure 30) and 62% reef species, 34% pelagic species, and 4% imported salt fish at Terrace 3 (Figure 31).

Using these data, it was possible to generate the relative proportions that each group of animals contributed to the diets of the occupants of both terraces. Figure 32 shows that British officers at Terrace 1 utilized fish more than mammals or birds. In fact, fish made up over half of their diet, and mammals were much more abundant (31%) than birds (11%). At Terrace 3, too, mammal species accounted for approximately a third of all animals consumed (Figure 33). Fish comprised 69% of the total, and birds accounted for only 1% of the diet of enslaved Africans occupying this site. These numbers differ significantly from those percentages initially derived without accounting for the omission of the unscreened materials from this site (Figures 18 and 19), especially with respect to the estimation of fish. Fish species account for approximately a quarter of the entire animal-based portion of the diet of both the British royal Engineers (Figure 34) and the enslaved Africans (Figure 35). The Engineers ate relatively more fresh chicken (Galliformes, 33%) and caprines (20%) (Figure 24) than the enslaved Africans did (19% and 34%, respectively) (Figure 35). At Terrace 1, *Sus* and *Bos* were far less abundant than either of these food resources (Figure 34). However, these two mammals filled a larger portion of enslaved Africans' diet (Figure 35). *Sus*, especially, was nearly as abundant as reef fishes at Terrace 3. Also, cattle (*Bos*) were three times as prevalent here than at Terrace 1.

The data presented in this study of the Brimstone Hill faunal material support existing literature which concludes that smaller screen size generally increases the recovery of skeletal remains of fish and other small animals. Exhaustive discussion of "the appropriate size of screen gauge" (Reitz and Wing 1998:193) has thus far failed to make fine screening standard practice in archaeological investigations. Perhaps resistance to the adoption of this practice derives in part from the tedious and time-consuming nature of sieving and analyzing such large amounts of minute specimens. As demonstrated in the analysis of the Brimstone Hill faunal assemblages, though, all fish and amphibian species, most reptiles, and several small birds and mammals appear drastically underrepresented in the one-quarter-inch screen captures. The results of this study indicate that sampling with one-eighth inch or even sixteenth inch mesh would greatly enhance zooarchaeological investigations in cases where these species represent a considerable portion of the faunal remains. Such generalization, however, is difficult because the decision to use any fine screen is ultimately dependent upon the research objective and the nature of the specific assemblage in question. Time and labor constraints are realities to be contended with. However, the results of this study demonstrate how fine screen samples help quantify the degree of recovery bias towards larger elements (and larger individuals and species), minimize short-sighted and inaccurate interpretations drawn from incomplete data sets, and produce a more accurate picture of the total faunal community present at any given archaeological site.

Chapter 8: Conclusions

The tropical Caribbean climate presented a novel environment for both Europeans and Africans with respect to nutrition and health. St. Kitts' sugar monoculture economy necessitated an import-based subsistence strategy that the British military also adopted in their practices of provisioning soldiers and slaves. However, due to their subservient socioeconomic status, enslaved Africans were disproportionately afflicted by malnutrition and diseases such as worms and *mal d'estomac* (pica or dirt eating) that are exacerbated by nutrient deficiencies (Richardson 1983; Kiple and Kiple 1980). Analysis of faunal assemblages from the BSH Fortress complex shows that while Europeans and Africans did utilize the same food species, they did so in unique ways. The data presented in this thesis provide important insight into the foodways of these two groups.

Previous research has indicated that the majority of protein came in the form of imported meat from England and North America. On St. Kitts, archaeofaunal identifications, zoogeography, stable carbon isotope analyses, and vertebrate skeletal part frequencies have revealed that the bulk of Africans' dietary protein (at BSH 2) came from imported salt fish and preserved meats (Klippel 2002). This thesis uses excavations at BSH 3 Terrace 1 and Terrace 3 to contrast the material cultures of coexisting British military officers' quarters and enslaved African occupations to address the questions concerning the proportions that different animal food contributed to the diet of each group.

Comparison of the food remains from these two contexts tells us that the animal based portion of British Royal Engineers' diet was more evenly distributed among mammals, birds, and fish, with mammal bones accounting for approximately one-third of the faunal material recovered at Terrace 1. This differs from the Terrace 3 assemblage where mammals make up more than half of all animal remains. At both locations, caprines were the most highly utilized mammalian group, followed by *Sus*, *Bos,* and minimal amounts of *Oryctolagus*.

Though previous research at Brimstone Hill Fortress has emphasized the dietary contributions of mammal species, bird remains were actually the most prevalent faunal category present at Terrace 1, accounting for 39% of the total diet of the Engineers. This pattern contrasts greatly with the Terrace 3 assemblage, where birds equal only 15% of the total diet. At Terrace 1, Galliformes dominate this faunal class; indeed, they are the most abundant group of all animals observed at the site. Poultry were important both for meat and for eggs. Though copious eggshell fragments were recovered at both sites (see appendices 3 and 4), the importance of their contribution to Kittitian diet has not been discussed in this thesis. Other avian specimens, which include very few representatives from the families Anatidae and Columbidae, were more numerous at Terrace 1 than at Terrace 3, giving the Engineers slightly more dietary diversity with respect to the variety of avian resources utilized. This difference could be explained by the fact that Royal Engineers had access to the weaponry and time necessary to hunt. It is not inconceivable that enslaved Africans enjoyed these luxuries less than the Europeans did. Certainly Gibson (2007) understood that "food procurement via either hunting and fishing or acquiring and raising livestock [required]… initial investment in tools, expenditure of time, and freedom of movement in order to hunt and fish" and that the availability of such opportunities may have been influenced in part by differential socioeconomic status. For this reason she concluded that "it seems likely that [temporal] fluctuations in the level of wild versus domestic fauna would be related to availability of free time… restrictions on mobility, and work schedules" (Gibson 2007:243). However, it is entirely possible that the enslaved Africans were as capable of hunting and fishing or even had as many opportunities to do so as were the Europeans.

Similar socioeconomic opportunities and constraints may also explain the observed differences in utilization of marine (i.e. fish) resources. Both the British and Africans utilized many species of tropical fishes, but the greater overall abundance of fish remains at Terrace 3 seems to suggest that they were relatively more important in the diets of Africans than they were to the British. At Terrace 1 Belonidae (i.e. houndfishes) makes up a relatively greater proportion of the fish assemblage than they do at Terrace 3. The explanation for these observances likely lies in the methods of capture used on different fishes. The capture of pelagic houndfishes requires offshore netting from boats, which is accomplished by multiple crews working in concert. Young snappers, groupers, and other reef fishes, on the other hand, can be caught by potfishing. This mode of fishing involves leaving woven traps unattended, perhaps over the course of a day, and returning later to retrieve fish that voluntarily swim into them and cannot escape. Since comparably less skill, expensive equipment, or time need be invested in this activity, enslaved Africans could have more easily incorporated this type of fishing into daily routines of enforced labor that would have made more elaborate fishing enterprises impossible. Perhaps fish in general are more abundant, relative to the other animal categories, at Terrace 3 than at Terrace 1 for this very reason – that this food source was readily available with very little diversion of time and resources away from other obligations.

In addition to archaeofaunal identifications, other lines of evidence such as skeletal part frequencies and stable carbon isotope analysis enhance interpretation of the BSH 3 faunal collections. At both terraces, low utility elements from caprine indicate that sheep (*Ovis*) and goats (*Capra*) were grazed locally and slaughtered on the island. The same may be true for some of the cattle (*Bos*) and pig (*Sus*), though the abundance of long bones and cranial elements from these species may be indicative of a pattern more attributable to imported preserved meat cuts. Certainly the stable carbon isotope analyses of *Bos* sampled here show a mixture of cattle from temperate and tropical origins.

What is interesting is how well the analysis of the BSH 3 Terrace 3 faunal assemblage correlates with materials previously excavated at BSH 2 (Klippel 2002, 2001). Both of these sites are known to have been occupied by enslaved Africans whereas BSH 3 Terrace 1 was occupied by European military personnel. The relative proportion of animal remains from BSH 2 and BSH 3 Terrace 3 show similar reliance on protein from salted or barreled meat sources as well as rougher species of locally available potfishes. In contrast, Royal Engineers occupying BSH 3 Terrace 1 consumed a wider variety of animal species in general.

These conclusions would not have been possible without the inclusion of data gathered using smaller than standard screening techniques in the field. Fish, for example, apparently functioned as a palatable alternative to the other available sources of protein on St. Kitts such as low-quality imported barreled and salted meats (DeVoe 1975; Franklin 2002). The same can be said of birds. Yet we would never know that without employing screening techniques that could adequately sample the presence or abundance of these animal classes. Without data collected from fine screening, the contribution of these food sources would have been overlooked. Also, it would have been difficult to interpret cultural practices that coincided with the marine zones exploited and the methods of capture utilized, both of which were addressed using data based on the fish species observed.

Enslaved African foodways on the island of St. Kitts were influenced by access to natural resources and the provisioning system as well as by an array of cultural traditions linked to the institution of slavery. The amount of fish consumed on St. Kitts is hardly surprising, considering the island's inhabitants' circumscription and the opulence of the Caribbean continental shelf ecosystem; utilization of marine resources is strongly influenced by the diversity, productivity, and availability of food resources in adjacent terrestrial habitats (Erlandson 2006). Thus, on a small island with few indigenous land animals at a time when economic interests favored sugarcane production and export over domestic animal husbandry, circumstances necessitated the development of a food system based on imported foodstuffs and marine resources. This system, coupled with a reliance on some locally raised animals such as caprines, ensured the survival of St. Kitts's inhabitants. The Brimstone Hill Fortress example well illustrates the role of this strategy in the success of European colonization in the Caribbean. Indeed, a version of this strategy of reliance on imported foodstuffs observed archaeologically at Brimstone Hill Fortress continues on the island today.

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Appendices

Appendix 1. Tables
Appendix 2. Figures
Appendix 3. Terrace 1 Faunal Assemblage (Excel source data)
Appendix 4. Terrace 3 Faunal Assemblage (Excel source data)

Appendix 1. Tables

Table 1. List of common and scientific names of fauna recovered at BSH 3.

CLASS	ORDER	FAMILY	GENUS	SPECIES	COMMON NAME
Osteoichthyes					bony fishes
		Clupidae			herrings
		Gadidae			cods
			Gadus	*morhua*	Atlantic cod
		Belonidae			needlefishes
			Tylosurus	*crocodilus*	houndfish
		Holocentridae			squirrelfishes
			Holocentrus	*rufus*	longspine squirrelfish
		Serranidae			sea basses & groupers
			Centropristus	*striata*	black sea bass
			Epinephelus	*adscensionis*	rock hind
			Epinephelus	*fulvus*	coney
			Epinephelus	*morio*	red grouper
			Epinephelus	*striatus*	naussa grouper
			Myctoperca	*Bonaci*	black grouper
			Myctoperca	*rufus*	
		Carangidae			jacks
			Caranx	*crysos*	blue runner
		Lutjanidae			snappers
			Lutjanus	*griseus*	gray snapper
		Haemulonidae			grunts
			Haemulon	*plumieri*	white grunt
		Scaridae			parrotfishes
			Scarus	sp.	parrotfishes
			Sparisoma	sp.	parrotfishes
		Sparidae			porgies
			Calamus	*nodosus*	knobbed porgy
			Calamus	*penna*	sheepshead porgy
		Sphyraenidae			barracudas
			Sphyraena	*barracuda*	great barracuda
Repitilia					reptiles
		Chelonidae			sea turtles
	Squamata				snakes and lizards
			Anolis	Sp.	tropical lizards
Amphibia	Anura				frogs and toads
Aves					birds
		Anatidae			ducks, geese, swans
			Branta	Sp.	true geese and swans
			Anas	Sp.	dabbling ducks
			Zenaida	*asiatica*	white-winged duck

Table 1. cont. List of common and scientific names of fauna recovered at BSH 3.

CLASS	ORDER	FAMILY	GENUS	SPECIES	COMMON NAME
		Columbidae			pigeons and doves
			Columba	Sp.	pigeons and doves
			Gallus	*gallus*	domestic chicken
			Numidea	*meleagris*	guinea fowl
Mammalia					mammals
			Felis	*domesticus*	domestic cat
			Oryctolagus	*cuniculus*	rabbit
			Sus	*scrofa*	pig
	Rodentia				rodents
			Mus	*musculus*	house mouse
			Rattus	*norvegicus*	brown rat
	Artyodactyla				even-toed ungulates
		Caprinae			even-toed ungulate bovines
			Bos	*tarus*	cattle
			Capra	*hirca*	domestic goat
			Ovis	*aries*	domestic sheep

Table 2. Faunal Assemblage for Terrace 1: British Engineer Occupation (n=10,757)

Mammalia	# bones	% identifiable
Felis domesticus	13	3.1
Mus musculus	41	9.8
Rattus sp.	129	30.8
Rodentia	3	0.7
Oryctolagus cuniculus	14	3.3
Sus scrofa	51	12.2
Bos tarus	25	6.0
Capra hirca	5	1.2
Ovis aries	0	0
Caprinae	136	32.5
Artyodactyla	2	0.5
Indeterminate	1487	
IDENTIFIABLE MAMMAL	419	
TOTAL MAMMAL	1906	

Aves	# bones	% identifiable
Anatidae	1	0.2
Branta sp.	1	0.2
Anas sp.	3	0.7
Zenaida asiatica	1	0.2
Columbidae	5	1.2
Columba sp.	1	0.2
Gallus gallus	393	95.6
Numidea meleagris	6	1.5
Indeterminate	568	
IDENTIFIABLE BIRD	411	
TOTAL BIRD	979*	
* excludes egg shell (n=303)		

Reptilia	# bones	% identifiable
Chelonidae	1	8.3
Anolis sp.	7	58.3
Squamata	4	33.3
Indeterminate	12	
IDENTIFIABLE REPTILE	12	
TOTAL REPTILE	24	99.9

Amphibia	# bones	% identifiable
Anura	20	100.0
Indeterminate	0	0.0
IDENTIFIABLE AMPHIB.	20	
TOTAL AMPHIBIANS	20	

Table 2 cont. Faunal Assemblage for Terrace1: British Engineer Occupation (n=10,757)

Osteoichthyes	# bones	% identifiable
Clupidae	19	
Indeterminate	19	7.9
Gadidae	0	
Gadus morhua	0	0
Belonidae	30	
Tylosurus sp.	30	12.5
Holocentridae	11	
Holocentrus rufus	4	1.7
Holocentrus sp.	4	1.7
Indeterminate	3	1.3
Serranidae	53	
Centropristus striata	1	0.4
Centropristus sp.	4	1.7
Epinephelus adscensionis	1	0.4
Epinephelus morio	5	2.1
Epinephelus sp.	33	
Myctoperca rufus	1	0.4
Myctoperca sp.	1	0.4
Indeterminate	7	2.9
Carangidae	6	
Caranx crysos	1	0.4
Caranx sp.	2	0.8
Indeterminate	3	1.3
Lutjanidae	21	
Lutjanus griseus	4	1.7
Lutjanus sp.	9	3.8
Indeterminate	8	3.3
Haemulidae	4	
Haemulon plumieri	2	0.8
Haemulon sp.	2	0.8
Sparidae	12	
Calamus nodosus	1	0.4
Calamus penna	3	1.3
Calamus sp.	4	1.7
Indeterminate	4	1.7
Scaridae	4	
Scarus sp.	4	1.7
Sphyraenidae	1	

Table 2 cont. Faunal Assemblage for Terrace1: British Engineer Occupation (n=10,757)

Osteoichthyes	# bones	% identifiable
Sphyraena barracuda	1	0.4
Acanthuridae	1	
Indeterminate	1	0.4
Diodontidae	1	
Diodon sp.	1	0.4
Indeterminate	1815	
IDENTIFIABLE FISH	240	98.3
TOTAL FISH	2055**	

**excludes 311 scales and 2828 spines, ribs, and fin ray fragments

Indeterminate bone	# bones	% total
TOTAL	5773	54.6

Table 3. Faunal Assemblage for Terrace 3: Enslaved African Occupation (n=16,796)

Mammalia	# bones	% identifiable	% total
Felis domesticus	13	1.6	
Mus musculus	19	2.3	
Rattus norvegicus	2	0.3	
Rattus rattus	2	0.3	
Rattus sp.	80	9.6	
Rodentia	3	0.4	
Oryctolagus cuniculus	21	2.5	
Sus scrofa	143	17.2	
Bos tarus	130	15.7	
Capra hirca	2	0.3	
Ovis aries	4	0.5	
Caprinae	411	49.5	
Artyodactyla	0	0	
Indeterminate	6897		
IDENTIFIABLE MAMMAL	830	100.2	62.1
TOTAL MAMMAL	7727		78.1

Aves	# bones	% identifiable	
Anatidae	1	0.633	
Gallus gallus	156	98.734	
Numidea meleagris	1	0.633	
Indeterminate	421		
IDENTIFIABLE BIRD	158	100.00	11.8
TOTAL BIRD	579*		7.1
* excludes egg shell (n=2885)			

Reptilia	# bones	% identifiable	
Chelonidae	40	59.701	
Anolis sp.	23	34.328	
Iguanidae	3	4.478	
Squamata	1	1.493	
Indeterminate	3		
IDENTIFIABLE REPTILE	67	100.00	5.0
TOTAL REPTILE	70		0.7

Amphibia	# bones	% identifiable	
Anura	46	100	
Indeterminate	0	0	
IDENTIFIABLE AMPHIB.	46		3.4
TOTAL AMPHIBIANS	46	100	0.5

Table 3 cont. Faunal Assemblage for Terrace3: Enslaved African Occupation (n=16,796)

Osteoichthyes	# bones	% identifiable
Clupidae	8	
Indeterminate	8	3.4
Gadidae	15	
Gadus morhua	15	6.4
Belonidae	30	
Tylosurus sp.	30	12.8
Holocentridae	8	
Holocentrus rufus	4	1.7
Holocentrus sp.	4	1.7
Serranidae	119	
Centropristus striata	1	0.4
Centropristus sp.	1	0.4
Epinephelus adscensionis	5	2.1
Epinephelus fulvus	1	0.4
Epinephelus morio	17	7.2
Epinephelus sp.	89	37.9
Myctoperca bonaci	2	0.9
Myctoperca sp.	3	1.3
Carangidae	1	
Caranx sp.	1	0.4
Lutjanidae	23	9.8
Lutjanus griseus	5	2.1
Lutjanus sp.	18	7.7
Haemulidae	5	
Haemulon plumieri	4	1.7
Haemulon sp.	1	0.4
Sparidae	9	
Calamus nodosus	3	1.3
Calamus penna	4	1.7
Calamus sp.	2	0.9
Scaridae	3	
Indeterminate	3	1.3

Table 3 cont. Faunal Assemblage for Terrace3: Enslaved African Occupation (n=16,796)

Sphyraenidae	2		
Sphyraena barracuda	2	0.9	
Acanthuridae	0	0	
Diodontidae	2		
Diodon hystrix	1	0.4	
Diodon sp.	1	0.4	
Indeterminate	1236		
IDENTIFIABLE FISH	235		17.6
TOTAL FISH	1471**		14.9

**excludes 360 scales or 3484 spines, ribs, and fin ray fragments

Indeterminate bone	# bones	% total
TOTAL	6903	100.0

Table 4. Terrace 1 Assemblage Identified to Class Level or Below

Class	NISP	% Total
Mammalia	1,906	38.3
Aves	979	19.7
Reptilia & Amphibians	32	0.6
Osteoichthyes	2,055	41.3
TOTAL	4,972	99.9

Table 5. Fish Portion of Terrace 1 Assemblage Identified to Family Level

Family	NISP	% Total
Clupidae	19	7.9
Belonidae	102	42.5
Holocentridae	11	4.6
Serranidae	53	22.1
Carangidae	6	2.5
Lutjanidae	21	8.8
Haemulidae	4	1.7
Sparidae	12	5.0
Scaridae	9	3.8
Sphyraenidae	1	0.4
Acanthuridae	1	0.4
Diodontidae	1	0.4
TOTAL	240	100.1

Table 6. Mammal Portion of Terrace 1 Assemblage Identified to Family Level

Taxon	NISP	% Total
Felis domesticus	13	3.1
Rodentia	173	41.3
Mus musculus	41	23.7
Rattus norwegicus	0	0
Rattus rattus	0	0
Rattus sp.	129	30.8
indeterminate	3	0.7
Oryctolagus cuniculus	14	3.3
Sus scrofa	51	12.2
Bos tarus	25	6.0
Caprinae	141	33.7
Ovis aries	0	0
Capra hirca	5	1.2
indeterminae	136	32.5
Artyodactyla	2	0.5
TOTAL	419	100.1

Table 7. Aves Portion of Terrace 1 Assemblage Identified to Family Level

Taxon	NISP	% Total
Anatidae	1	0.2
Anas sp.	3	0.7
Branta sp.	1	0.2
Zenaida asiatica	1	0.2
Columbidae	5	1.2
Columba sp.	1	0.2
Gallus gallus	393	95.6
Numidea gallapova	6	1.5
TOTAL	411	99.8

Table 8. Reptile and Amphibian Portion of Terrace 1 Assemblage Identified to Family Level

Taxon	NISP	% Total
Chelonidae	1	3.1
Anolis sp.	7	21.9
Iguanidae	0	0.0
Squamata	4	12.5
Anura	20	62.5
TOTAL	32	100.0

Table 9. Terrace 3 Assemblage Identified to Class Level or Below

Class	NISP	% Total
Mammalia	7,727	78.2
Aves	579	5.9
Reptilia & Amphibians	116	1.2
Osteoichthyes	1,461	14.8
TOTAL	9,883	100.1

Table 10. Fish Portion of Terrace 3 Assemblage Identified to Family Level

Family	NISP	% Total
Clupidae	8	3.6
Gadidae	15	6.7
Belonidae	30	13.3
Holocentridae	8	3.6
Serranidae	119	52.9
Carangidae	1	0.4
Lutjanidae	23	10.2
Haemulidae	5	2.2
Sparidae	9	4.0
Scaridae	3	1.3
Sphyraenidae	2	0.9
Diodontidae	2	0.9
TOTAL	225	100.0

Table 11. Mammal Portion of Terrace 3 Assemblage Identified to Family Level

Taxon	NISP	% Total
Felis domesticus	13	31.6
Rodentia	106	12.9
Mus musculus	19	2.3
Rattus norwegicus	2	0.2
Rattus rattus	2	0.2
Rattus sp.	80	9.6
indeterminate	3	0.4
Oryctolagus cuniculus	21	2.5
Sus scrofa	143	17.2
Bos tarus	130	15.7
Caprinae	417	50.2
Ovis aries	4	0.5
Capra hirca	2	0.2
indeterminae	411	49.5
TOTAL	830	100.1

Table 12. Aves Portion of Terrace 3 Assemblage Identified to Family Level

Taxon	NISP	% Total
Anatidae	1	0.6
Gallus gallus	156	98.7
Numidea gallapova	1	0.6
TOTAL	158	99.9

Table 13. Reptile and Amphibian Portion of Terrace 3 Assemblage Identified to Family Level

Family	NISP	% Total
Chelonidae	40	35.4
Anolis sp.	23	20.4
Iguanidae	3	2.7
Squamata	1	0.9
Anura	46	40.7
TOTAL	113	100.1

Table 14. Skeletal Part Distribution for Three Mammals

	Terrace 1		Terrace 3	
	n	%	n	%
Sus scrofa				
High utility	43	87.8	139	97.2
Low Utility	6	12.2	4	2.8
Bos tarus				
High Utility	14	56.0	107	90.7
Low Utility	11	44.0	11	9.3
Caprinae				
High Utility	48	34.3	167	40.3
Low Utility	92	65.7	247	59.7

Table 15. Stable Carbon Isotope Analysis Report for 4 *Bos* Bones from BSH 3 Terrace 3

UGA #	Sample ID	Material	Δ13C,%
5620	006-150	Collagen	-21.28
5621	006-152	Collagen	-14.67
5622	006-134	Collagen	-18.94
5623	005-316	Collagen	-18.02

Table 16. Stable Carbon Isotope Analysis Report for 10 *Bos* Bones from BSH 5 (Enlisted Men's Barracks)

UGA #	Sample ID	Material	Δ13C,%
4106	007-074A	Collagen	-8.42
4107	007-074B	Collagen	-20.29
4108	007-074C	Collagen	-12.53
4109	007-082A	Collagen	-20.89
4110	007-098A	Collagen	-8.43
4111	007-098B	Collagen	-17.49
4112	007-100A	Collagen	-20.74
4113	007-100B	Collagen	-10.03
4114	007-100C	Collagen	-20.41
4115	007-105A	Collagen	-18.22

Table 17. Volume Screened

	1/4	1/8	1/16	Total Volume
Terrace 1	10.1 m3	1.5 m3	1.4 m3	13.0 m3
Terrace 3	21.6 m3	5.6 m3	3.9 m3	31.1 m3

Table 18. Terrace 1 Fine Screen Calculations

BIRDS	SAMPLE POPULATION			Capture rates		TEST POPULATION (1/4" w/o fine screen)	
	NISP 1/4	NISP fine	total	% 1/4	% fine	1/4"	EXPECTED NISP
Anatidae	4	1	5	0.80	0.20	0	5.00
Gallus	171	148	319	0.54	0.46	37	388.02
Meleagris	3	0	3	1.00	0.00	1	4.00
Columbid	1	4	5	0.20	0.80	1	10.00
unID bird	245	254	499	0.49	0.51	63	627.31
						Total	1034.34

MAMMALS	SAMPLE POPULATION			Capture rates		TEST POPULATION (1/4" w/o fine screen)	
	NISP 1/4	NISP fine	total	% 1/4	% fine	1/4"	EXPECTED NISP
Bos	3	1	4	0.75	0.25	21	32
Felis	4	8	12	0.33	0.67	1	15
Caprine	21	57	78	0.27	0.73	84	390
rodent	138	159	297	0.46	0.54	14	327.13
Oryctolagu	3	11	14	0.21	0.79	3	28
Sus	9	13	22	0.41	0.59	29	92.89
unID mam	517	299	816	0.63	0.37	671	1875.06
						Total	2760.08

FISH	SAMPLE POPULATION			Capture rates		TEST POPULATION (1/4" w/o fine screen)	
	NISP 1/4	NISP fine	total	% 1/4	% fine	1/4"	EXPECTED NISP
Acanthuri	0	1	1	0.00	1.00	0	1
Belonidae	33	68	101	0.33	0.67	1	104.06
Carangida	1	5	6	0.17	0.83	0	6
Clupidae	2	17	19	0.11	0.89	0	19
Diodontid	0	0	0	0.00	0.00	1	0
Haemulid	3	1	4	0.75	0.25	0	4
Holocentr	2	7	9	0.22	0.78	2	18
Lutjanidae	8	11	19	0.42	0.58	2	23.75
Scaridae	2	7	9	0.22	0.78	0	9
Serranida	24	21	45	0.53	0.47	8	60
Sparidae	4	7	11	0.36	0.64	1	13.75
Sphyraeni	1	0	1	1.00	0.00	0	1
unID fish	489	4226	4715	0.10	0.90	22	4927.13
						Total	5186.69

AMPHIBIA	SAMPLE POPULATION			Capture rates		TEST POPULATION (1/4" w/o fine screen)	
	NISP 1/4	NISP fine	total	% 1/4	% fine	1/4"	EXPECTED NISP
Anura	1	19	20	0.05	0.95	0	20.00
Squamata	0	4	4	0.00	1.00	0	4.00
Anolis	1	6	7	0.14	0.86	0	7.00
Testudina	1	0	1	1.00	0.00	0	1.00
indetermi	1	10	11	0.09	0.91	2	33.00
						Total	65.00

Table 19. Terrace 3 Fine Screen Calculations

BIRDS	SAMPLE POPULATION			Capture rates		TEST POPULATION (1/4" w/o fine screen			
	NISP 1/4	NISP fine	total	% 1/4	% fine				
Anatidae	0	0	0	0.00	0.00	0	0		
Gallus	21	25	46	0.46	0.54	109	284.76		
Meleagris	0	0	0	0.00	0.00	0	0		
Columbid:	0	0	0	0.00	0.00	0	0		
Numidea	0	0	0	0.00	0.00	1	1		
unID bird		87	48	0.00	1.81	284	284		
						Total	568.76		

MAMMAL:	SAMPLE POPULATION			Capture rates		TEST POPULATION (1/4" w/o fine screen			
	NISP 1/4	NISP fine	total	% 1/4	% fine		EXPECTED NISP		
Bos	29	0	29	1.00	0.00	**101**	**130**		
Felis	1	6	7	0.14	0.86	6	49		
Caprine	81	28	109	0.74	0.26	308	523.47		
rodent	6	79	85	0.07	0.93	21	**382.5**		
Oryctolagı	0	5	5	0.00	1.00	16	**5**		
Sus	26	20	46	0.57	0.43	97	**217.62**		
unID mam	1716	177	1893	0.91	0.09	5038	**7450.65**		
						Total	**8758.24**		

FISH	SAMPLE POPULATION			Capture rates		TEST POPULATION (1/4" w/o fine screen			
	NISP 1/4	NISP fine	total	% 1/4	% fine		EXPECTED NISP		
Acanthuri	0	0	0	0.00	0.00	0	0.00		
Belonidae	2	12	14	0.14	0.86	16	126.00		
Carangida	0	0	0	0.00	0.00	1	1.00		
Clupidae	0	8	8	0.00	1.00	0	8.00		
Diodontid	1	0	1	1.00	0.00	1	1.00		
Haemulid:	0	2	2	0.00	1.00	2	4.00		
Holocentr	2	4	6	0.33	0.67	2	12.00		
Lutjanidae	7	2	9	0.78	0.22	17	30.86		
Scaridae	1	1	2	0.50	0.50	1	4.00		
Serranidae	22	15	37	0.59	0.41	82	174.91		
Sparidae	0	2	2	0.00	1.00	7	2.00		
Sphyraeni	0	2	2	0.00	1.00	0	2.00		
Gadidae	0	0	0	0.00	0.00	15	15.00		
unID fish	139	4498	4637	0.03	0.97	454	19782.31		
						Total	20163.08		

AMPHIBIA	SAMPLE POPULATION			Capture rates		TEST POPULATION (1/4" w/o fine screen			
	NISP 1/4	NISP fine	total	% 1/4	% fine		EXPECTED NISP		
Anura	0	46	46	0.00	1.00	0			
Squamata	0	0	0	0.00	0.00	1			
Anolis	0	23	23	0.00	1.00	0			
Testudina	3	1	4	0.75	0.25	36			
indetermi	0	3	3	0.00	1.00	0			
						Total			

Appendix 2. Figures

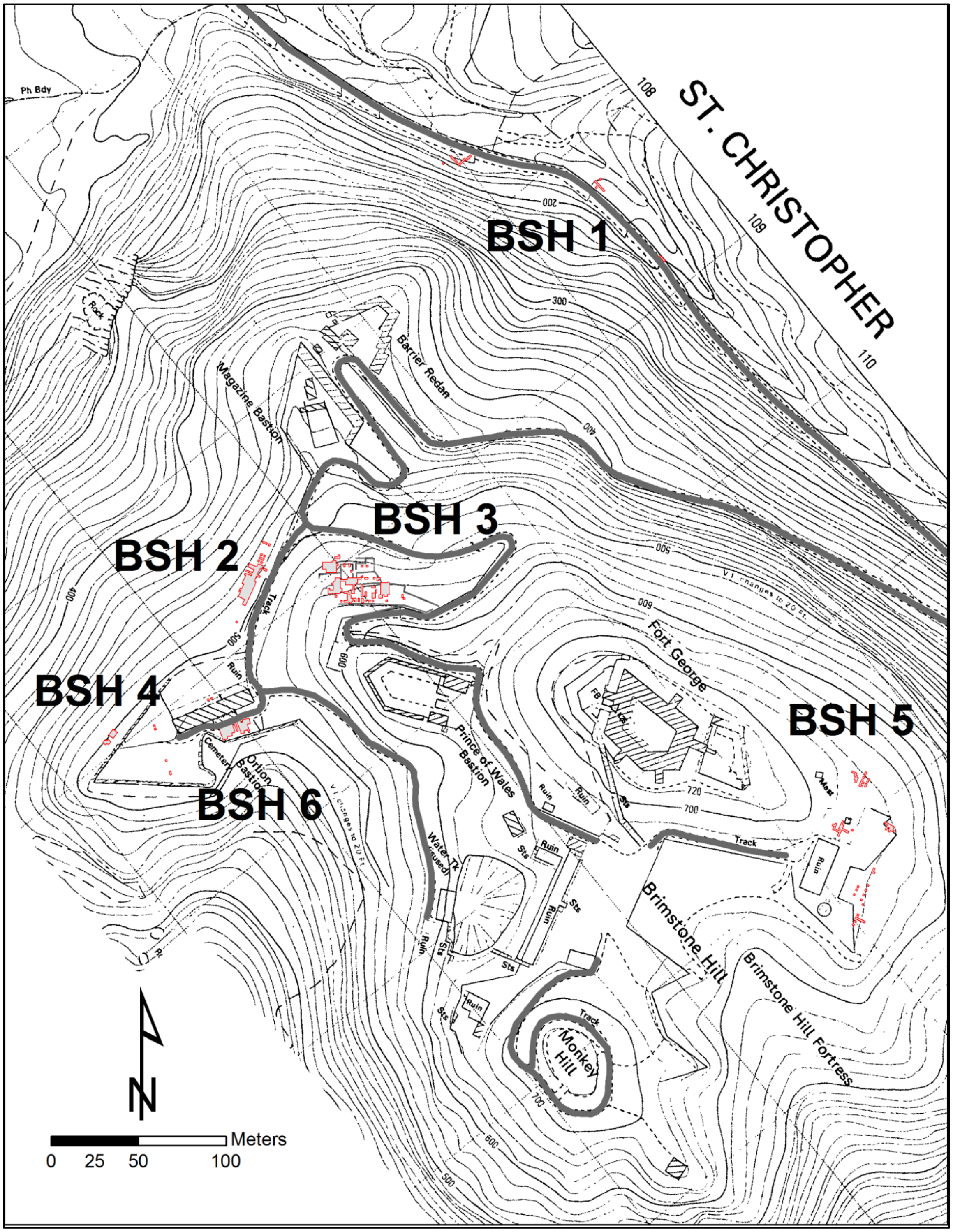

Figure 1. Map of Brimstone Hill Fortress Excavation Areas
Ordnance Survey Series DOS 043, Sheet St. Christopher 1017 and Part of 0917, 1986 edition

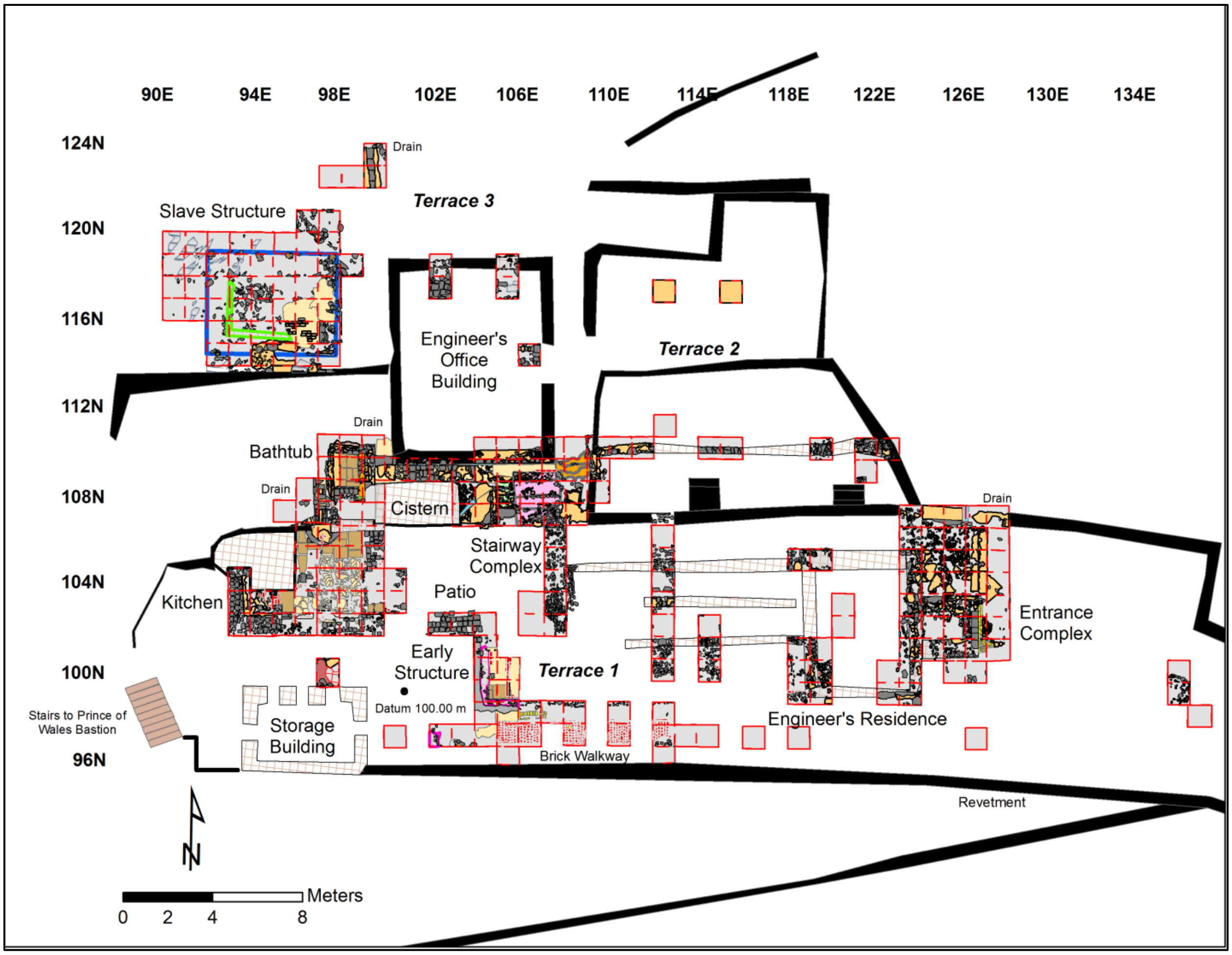

Figure 2. Map of Units Excavated at Brimstone Hill 3
Map compiled by Gerald F. Schroedl and Bobby Braly. ©

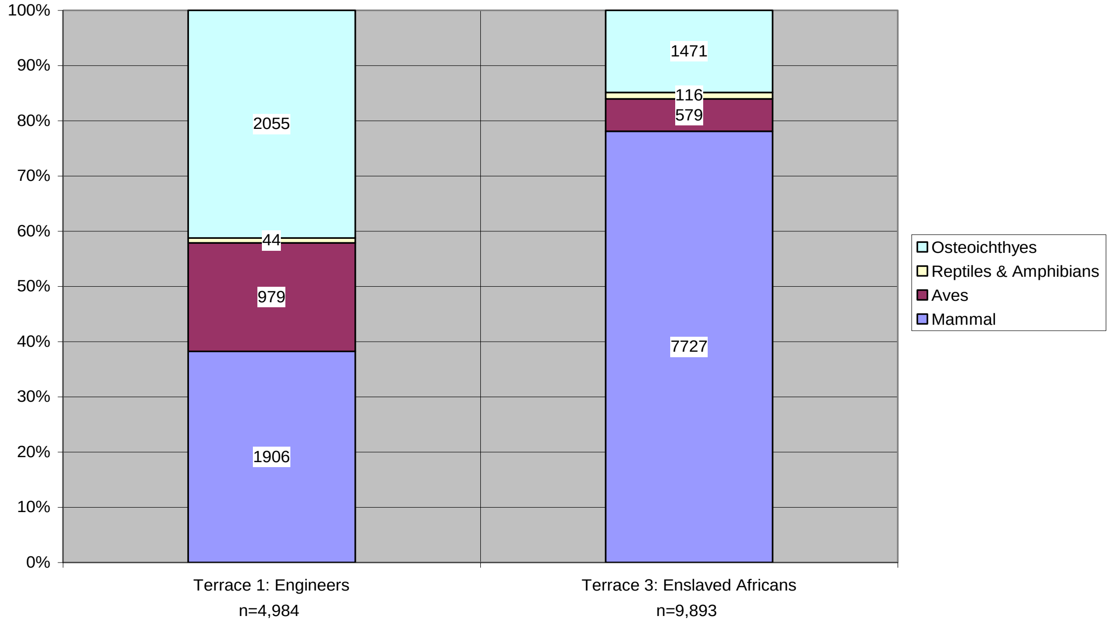

Figure 3. Relative Proportions of Faunal Material Identified to Class Level

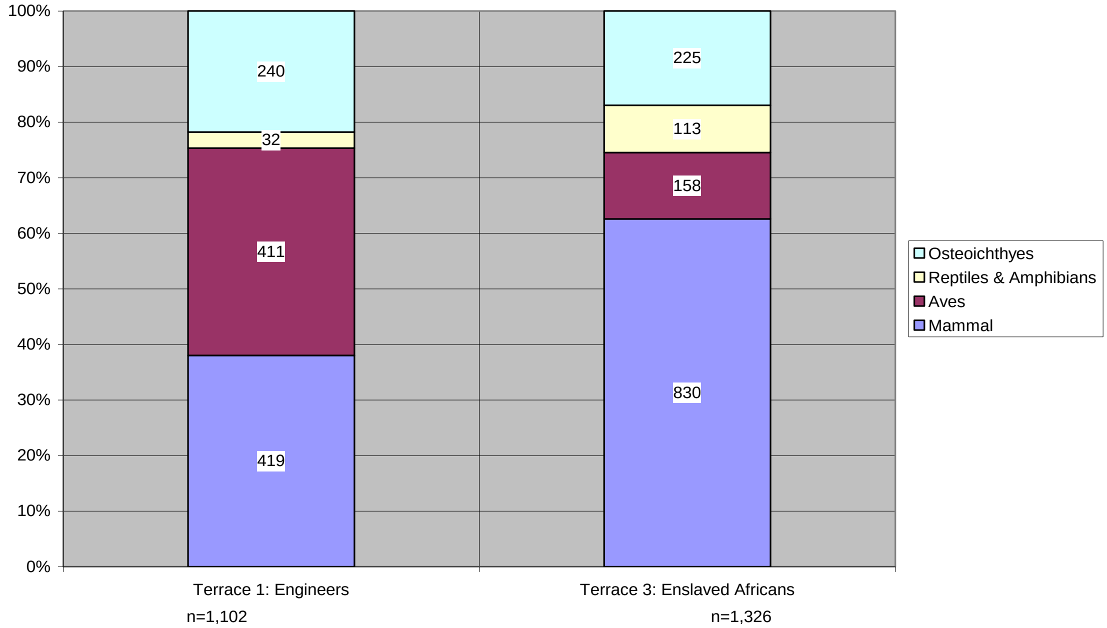

Figure 4. Relative Proportions of Faunal Material Identified to Family Level

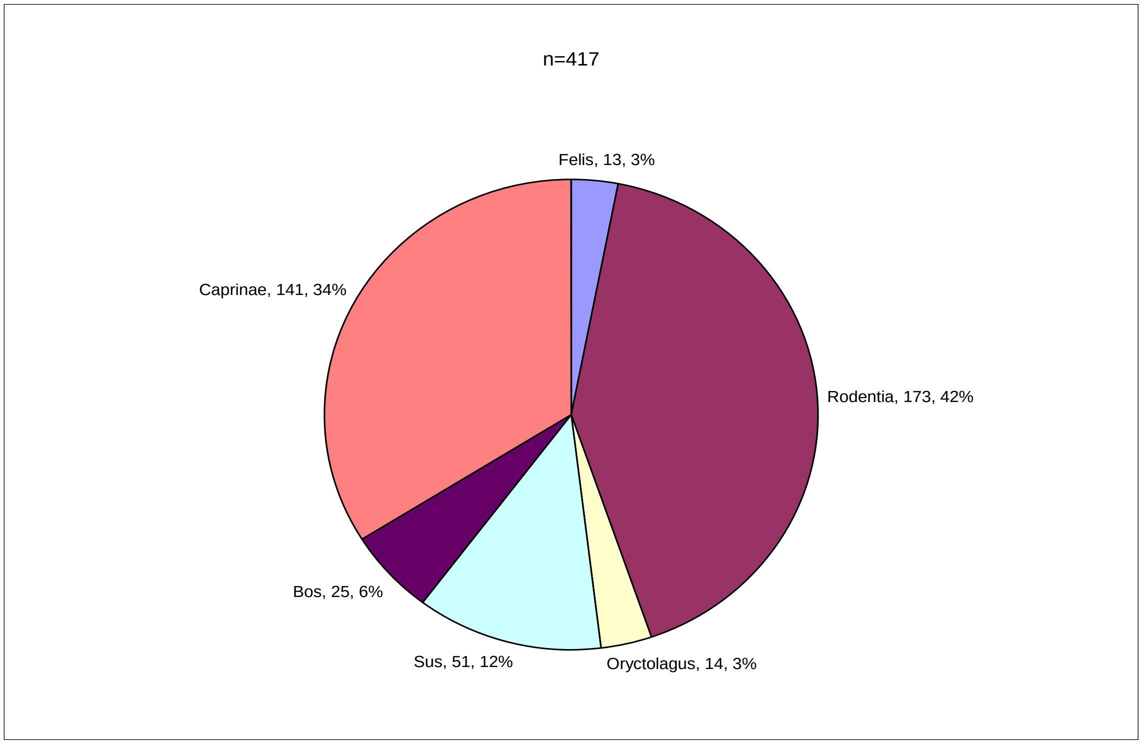

Figure 5. Relative Proportions of Mammal Remains Recovered at Terrace 1

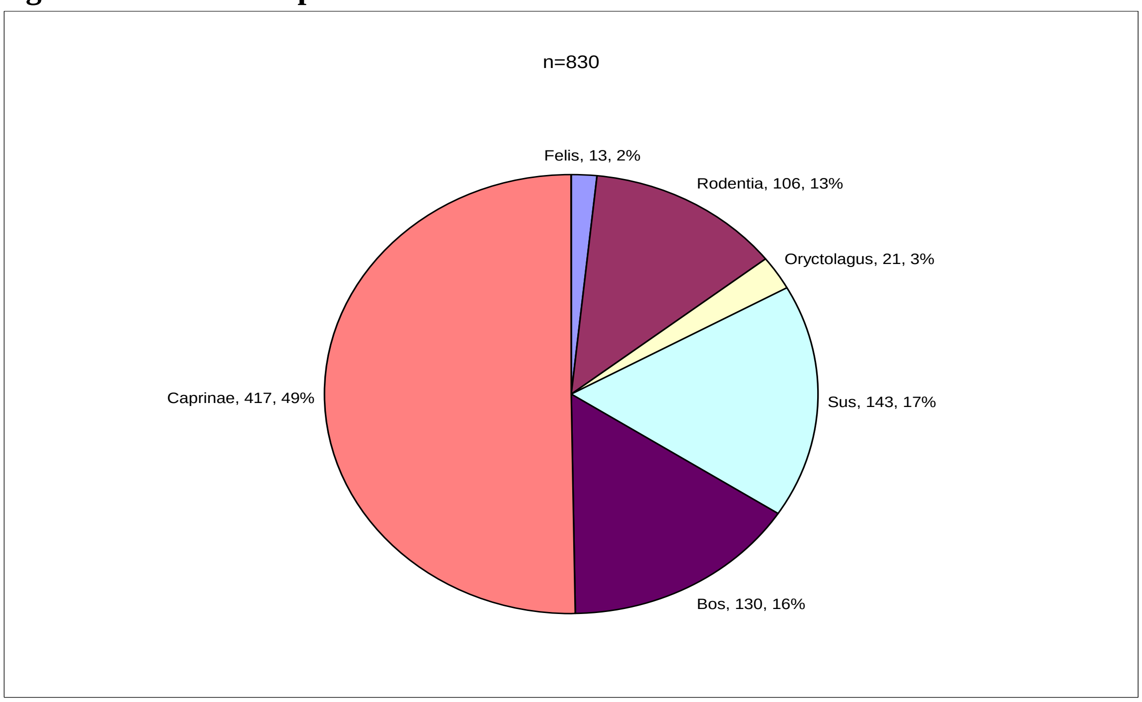

Figure 6. Relative Proportions of Mammal Remains Recovered at Terrace 3

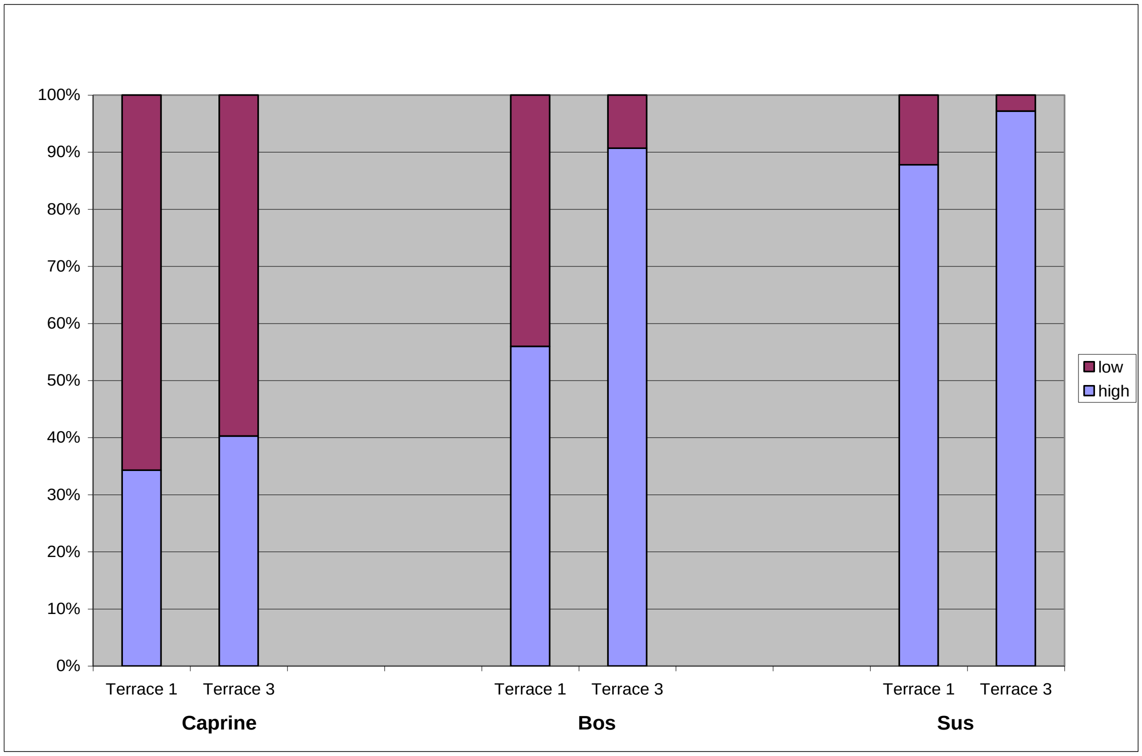

Figure 7. Skeletal Part Utility for Three Mammals

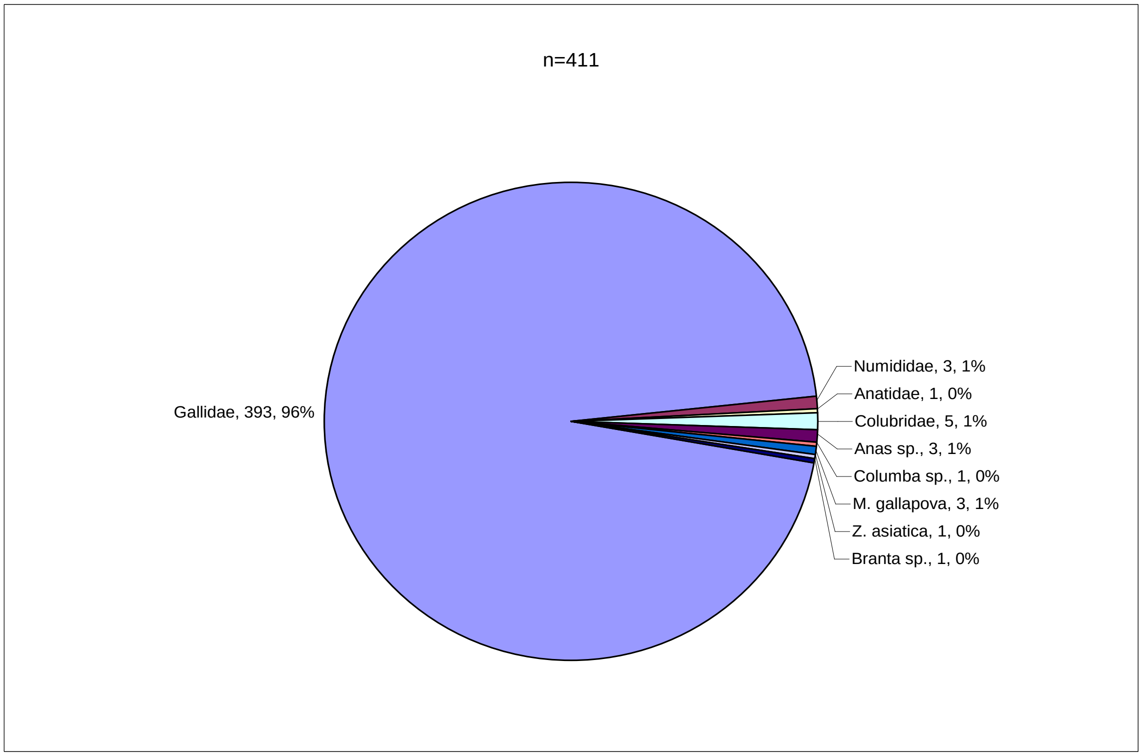

Figure 8. Relative Proportion of Bird Remains Recovered at Terrace 1

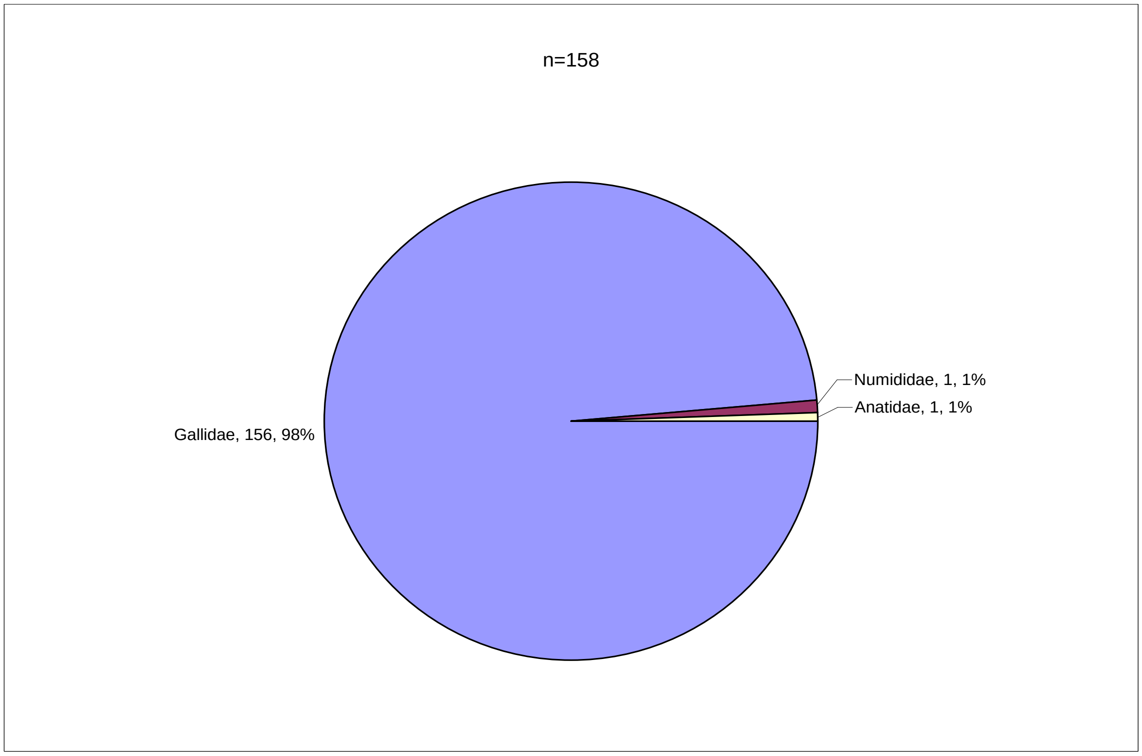

Figure 9. Relative Proportions of Bird Remains Recovered at Terrace 3

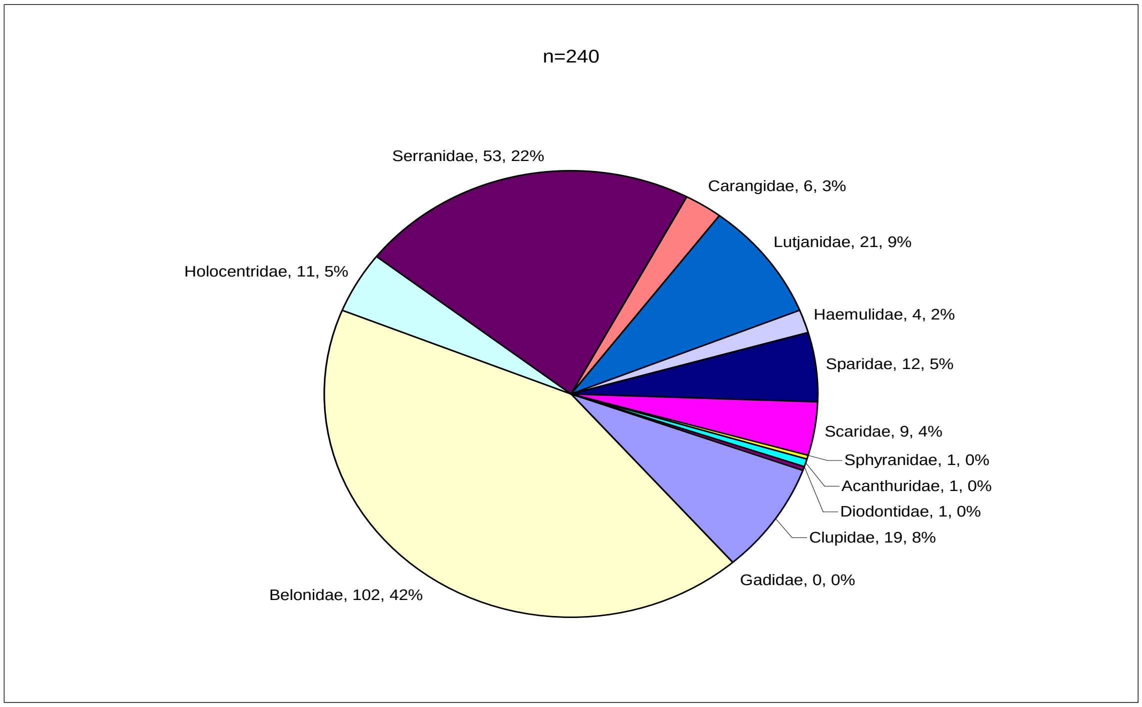

Figure 10. Relative Proportions of Fish Remains Recovered at Terrace 1

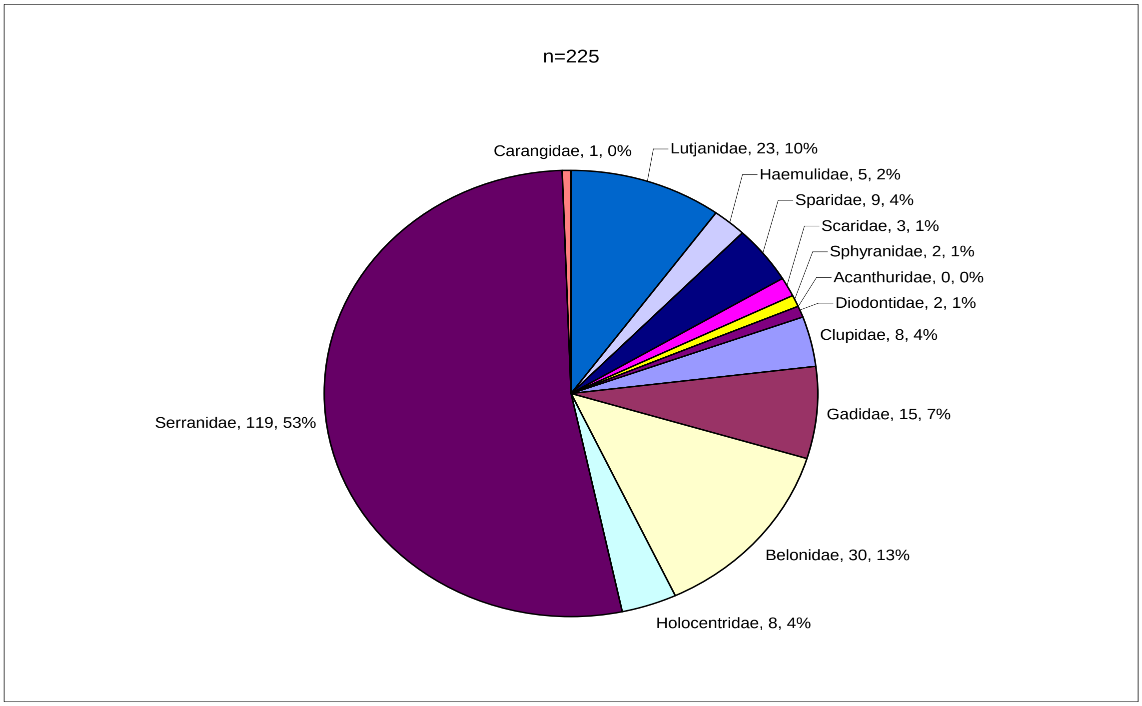

Figure 11. Relative Proportions of Fish Remains Recovered at Terrace 3

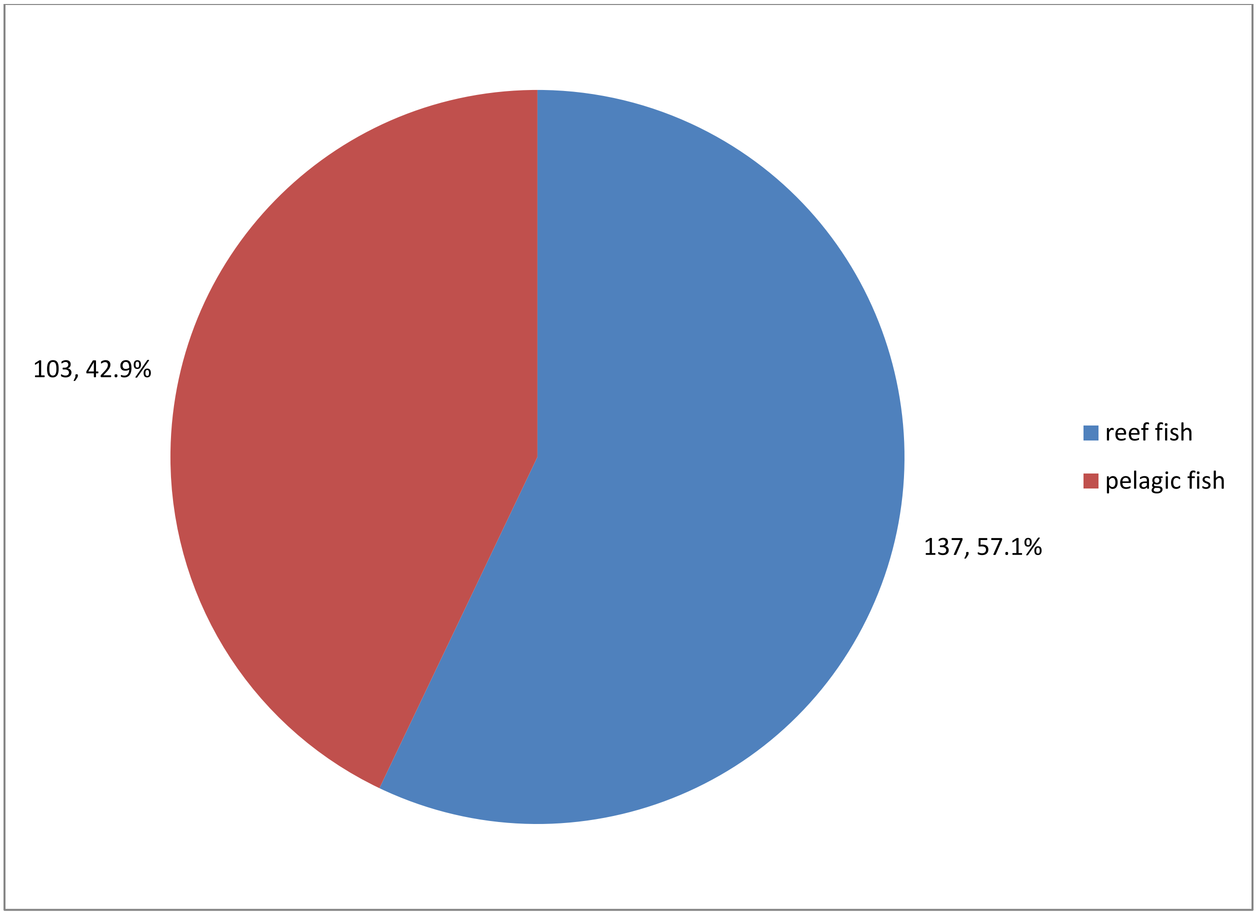

Figure 12. Terrace 1: Relative Proportions of Fish Categorized by Habitat

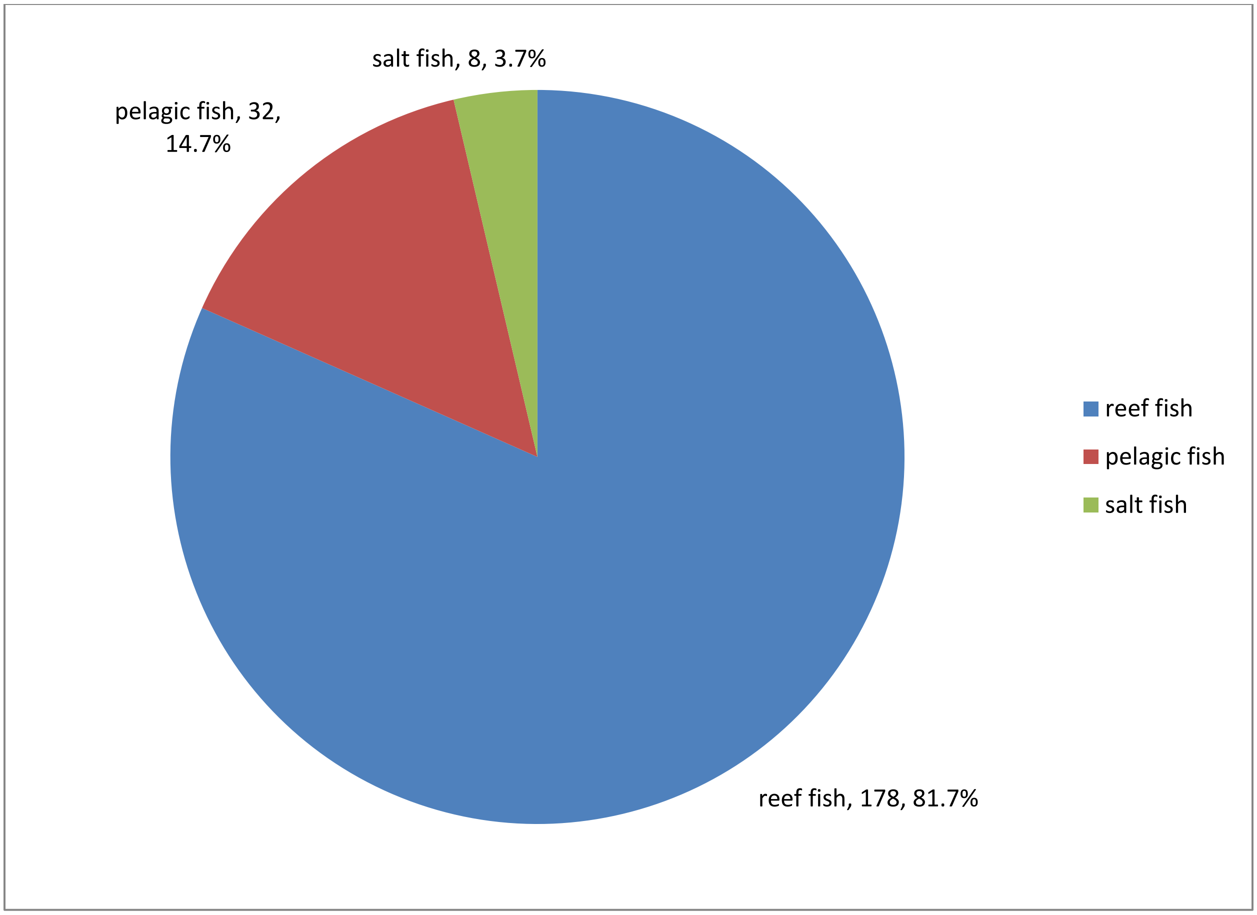

Figure 13. Terrace 3: Relative Proportions of Fish Categorized by Habitat

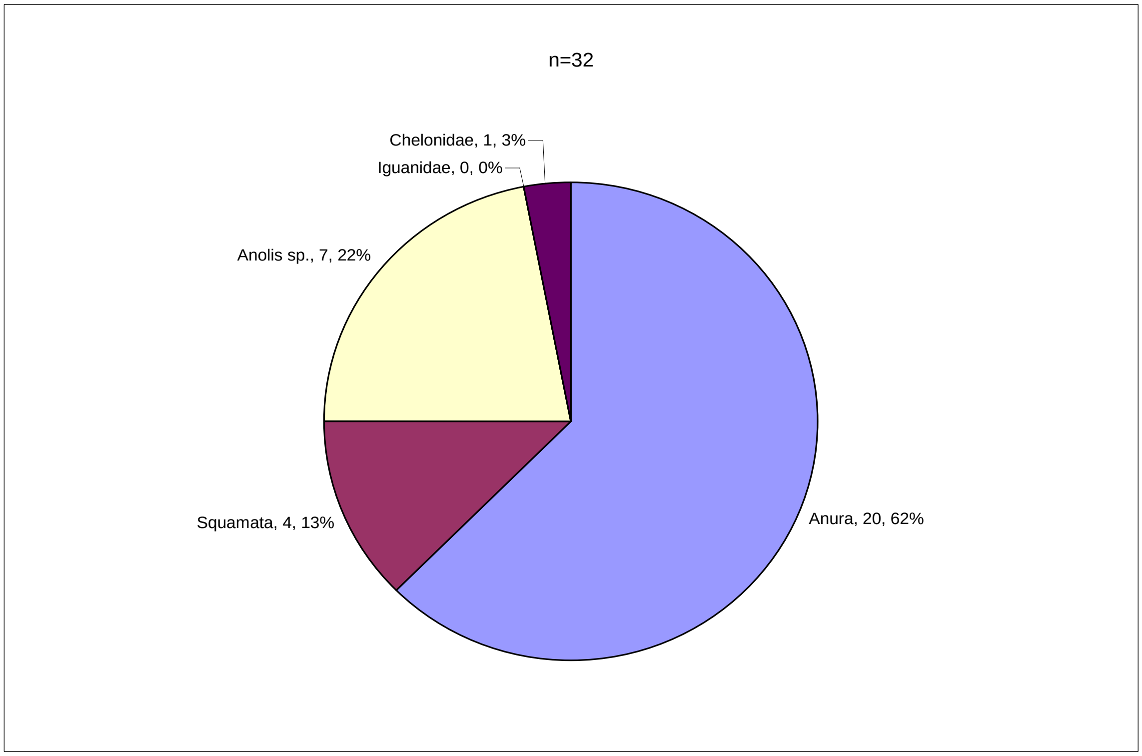

Figure 14. Relative Proportions of Reptile and Amphibian Remains Recovered at Terrace 1

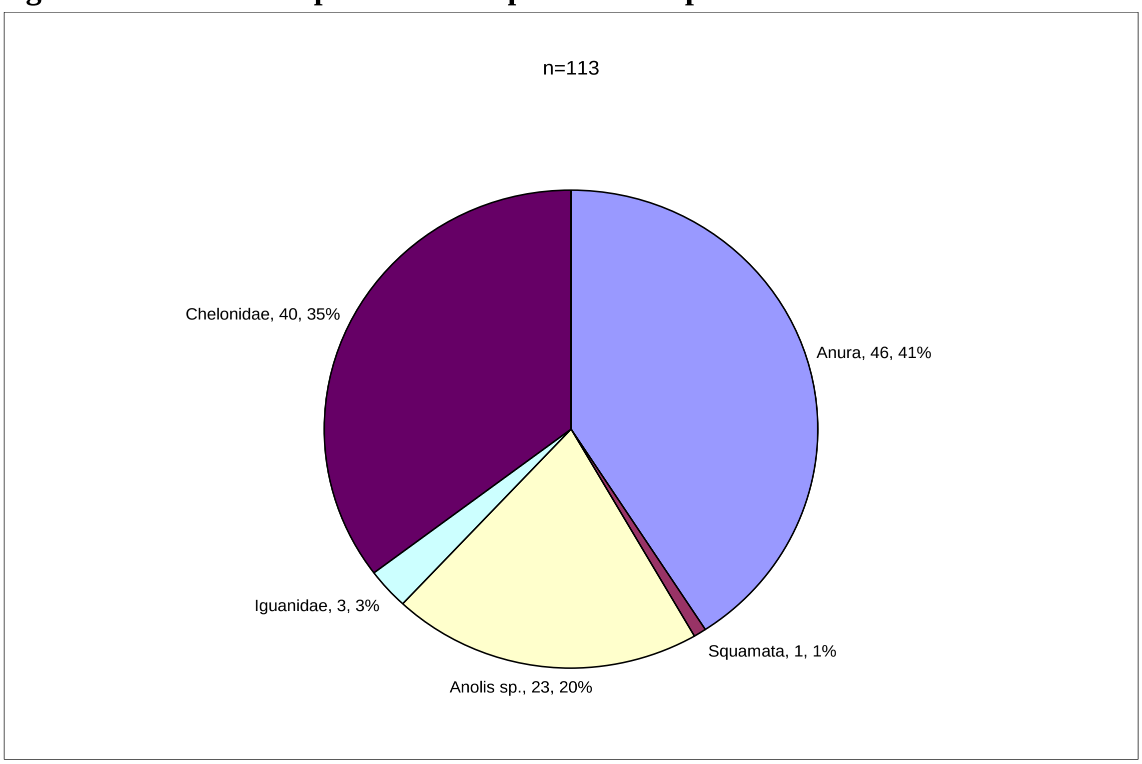

Figure 15. Relative Proportions of Reptile and Amphibian Remains Recovered at Terrace 3

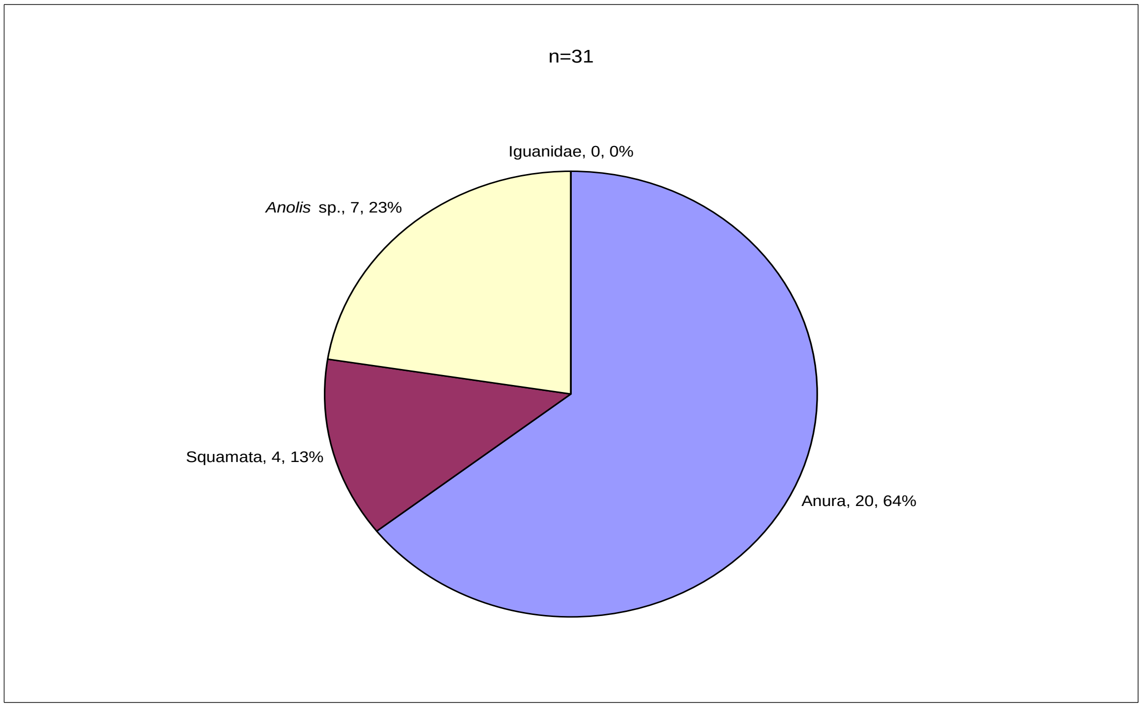

Figure 16. Reptile and Amphibian Remains Recovered at Terrace 1 (Excluding Chelonidae)

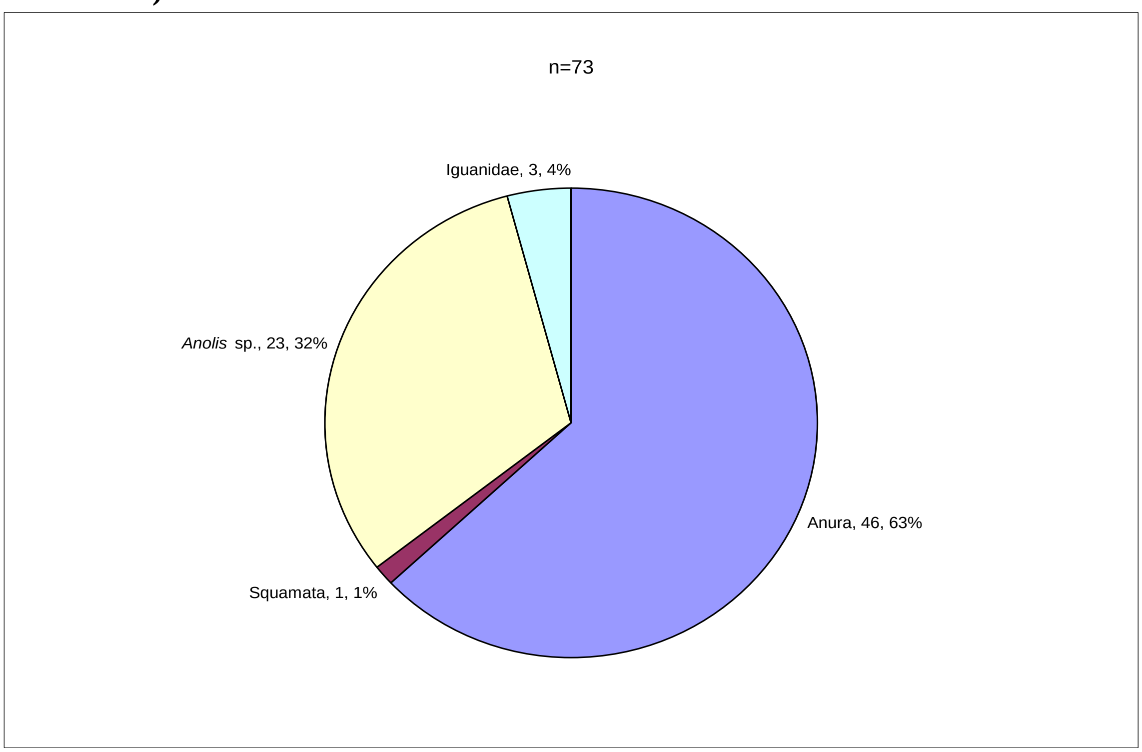

Figure 17. Reptile and Amphibian Remains Recovered at Terrace 3 (Excluding Chelonidae)

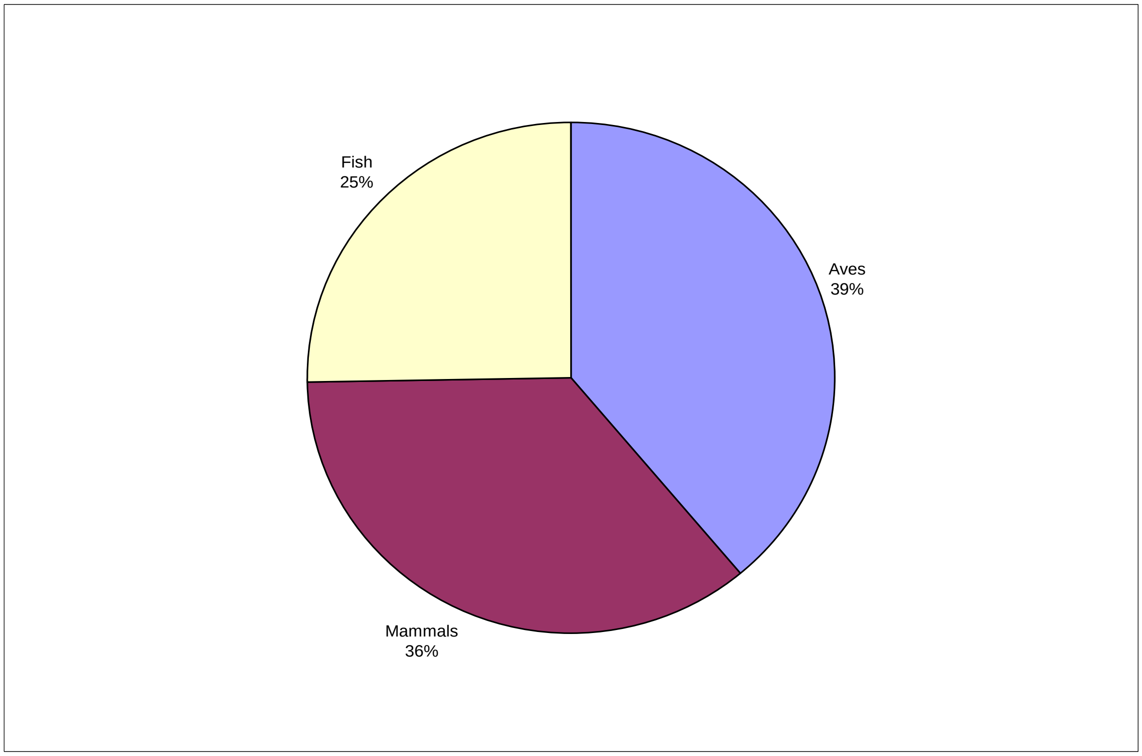

Figure 18. Relative Proportion Individual Animal Classes Contribute to Engineers' Diet

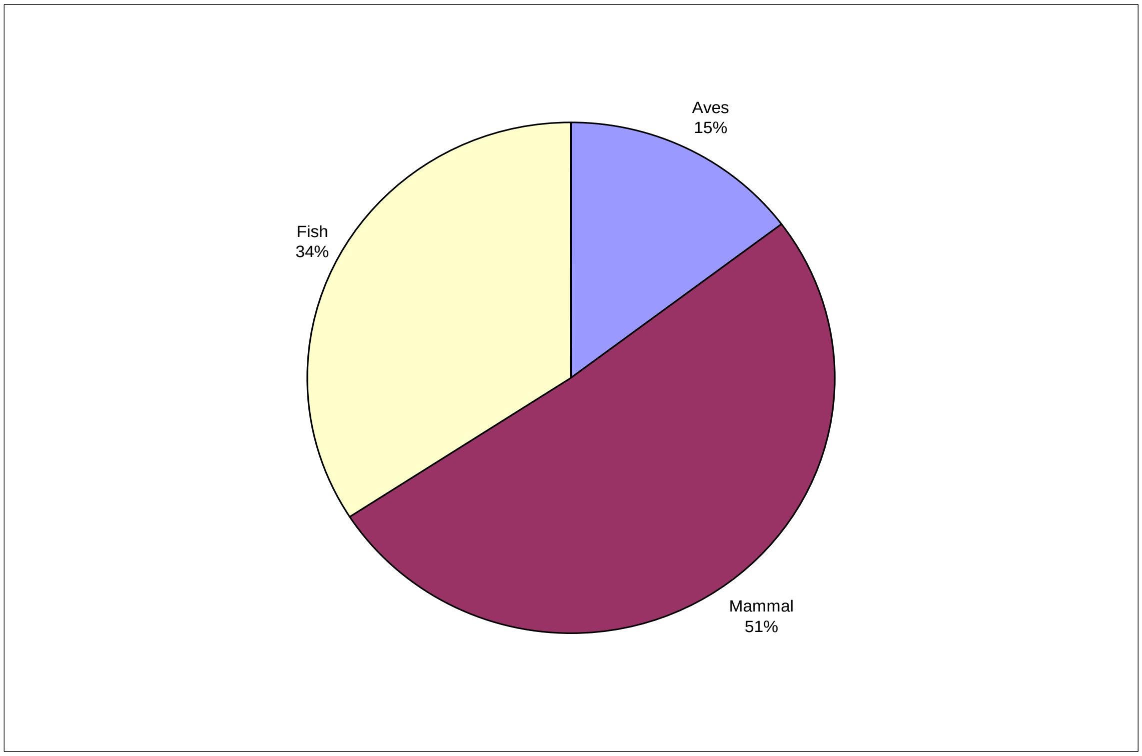

Figure 19. Relative Proportion Individual Animal Classes Contribute to Enslaved African Diet

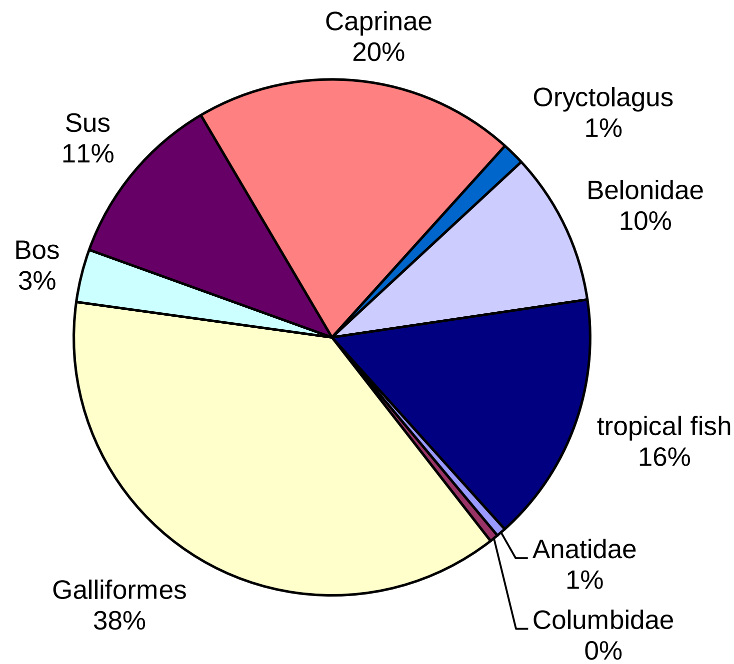

Figure 20. Specific Family and Genus Composition of British Engineers' Diet

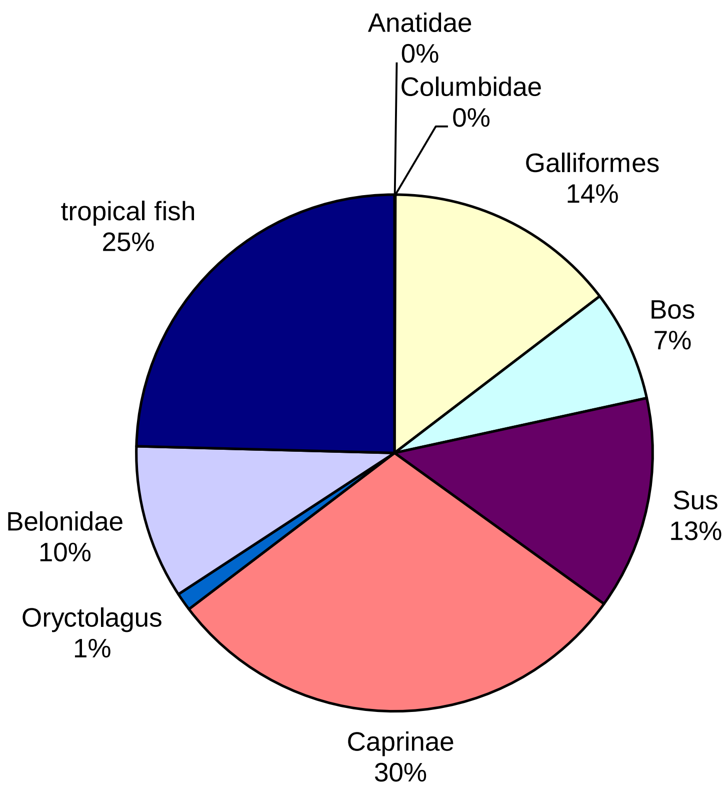

Figure 21. Specific Family and Genus Composition of Enslaved Africans' Diet

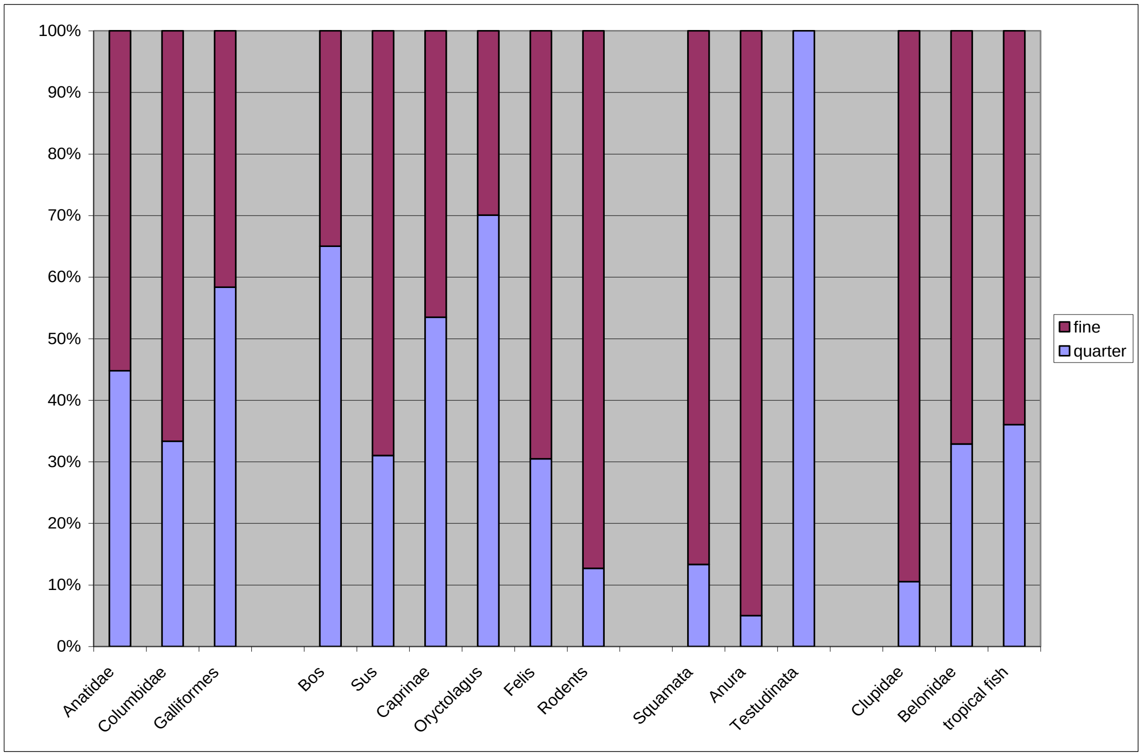

Figure 22. Terrace 1: Comparative Faunal Recovery Rates at Terrace 1

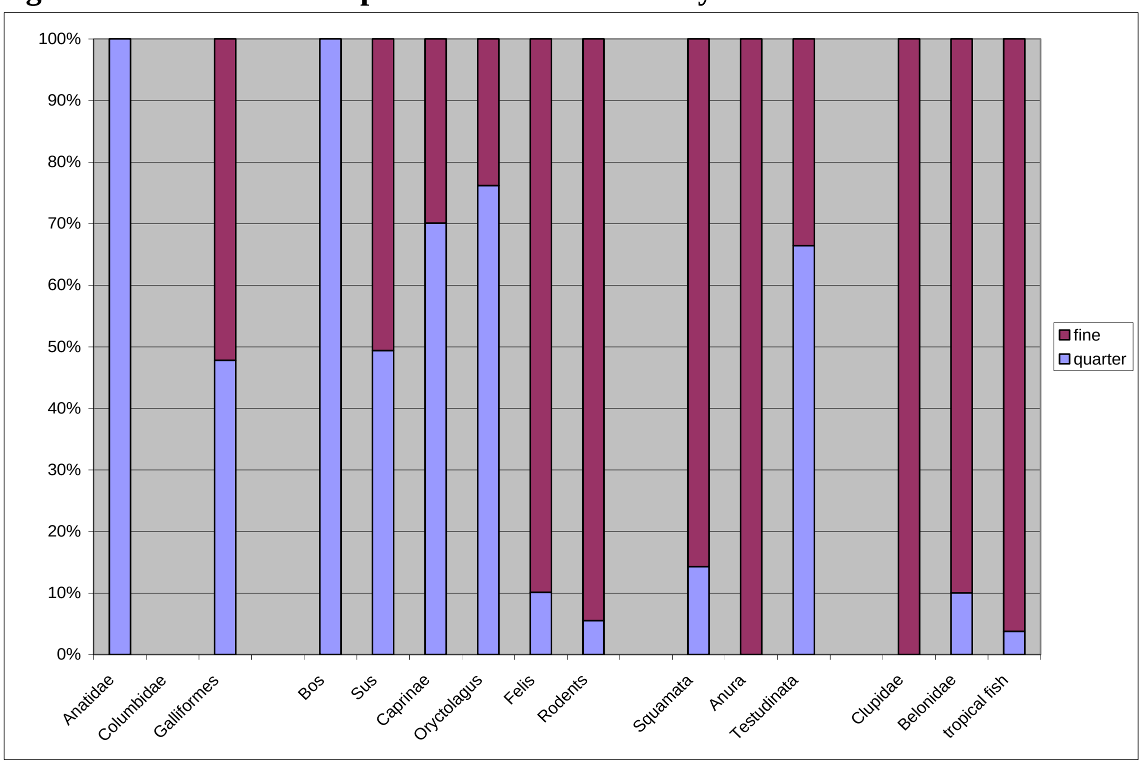

Figure 23. Terrace 3: Comparative Faunal Recovery Rates at Terrace 3

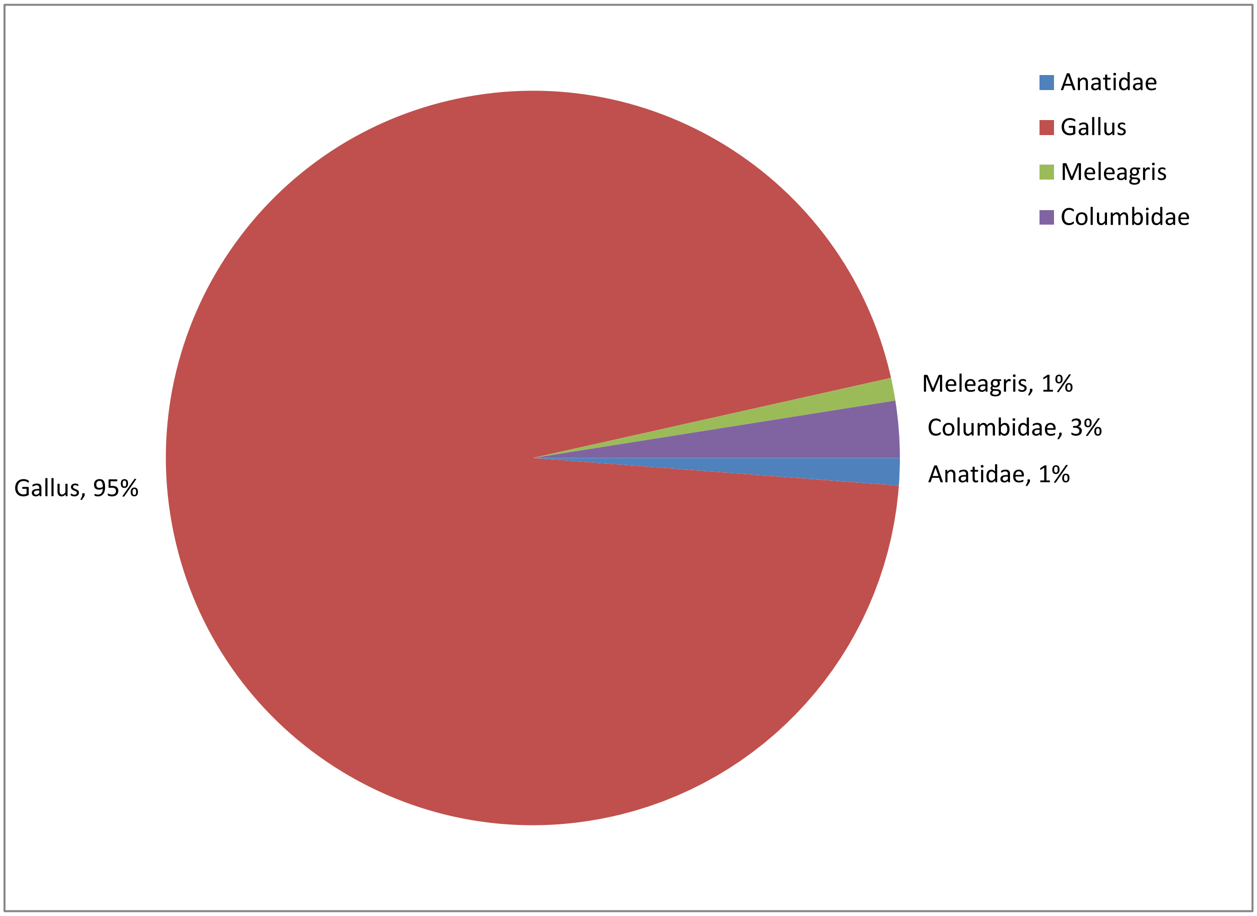

Figure 24. Terrace 1 Bird Remains (Expected Relative Proportions)

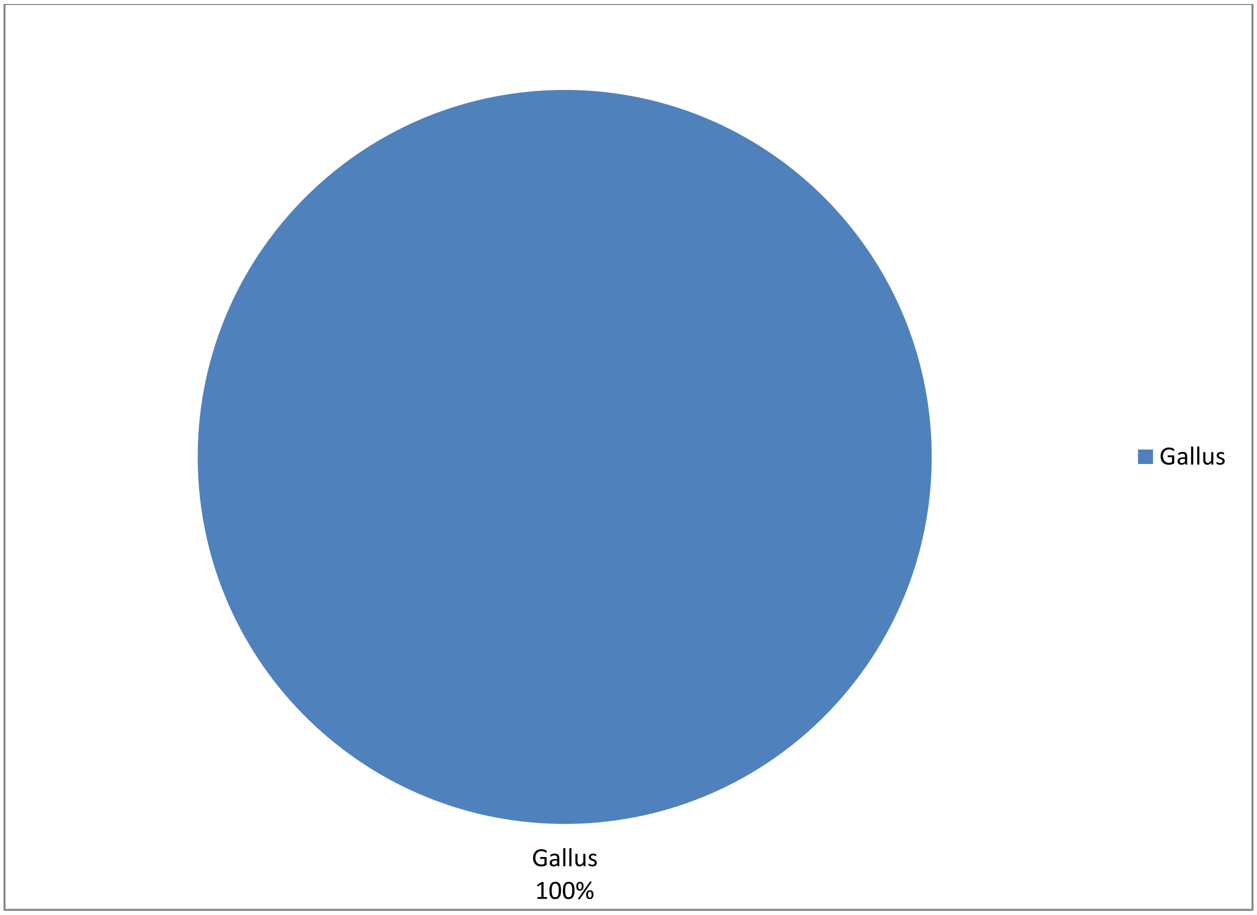

Figure 25. Terrace 3 Bird Remains (Expected Relative Proportions)

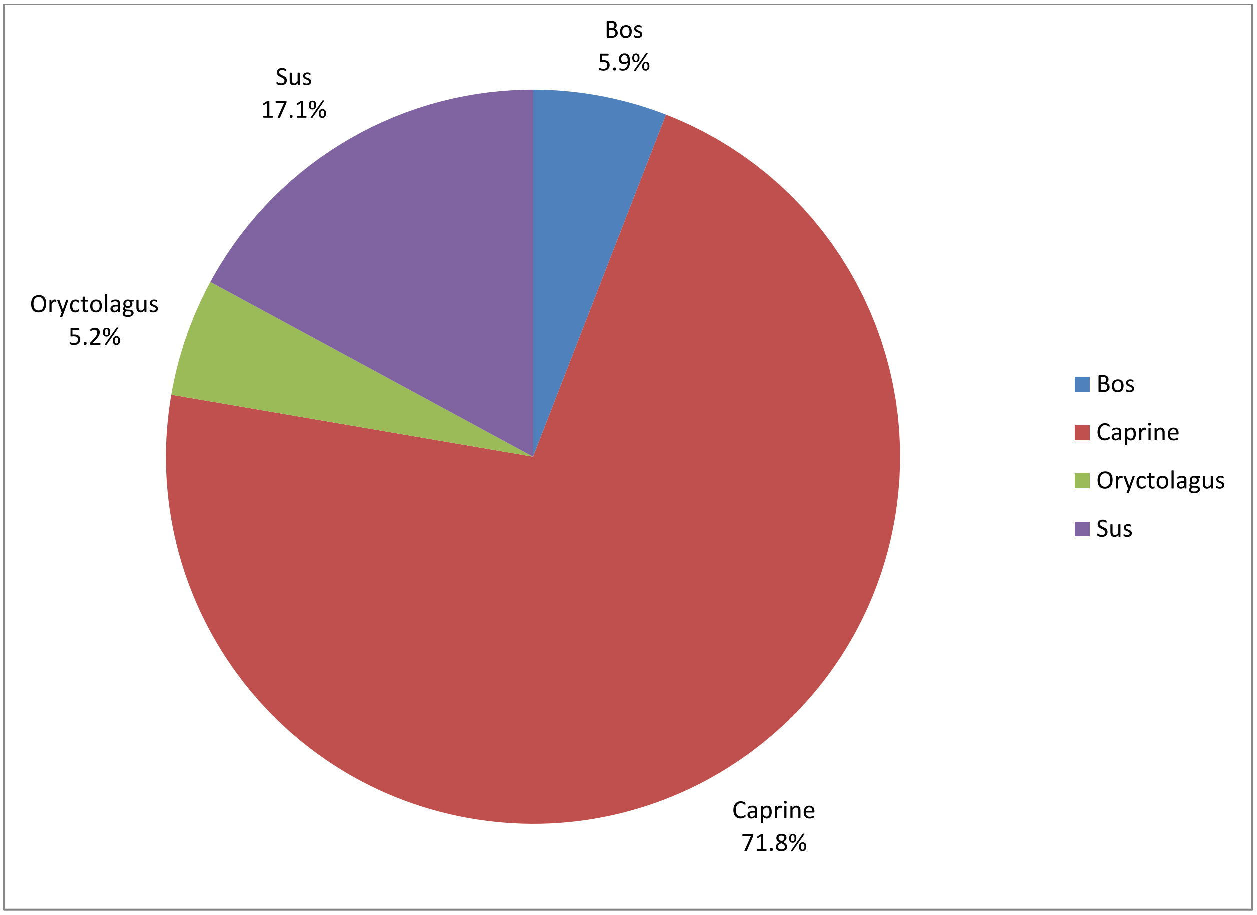

Figure 26. Terrace 1 Mammal Remains (Expected Relative Proportions)

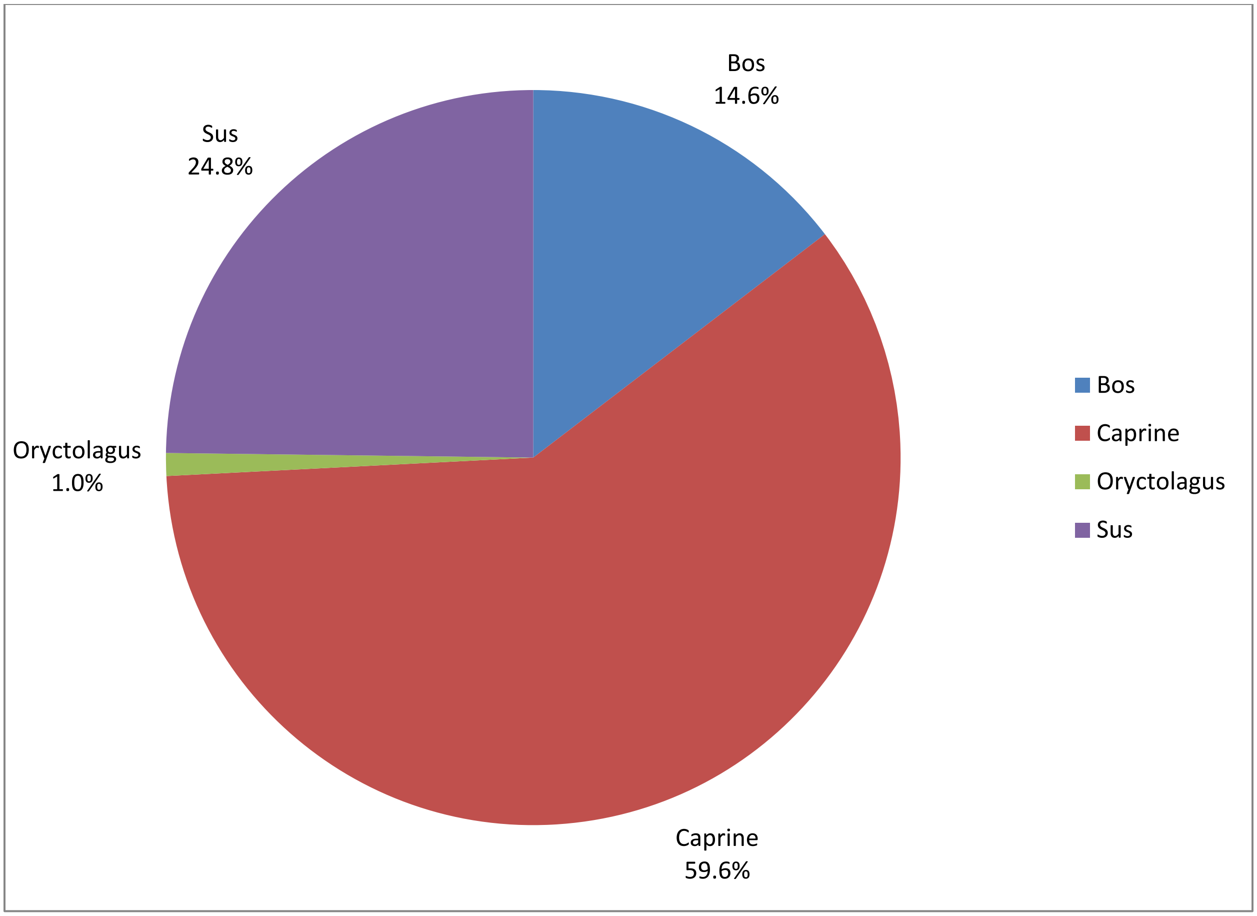

Figure 27. Terrace 3 Mammal Remains (Expected Relative Proportions)

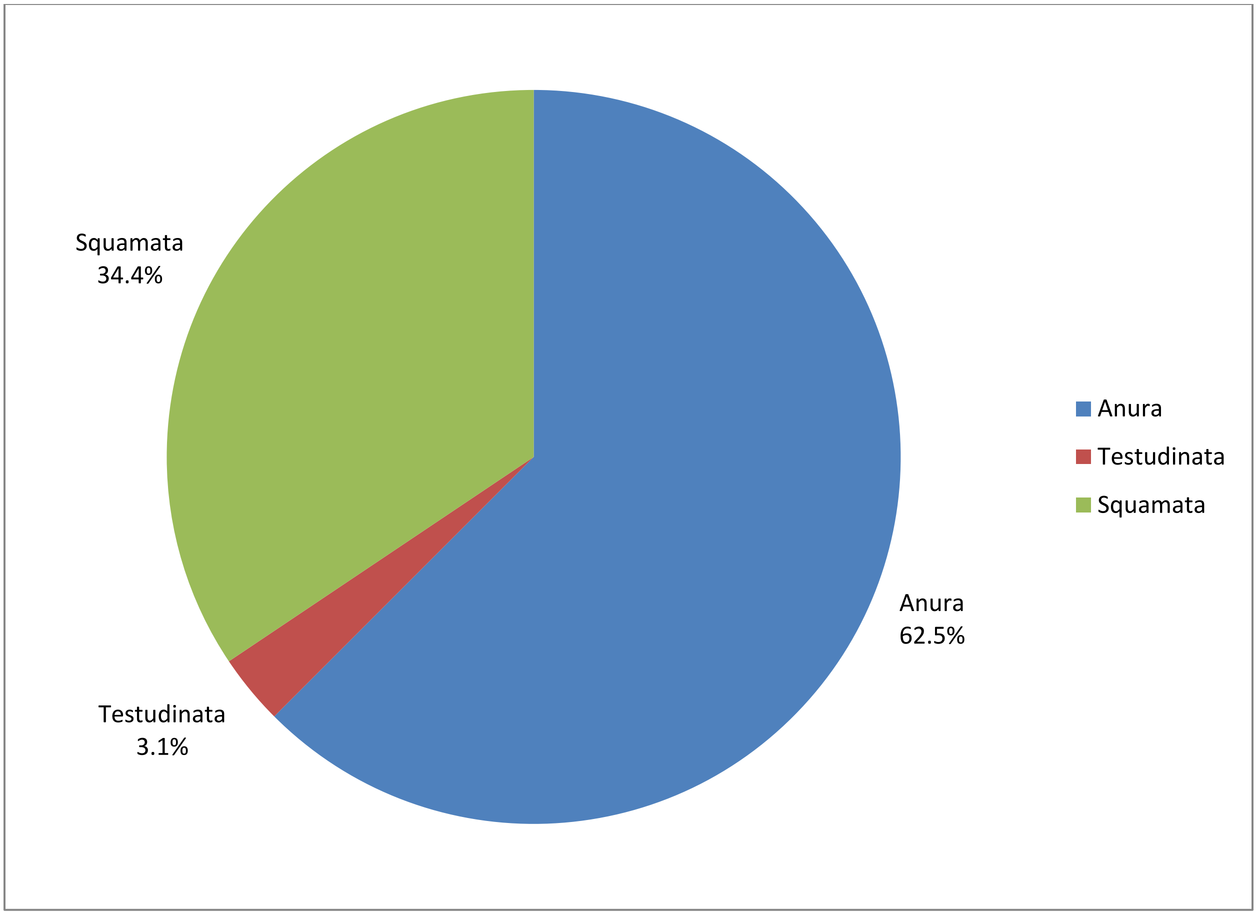

Figure 28. Terrace 1 Amphibian and Reptile Remains (Expected Relative Proportions)

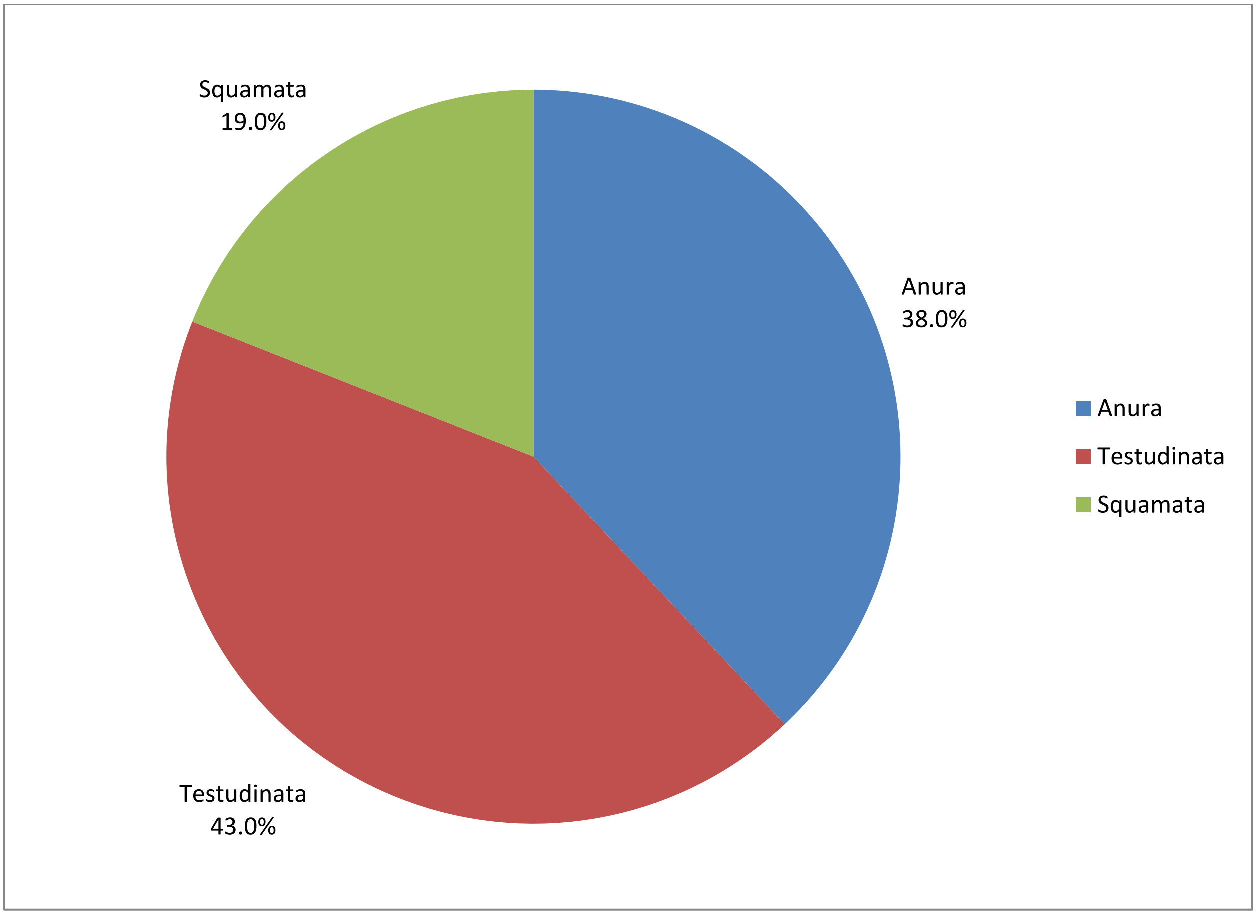

Figure 29. Terrace 3 Amphibian and Reptile Remains (Expected Relative Proportions)

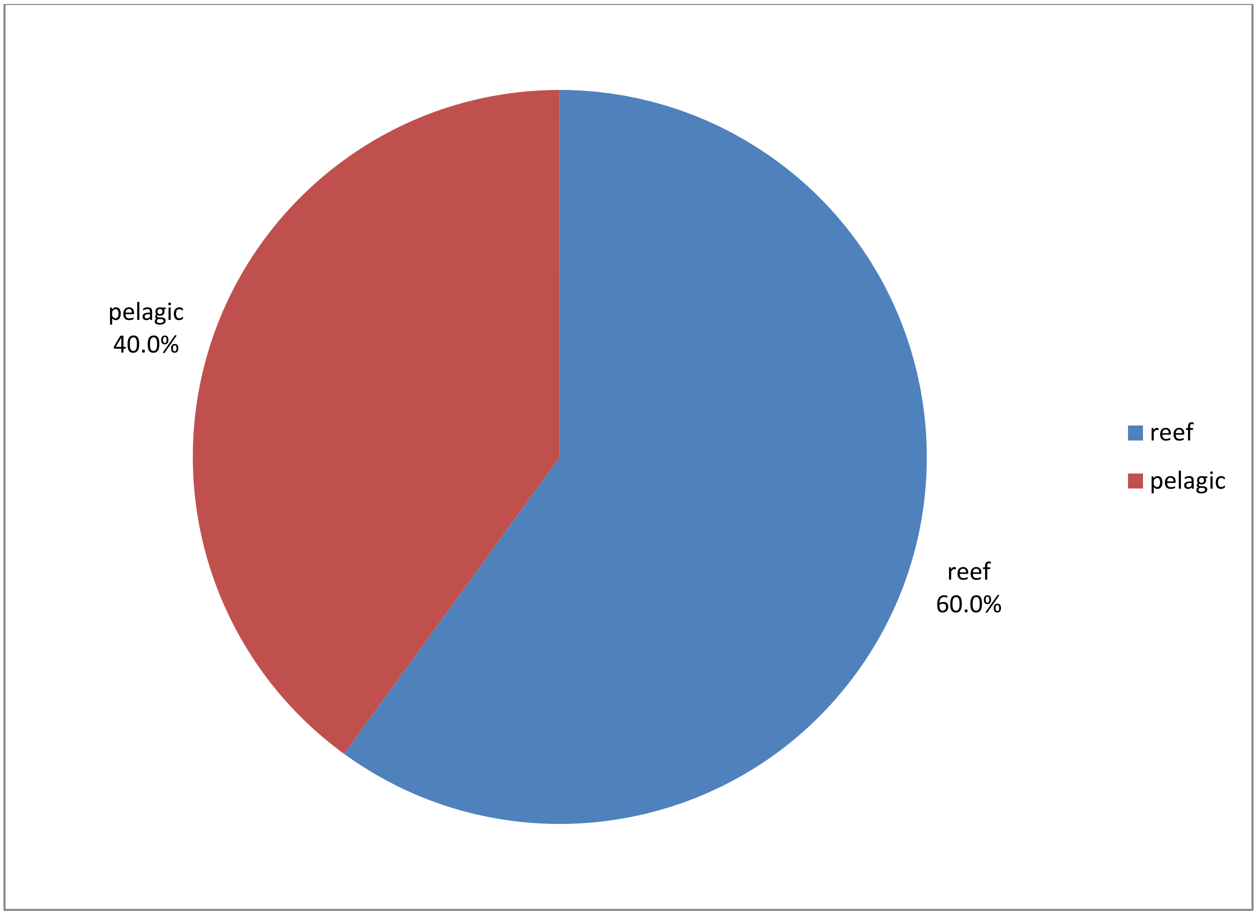

Figure 30. Terrace 1 Fish Remains (Expected Relative Proportions)

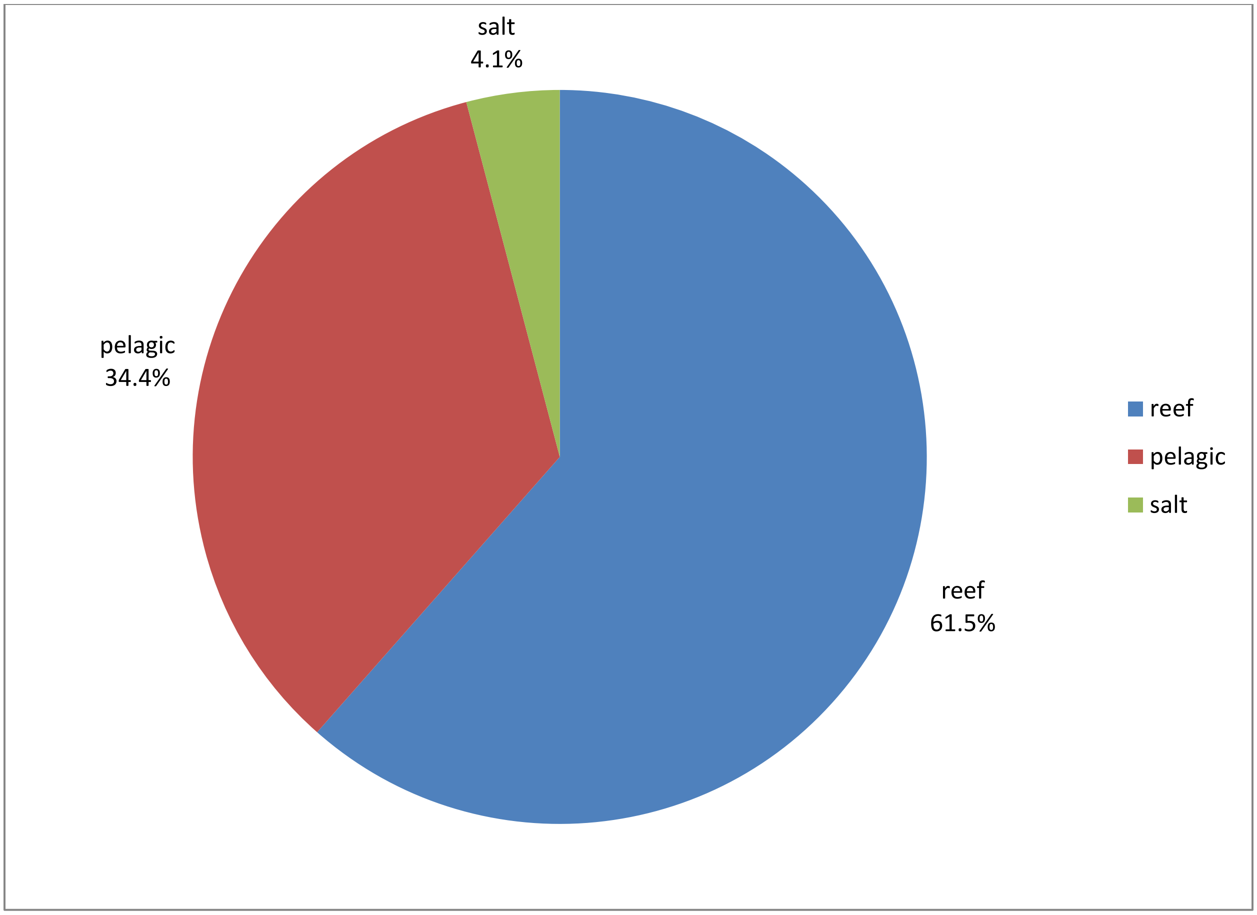

Figure 31. Terrace 3 Fish Remains (Expected Relative Proportions)

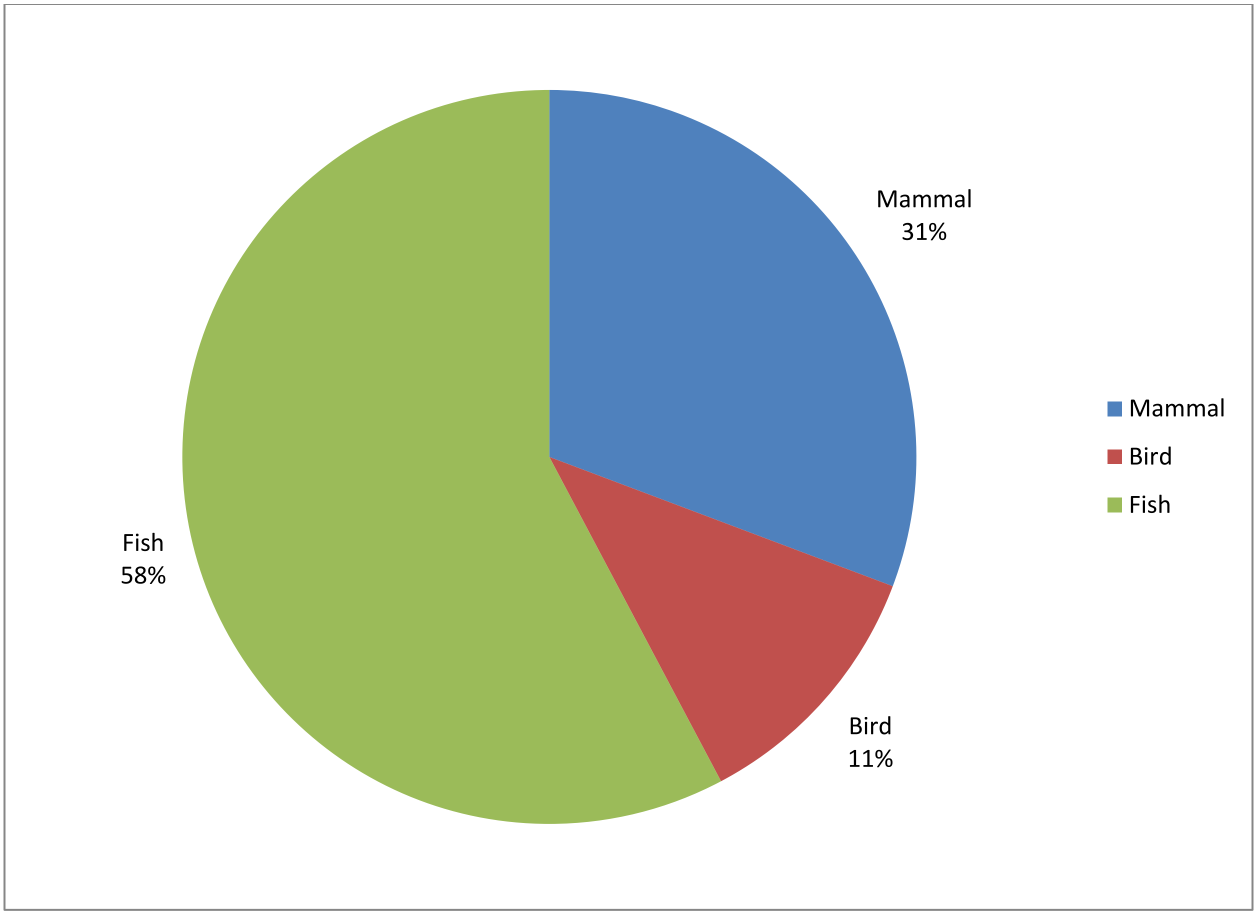

Figure 32. Animal Contributions to Engineers' Diet (Expected Relative Proportions)

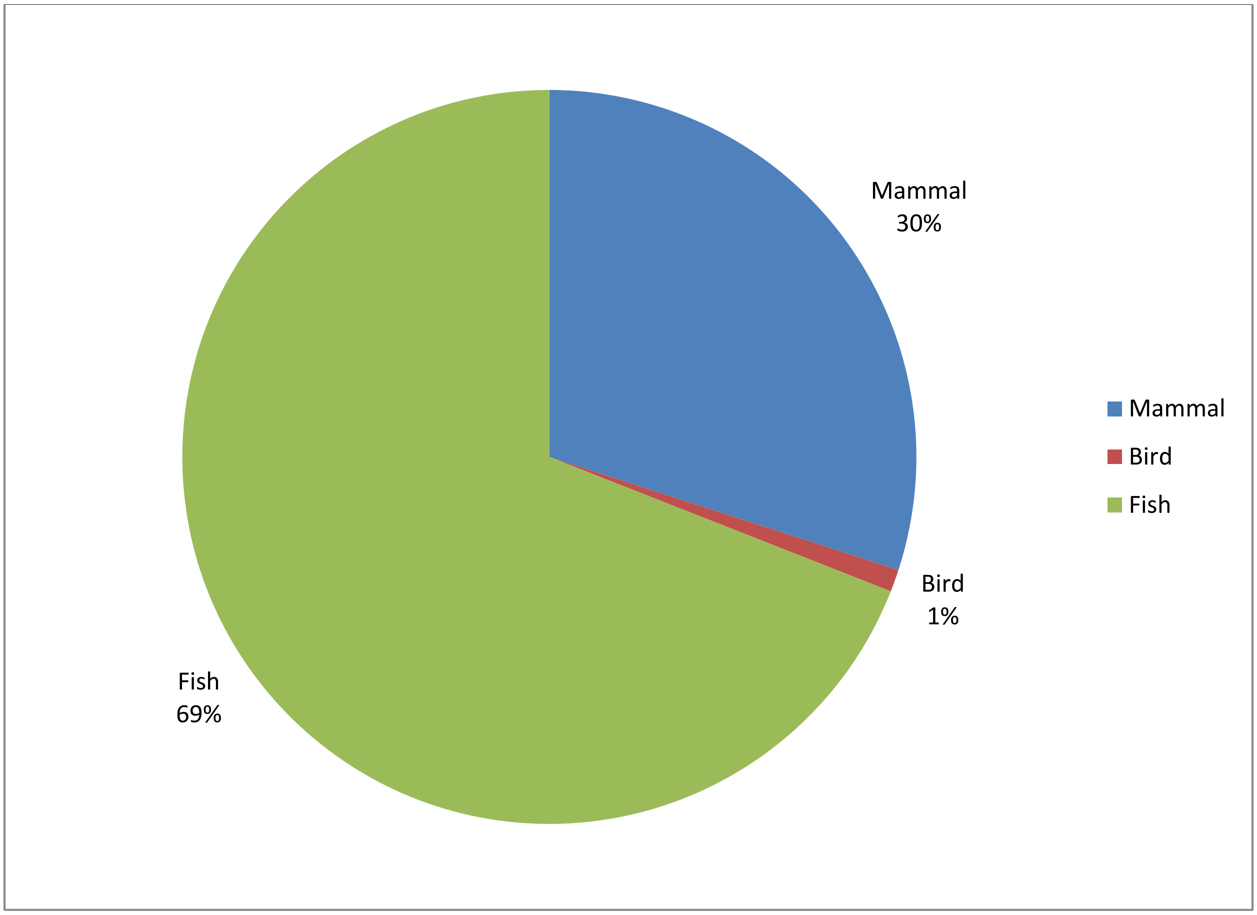

Figure 33. Animal Contributions to Enslaved African Diet (Expected Relative Proportions)

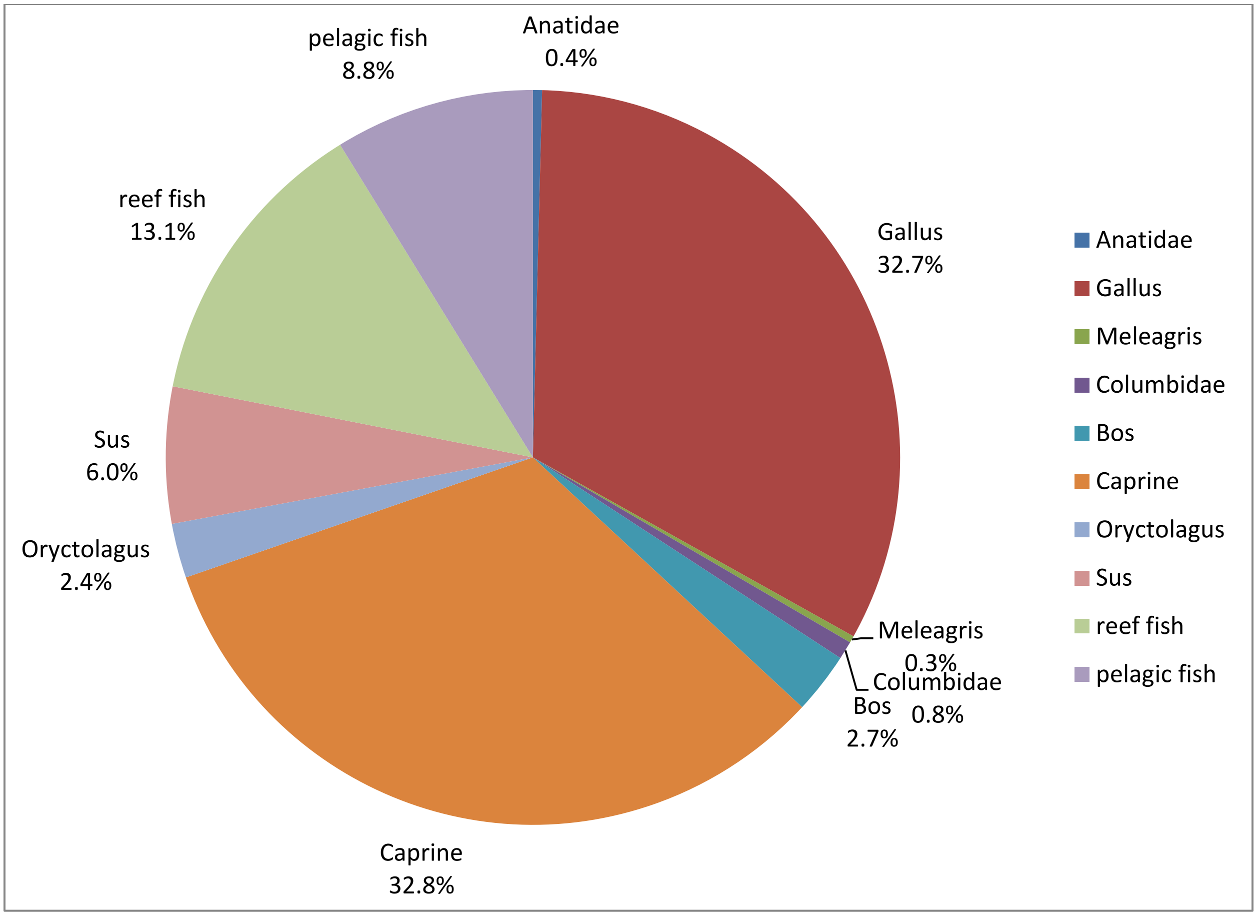

Figure 34. Animal Contributions to Engineers' Diet (Expected Relative Proportions)

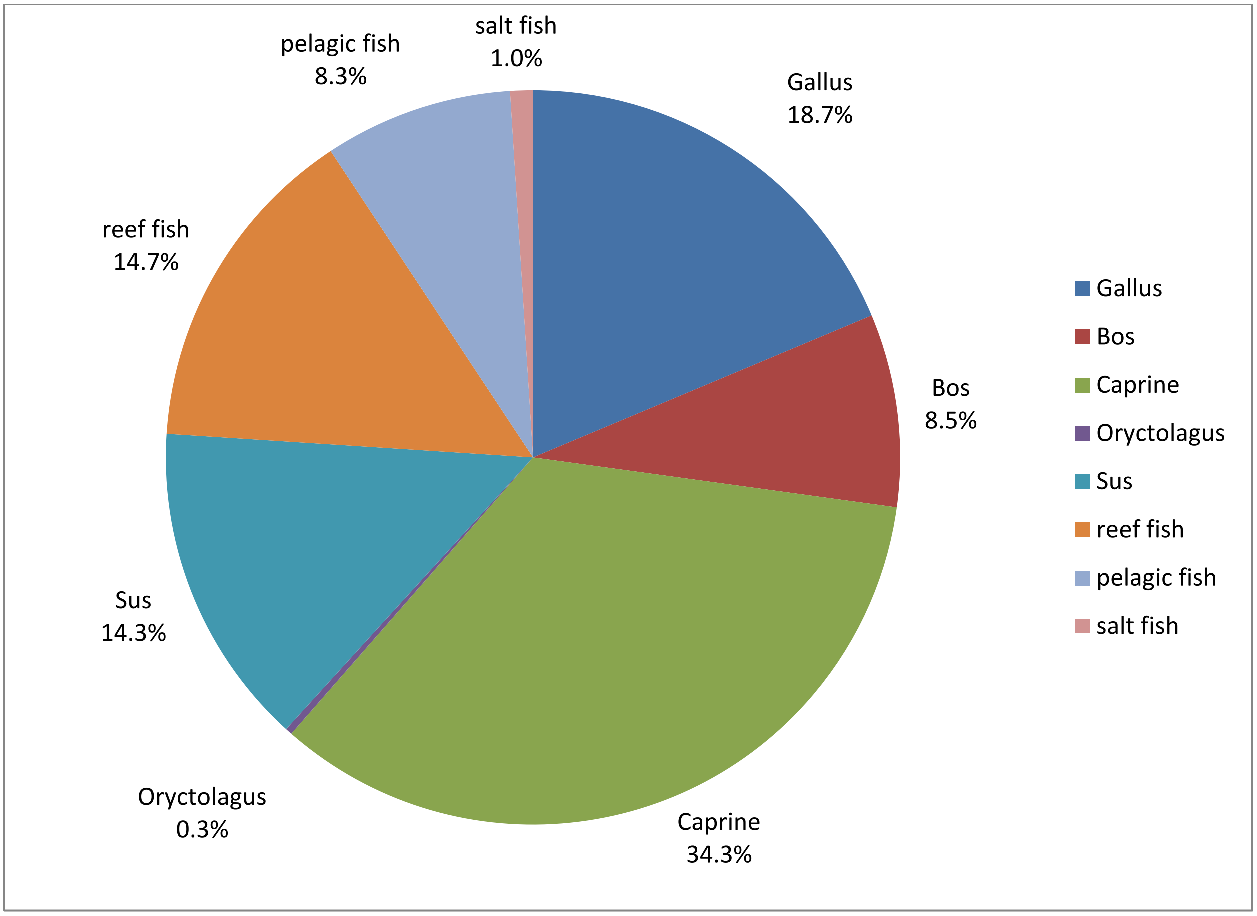

Figure 35. Animal Contributions to Enslaved African Diet (Expected Relative Proportions)

Vita

Ann Ramsey graduated Cookeville High School in 1998. She earned a B.S in Biology at the University of the South in 2002 and a B.A. in Anthropology at the University of Tennessee in 2004. In addition to zooarchaeology, her research interests include foodways and agroecosystems. Currently she is pursuing studies in sustainable agriculture.