

# **WHEN THERE'S NOTHING BETTER TO EAT: Subsistence Strategies in Eighteenth Century Bermuda**

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A Thesis

Presented to

The Faculty of the Department of Anthropology

The College of William and Mary in Virginia

In Partial Fulfillment

Of the Requirements for the Degree of

Master of Arts

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by

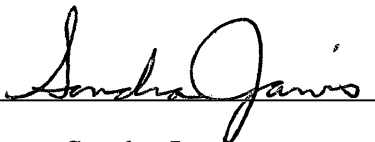
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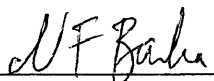
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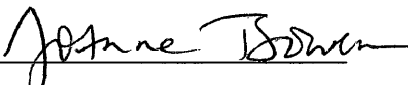
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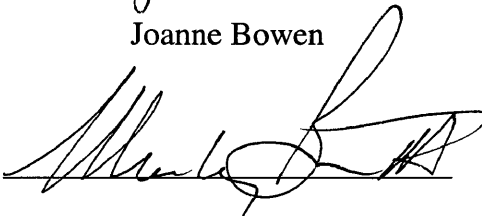
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# **Dedication**

To Mao and Pez

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## ABSTRACT

Subsistence studies analyze the relationship between a population and its resources. The means by which a population obtains foodstuffs and the subsistence resources exploited are reflective of the social and economic values of a given population. When used in conjunction with historical documents, archaeologically derived faunal remains are instrumental in the reconstruction of colonial diets and the ways in which foodstuffs were acquired, prepared and distributed.

In Historical Archaeology, subsistence studies have often been viewed as a means in which to validate the success of colonial adaptation to the New World. Traditional theoretical approaches to subsistence strategies, such as the British Barnyard Complex model and the Frontier model, are excellent examples of the uncritically accepted notion that 'traditional British foodways' would be reestablished in the colonies. Although both these models acknowledge the impact that the environment had upon the settlers and their subsequent adaptive strategies, they are incapable of providing an explanation as to how and why a subsistence strategy developed.

The analysis of the faunal assemblage from the Hill House site, Hog Bay Park, Sandys Parish, Bermuda, illustrates the need to examine all the variables affecting the subsistence strategies available to Bermudians during the seventeenth and eighteenth centuries. The analysis of the data in terms of Risk Reduction Theory helps to comprehend why fish became such an integral part of the Bermudian diet.

The persistence of fish in the diet of the Hill House occupants throughout the eighteenth century suggests that variability in food resources prevented the development of a subsistence system similar to those found in the mainland British colonies. The distinctly Bermudian subsistence system evolved in keeping with the local environmental limitations and the economic considerations

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## Introduction

European colonization of the New World had a tremendous impact on indigenous populations and on native fauna and flora in the Western Hemisphere. The clearing of fields for agricultural purposes and the establishment of provisional dwellings marked a new course for civilization in this region, and British colonists were foremost in setting this course. Academics have long been interested in how the newcomers adapted to their environment and how they adapted their lifeways to their circumstances.

Subsistence studies examine the relationship between a population and its resources. The choices made in terms of subsistence strategy availability and resource utilization are reflective of the social and economic values of a given population. The study of subsistence is not limited to the fields of anthropology and archaeology. Economists use diet as an index of growth and welfare in the economy (David 1967; Gallman 1971). Others use it to establish the general standard of living of a segment of society (Fogel *et al* 1978; Carr and Walsh 1980). Demographers attempt to reconstruct past diets in terms of nutritional quality to explain changes in population dynamics (Frisch 1978). Above all, subsistence studies contribute significantly towards understanding the history of a society when they are used as indicators of change.

The foremost historical, architectural, economical, and archaeological studies conducted for the early colonial period have focused on the British colonies in the Massachusetts Bay colonies and the Chesapeake region. Through such significant works as Yentsch's "Farming, fishing, whaling, trading: Land and sea as resource on eighteenth century Cape Cod" and Bowen's "Probate Inventories: An evaluation From the

Perspective of Zooarchaeology and Agricultural History at Mott Farm”, we have developed an understanding of the process by which colonists exploited local resources for subsistence and how they progressed from mere subsistence to prosperity.

Anne Yentsch used data from historical documents to reconstruct the subsistence systems of eighteenth century Cape Cod inhabitants. She examined probate records in terms of basic subsistence patterns. Patterns were distinguished by the presence or absence of technological objects and those associated with specific activities. Once established, Yentsch related these patterns to society in an attempt to understand regional differences (Yentsch 1988). Her work demonstrated that historical documents are extremely important in the analysis of subsistence. They provide information about the subsistence strategies employed by the colonist as well as some of the resources exploited – the types of livestock, the crops raised, etc. Travelers’ observations and letters, in particular, frequently give an impressionistic view of what was eaten. Quite often these travelers’ accounts will provide more details than native accounts since common everyday occurrences were often not noted. Historical documents cannot, however, reveal the relative importance of the various types of domestic animals and the significance of wild foods in the colonists’ diet, while the examination of archaeologically recovered faunal remains can (Bowen 1996).

Though American and Bermudian colonists share similar backgrounds, less is known about the Bermudian settlements. Westerners discovered Bermuda in 1609 when the Sea Venture, part of a fleet bound for the Jamestown settlement in Virginia, was cast upon the reefs off its eastern shore. Concurrently, as replacement ships were being built, several survivors surveyed the islands, recording the riches of the land. News of the potential wealth of Bermuda – fish, birds, citrus fruits and fertile soil – soon persuaded members of the Virginia Company in England of the great economic potential in a Bermuda colonization. In 1612, the Somers Island Company, an extension of the Virginia Company, sent sixty settlers to Bermuda.

Initially, the development of Bermuda resembled that of the American colonies. Labor-intensive tasks were required to establish the security and the profitability of the land. Wild resources supplemented the foodstuffs that the colonists had brought from England. However, after the first decade, colonial development in Bermuda began to diverge from that on the mainland. Bermuda experienced an increase in population in the 1620s due to early economic successes and its healthful climate. By the 1650s and 1660s, the Bermudian population, burgeoning from low mortality and high fertility rates, had surpassed the carrying capacity of the finite amount of land (Jarvis 1994:5). In addition, the production of tobacco in the mainland colonies depreciated the economic strategies practiced in Bermuda. Population pressures, combined with shifts in economic strategies, affected the subsistence practices used in Bermuda (Bowen and Jarvis 1994:81).

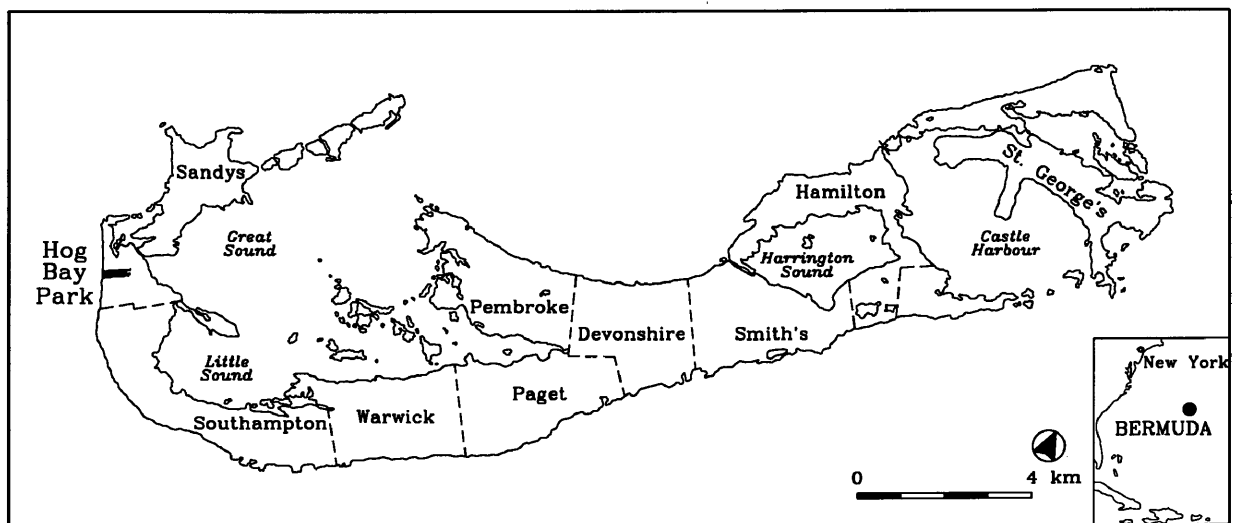
Until recently, data obtained from the examination of faunal remains was delegated to the appendices of archaeological research papers – mere “descriptive afterthoughts” (Honerkamp and Reitz 1983:335). The rise of zooarchaeology has greatly advanced the role of faunal remains in our interpretations of past lifeways. Faunal remains are instrumental in the reconstruction of colonial diets and the means by which foodstuffs were acquired, prepared and distributed. The analysis of faunal remains can reflect economic status, ethnicity, changes in the environment, and changes in group values. When used in conjunction with historical documents, faunal remains can help establish or refute the validity of working hypotheses (Honerkamp and Reitz 1983:22). The validity of this approach can be seen with Joanne Bowen’s research into subsistence systems at the Mott Farm, located on Narragansett Bay, Rhode Island. The inhabitants of the Mott Farm, during the early eighteenth century, were sheep owners who raised sheep to be sold at market. Following logically, the assumption was made that mutton would constitute a large portion of the Mott’s diet and would thus be reflected in the faunal remains. However, the analysis of the faunal assemblage indicated that pigs and cattle

were the predominate species that made up the diet. Bowen was able to explain the contradictions between the archaeological evidence and the documentary evidence by examining the probate records (Bowen 1975).

Our knowledge of lifeways in Bermuda is still very limited. Until recently, a majority of the historical works written presented a generalized view of Bermudian economic and social history. These works have primarily focused on St. George's, especially during the following time periods: (i) the discovery and subsequent settlement of Bermuda (1609); (ii) the dissolution of the Somers Island Company (1684); and (iii) the American Revolutionary War (1776 - 1781) (Agbe-Davies 1993:4). To augment this historical research, archaeological investigations have been conducted in St. George's and Devonshire Parish and on Castle Island (Barka and Harris 1994; Barka, Harris and Harvey 1997). These investigations have provided a better understanding of life in Bermuda in the eighteenth and nineteenth centuries. To date, however, the only faunal remains that have been completely analyzed are those from the Henry Tucker House in St. George's (1762 - 1840s). The analysis of the Tucker assemblage has helped to identify subsistence strategies used by the individuals living in the house (Bowen and Jarvis 1994:88). Although Somerset Island was the most densely populated portion of Bermuda in the eighteenth century, very little historical or archaeological research has occurred. Historical references to the West End of the island, Sandys Parish in particular, have generally been concerned with illegal activities. Therefore, very little is known about the lifeways of Bermudians in Sandys Parish in the seventeenth and eighteenth centuries.

In 1992 the College of William and Mary International Field School took the first step to remedy this deficiency. Archaeological investigations focused on three domestic structures located within the newly established Hog Bay Park – the Zuill and Mayor Cottages and the Hill House. (Figure 1). The goal of this project was to evaluate the archaeological and historical potential of each site. Although the excavations at the Zuill

and Mayor Cottages were informative, the Hill House excavations proved to be the most fruitful. Contrary to expectations, the soil buildup surrounding the house was relatively deep and it yielded a multitude of artifacts and faunal remains. Investigations of primary documents, including island assessments, parish wills, probate inventories and deeds, could not confidently associate an individual name to the Hill House (Agbe-Davies 1993:5). An analysis of the artifacts suggest that the occupants were of a fairly low socio-economic status – either tenant farmers, slaves or indentured servants.



**Figure 1** Map of Bermuda showing the location of Hog Bay Park, Sandys Parish.

Despite the lack of a known personage, the archaeological assemblage from the Hill House is significant. The seemingly undisturbed stratigraphic sequence, dating from the late seventeenth century to early eighteenth century through the middle of the eighteenth century, provides a unique, insightful view of early Bermudian lifeways. Of particular interest is: (i) How the Hill House faunal assemblage compares to the ‘traditional British foodways’ model of animal use?; (ii) Would the diet of the Hill House occupants resemble those found at British colonial sites in Georgia and the Chesapeake?; (iii) If not, then what were the variables influencing the decisions to use one subsistence resource over another?

The analysis of the Hill House faunal remains should provide a better understanding of how Bermudians satisfied their dietary needs – especially those without substantial means. The traditional theoretical approaches to subsistence strategies will be discussed to illustrate the need for new models of resource use which are less historic and less specific. An introduction to the concept of risk aversion theory and its value in subsistence studies will be followed with a discussion regarding the archaeological findings at the Hill House site. The risk aversion theory will be used to explain cultural processes as they are reflected in faunal remains. The variables affecting each subsistence strategy available to Bermudians during the seventeenth and eighteenth centuries will be examined. Summations discuss how effectively risk reduction theory was able to explain how and why Bermuda developed its distinct subsistence strategies.

## **Approaches to Subsistence Studies in Historical Archaeology**

In the past, historical archaeologists have viewed subsistence studies as a means in which to validate the success of colonial adaptation to the New World. These studies uncritically accepted the notion that domestic food sources allowed the colonists to re-establish themselves, their former ways of life intact, with little interference from environmental factors. In other words, a well established, highly complex cultural system could alter a unfamiliar environment and effectively maintain its superior status. If this assumption is correct, then the colonists would have practiced a mixed farming strategy (the raising of subsistence crops and domestic livestock) supplemented with available local resources. In keeping with 'traditional British foodways', the colonists' diet would have been composed chiefly of pork and mutton, followed by beef, fowl, bread, beer, pulse<sup>1</sup> and dairy products. Supplements of vegetables, fruit, wild game and fish would have added variety to this otherwise monotonous diet. This model, referred to as the British Barnyard Complex, is based upon Jay Allen Anderson's<sup>2</sup> analysis of rural and urban food habits in seventeenth century England (Honerkamp and Reitz 1983:336).

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<sup>1</sup> Pulse is defined as the edible seeds of various legumes, such as peas and beans. In this particular scenario, pulse most likely refers to porridge made from such legumes.

<sup>2</sup> Honerkamp and Reitz (1983) note that Anderson's work provides a workable basis for this model despite the generality of his work – in reality, the food habits were regionally more complex.

## **Coastal Georgia**

The recovery of faunal remains from a British archaeological site provides an excellent opportunity to test the validity of this model. If the British Barnyard Complex was indeed successfully transferred, then one would expect to find large quantities of pig and sheep remains accompanied by aged cattle, goats, domestic and wild rabbits, a few deer, domestic and wild birds and a variety of fish in a typical British colonial settlement. Elizabeth Reitz and Nicholas Honerkamp applied this model to a faunal collection from a domestic site occupied by a Thomas Hird at Fort Frederica, Georgia. They proposed that the faunal collection would reflect modifications forced upon the colonists by the new environment.

The settlement at Fort Frederica, St. Simons Island, Georgia was established in 1736 as a defensive outpost against Spanish Florida. The Trustees for Establishing the Colony of Georgia had expected the 450 civilian inhabitants to become self-sufficient through subsistence farming and the practicing of their crafts and trade (Reitz and Honerkamp 1983:6). By 1738, however, the settlers were unable to support themselves and became quite reliant upon the patronage of the 600 man military regiment stationed at the fort. This arrangement remained beneficial until 1749, when the regiment was transferred from Frederica due to the discontinuance of Spanish-British hostilities. By 1750 most of the population of Frederica had moved away, leaving a few families to sporadically farm the land until 1945. Given the short existence of the site and the minimal post-abandonment disturbance, the faunal collection analyzed by Reitz and Honerkamp should indicate if the subsistence diet practiced at the Thomas Hird site significantly deviated from the British Barnyard Complex.

As Reitz and Honerkamp predicted, the faunal remains did not resemble the proposed model of resource utilization. The estimates of biomass for each taxa grouping (domestic animals, wild terrestrial animals, cartilaginous and bony fish, aquatic reptiles,

wild birds and commensal species) appear to validate the British Barnyard Model, with domestic animals contributing 77.9% of the biomass to the diet versus the 22.1% of wild animals. However, when the assemblage is examined in terms of individual contributions the deviations become more apparent. At the Hird site, domestic cattle were the primary animal source (67.2%), followed by deer (14.7%) and pig (9.9%) (Reitz and Honerkamp 1983). Perhaps the greatest deviation from the model was the conspicuous absence of mutton from the diet. Reitz and Honerkamp postulate that the presence of only one caprine individual in the assemblage was the result of either the uncommon occurrence of sheep in Georgia or its being a high status food during the colonial period (Reitz and Honerkamp 1983:21). For whatever reason, deer replaced sheep as the second most significant resource in the Hird diet. Secondly, the hierarchy of meat as predicted by the model was altered. Instead of eating pig, sheep and aged beef, the Hirds subsisted upon young cattle, deer and pigs. Lastly, it is interesting to note that although domestic cattle were the primary animal resource, the secondary resources were wild animals<sup>3</sup>. As for wild birds and fish, the quantity consumed fell well into the range found within the British Barnyard Complex. Despite a few similarities, the faunal remains from the Hird site in Fort Frederica illustrate that the Hirds had to rely upon the local environment in order to survive. Reitz and Honerkamp concluded that the heavy use of wild animals was an adaptive response in a situation where resources, *i.e.* domestic livestock or company supplies, were not predictable or were in limited supply.

### **The Chesapeake**

Henry Miller took a decidedly different approach when he studied subsistence in tidewater Virginia and Maryland. Rather than comparing a particular site's faunal remains with the British Barnyard model, he applied the colonization model to observe how colonial subsistence changed over time. Miller perceived colonization as a cultural

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<sup>3</sup>Documentary evidence for early animal husbandry techniques suggest that pigs can be classified as either free-ranging or feral (Weeden 1890; Bruce 1895; Gray 1933; Bonner 1964).

process. The colonization model states that when a population migrates or readapts to new lands and environments its well established socio-cultural system will be rapidly extended, replicated or reintegrated (Miller 1984:2). The basic assumption of this model was that change on the frontier was directional and regularized. Not unlike the British Barnyard Complex, the colonization model assumes that tradition is a compelling force and the goal of the settlers was to re-establish familiar cultural practices as rapidly as possible. However, central to the model is the notion that the new environment had a significant impact upon the settlers and would necessitate adaptive responses.

Miller believed that the expression of cultural change as a result of colonization would best be illustrated through the society's subsistence system. If the colonization process truly expressed a directional and regularized change through time, then it would be reflected in archaeologically recovered faunal remains. During the initial years of settlement the subsistence practices would be less complex and specialized than those found in the homeland. The settlers would exploit those resources deemed dependable. Not only would they be exploiting a wide range of animals but the predominant meats would come from wild animals. By exploiting a wide subsistence base, the settlers could guarantee an adequate return that would satisfy their subsistence requirements. In other words, the settlers would never be under any great threat of starvation, for if one resource failed they would just exploit another. Archaeologically, this diffuse adaptive strategy would be expressed by a high proportion of wild animals in the faunal remains. As time passes, and the colonial population stabilizes, the diffuse adaptive strategies are gradually replaced by adaptive strategies that concentrate on one or more resource. Miller theorizes that the faunal remains from a focal adaptive strategy would closely resemble the 'traditional British foodways' as proposed by the British Barnyard Complex model. The faunal remains would demonstrate a significant increase in the consumption of domesticates while the utilization of wild animals declines. In other words, the subsistence strategies utilized would reflect a directional change over time towards a

greater stability and complexity. Miller concludes that all colonizing populations will demonstrate similar characteristics and patterns of change, although unique environmental, economic and cultural factors may alter its expression.

Miller applied the colonization model of cultural change to the faunal remains recovered from twenty-four households on seventeen sites located in tidewater Virginia and Maryland. Well-sealed deposits, which could be dated to a short time range, allowed Miller to divide the samples into three time periods: (i) 1620 - 1660; (ii) 1660 - 1700; and (iii) 1700 - 1745.

The analysis of the faunal remains from Period I (1620 - 1660) revealed that the early settlers ate a diet composed of a wide variety of meat. The animals present included domestic species such as cow, pig and chicken but each collection was predominately wild animal (40%). Among the wild animals consumed were white-tailed deer, opossums, quails, ducks, black and red drum, sheepshead, catfish and sturgeon. Miller's finding from this period closely resemble Reitz and Honerkamp's at the Hird site. Of particular interest was the variety of fish consumed at the different sites. The fish recovered from the Hird site were restricted to four species – red drum, black drum, sea catfish and mullet. Reitz and Honerkamp reasoned that the limited variation was due to local resources, estuarine species versus off-shore species, and the type of fishing technology employed, *i.e.* hook and line versus nets (Reitz and Honerkamp 1983:21). Miller found that the species of fish and the amounts consumed were directly related to the location of the site along the Chesapeake bay and its tributaries. Those sites with access to the high-salinity waters of the Chesapeake consumed such species as drums and sheepheads in considerable quantities. Those sites farther upstream consumed species that are confined to low-salinity waters, *i.e.* catfish, white perch and other small species. Overall, Miller summarized the diet of the early colonists as being composed of a wide variety of animals, both domestic and wild. He viewed the diversity as a natural consequence of the process of colonization – “A reliance upon many foods provides

greater nutritional security in an unfamiliar environment, where the failure of one resource can be compensated for by exploiting others” (Miller 1988:186).

For Period II (1660 - 1700), Miller hypothesized that as the population grew and as society stabilized, the subsistence pattern found in Period I would begin to resemble the British Barnyard Complex – that is, more uniform with less variety. The evidence supports this interpretation. Domestic animals became more important within the diet, while the consumption of wild animals declined from 40% to 10%. This pattern remained constant even when the effects of the emerging social stratification were taken into consideration. Miller compared the faunal remains from a plantation house with those of a tenant. Surprisingly, both households were eating a similar diet – a large amount of cattle, followed by pig and supplemented with sheep and wild animals. It was noted, however, that more fish remains were found at the tenement. Certain that status would affect the diet in some form or another, Miller separated the bones into high and low quality meat cuts and calculated the frequency. But once again the results showed that both sites were eating meat cuts of similar quality<sup>4</sup>. Not until Period III would wealth and status alter the meat diet of the Chesapeake settlers.

Miller found that the remains from Period III (1700 - 1745) continued the trend found in Period II – a heavy reliance on domestic animals and a decline in the consumption of wild resources, especially fish. The difference between social standings was not reflected in the amount of domestic versus wild meat being consumed. Rather, the differences were found with the proportions of domestic species exploited. The faunal remains from the Period III sites indicate that beef made up two-thirds of the estimated meat diet while pork accounted for one-quarter. At a tenant site, albeit the only representative lower income site for this period, Miller found that the occupants were eating more pork and chicken than beef and had a greater reliance upon wild resources

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<sup>4</sup> Miller qualified this observation since none of the sites were from the poorest households or slave and/or servant quarters. Very few of these sites have been located.

(although not as high as in Period I). Despite this bias, Miller suggests that this proportional difference could be “a reflection of limited economic wealth” (Miller 1984:192).

Henry Miller aptly demonstrated how the colonial diet in the Chesapeake region changed over the course of a century. During the initial years of settlement the colonists placed a heavy reliance upon wild meat resources with a lesser reliance upon domesticates such as sheep, pig and cow. Faunal remains from the later part of the seventeenth century and the first part of the eighteenth century demonstrate that the colonists were consuming considerably more domesticates and fewer wild resources, especially fish. The following table illustrates this trend:

**Table 1**

**Biomass Contributions to Diet**

	<b>Mammal</b>	<b>Fish</b>
<b>Period I (1620 - 1660)</b>	57.2%	35.0%
<b>Period II (1660 - 1700)</b>	74.4%	20.0%
<b>Period III (1700 - 1745)</b>	85.3%	4.5%

(after Miller 1984:191)

Two aspects of Miller’s research should be kept in mind when analyzing the faunal remains from other British colonial sites. Firstly, colonists will develop a subsistence system that is appropriate to the local environment. After a period of time, the reliance upon local resources will diminish as traditional practices, *i.e.* domesticated animals, take root. Perhaps if Fort Frederica had perpetuated into the nineteenth century then Reitz and Honerkamp would have found similar trends in the faunal remains as Henry Miller found in the Chesapeake.

Secondly, although the diet in the Chesapeake region began to resemble the British Barnyard Complex by the late seventeenth century, an important difference should be noted. In Britain, the ranked importance of meat was pork, sheep and beef – sheep and cattle being raised primarily for their by-products (Miller 1984:69). As noted previously, in the New World, beef was consumed in greater quantities than pork and mutton. The predominance of beef and pork, especially beef, in the colonial diet has been attributed to the hardiness of the said animals and the form of animal husbandry practiced (Miller 1984:84). In the Chesapeake, woodland-pasture husbandry required minimal labor and facilities, thus allowing an increase in population that was only hindered by a lack of land. Conversely, the sheep population never truly stabilized due to predators such as wolves and the lack of labor to adequately protect them (Miller 1984:183). Reitz and Honerkamp attribute the scarcity of sheep remains to the parasites and diseases found on the coastal plain of Georgia (Reitz and Honerkamp 1983:21). Thus, the preponderance of beef in the colonial diet strongly supports the Reitz and Honerkamp's notion that the British Barnyard Complex could not be transferred in its entirety to the New World. Rather, a subsistence system developed in accordance with the local environmental influences.

In their study of subsistence practices, Honerkamp and Reitz expressed their displeasure with the notion that 'traditional British foodways' were transplanted directly to the New World without modification. In an attempt to negate this theory they developed the British Barnyard Complex of resource utilization. The application of this model to archaeological faunal remains would determine whether or not the use of animals remained unmodified from traditional patterns or if they reflected adaptations to the environment (Reitz and Honerkamp 1983:4). The basic principle behind the development of this model is valid. The application of the British Barnyard Complex to any archaeological site in colonial North America will have the same result – that the colonial settlers were forced to modify their subsistence system in response to new

environmental stimuli. As effective as the British Barnyard Complex of resource utilization is at dispelling the belief of direct transference, it does not offer an explanation as to how or why the environment had such a profound influence upon the colonists' subsistence strategies. Furthermore, the British Barnyard Complex assumes that each taxa grouping contributes a fixed percentage of the biomass to the diet. The constellation of animals that make up the diet is culturally bound. However, it is the economics of the time period that directly affect the percentages of each taxa.

The colonial model, as utilized by Henry Miller, addresses many of the deficiencies found within the British Barnyard Complex model. Like Reitz and Honerkamp, Miller viewed the environment as having a significant impact upon the settlers and their subsequent adaptive strategies. The adaptive strategies adopted were designed to meet the satisfying level of subsistence needs. Miller examines some of the criteria involved when selecting a procurement strategy – cost, as in terms of time and energy, and risk, the reliability of a specific resource. Although Miller states that the expression of the colonization process is likely to vary due to unique factors, he assumes that cultural systems and subsistence practices will display directional change through time. The directional change would move from diffuse to focal, with the end result closely resembling traditional British subsistence strategies. This implies that cultural systems have continuity over time.

Neither of these approaches attempts to explain why certain subsistence strategies were adopted by colonists. Miller states that such criteria as cost and risk were integral in the process of adopting subsistence resources. However, he does not go into detail as to why one resource was better than another. What were the variables affecting each resource? Were there any responses that a socio-cultural group could develop to protect themselves from the risk associated with a resource? The following chapter offers an alternative theory in which to examine cultural process and subsistence strategies in the New World.

## Risk Aversion Theory

Without a continual supply of food and nutrients, a population ceases to exist. The means by which a population obtains foodstuffs and the environmental resources exploited are often referred to as adaptive strategies (Miller 1984:29). Generally, a subsistence system is composed of a mixture of strategies – hunting, gathering, farming and herding. The local environment, including the climate, flora and fauna, and the size of a population tend to be the greatest factors influencing the strategies adopted. Many subsistence studies have focused upon diet choice and the net acquisition rate of energy (Winterhalder 1986)<sup>5</sup>. Others have expanded upon this premise and have asked questions relating to the uncertainty and unpredictability of resources. The goal of this study is to demonstrate that the predominance of fish from the Hill House site is the result of practices that were used to counteract the uncertainty and unpredictability of resources in Bermuda.

Variability in food supplies has been described as “those factors ... that influence the availability of a particular food resource” (Halstead and O’Shea 1989:3). Sources of variability, resulting in an unpredictable scarcity of resources, tend to be either natural or cultural. Natural causes include climatic and environmental variability such as drought, microorganisms or hurricanes. Cultural causes, such as war, the removal of a labor force or human judgment, will have much the same effect. The extent to which a society is

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<sup>5</sup> Whether or not the chances of finding food will offset the energy expended during the quest (Winterhalder 1986; Strum and Mitchell 1987).

affected by variability depends upon the following characteristics: temporal structure, spatial structure and relative intensity (Halstead and O'Shea 1989:3). A temporal structure refers to the duration and the frequency of the variability. The spatial structure relates not only to the size of the affected area but whether or not the effect had a homogeneous distribution. The relative intensity assesses the severity of damage and the degree of variation within the severity itself (Halstead and O'Shea 1989).

An understanding of the sources of variability that affect food supplies will help a society to develop practices that will lessen the impact of variability. However, in order for any practice to be effective, it must match, in both capacity and scale, the variability with which it is to cope. The bounds of variability, given time, can be measured by their relative predictability. Predictable sources of variation, those events that can be foretold due to facts already known, include the cyclical nature of the seasons, the advent of hurricane season and migration of certain species of fish. The certainty of these events, defined through experience, allows for practices to be incorporated into everyday life. Events deemed unpredictable, those where the timing nor the severity can be foretold, such as pest infestations or severe drought, have a greater impact upon a population's ability to respond effectively.

The unpredictability of these variables creates a state of uncertainty – that is, where the probability of a set of outcomes can not be determined due to a lack of information. Related to uncertainty, yet distinct, is the concept of risk. Risk is when the outcome of a given event may not be certain but a numerical probability can be established for it (Jongman and Dekker 1989:115). In terms of subsistence, risk is the probability of failing to meet dietary requirements. The responses to both uncertainty and risk must be incorporated into the society during both good and bad years in order to be effective.

The ways in which a population minimizes uncertainty and risk, have been referred to as 'buffering mechanisms' (Halstead and O'Shea 1989:3) and as 'risk aversion

strategies' (Stein 1989:87). The multitude of responses used to counteract subsistence scarcity may be divided into four categories: mobility, diversification, storage and exchange (Leatherman *et al* 1988; Messer 1988; Halstead and O'Shea 1989; Jongman and Dekker 1989; Stein 1989). **Mobility**, the simplest of responses, is the movement of a population away from the area of scarcity. For example, during the Dustbowl of the 1930s, the complete failure of agriculture in Oklahoma, Texas and parts of Kansas, thousands of families emigrated to California. **Diversification** is defined as any act that broadens the base of the subsistence system. Halstead and O'Shea state that this can be achieved by either exploiting a wide variety of resources (active) or by including less desirable types of foods in the diet (passive). During the seventh millennium, villagers at Grittle, Turkey, were supplementing their winter diet of domesticated cereals and caprines with wild caprines. The predictable seasonal migratory patterns of the wild caprines allowed the villagers to reduce their subsistence risk while exerting the least amount of effort (Stein 1989). **Storage** refers to the range of activities that will enable foods to be eaten at a later date. This takes the shape of both physical storage and live storage (Bowen 1990). The probate inventories available for Middlesex County, Massachusetts during the first half of the eighteenth century indicate that storage was an integral part of the New England subsistence economy. "Salt pork, bacon, hams, sausage and salt beef" (McMahon 1981:16) were common staples within the wealthier households in Middlesex County. In addition to the usual biases associated with probate inventories (*i.e.* the representation of wealthy individuals during the later point of their lives), the extent to which storage was utilized is further suspect since there were no set standards for the minimum quantity or quality of foods to be listed or valued (McMahon 1981:6). The time of year also would have affected the quantity of food that a family had set aside for storage – inventories taken in the fall would be considerable compared to those taken in the spring.

The buffering mechanism of **exchange** is the conversion of auxiliary resources into future obligations in times of need. The social and economic structure of the household strongly influences the certainty of reciprocation (Leatherman *et al* 1988; Messer 1988; Halstead and O'Shea 1989; Jongman and Dekker 1989; Bowen 1990). Reciprocity can be further classified as being positive or negative. Positive exchange, as seen within kin groups, has been successfully utilized throughout history, from the earliest hunter-gathers to present day individuals<sup>6</sup>. Negative exchange, theft, privateering (raiding), smuggling and wrecking, although difficult to document, also played a part within the subsistence system of many cultures.

The buffering mechanisms employed by a society heavily depends upon the severity of the shortages and the allocation of resources – land, labor, and capital. From Neolithic times to the present, tensions with subsistence strategies have resulted from the need to strike a balance between these resources. Throughout history, most decisions involving the allocation of land have been based upon profit making ventures. During the seventeenth century England experienced a rise in both population and prices. Simultaneously, the number of unemployed individuals increased due to decisions made in the agrarian sector. Enclosures, engrossing and the increasing importance of market production led to the creation of larger farming units. Although more land was under cultivation, these consolidations greatly affected the labor supply. Individuals once involved with farming were moving to the cities in search of employment or were induced to emigrate to the colonies (Horn 1979; Miller 1984). The decisions made by the moneyed elite, not only had a profound affect upon the economy of England, but it severely limited the types of responses that the lower levels of society could employ to buffer variability (Leatherman *et al* 1988:10).

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<sup>6</sup> The examination into the extent of storage and exchange among kin is beyond the scope of this study.

Another source of aggravation that may interfere with traditional coping mechanisms at the local level is government policy (Messer 1988:138). A country's involvement in a war generally tends to have a profound affect upon the ability of its population to maintain an adequate subsistence level. In addition to the possible destruction of food crops, often times the laborers who work the land are lost to the war movement. The affects of war are not always felt by the warring countries. During the Second World War, a large famine occurred in India due to decisions made in England. The British felt that privately owned boats in Bengal posed a security threat. To eliminate this threat, the British destroyed many of the boats. This, in turn, made the normal transportation of rice impossible, thus triggering a subsistence crisis (Jongman and Dekker 1989:115). Even during times of peace, the affects of war can reverberate through slackened trade and economic hardships.

The economic status of an individual often influenced the type of strategy employed to counteract starvation. The wealthy, with their ample supply of land, labor and capital, had more flexibility in securing their food supply: the money to purchase imported foods or goods from the local market, the land to plant a garden or to keep livestock, and the labor, in the form of slaves or indentured servants, to send out fishing or toiling in the fields. But what about the poor and those without their freedom? What strategies were available to those who had restricted access to resources? The poor were reliant upon the 'generosity' of their wealthier neighbors and their own finesse. A majority of the poor's food resources came from fishing, gardening, imported goods (if affordable), familial exchange networks and perhaps even smuggling and stealing. This 'hand to mouth existence' undoubtedly resulted in a varied diet.

In the following chapters, the three main subsistence strategies, fishing, farming, and the importation of goods, available to those without substantial means will be explored. Events, attitudes and other conditions influencing each strategy should give an

insight into why fish were so important in the foodways of Bermudians in the eighteenth century.

The faunal collection from the Hill House site in Bermuda provides an excellent opportunity to observe the development of a subsistence system. If the trend that Miller observed in the Chesapeake is applicable to all British colonial sites, then the faunal remains should initially show a heavy reliance upon wild resources, most likely fish, with a gradual shift to domesticates over time. Secondly, if the trend is apparent, then how successful were the Bermudian settlers at recreating the British Barnyard Complex? Would beef be heavily relied upon, such as was found at colonial sites on the mainland? Or would some other meat resource predominate? And finally, what were the variables that helped shape the subsistence practices at the Hill House? The analysis of the data in terms of Risk Reduction Theory should provide a succinct explanation as to why the subsistence strategy developed as it did.

## Archaeology at the Hill House

The creation of Hog Bay Park<sup>7</sup> in Sandy's Parish, Bermuda, provided archaeologists with an excellent opportunity to examine a tract of land that had remained essentially intact since the 1600s. During the summer of 1992, students participating in the College of William and Mary International Field School<sup>8</sup> used this site as a focus in their inquiry into the nature of rural domestic sites in Bermuda. The purpose of their investigations was (i) to gather information regarding the construction techniques of standing structures; (ii) to establish construction dates; and (iii) to assess soil and artifact content below ground (Barka 1992:1).

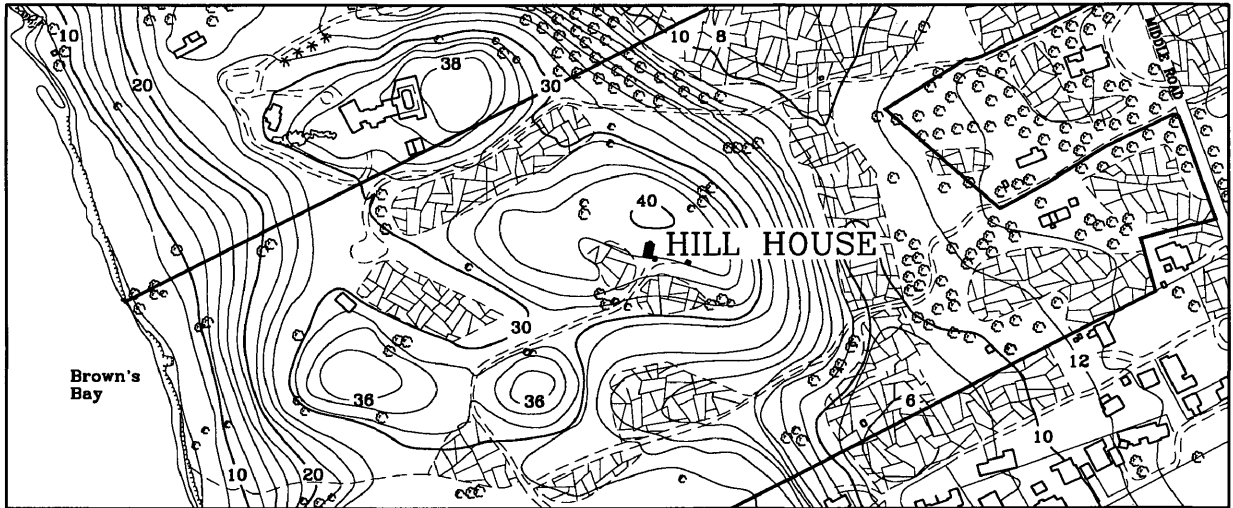
The thirty-eight acre parcel investigated, known locally as Hog Bay Flat, extends from Middle Road on the east to the Atlantic Ocean on the west. (Figure 2). Within the park and immediately adjacent to it, three archaeological sites were known to exist. The Zuill Cottage and the Mayor Cottage<sup>9</sup> are located near the entrance of the park, approximately seventy-five meters back from Middle Road. Both cottages consisted of a main building, an outhouse structure and a cistern. The main buildings each had two living quarters, a cooking or washing room and two fireplaces. These 'mirror' buildings

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<sup>7</sup> The result of a purchase of land by the Department of Agriculture, Fisheries and Parks.

<sup>8</sup> In cooperation with the Department of Archaeology, Colonial Williamsburg Foundation, the Bermuda Maritime Museum, and the Department of Agriculture, Fisheries and Parks, Bermuda.

<sup>9</sup> The Mayor cottage is privately owned by Eugene Mayor.

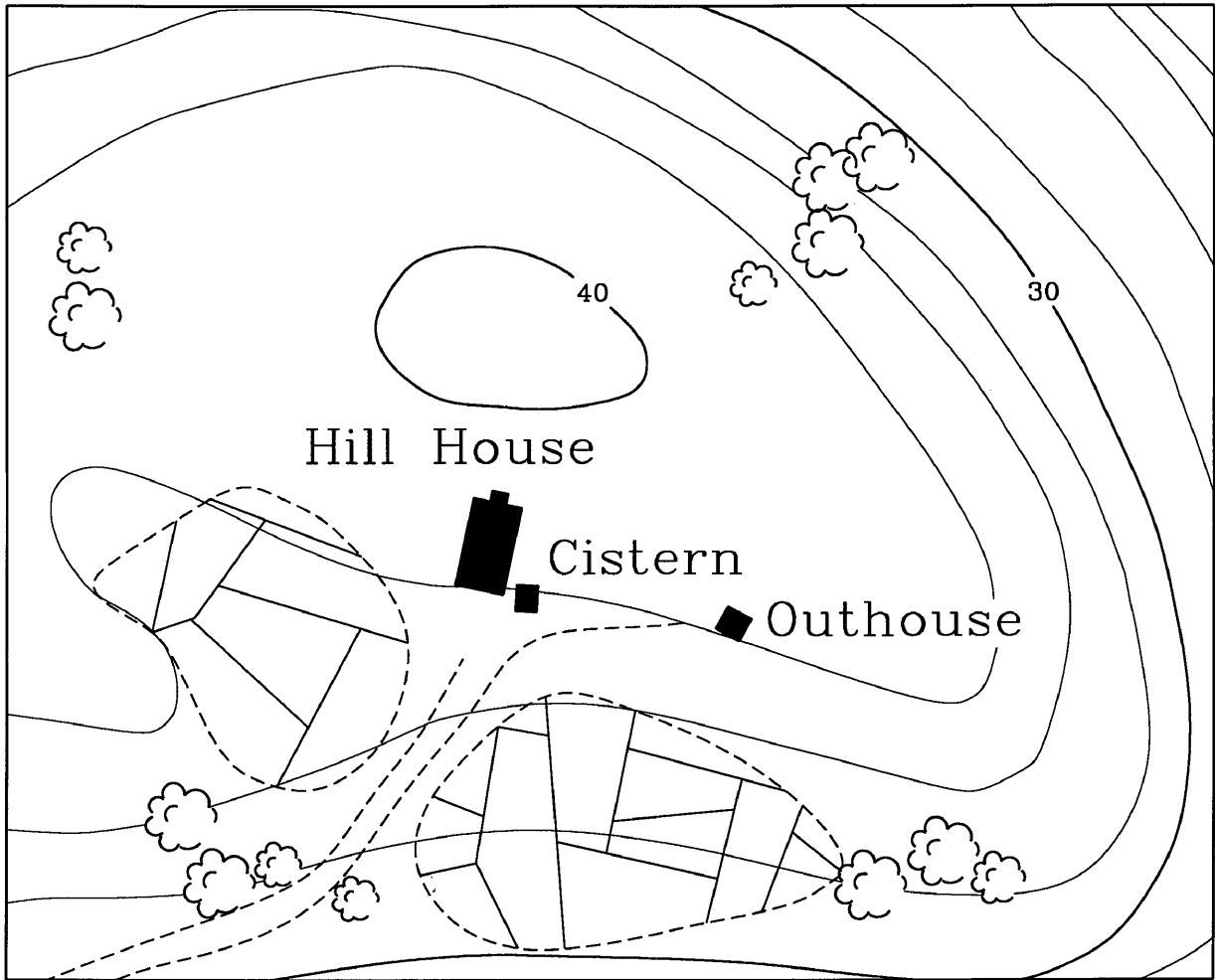


**Figure 2** Location of the Hill House within Hog Bay Park (after Department of Agriculture, Fisheries and Parks [DAFP] 1992).

may have been service buildings for a larger estate, but the existence of such an estate has not been discovered. The third site, known as the Hill House<sup>10</sup>, is located on a rise, two hundred meters west of the Zuill and Mayor Cottages. The Hill House site is comprised of a standing domestic structure, an abandoned cistern and an outhouse. All of these structures are nestled up against the southern side of a hill, elevation about 36 feet. (Figure 3). The land surrounding the site is hilly with flat, fertile land in between. The hill sides today are lush with vegetation – cedar trees, bermuda grass, crab grass, sage brush, oleander and casuarina trees (the last four having been introduced to the islands) (Watson *et al* 1965). The flat, fertile land is currently being used to grow turnips and other agricultural crops.

The house itself is a small four meter by eight meter limestone structure. At the time of excavation the house consisted of one large room with a fireplace situated along the northern wall. The interior was originally divided into three rooms. Scars from two partition walls were visible on the interior walls and ceiling. The roof was constructed in the typical Bermudian fashion of gabled limestone slates. According to architectural

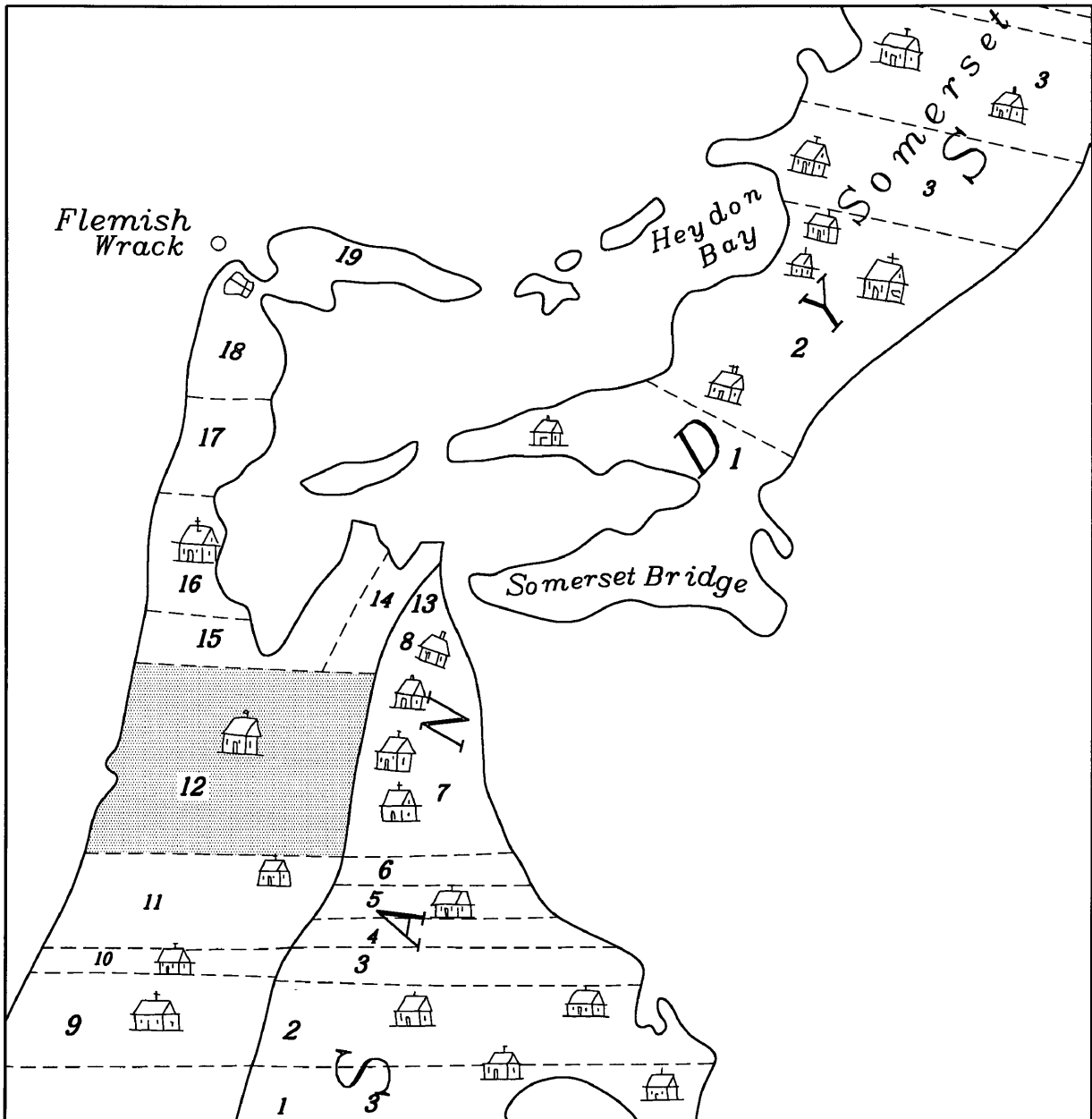
<sup>10</sup> The location of this cottage gave rise to its name since an official designation had not been determined.



**Figure 3 Plan of Hill House, Cistern and Outhouse (after DAFP 1992).**

historian Edward Chappell, the architectural features of this structure – the tray ceiling, and strait-faced front and rear roof facades – suggest a possible construction date of 1840– 1880 (Jarvis 1992a).<sup>11</sup> Norwood’s survey map of 1663 (Figure 4) depicts a building that closely corresponds to the present day location of the Hill House. Given the often times questionable accuracy of historical maps, the location of this building suggests (i) that an earlier structure once occupied the same location as the present day Hill House; (ii) that the standing structure is much older than previously suggested (1840 - 1880); or (iii) that the building on Norwood’s map casually represents another structure

<sup>11</sup> For a detailed description of this structure refer to Anna Agbe-Davies’ thesis “The Ceramics from the Hill House: A Bermudian Site in Historical Perspective.”



**Figure 4** Norwood's Survey Map of 1663. The building depicted in the center of tract 12 closely corresponds to the location of the Hill House (after Norwood 1663).

on the property altogether. Agbe-Davies (1993) states that this house plan closely resembles a 'slave house' that had been built near Ely's Harbor, Somerset, Sandys Parish. Historic plans for this 'slave house' have been tentatively dated to the early eighteenth century (Bermuda Historical Monuments Trust 1948:41). Despite the discrepancies in

the construction date, the Hill House, with its cistern and outhouse, was standing by 1898, the year of Thomas Savage's survey for the Royal Navy.

Historic research into the prior occupancy of this building has been unsuccessful. The present day park closely resembles the original tract of land surveyed in 1663. At this time the tract was probably owned by Sir John Heydon, Deputy Governor of Bermuda. Heydon leased the land and 'a tenement' to a planter named William Birch. Historical documents indicate that Birch and his family occupied the property until Birch's death in 1679. Documentation indicating subsequent ownership between 1680 and 1780 is rather vague. However, since the purchase of the land by Colonel Henry Tucker of Somerset in the 1780s, the history of ownership has been well documented until the present.<sup>12</sup>

While there is a limited amount of historical documentation relating to ownership of Hog Bay Park, more evidence is found for the primary use of the land including the growing of tobacco, cedar trees, subsistence farming and possibly animal husbandry. There are at least ten areas within the park currently being used for agricultural crops today. The proximity of the Hill House to these fields suggests that this structure may have been the residence of tenant farmers, slaves or indentured servants. The house itself is too small to have been a 'Manfion house'<sup>13</sup> (Bermuda National Archives [BNA] 1976) and there is no indication that the Hill House was an outbuilding to a larger house.

Before archaeological excavations began, the interior of the Hill House had to be cleared of the debris that had accumulated since it went out of use in 1982. The recovery of tools and other building materials during the clean up suggested that the house had been used as a carpenter's shop<sup>14</sup>. Since then, despite its dilapidated state, the Hill House

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<sup>12</sup> For a detailed description of the ownership of this tract of land see Agbe-Davies' thesis.

<sup>13</sup> Most of the probate records for Sandys parish were inventoried room by room. Although the probates are few, they all tended to consist of four or more rooms, *i.e.*, a "manfion house".

<sup>14</sup> The date of abandonment was based upon the discovery of several renovation contract plans, the latest dating from 1982.

had been the intermittent residence of a homeless man known as Red Demon. With the interior of the house and the surrounding areas cleared of debris the Hill House crew drew detailed drawings (1:20 scale) of the interior and exterior walls of the structure and the outhouse. Once these drawings were completed a grid was laid out parallel to the exterior of the southern wall of the house. The grid was composed of nine operational areas, each subdivided into twenty-four one meter square units. As illustrated in Figure 5, excavation units were opened in Operations 1, 2, 3, 5 and 7<sup>15</sup>. Two units in Operation 1 were opened to establish the relationship between the fireplace and the interior of the standing structure. Likewise, two units were opened along the exterior walls of the chimney in Operation 3. The units in Operation 2 were opened to help understand the construction of the Hill House. In addition, these units would disclose the types of artifacts found within close proximity of the structure. Five units were excavated in Operation 7 to determine the stratigraphic sequences for the site. Finally, in an attempt to establish some stratigraphic continuity between Operation 2 and Operation 7, a single unit was opened in Operation 5. Each of these units were excavated by natural stratigraphy and all soil was dry screened with a 1/4 inch sieve. An 1/8 inch sieve was used for all features. Plans and selected sections were drawn accordingly for each unit. (Figure 6).

Contrary to expectations, the soil buildup surrounding the Hill House was quite significant – up to a meter deep in places. Generally, the visible stratigraphy represented five broad layers<sup>16</sup>. In some units, particularly those found in Operation 7, the layers were divided into sublayers. The stratigraphic sequence for the site was established by Michael Jarvis in his 1992 preliminary report. He concluded that the stratigraphic sequence represented five periods of site development. Four of these periods could be

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<sup>15</sup> The units in Operation 1 and Operation 3 were deliberately left off Figure 5 since the faunal remains recovered from these units were not included in this study.

<sup>16</sup> Michael Jarvis' report, "A Preliminary Report on the 1992 Excavations at Hill House, Hog Bay Flat, Bermuda," gives a detailed analysis of the stratigraphic sequences.

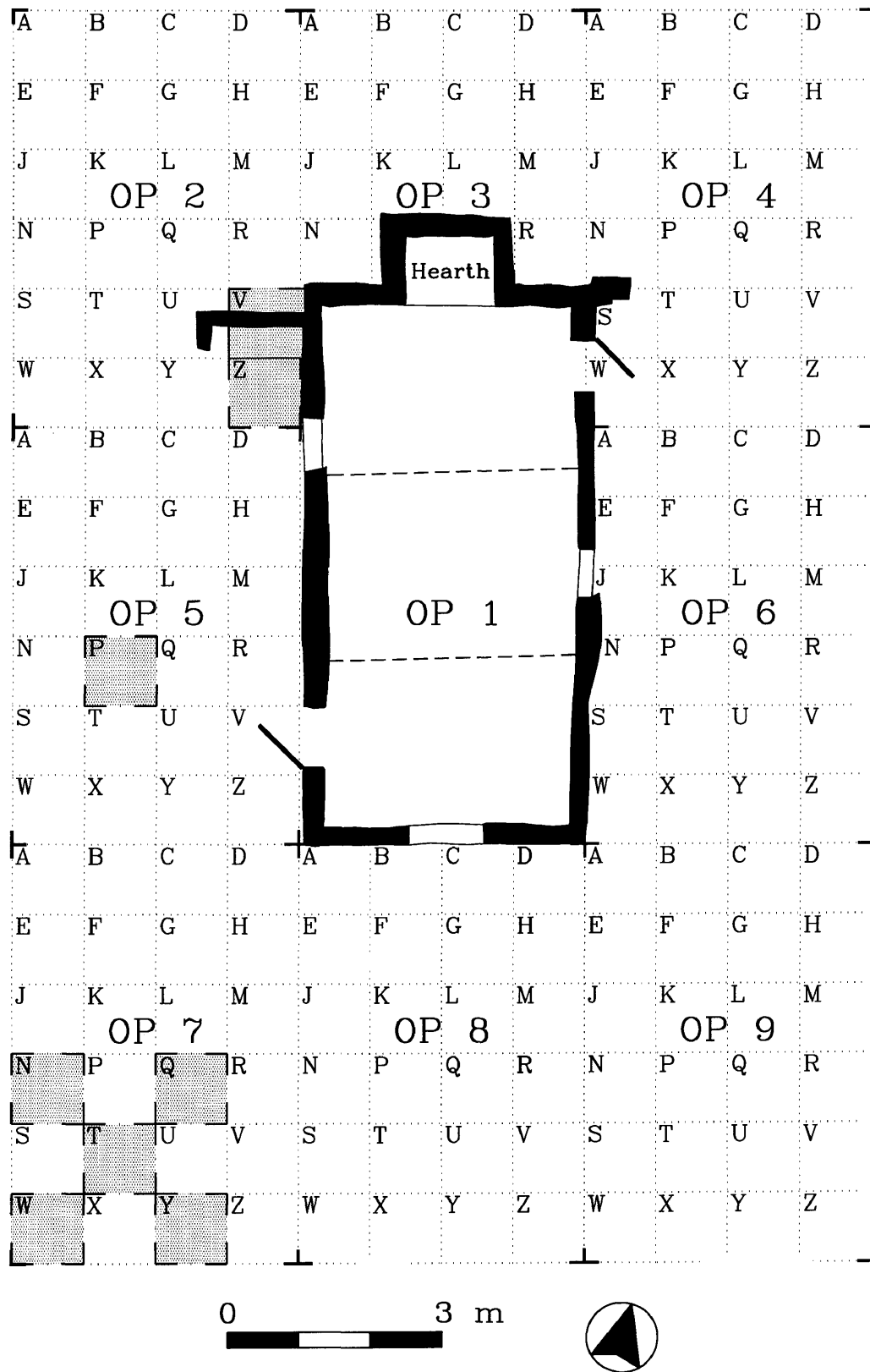
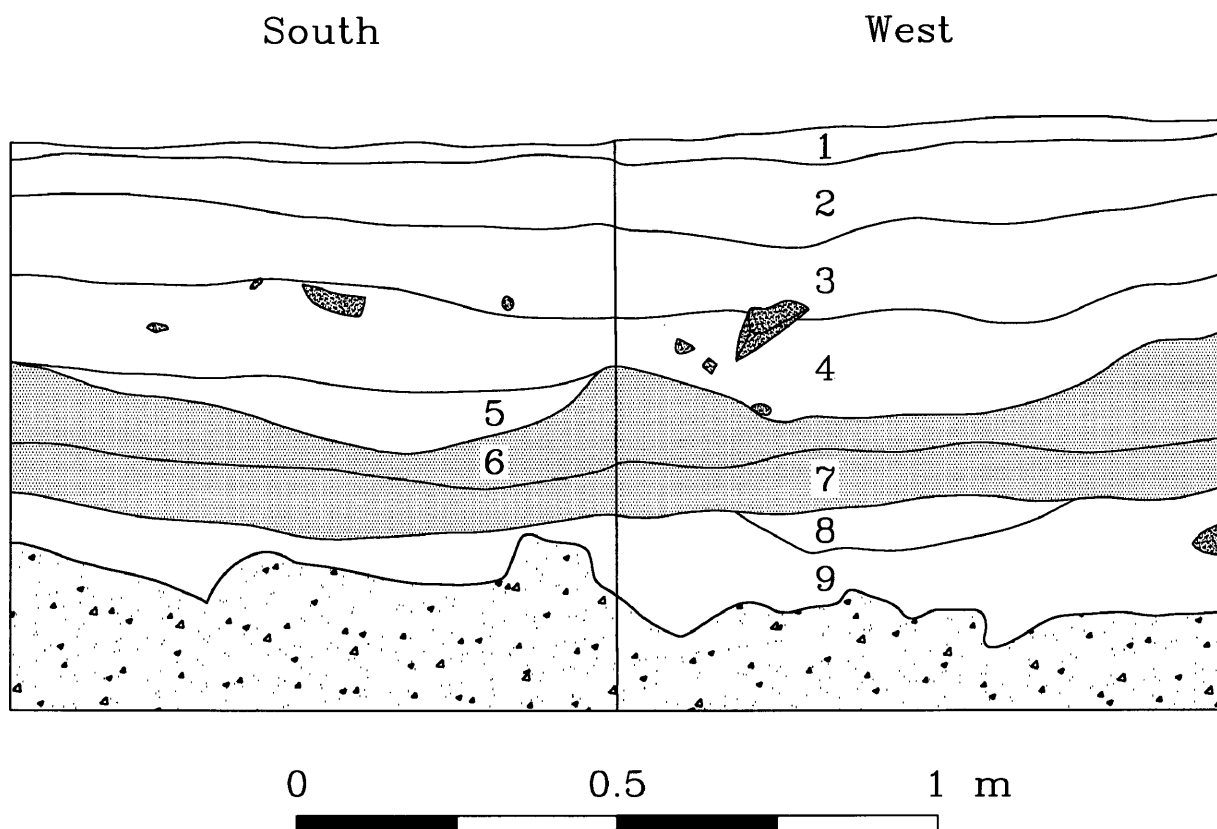


Figure 5 Plan of Hill House showing grid and excavated units.



**Figure 6 South and west sections of Unit 7Q. The stratigraphic levels representing Occupation period 4 are shaded (6-7).**

directly equated with human activity.

### **Occupational Periods at the Hill House**

The first period of occupation is associated with the modern occupation of the Hill House. The surface collection of the debris from all the operations yielded remnants associated with the carpenter's shop and a multitude of liquor bottles and fish bones probably discarded by Red Demon and other vagrants. Occupation period 2, otherwise referred to as the Recent Hill House Occupation, represents the span of time in which the Hill House was used as a domestic residence. The ceramics recovered from these stratigraphic levels ranged from the late eighteenth century through the early to mid-twentieth century<sup>17</sup>.

<sup>17</sup>Agbe-Davies used Stanley South's Mean Ceramic Date formula to establish the dates of occupation for each period.

The recovery of building materials from the stratigraphic levels of Occupation period 3 has been interpreted as a period of 'Construction and/or Destruction' (Jarvis 1992a:5). The soil contained varying amounts of charcoal, nails, brickbats, burnt lime and limestone rubble<sup>18</sup>. The recovery of squared-off building stone and plastered rubble led Jarvis to believe that an earlier stone structure had been dismantled. This theory, coupled with the building on Norwood's map, is further supported by the artifacts recovered. The presence of polychrome and blue and white delftware and Westerwald stoneware indicate a mid-eighteenth century occupation. However, wire-cut nails, three-piece molded glass and whitewares were also recovered in these levels. These artifacts provide a *terminus post quem* of 1850 or later.

Occupation period 4 represents the initial occupation of a dwelling located at the Hill House site. The vast array of artifacts and faunal remains recovered from this period suggest a continuous occupation from the late seventeenth or early eighteenth century to the middle of the eighteenth century (Jarvis 1992a:6). Period 5, designated the 'Pre-Occupation' level, was thought to have been the ground surface when the site was first occupied. The few artifacts that were recovered were found upon or directly above the bedrock, and were dated to the early 1700s. The scarcity of artifacts in Period 5 suggests a lower boundary date of 1700 for the settlement of the Hill House site. Unfortunately, this data is very inconclusive since unit 7Q was the only square to be taken down completely to bedrock.

### **Ceramic Analysis at the Hill House**

The artifacts recovered from the excavation are considered 'sheet refuse'. Sheet refuse is defined as "a broadly spread, thin deposit found on living or construction surfaces" (Rothschild 1990:145). These artifacts are often fragmentary due to trampling

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<sup>18</sup> Michael Jarvis further subdivided the stratigraphic levels according to the concentrations of rubble.

**Table 2**

## Summary of Occupation Periods at the Hill House Site

<b>Period</b>	<b>Description</b>	<b>Date Range</b>	<b>Mean Date</b>
Occupation 1	Modern debris	Late 20th C	Not established
Occupation 2	Recent Occupation	Circa 1769 to early - mid 20th C	1807
Occupation 3	Construction/Destruction	Middle 18th to Early 19th C	1769
Occupation 4	Initial Occupation	Late 17th - early 18th C to Middle 18th C	1740
Occupation 5	Pre-Occupation	1700	Not established

and other destructive elements. The Hill House ceramics were generally small, therefore restricting the level of analysis to waretypes. However limiting, an analysis of the ceramics allowed Agbe-Davies to establish the dates of occupation for the site and to make some broad generalizations.

Agbe-Davies (1994) examined the ceramic waretypes present at the Hill House through time to determine if a pattern of ceramic refinement similar to those found by James Deetz and Marley Brown in Plymouth, Massachusetts existed. Deetz (1973) and Brown (1973) divided the progression of ceramic refinement they observed into three stages. During the early years of settlement in New England, most ceramics were associated with food processing and storage, with coarsewares the dominant waretype. Tablewares, those ceramics associated with serving and consumption, would have been rare. The second stage is characterized as a transitional period. As coarsewares decline in popularity, there is a significant increase in refined tablewares. In the third stage, refined tablewares would be dominant. Despite the time discrepancy – early eighteenth

century for the Hill House versus the mid-seventeenth century for Plymouth – Agbe-Davies concluded that the distribution of waretypes at the Hill House site was similar to those observed by Deetz and Brown (Agbe-Davies 1994:139).

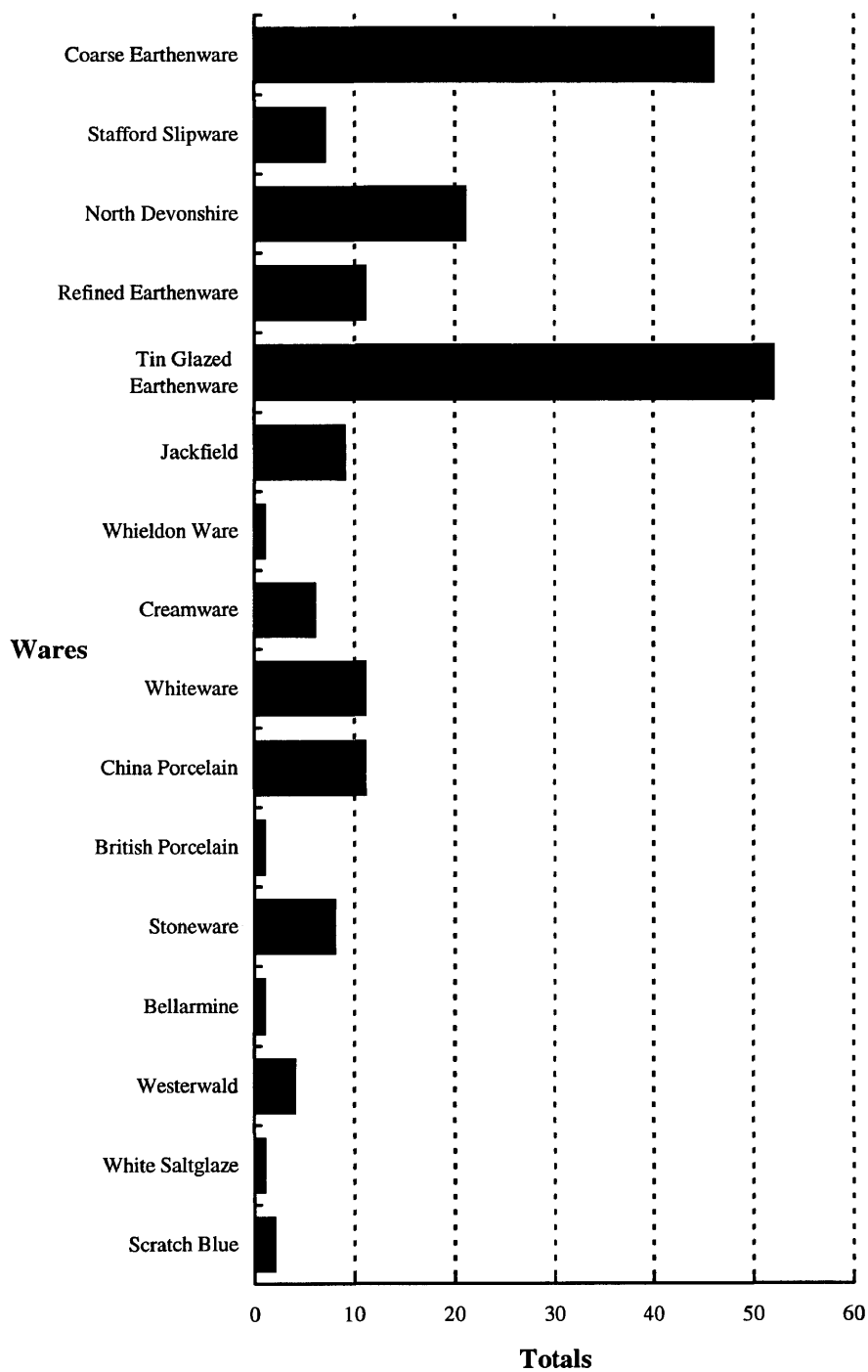
The archaeological ceramic assemblage recovered from the Occupation 4 stratigraphic levels is dominated by utilitarian wares. The coarse earthenwares, North Devonshire in particular, are thick and undecorated, and appear to be from large milk pans or other storage vessels (Agbe-Davies 1993:74). Although the tin-glazed earthenwares are the most prominent waretype, Agbe-Davies has classified them as utilitarian wares. The justification for this is based upon the long period of manufacture for tin-glazed earthenware, approximately 1600 to 1800. During the early years of production, tin-glazed earthenwares were primarily used for serving vessels and small containers (Agbe-Davies 1994:144). The Graph 1 illustrates the range of waretypes found in the Occupation period 4 assemblage. The graph is based upon the number of sherds present rather than a percentage or vessel count.

The Occupation period 3 (Construction/Destruction) ceramic assemblage is still dominated by tin-glazed earthenwares. However, the number of coarsewares present has declined while the number of refined tablewares, such as whiteware, creamware and pearlware, has increased. The ceramic assemblage of Occupation period 2 (Recent Occupation) closely corresponds to the third stage described by Deetz. Although coarsewares, tin-glazed earthenwares and stonewares contribute to the assemblage, they are greatly outweighed by refined tablewares, particularly whitewares. The Graph 2 illustrates the progression of ceramic refinement at the Hill House.

Archaeologists quite often use ceramic evidence to establish the socio-economic status of the individuals associated with the site. Some have argued that the use of ceramic evidence as status indicators is not feasible unless specific information regarding vessel shape can be established (Baugher and Venables 1987:43). Therefore, to accurately assess the socio-economic status of the Hill House occupants during

## Graph 1

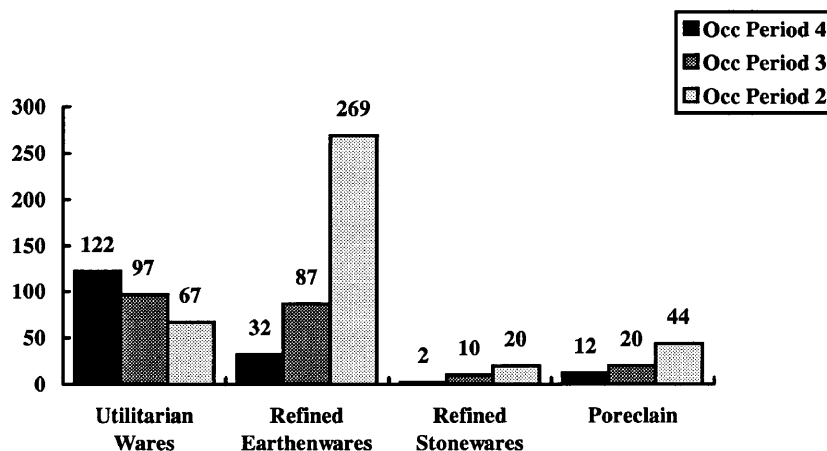
### Ceramics from Occupation Period 4, the Hill House Site, Bermuda



(After Agbe-Davies 1993:98)

## Graph 2

Number of Sherds by Ware



(after Agbe-Davies 1994)

Occupation period 4 (1700 - 1750), a variety of factors must be taken into consideration. The quantity and quality of ceramic waretypes combined with historic architectural plans and the proximity of the Hill House to the agricultural fields suggests that the Hill House was occupied by individuals of low socio-economic status.

The data recovered from the 1992 excavations, combined with the analyses completed by Jarvis and Agbe-Davies provide the basis for this study. The uniqueness of this domestic site – its rural location at the West End of Bermuda, as well as the seemingly uncontaminated, continuous level of occupation from the late seventeenth century or early eighteenth century to the middle of the eighteenth century – provides an opportunity to learn about early Bermudian life.

## **Faunal Analysis at the Hill House**

An analysis of the faunal remains would help to illuminate the types of food practices that evolved in Bermuda. How would the faunal remains from the Hill House site compare to the 'traditional British foodways' model of animal use at a domestic British colonial site (Honerkamp and Reitz 1983:336)? In addition, would the results be similar to those discovered at other colonial sites namely in coastal Georgia and the Chesapeake?

The faunal remains recovered from the stratigraphic levels corresponding to the Initial Hill House Occupation (1700 - 1750) should provide an insight into the development of subsistence practices in early rural Bermuda.<sup>19</sup> The faunal remains included in this study were from Operation 5, Unit P, levels 4 and 6, (hereafter referred to as 5P4 and 5P6), 7N4, 7N5, 7N7, 7Q6, 7Q7, 7T4, 7T5, 7W4, 7W5, 7Y4, 2V7, 2V8 and 2V9 (See Figure 5). Initially, the lowest stratigraphic level in Operation 3, Unit N/P was considered part of the Initial Hill House Occupation. However, the discovery of nineteenth century ceramics in a seventeenth to eighteenth century context, effectively placed this level into the Recent Hill House Occupation (Period 2), and was thus eliminated from the study.

As noted before, the artifacts and faunal remains recovered from the Hill House excavation were considered 'sheet refuse'. As evidenced with the ceramics, one would expect the faunal remains to exhibit a high amount of fragmentation due to the exposed nature of sheet refuse. Small, fragile bones, such as birds and fish, are often destroyed, reducing the potential knowledge of what food resources were actually consumed. An additional source of bias affecting the faunal assemblage came from the use of a 1/4 inch sieve to screen the excavated soil. Singer (1987:85) states that a minimum of 75% of all herring-sized bones are lost when using a 1/4 inch mesh screen. Had an 1/8 inch sieve

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<sup>19</sup> The faunal remains that comprised this study were selected based upon Michael Jarvis' stratigraphic analysis and Anna Agbe-Davies' ceramic analysis and dating.

been used for screening, a higher proportion of small bones may have been recovered – in particular those fish species that were known to have been imported into Bermuda (mackerel, cod, menhaden and Atlantic herring) (Bowen and Jarvis 1994:89; Jarvis 1997). The presence of these species would have provided information regarding the degree to which the Hill House occupants relied upon the importation of foodstuffs.

Despite the biases inherent to this faunal assemblage, a high recovery rate of fish elements was made. The preservation of faunal remains is directly related to the nature of the surrounding soil. Soils that are clayey or acidic tend to lower the preservation rate. While those soils of a sandy or alkaline nature – a pH level of seven or greater – tend to have a higher recovery rate of small and fragile bones (Miller 1984:202). Given the alkaline nature of the surrounding soil, the presence of fish bones in the Hill House assemblage is not surprising.

The initial laboratory analysis of the Hill House faunal remains took place in the zooarchaeological laboratory at the Department of Archaeology, the Colonial Williamsburg Foundation, Williamsburg, Virginia. After being washed, the faunal remains were sorted into unidentifiable and identifiable elements. The unidentifiable bones were first sorted by taxonomic class, *i.e.* Mammalia, Osteichthyes, Aves, and then by element type, *i.e.* vertebrae, long bone, flat bone. They were then counted and weighed. The identifiable bones were identified to the lowest possible taxonomic level using the zooarchaeological laboratory's comparative skeletal collection. The fish remains were identified to the family level using the comparative fish collection. The fish assemblage was then sent to the Zooarchaeological Laboratory at the Florida State Museum (FSM) at Gainesville, Florida for further identification. The extensive tropical fish collection at FSM allowed for identification to at least the genus level.

With an ideal faunal collection, a variety of quantitative methods will be employed to interpret the findings. A calculation of the number of identified specimens, NISP, is the most basic method. NISP counts the number of individual bone fragments

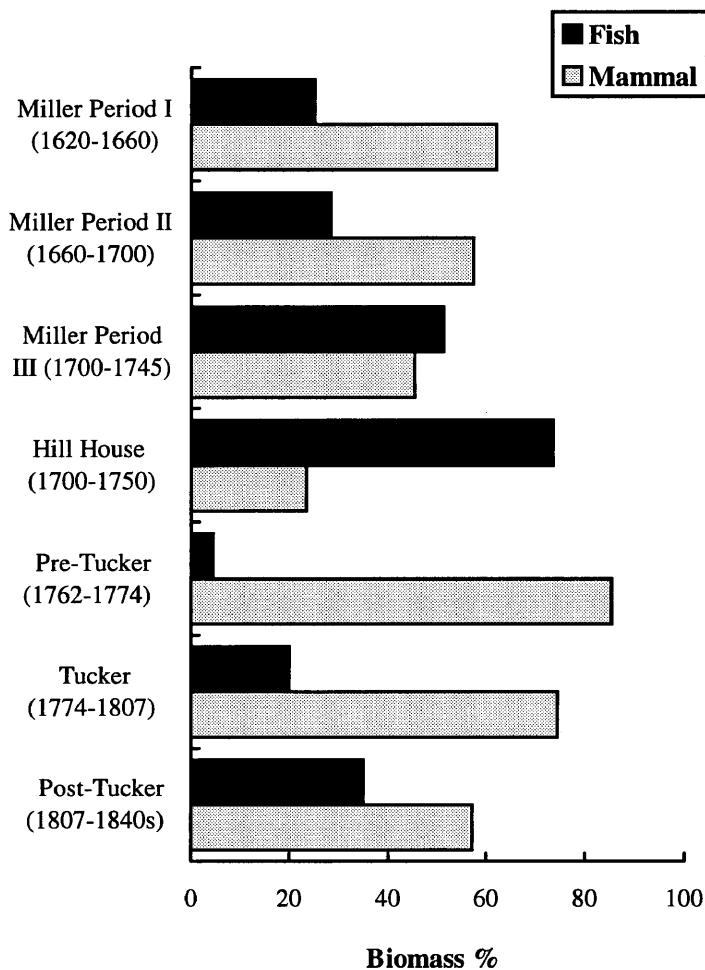
recovered to measure the relative abundance of a taxon (Miller 1984; Rothschild 1990). To estimate how many animals, regardless of size, are represented in an assemblage, a calculation for the Minimum Number of Individuals (MNI) is performed. This is achieved by tabulating the most frequently occurring element of a particular animal, with size and age variables taken into consideration. MNI is a valuable quantifier in faunal analysis for it establishes which animals were major contributors to the diet. However, this is often misleading since a cow obviously contributes more meat to a diet than ten herring (Reitz and Honerkamp 1983). The dietary importance of a taxon is determined by estimating the biomass for each animal. The biomass for each species is determined by taking information known about the original size of the animal and estimating the quantity of meat represented by the recovered bone (Wing and Brown 1979; Reitz and Honerkamp 1983).

Due to the previously mentioned biases and the small size of this faunal collection (486 NISP), a calculation of MNIs was not performed. Therefore, the summary of the faunal remains from the Hill House site (Appendix I - Table 5), consists only of NISP and biomass estimates. However, an interpretation of the data provided by these two quantitative measures does allow the diet of the Hill House occupants to be reconstructed. This, in turn, provides an opportunity to examine the subsistence resources and strategies available to these occupants.

The analysis of this data revealed that the Hill House occupants were subsisting on a diet composed primarily of fish, supplemented with domestic animals and fowl. Bony fish (Class Osteichthyes) contributed 73.5% of the total biomass, while domesticates (cow, pig and sheep/goat) contributed 19.5% and birds (Class Aves) contributed 0.5%. When compared to mainland colonial British sites, with the variables of time and socio-economic status ignored, this heavy reliance upon fish at the Hill House site appears to be unique.

### Graph 3

#### Relative Dietary Importance



(after Miller 1984 and Bowen 1992b)

Had the faunal remains from the Hill House been analyzed in terms of the British Barnyard Complex model of animal use there would have been no doubt that environmental factors strongly altered the settlers' traditional subsistence strategies. The Hill House site could be classified as just another example of how inappropriate the notion of unmodified transference was. The Colonization model fails to explain this incredible reliance upon fish. According to Henry Miller's theory, the Hill House site

should reflect the stability and complexity of the surrounding socio-cultural group. Therefore, the subsistence system should reflect a greater reliance upon traditional meat sources and not fish. The Colonization model would examine the various criteria of fish as a resource and would conclude that the mere dependability of fish was enough to justify its persistence as a subsistence resource. As noted earlier, neither of these models answer the question 'why' with any amount of clarity or detail. However, the application of the Risk Aversion Theory, with its analysis of the problems faced and the solutions adopted by the Bermudians, should illuminate the persistence of fish in their diet.

According to Henry Miller's colonization model, Bermuda, having been settled since 1612, should have reached the same level of stability as the Chesapeake region by the early eighteenth century. By the first half of the 1700s, Bermuda was practicing a mixed subsistence strategy based upon farming, importation of goods from Britain and fishing. Given that the Bermudian subsistence system evolved from the same rudimentary practices as those found in the Chesapeake region, why were fish so prominent in the diet of the Hill House occupants? Limited economic means undoubtedly restricted the types of meat available for consumption. However, Henry Miller found that even poor to middling households in the Chesapeake were eating substantially more domestic meat than wild. In an attempt to understand why fish became such an integral part of the Bermudian diet, the variables affecting each subsistence practice must be taken into consideration. When the variables that affect the certainty and productivity of each practice is considered then the Hill House's reliance upon fish becomes more comprehensible.

## Farming

An Act intituled An Act for the renewing the Act intituled an Act for the greater encouragement of planting Indian corn in these Islands. (BHQ 1950 7(3):100)

The preceding legislative act, dated November 15, 1722, accurately depicts the status of agriculture throughout the history of Bermuda. The reluctance of Bermudians to raise subsistence crops for consumption can be traced back to the first years of the colony. As is true of most colonization efforts, the primary goal of the settlers was to make Bermuda secure, then to make the islands profitable. The labor intensive tasks of building forts, clearing and planting fields for tobacco crops left the colonists with little impetus to provide for themselves. As a result, the colonists relied heavily upon the local wildlife and sundry supplies provided by the Somers Island Company. With profit paramount, the Somers Island Company provided the settlers with cattle, sheep and fowl and encouraged them to plant Indian corn and potatoes (Bowen and Jarvis 1994:86). Idealistically, once the settlers were self-sufficient then the Company would get a return on its investment with minimal expenditures. Therefore, the Somers Island Company resolutely insisted upon the raising of commercial crops, especially tobacco, despite colonial suggestions that the cultivation of other crops might be more suitable to the island environs. This narrow-minded insistence upon money making ventures ultimately became the underlying theme to Bermudian subsistence practices – why grow it yourself when it is easily obtainable elsewhere?

Many authors have commented upon the Bermudians' aversion to agriculture (Strode 1932; Kerr 1936; Michaux 1959; Butland 1980; Hayward *et al* 1981). The source of this aversion has not been clearly defined, although some attribute it to the association of farming with socially inferior individuals, *i.e.* slaves (Kerr 1936;

Hayward *et al* 1981). Others claim that the size of the land holdings (approximately twenty-five acres) was the deciding factor. For the land holdings were so small “that no one could support a large family, let alone improve one’s situation” (Agbe-Davies 1993:29). The social stigmatism of farming, combined with prevailing economic strategies, environmental restraints, and climatic variability undoubtedly contributed to this attitude. “The people will go out in their boats to catch a groats<sup>20</sup> worth of fish rather than earn a piece of eight by improving their land” (Wilkinson 1950:275).

### **Economic Strategies**

The importance of agriculture in Bermuda has been intricately bound to the economic strategies of the time. From 1612 to about 1630, the colonists were cultivating crops designated for export to England. The Somers Island Company stipulated that the colonists would pay their rent through the system of half-shares. That is, the tenant would be responsible for growing commercial crops on the (absentee) owner’s land. Once the crop was harvested, the tenant would receive half of the profits and the owner the other half (Lefroy 1879:165). Primarily, the colonists planted tobacco and Indian corn although other crops included sugar cane, fennel, aniseed, pineapples, citrus trees and onions (Bowen and Jarvis 1994; Jarvis 1994). Unfortunately, crops such as Indian corn and tobacco were ‘heavy feeders’ and soon depleted the soil of its nutrients (Hayward *et al* 1981:137). By the 1630s the depletion of the soil resulted in the production of poor quality tobacco, which in turn, elicited a depression in tobacco prices (Pares 1960; Jarvis 1994). In response to the tobacco depression, many Bermudians began to diversify their crops and began to convert many fields into pasture for livestock.

The success of livestock herding, coinciding with a growing market in the West Indies during the 1640s and 1650s, led to the next shift in Bermudian economic strategy. For the next thirty to forty years, Bermudians would concentrate their efforts into raising

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<sup>20</sup> A groat is a British silver fourpiece used from the fourteenth to the seventeenth century.

provisions for the West Indies. Exports included tobacco, citrus fruits, potatoes, onions, spices, salted beef, pork and fish, cedar timber and perfume (Jarvis 1994:7). Tobacco and fruit continued to be shipped to England but the majority of exports were sent to the West Indies in exchange for sugar and rum. As Bermuda's trade with the West Indies increased, conflicts arose between the colonists and the Somers Island Company. The Company wanted to maintain their control over the colony's trade – the freight charges on commodities shipped from Bermuda and the high mark up rates on British manufactured goods sold by the magazine ship continued to generate considerable revenues. The colonists, on the other hand, wanted to be able to build their own ships – thus enabling them to ship their goods directly to the West Indies and then trade for manufactured goods at rates much lower than those offered by the magazine ships (Jarvis 1994:12). This discord contributed to the dissolution of the Somers Island Company in 1684 and the inception of Bermuda's maritime economy.

The Bermudians initially began to construct ships to expedite their trading opportunities. However, by the 1690s, overgrazing by livestock had once again depleted the soil and consequently many of the pastures and fields were utilized for the production of raw materials needed for shipbuilding<sup>21</sup> (Bowen and Jarvis 1994:86). The islanders' primary source of revenue came from the exploitation of palmetto and cedar trees. The leaves of the palmetto were used to make platt, ropes and cables to fit the boats which were constructed from the cedar trees. A visitor to Bermuda commented that “the *Juniperus Bermudiensis* was the only wealth of the inhabitants” (Michaux 1959:108).

The decision to allocate land for the sole purpose of raising cedar trees had a significant impact upon the subsistence strategies of the Bermudian population. The production of crops for local consumption, as well as for export, was diminutive by 1720.

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<sup>21</sup> For a complete history of ship building in Bermuda refer to Michael Jarvis, 1992, Cedars, Sloops, and Slaves: The Development of the Bermuda Shipbuilding Industry, 1680 - 1750. Unpublished M.A. Thesis, Department of History, the College of William and Mary.

The small amount of land still being cultivated would perchance yield enough provisions to support the islanders for three months a year (Kerr 1936:2). However, the shipping records indicate that potatoes, onions, garlic, ginger, coconuts, limes, livestock and some tobacco were still being grown for export to some extent. Ultimately, this shift to a full scale maritime economy left most Bermudians increasingly dependent upon imported goods, such as pork, beef, peas, corn, flour and bread (Bowen and Jarvis 1994:87).

### **Household Gardens**

One strategy available to the poor, as well as others, was the planting of household gardens. Vegetables were reputed to be suitable foods in times of hunger (passive diversification) and often associated with the poor (Miller 1984:93). However, for many, foodstuffs raised in the garden may have been the only source of variation in a diet dominated by fish. Little documentation exists describing what was actually raised but common plants might have included melons, cucumbers, carrots, onions, artichokes, lettuce, spinach, cabbages, legumes, parsnips, radishes, and turnips (Miller 1984:78). The presence of household gardens in Bermuda has been implied in the eighteenth century probate inventories. “New howes, old howes, digging howes, branory howes, and spades” are listed in a majority of the probate inventories from Sandys Parish (BNA 1976; Vols. 4 - 8). The probate inventory of William Harmer, planter, December 8, 1730, records the existence of ‘a parcell of Growing potatoes’, valued L 1 (BNA 1976; Volume 6). Whether or not these potatoes were for local consumption or for export is not clear.

During times of stress, the Bermudian government would make available other strategies to ensure that the poor had adequate access to foodstuffs. When Bermuda was originally settled, the Somers Island Company decreed that the land be divided into eight tribes, with two thousand acres set aside as ‘general land’, to be held by the Company. This ‘general land’ was worked by a public labor force and the profits were to help reduce the cost of supply and government (Jarvis 1994:3). By the middle of the

eighteenth century, portions of the 'general land' were "Let without any Limitation of Time, some few Tenants that have no other way of subsisting themselves rear stocks, plant onions, cabbages, potatoes, barley, Indian Corn..." (BHQ 1968 25(2):44). Undoubtedly, the Bermudian government took a portion of the crops' yield in exchange for rent.

### **Topography**

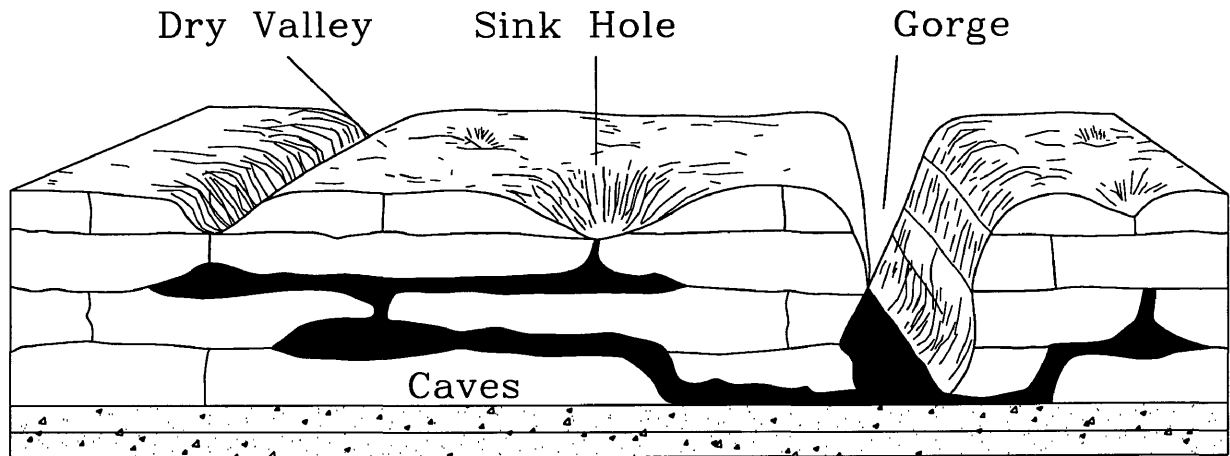
Ambivalence and economic strategy aside, the geography of Bermuda is not well suited to long term agriculture. Bermuda has a total land mass of a little more than twenty square miles and consists of approximately 350 islands. The terrain consists of marshy depressions surrounded by hills. Soils suitable for agricultural purposes are confined to areas surrounding marshes and the floor and sides of the depressions between hills. The nature of the Bermudian soils and climate, as well as the prevailing economic strategy, played a major role in deciding what types of crops could be raised.

In 1760, a visitor to Bermuda described the islands as:

... the summits of some unfathomable Rocks the Basis of which are lost with those of y<sup>e</sup> Earth, which the Oceanick waters in the ancient depression cou'd not well Cover, but in revenge its agitated Billows have broke & destroyed every adjoining part which cou'd not resist their Ponderous Fury ... the geographical View of this Cluster presents you with a sort of Archipelagus, where breakers, single Rocks Bars, shallows & Sands may be considered on a Small Scale as so many contiguous Islands... (Moore 1995:108).

The topography of Bermuda is typical of a Karst landscape. The relief is due to dune formation and solution sinks (Watson *et al* 1965:21). The dunes were formed during and after the Ice Age, when strong winds blew fine calcareous sand upon beaches that had been exposed by the lowering of the seas. Consolidation of the sand particles (disintegrated coral, shells, serpulae and other organisms) due to the percolation of rain water resulted in an Aeolian Limestone. Solution sinks, the dissolution of the limestone through erosion, have created many gorges, caverns and basins. (Figure 7). In other

Karst regions of the world, these basins would have acted as a natural reservoir for fresh water. However, due to the porous nature of the Bermudian limestone, rain water percolates downward as sea water flows in from the sides or underneath (Watson *et al* 1965:23). The result is salty or brackish water, unsuitable for human consumption or agricultural irrigation.

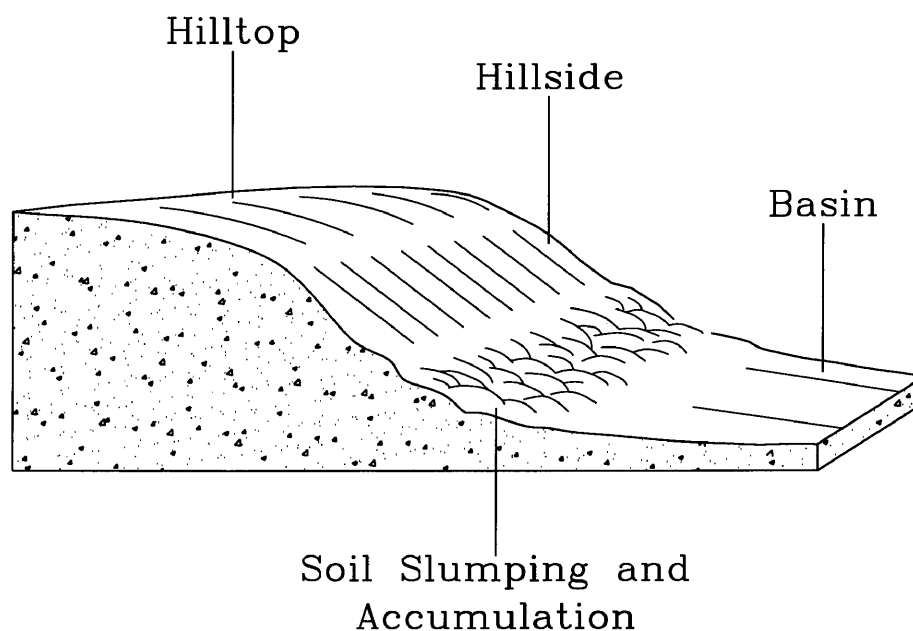


**Figure 7** Example of a Karst topography (after Watson *et al* 1965).

The generally low hills of Bermuda can be divided into four sections: (i) hill tops; (ii) steep hillsides; (iii) sides of the basins and depressions; and (iv) the bottom of the basins. The soil found on hill tops tends to be thin, loose, sandy, low in organic content and highly calcareous. The rapid absorption of water has left the hill tops relatively dry, thus rendering them inappropriate for agricultural pursuits. During the colonial period Bermudians often used the hill tops as pasture for livestock, a practice which led to extensive erosion (Watson *et al* 1965:91). The soil found on the steep hillsides is very similar to that on the hill tops (thin, low organic content, highly calcareous and minimal water retention capabilities) and subject to erosion. If the soil is not actually washed down the slope, it moves gradually, slumping down in a rippling effect into the basins. (Figure 8). The most fertile land in Bermuda is found on the sides of basins and depressions. The sandy-loam soils found here are the result of fine silt mixing with the

soils that were washed down the hillsides (Watson *et al* 1965:91). These soils characteristically have a good supply of organic and mineral nutrients, are moderately calcareous and retain most moisture and are thus ideal for raising crops (Watson *et al* 1965:87). The basins, formed between dune hills or developed by cave collapse, should have provided Bermuda with an abundance of fertile land. However, brackish waters have invaded the basins, turning them into ponds and marshes, and consequently rendering the land useless.

The soil depth in Bermuda ranges from insubstantial on the hill tops to several feet in the basins and depressions, averaging six inches island-wide. The west section of



**Figure 8** Cross-section of a typical Bermudian hillside (after Watson *et al* 1965).

unit 7Q illustrates the depth of soil surrounding the Hill House (See Figure 6). The virgin soils of Bermuda were typically (i) high in lime content; (ii) porous in texture; (iii) low in nitrogen; and (iv) low in organic matter (Hedlund 1939:10). The high lime content is due to the nature of the parent rock. High lime content means that the soils are naturally alkaline, a pH level of seven or greater. The high recovery rate of faunal bones,

particularly of fish bones, at the Hill House site is typical of alkaline soils. (Miller 1984:202) Bermudian soils tend to be rather sandy due to their derivation from aeolian dunes. The porosity of the soil directly influences its moisture holding capacity, *i.e.* the larger the particles (of sand), the less moisture is retained, and nutrient leaching is accelerated. The amount of plant nutrients present, nitrogen and organic matter (humus), directly determines the fertility of the soil. Soils low in nitrogen, phosphorous and potash (components of humus) tend to inhibit plant growth.<sup>22</sup> Unless nutrients are added through fertilization the productivity of virgin soil is short lived.

Within twenty years, the agricultural practices (cultivation of tobacco and Indian corn) of the early settlers of Bermuda had depleted the soils of their nutrients. In an attempt to improve this situation, many of the planters diversified their crops, introducing citrus trees, potatoes and onions. It was not until the 1730s that fertilizers were used<sup>23</sup>, adding nutrients to the soil and increasing the soil's water retaining capacity. Governor Alured Popple (1738 - 1764), in an attempt to revive farming, found that seaweed was an effective fertilizer, along with barnyard manure, compost and green manure (Wilkinson 1950:195 and Hedlund 1939:94). One ton of seaweed contains the same amount of nitrogen, phosphorous and potash, as one ton of manure. Economically speaking, the expense of getting and composting seaweed is lower than obtaining the same amount of manure. However, seaweed cannot be spread directly on the fields and plowed under as is the case with manure. Rather, seaweed must be composted with care that nitrogen will not be lost as ammonia (Hedlund 1939:106).

## **Climate**

Another factor with which farmers in Bermuda had to contend was the climate. Located about 650 miles east of North Carolina, the climate of the islands is influenced

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<sup>22</sup> See Hedlund (1939) and Watson *et al* (1965) for more information regarding the soils of Bermuda.

<sup>23</sup> The act of fertilizing may have been in use before this time but there is no historical documentation.

by both the tropical trade-wind belt and the temperate westerly belt. The average annual temperature is 70 degrees Fahrenheit, with August being the hottest month (80° F) and February being the coldest (62° F) on average. The annual rainfall in Bermuda is approximately 57.6 inches, distributed evenly throughout the year. Relative humidity is usually greater than 70%. With no true winter and no true dry season, farming may be practiced continuously year round, with some fields cropped two to three times (Watson *et al* 1965).

Despite the conducive growing conditions, the practice of agriculture in Bermuda is fraught with high risks: plant diseases, pests and hurricanes. Upon his arrival in Bermuda in 1720, Governor Hope observed that "...the trees and plants which remain, after blasts and mildews, seldom bear fruit and the tobacco has gone after having been eaten by a worm" (Wilkinson 1950:100). Other agricultural pests and diseases that have been noted include ants, red spiders, nematodes, tuber moths, wireweed and mosaic (Hedlund 1939; Wilkinson 1950). But perhaps the most destructive and unpredictable risk to the Bermudas is the hurricane.

The principle farming season in Bermuda is from September to early May, when the heat and the rain are not excessive. Unfortunately, the farming season coincides with the Atlantic hurricane season, June 1 to November 10. Hurricanes are characterized by (i) storm surge; (ii) tornadoes; (iii) heavy rainfall; and (iv) high winds. The storm surge is the rapid rise in water produced by offshore hurricane winds and falling barometric pressures (Dunn 1960:207). Waves associated with the storm surge can break upon the shore four hundred to five hundred miles ahead of the storm. The coral reefs surrounding Bermuda protect the coastline from severe damage by breaking the wave and current action associated with the storm surge. Tornadoes associated with hurricanes usually occur in advance of landfall and tend to have short path lengths. Tornadoes rarely occur in the Bermuda region and only if they move over land do they wreak substantial damage. The most destructive elements are the wind and the rain. Hurricanes generally have

sustained wind speeds of at least seventy-five miles per hour. The winds may exceed seventy-five miles per hour to the south of the eye of the storm and one hundred and fifty miles per hour to the north. If a hurricane passes to the west of Bermuda or directly over top, the winds are more severe since the progressive movement of the storm increases the force of the winds (Tannehill 1944:29). Likewise, if a hurricane passes to the east, the winds tend to be less severe, causing less damage. Damage to tree crops includes defoliation, the stripping of fruits, the snapping of tree branches and trunks, and uprooting. Low-growing agricultural crops are similarly affected.

The destruction caused by torrential rainfall is manifold, breaking off leaves and flowers, bending or breaking stems, and splattering or partially burying low lying crops. Vegetables that develop from flowers – tomatoes and eggplant – usually cannot recover. Flooding in low lying areas, such as basins and depressions, will uproot or snap plants. However, the greatest damage sustained is when the crops are covered by flood waters, debris and mud. Aside from damaging crops, heavy rains will increase the amount of leaching and soil erosion that Bermuda already incurs. Occasionally, rainfall will be light, allowing salt spray to be carried over the land. The accumulation of salt not only affects vegetation (tender crops such as tomatoes and potatoes in particular) but the water supply of the population. Terry Tucker noted that “impoverished Bermudians ... became disinclined to grow crops which might be burnt by salt spray” (Tucker 1982:37). Long term effects of hurricane damage are (i) the loss of production potential and expected income; and (ii) the loss of the food supply means that foodstuffs must be imported (Hammerton *et al* 1984:281).

Despite the notable effect that hurricanes can have on Bermuda’s agricultural productivity, the number of hurricanes that have actually affected Bermuda since the colony was established in 1612 is difficult to determine. Andreas Poey's 1856 chronological “List of Tropical Storms of the North Atlantic, Including the Gulf of Mexico and Caribbean Sea, From 1494 - present” states that there were no observable

hurricanes near Bermuda between 1700 and 1760 (Tannehill 1944:233). However, there was no formalized method of recording hurricanes until the creation of the United States Weather Bureau in the late nineteenth century<sup>24</sup>. Twelve major storms / hurricanes were noted between 1710 and 1750, as a result of damage to parish churches, bridges or the Governor's house. The only firm reference to crop damage is found in a petition sent to King George II stating that the previous year (1726) had been so stormy that their crops had failed (Tucker 1982:37).

In order to minimize potential crop losses, a number of strategies were adopted by the Bermudian farmers during the colonial period, including: (i) selective locations for planting crops; (ii) small, dispersed plots;<sup>25</sup> (iii) scheduling the agricultural season around the high risk times of year; and (iv) planting a variety of crops such as cabbage, carrots, cucumbers, legumes, sweet potatoes and yams (McCloskey 1976:125-6; Hammerton *et al* 1984:286). An examination of the map of Hog Bay Park in Figure 2 illustrates that these risk reduction strategies are still being practiced today. The fields within the park tend to be located between hills or on hill slopes, away from the coast and the salt spray. The fields themselves are a patchwork of irregularly shaped plots, each likely planted with a different crop.

The risks and uncertainty associated with agricultural pursuits, combined with economic factors, had a profound affect upon the food procurement strategies of the Bermudians in the seventeenth and eighteenth centuries. The shift from an agriculturally based economy to a maritime industry, beginning in the 1690s through the 1720s, effectively eliminated a viable food resource for a majority of the population. Bermudians were now heavily dependent upon the importation of foreign provisions.

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<sup>24</sup> Evidence of hurricanes in Bermuda is derived from the Minutes of Her/His Majesty's Council and secondary sources.

<sup>25</sup> See McCloskey (1976) "English Open Fields as Behavior Towards Risk." Research in Economic History 1:124-170.

However, for some levels of society, the purchasing of imported goods was not an option. They had to develop alternative subsistence practices to counteract hunger.

## Imported Goods and Alternative Subsistence Practices

Since the colony's inception, Bermudians have been heavily reliant upon imported goods from England and her colonies. The early settlers had to rely upon the Company's magazine ships that arrived once, perhaps, twice a year. 'English Woolen and other Manufactures' offered by the magazine ship were to keep the colonists 'in a firmer Dependence' upon England and to render them 'more beneficial and advantageous' to her (Barrow 1967:4).<sup>26</sup> The dissolution of the Somers Island Company and the expansion of Bermudian trade in the last quarter of the seventeenth century increased the variety of goods available for purchase in Bermuda. Merchants continued to retail British manufactured goods, as well as, wares from colonial America that were modeled after their British counterparts, and foreign products which were undoubtedly imported illegally at the West End of the island (Wilkinson 1950:196 and Jarvis 1992b:40). The increase in Bermudian trade, which should have brought about a depreciation in prices, was not significant enough to offset the risks involved. This chapter will explore some of the variables affecting the certainty and accessibility of imported goods and how some Bermudians coped with this subsistence resource.

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<sup>26</sup> Excerpts from the Staple Act of 1663 as recorded in T.C. Barrow, 1967, Trade and Empire: The British Customs Service in Colonial America, 1660 - 1775.

During the latter decades of the 1600s, Bermuda's economy shifted from commercial agriculture to maritime industry. Lands that had been used for agricultural purposes during the seventeenth century were being reforested with cedar trees. Not only did the economic shift affect land usage in Bermuda but it greatly affected the subsistence strategies of the local population. During this transitional period, Bermudians became increasingly dependent upon the importation of provisional goods – apples, butter, cheese, mackerel, onions, rice and wheat. The cumulative import data for the years 1716 and 1750, compiled by Michael Jarvis, illustrate this reliance. In 1716 sixty-six barrels of beef were imported into Bermuda. By 1750 this number had risen to two hundred and ninety-three barrels. The following table lists just a few of the goods being imported during these time periods.

**Table 3**

	<b>1716</b>	<b>1750</b>	<b>Unit</b>
<b>Beef</b>	66	293	barrels
<b>Bread</b>	41	404	barrels
<b>Flour</b>	427	729	barrels
<b>Pork</b>	296	718	bushels
<b>Corn</b>	28,558	79,367	bushels
<b>Peas</b>	170	1,144	bushels

(after Jarvis 1997)

It should be noted that the list consists only of those goods that were of equivalent units of measurement. In addition, the amount of foods designated for re-exportation has not been calculated (Michael Jarvis 1997, pers. comm.). Therefore this list should be interpreted as being exemplary rather than definitive. Unfortunately, few shipping records have survived prior to 1715 to truly appreciate this increased dependency. This dependency upon one resource ultimately increased the uncertainty of the Bermudians' ability to fulfill their dietary requirements.

August 20, 1707... very hazardous at hurricane time which attends these American parts at this time of year also being very well assured that the French Privateers are Cruising upon the Northern Coasts so that had any accident attended her Majesty's interest had bin Intirely lost (BHQ 1948 5(1):13).

Risks such as those described above prompted many Bermudian shippers to take measures to protect their investments. In response to threats from pirates and enemy ships, the number of ships outfitted as privateers or sailing under a 'Letter-of-Marque' increased greatly during the first half of the eighteenth century. Originally privateers were private armed vessels that sailed under the flag and commission of a government. The commission, also known as a 'letter-of-marque and reprisal', entitled the subject to "make reprisals on the subjects of a hostile state for injuries alleged to have been done to him by the enemy's army or navy" (Chapin 1926:7). By the eighteenth century, a distinction had been made between a privateer and a 'Letter-of-Marque' ship. A privateer was an armed vessel used to capture the enemy's merchant ships only during periods of declared war. The crew received no wages since their pay was a portion of the prizes captured. 'Letter-of-Marque' ships were merchant-traders with the authority to capture enemy vessels. For the most part, these vessels were primarily out for commercial purposes with raiding a secondary benefit. However, in some cases, the reverse was true since the crews of these ships received a portion of the prizes as well as wages (Chapin 1926:8). The taking of valuable prizes (sugar, coffee and indigo) was subject to fortuity. However, once captured, the prizes were 'the sole interest and property' of the captors, as laid out in the Prize Act of 1708 (Starkey 1990:22). Essentially, the capture of a prize meant that additional subsistence goods were available for sale in the islands, though these supplies were characteristically sporadic and unrelated to demand.

The outfitting of a privateer provided the crew members with a relatively stable source of food throughout the length of the cruise. In addition to the supplies taken on board in Bermuda, foodstuffs were replenished in other ports, and supplemented by the

procurement of fresh fish. The following provides an example of supplies taken onboard by privateers in Bermuda.

Resolved that 6 barrels of pork 6 barrels of flour 2 barrels of bread 50 gallons of rum 20 gallons Madera Wine a barrel of sugar 3 barrels of gunpowder 200 of musquett Ball from His Majestys Magazine, with sufficient water casks and water to be taken from on board the several vessels now in these Islands and put on board the said sloop Rose for this expedition (BHQ 1956 13(1):5).

Demand for crew members quite often exceeded the supply of able-bodied men. In 1741, the governor refused to outfit another privateer because the island was already dangerously depleted of men. Not only was the defense of Bermuda at stake, but, as was seen in Chapter 5, few remained to carry out subsistence strategies such as farming.

Privateering seems to have been an extremely successful venture for a limited number of Bermudians. The amassing of wealth for some had negative repercussions on those who remained in the islands, for the reliability of provisions arriving in the islands to ward off subsistence stress was now uncertain. During times of war and increased privateering, supplies may not have reached the islands due to attacks by foreign privateers or were intermittently delayed by the raiding adventures of the Bermudian seamen. Ultimately, the advent of war during the early eighteenth century<sup>27</sup> had far more of an impact upon the shipping industry than mere delays. Operating costs rose as a result of increased insurance, the need for larger crews and more armament, and the delays incurred from having to sail in convoy for protection. The possible loss of markets and trading partners had an equally adverse affect upon the costs of imported goods. During the Seven Years War (1756 - 1763), Governor Pople had to petition the Provincial Congress of Pennsylvania for permission to import foodstuffs (Chester 1980:86). At the consumer level, any restriction in the market led to a reduction of goods available, accompanied by an increase in price.

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<sup>27</sup> War of Spanish Succession (1702 - 1712), War of the Quadruple Alliance (1718 - 1720), War of the Austrian Succession (1739 - 1748), and the Seven Years War began in 1756.

Price increases for imported goods further limited their availability to the common populace. During the early years of the colony, the settlers were subject to the exorbitant prices offered for goods from the Company's magazine ship. In later years,

... there are sundry people that Engross the goods that are brought into these Islands (particularly Indian Corn) so that the poor people cannot have any without paying an Extravagant price to the Engrossers which is a Great Injury done to them (Bell 1920)<sup>28</sup>.

Accounts differ as to the markup rate of the imported goods. One observer notes that the goods were sold at a mere 100% markup (Watlington 1945: 2(4):191), while another claims a 400% markup (Jarvis 1994:12)<sup>29</sup>.

Compounding the issue further was the demand for payment of imported goods in cash<sup>30</sup>. By the end of the seventeenth century, Bermudian currency was based upon Spanish silver and gold coins<sup>31</sup>. In time, there was a virtual absence of small coins available on the islands. Those small coins still in circulation had been clipped and devalued before reaching Bermuda. In the early 1720s, the Board of Trade attempted to issue copper pennies so that "fish, bread, eggs, snuff and the other small household necessities for every family" (Wilkinson 1950:186) could be procured. This effort failed when the Bermudians rejected the pennies, continuing to use the defaced and mutilated Spanish coins (Arnell 1991:19). Table 4 presents the wide range of coins found in Peter Mallory's possession at the time of his death in 1741:

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<sup>28</sup> The Records of His Majesty's Court of King's Bench, Common-Pleas Oyer and Terminer, General Goal -- Delivery and Assize, Held in Bermuda, Vol. 9. was Bell's source for this account.

<sup>29</sup> Jarvis' source for this was John Hardy (1671) A Description of the Last Voyage to Bermudas, in the Ship *Marigold*, S.P. Commander, London.

<sup>30</sup> For a complete history of currency in Bermuda see Arnell, J.C. (1991) "The Medium of Exchange in Early Bermuda." Bermuda Journal of Archaeology and Maritime History 3:19-36.

<sup>31</sup> Although business may have been conducted in pounds, shillings and pence, these were identified as Currency to distinguish the local medium of exchange from the English Sterling equivalent (Arnell 1991: 19).

**Table 4**

4 DoubleLoons	4 Johannes	2 Maydores
Half a Maydore	1 Ffrench Guineas	3 English Guineas
Fifteen Pistoles	Three half Pistoles	109 Pistoreens
17 half Pistoreens	1 quarter Pistoreen	1 French Crown
2 Mill'd pieces of Eights	2 Spanish Pieces of Eights	5 double Bitts
9 single Bitts	2 half Bitts	2 Half Bitts
3 Crimbles	1 DoubleLoon	1 half Pistole
7 Pistoreens	3 Groats	1 half Johannes
1 Quarter Johannes	1 1/2 Ffrench Crown	

(BHA 1976: Vol. 7)

The lack of small coinage does not imply that the poor of Bermuda were not able to obtain goods from mercantile stores. Frequently, necessity items could be purchased through lines of credit or in exchange for future labor. Additionally, some Bermudians employed such opportunistic strategies of negative exchange as smuggling, wrecking and/or stealing.

### **Smuggling**

The incidence of illegitimate trade in Bermuda was apparently not very high. Smuggling should, however, be considered a contributor to the subsistence strategies in Bermuda due to its noticeable mention in the historical record. In the Popple Report of 1749, the governor reports that there are “numerous violations of the said [Navigation] Acts and much smuggling” (BHQ 1968 25(2):36). Smuggling is essentially the importation of “those items which England herself could not supply as readily or as cheaply as other nations” (Barrow 1967:114). Many resorted to smuggling due to the multitude of rules and regulations imposed by the Acts of Trade, the exorbitant rates of duties on imports and exports, as well as the possibilities of considerable profit. Smuggling can be viewed as part of an adaptive strategy that allowed merchants to maintain economic stability (Schmidt and Mrozowski 1983:34).

The Navigation Acts were developed in the mid-seventeenth century to make England “a staple, not only of the Commodities of [her] Plantations, but also of the Commodities of other Countries and Places, for the Supplying of them” (Barrow 1967:4). The individual responsible for the enforcement of the Acts of Trade and Navigation was the collector. The collector’s duties were to oversee the entry of all goods, to collect all duties, to make sure that cargoes were not loaded or unloaded without the proper warrant and to issue the proper bond when needed (Barrow 1967:76). By the eighteenth century, the Acts of Trade had become so confusing that most collectors had difficulties enforcing them. The Custom officers were further hindered with the reality that they were financially dependent upon the local population. The fees and fines the Customs officers collected from duties and illegal cargoes constituted a majority of their pay. The Customs Officers were often poor, and lacking official support, were often easily bribed.

... it is hard to obtain good local customs-officers for apparently the inhabitants were unwilling to prosecute their own and were more interested in violating the law for gain rather than to uphold the law as laid down by parliament (BHQ 1968 25(2):36)<sup>32</sup>.

The effectiveness of the Customs officers was further inhibited by the natural geography of Bermuda. With so many islands, inlets, and mangrove bays, the prevention of illegal trade was almost impossible for two officers.

Traders with rum on board thought nothing of passing the Custom House at St. George under pretense of going to Crow Land with their cargo but unloading their freight where they thought best in the many obscure creeks in the Great Sound and Mangrove Bay (Bell 1920:140).

Merchants, traders and mariners were not the only individuals involved in smuggling. Neville Williams relates that Governor Bennett of Bermuda was a blatant contributor to illicit trade. Under the ‘flag of truce’, Governor Bennett exchanged a

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<sup>32</sup> Excerpt from The Popple of 1749. The Governor's response to the inquiry “What methods are there used to prevent Illegal trade and are the same effectual?”

shipload of French prisoners of war in Martinique for a considerable amount of wine and spirits rather than for English prisoners (Williams 1961:141).

Obviously, the opportunities for smuggling in Bermuda were numerous – especially when the inhabitants, the courts and the governors all benefited. Schmidt and Mrozowski (1983) view this acceptance of smuggling as a means of circumventing an economic system that offered limited opportunity. Often times, the choice of items to be smuggled was dependent on the needs and the profits of the time. Once these goods were obtained, the merchants could then manipulate the system to their benefit. Thus, by limiting their availability, the merchant was effectively guaranteeing a premium price. However, most of these goods remained out of reach for those without substantial means.

### **Wrecking**

One opportunistic strategy available to those individuals of unscrupulous nature was wrecking. These individuals “lay in wait for ships during storms, to pillage those who have the misfortune to fall on the shores” (Michaux 1959:108). Supposedly, wreckers would wave lamps from the top of Wreck Hill, also known as The Flemish Wreck (see Figure 4), to lure vessels onto the reefs. Once the vessel was in distress, the wreckers would come to their aid by salvaging the goods, while blatantly ignoring the survivors. In 1692 a regulation was enacted that required all individuals who aid a wrecked vessel to act out of good faith. This regulation curtailed the activities of the wreckers about as effectively as the Custom officers prevented illegal trade. In 1724, it was reported that a certain Captain William Nailor was in a “violent, scandalous and barbarous manner robed and plundered by Several P'sons who went out in Boats under friendly pretense of Saving goods” (Bell 1920:95). Unfortunately, the extent of this practice and it's relative contributions to subsistence will be very difficult to establish. However, the mention of wrecking in both official records and local folklore, suggest that it was pervasive.

## Stealing

A third example of the buffering mechanism of negative exchange being utilized within the Bermudian subsistence strategy is thievery. In times of stress or despair, many individuals resort to theft to obtain items that are otherwise denied. Most recorded incidences of theft seem to have involved slaves and their appropriation of foodstuffs. The meager diet provided to the slaves compelled many to steal vegetables and other foodstuffs when they were hungry.

It is no wonder to us that the negroes in General in the Country are daily complain'd of for their nightly Incursions and depra-dations since ... the said Negroes stealing in the Night and digging out the palmetto tops to the Entire destruction of the trees, is very detrimental to the Owners thereof, whose greatest Income is the product of the same trees... (Bell 1920:41-42).

The primary indication that theft was an adaptive subsistence strategy comes from the Records of His Majesty's Court of King's Bench. These records documented the creation of acts "to prevent stealing corn, palmetto topps, pumpions, or any provisions..."(BHQ 1956 13(1):7) or the indictment of a thief for the stealing a 'remnant of Cruda (?), part of a barrel of pork and divers other goods'" (Bell 1920:14).

The alternative or opportunistic strategies presented in this chapter are rarely documented in either the historical or the archaeological records. However, from the evidence that is available, it is possible to suggest that these strategies had a supplementary role in the Bermudians continual attempts to ensure an adequate resource base.

## Fishing

The success of any colonial venture depends entirely upon the development of the subsistence system. Initially, settlers attempt to establish traditional subsistence strategies, typically in the model of the 'British Barnyard Complex'. For Bermudian colonists – as discussed in Chapter Two – the transference of the 'British Barnyard Complex', in the form in which it existed in Great Britain was not viable (Honerkamp and Reitz 1983; Miller 1984) and alterations had to be made until the stability and the continuity of food resources could be established. The analysis of the faunal remains from the Hill House site revealed that the occupants were heavily reliant upon wildlife, especially fish. Over time, this dependence upon fish did not diminish, as it did at British colonial settlements in the Chesapeake. What was it about fish that allowed them to become such a prominent aspect of the Bermudian diet?

In addition to bringing over traditional food procurement strategies, the colonists arrived with a preconceived set of beliefs and attitudes about the edibility of certain foods (Rozin 1987:183). The British have never been overly fond of fish, although it was a supplementary aspect of the 'British Barnyard Complex'. Fish as a food may be rejected or accepted for a variety of reasons including taste, odor, appearance, the anticipated consequences of ingestion, the expected change in social status or the mere knowledge of what the food was and where it came from (Rozin 1987:184). According to English sources, fish are characteristically hard to cook, odorous and difficult to eat, due to the small bones. The process of preparing a fish for cooking – scaling, gutting, deboning and removing the head and tail – is labor intensive with a minimal payoff. Cooking

methods aside, fish flesh tends to fall apart easily, while the texture of some species, no matter how long it is cooked, remain flaccid and unappealing. One method used to prepare preserved fish for consumption was to soak the fish overnight to extract the salts. However, this method often left the fish watery and tasteless. To compensate for this unsavoriness, the fish were then smothered in a rich sauce that many people found indigestible (Oliver 1995:333). Additional consequences of eating fish are the possibilities of toxic food poisoning<sup>33</sup> or having a fish bone caught in one's throat.

Social disparagement may result from being known to eat certain foods or not to eat others (Mennell 1985:302). Quite often there is nothing nutritionally or physically wrong with the food item itself. Rather, social pressures dictate what foods are acceptable or unacceptable. In Britain, fish were commonly associated with the poor, immigrants and Catholics. Since fish were “not considered as substantial as meat” they were considered a poor man's fare (Oliver 1995:332). Fish was eaten only when there was nothing better to eat. In the sixteenth century, the consumption of fish increased due to the intensification of the Catholic rituals of weekly fish days and the season of Lent, during which meats could not be consumed. After the Reformation, the Protestant churches' disapproval of fish days and their connotations, led to a slight decline in the consumption of fish but the traditions carried on well into the seventeenth century (Miller 1984:80; Mennell 1985:28). An example of rejecting a food due to the knowledge of what it was and where it came from may be seen during the times of subsistence stress in Bermudian history. Bermudians were not so particular about the types of fish that were eaten when food was scarce, however, they were “reluctant to eat whale meat” (Hayward *et al* 1981:146). By the eighteenth century, Bermudians had cultivated their tastes for fish, so that they rejected “pickled shad or cheaper alewives imported from the north” during times of stress (Wilkinson 1950:276).

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<sup>33</sup> See Appendix I, Table 5 for suspect species from Bermuda.

In Bermuda, during the early years of settlement, the subsistence pattern closely resembles that found in the Chesapeake and coastal Georgia, with a considerable reliance upon wildlife. However, unlike in the Chesapeake and Georgia, colonists in Bermuda were never able to effectively establish a stable subsistence economy. Their reliance upon fish and other wildlife persisted well into the eighteenth century. Contributing to Bermuda's failure to meet its subsistence needs was the initial lack of knowledge about the local ecology or the available resources. By the time the settlers had established the certainty or the risk of the various resources, they had been depleted. The notion of inexhaustible resources may have been instilled in the settlers' minds long before they ever arrived in Bermuda. Many reports had been sent back to England that often exaggerated the wealth of the islands:

... promoters probably believed the reports that the fishes on the coast of Bermuda were so abundant that bathers had to retire from the water for fear of their bites, and that there were on the mainland flocks of pigeons so vast and so dense that they could seriously be mistaken for eclipses of the sun (Pares 1960:11).

When the colonists first arrived in Bermuda they did in fact encounter large numbers of fish and birds, and, additionally, turtles and feral swine<sup>34</sup>. It was upon these wild resources that the Bermudians subsisted while they set about establishing the colony. However, by the time the settlers had comprehended the certainty and/or the risk of these various resources, they had all been depleted except for the fish. David Yesner (1987) states that marine resources are less likely to be depleted than terrestrial resources since they can withstand higher culling rates.

Even after the other wild resources had been depleted, Bermudians came close to eliminating their most reliable resource base, fish, while pursuing money making ventures. During the 1680s, Bermudians were heavily involved in producing provisions

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<sup>34</sup> The feral swine were remnants of early Spanish colonization attempts.

for the West Indies. In addition to raising livestock, they began to fish commercially using hauling nets (Bowen and Jarvis 1994:86). Fishing nets not only captured a broad range of species but large quantities of fish as well (Reitz and Honerkamp 1983:21). By 1690, the use of hauling nets had nearly depleted the reefs surrounding Bermuda. Observing that the use of hauling nets were detrimental to both fish and human populations, the government repeatedly enacted laws to prohibit their use.<sup>35</sup> If an individual was caught breaking the fish net law, he was fined. However, it appears that the enforcement of this law was rather lenient in times of need:

... until an application could be made unto your Excellency for permission to haul fish which your Excellency of your indulgent goodness is always ready to grant to those in necessity. ... to commiserate our unhappy condition the payment of the ffine aforesaid being unto most of us utterly impossible being extremely poor ... be pleased to remit unto us the payment of the fines aforesaid hereby sincerely promising never to be guilty of the like crime for the future ... the Governor therefore at the intercession of the Council remitted the fines which the above mentioned persons had incurr'd (BHQ 1963 20(1):6-7).

At least in part some authors have attributed this continued reliance upon fish in the eighteenth century to the evolution of the slave system. Due to the reforestation of the island and the lack of labor-intensive staple crops, the work load of the slaves was greatly reduced. Those slaves who were not involved in ship building were often sent out to sea for extended periods of time. Any herding or agricultural pursuits were taken care of by the very young and the elderly. As a result of having the time, fish remained part of the Bermudian's diet since "slaves probably fished for their masters, themselves and for extra to sell at the market place" (Bowen and Jarvis 1994:89). Additional evidence supporting this interpretation stems from comparative analyses of slave-related and white-related faunal assemblages in the Chesapeake region. The slave-related assemblages showed a significantly greater proportion of fish than the white-related.

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<sup>35</sup> Laws to protect land-crabs and oysters and mussels (March 13, 1729/30) were also enacted. (BHQ 1954: 11(2):71)

Anne Yentsch and Elizabeth Reitz attribute the importance of fish in African and African slave diets to a long tradition of fishing (Bowen and Jarvis 1994:89). In summation, the allocation of resources (the use of land, labor and capital), the risks associated with them, the nature of fish themselves and the slaves' natural inclination to fish helped to keep fish prominent within the Bermudian subsistence diet.

Fish provide security against subsistence failure, due to their dependability (Miller 1984:339). Marine foods are generally highly reliable in space and time. That is, they are available during times of the year when land resources are the least productive or the least accessible (Yesner 1987:295). In addition, many fish species are migratory, following predictable routes at specific times of the year. William Beebe and John Tee-Van (1933) observed that there were two types of fish migrations prevalent in the waters around Bermuda – seasonal and daily. Some fish species move out to deeper waters when the weather becomes colder. Others migrate between the sheltered waters of the islands and the deeper waters offshore. Therefore a variety of fish species are available to Bermudians year round.

Another contributing factor for the persistence of fish in the settlers' diet was the diversity of species present in the waters surrounding Bermuda. Today approximately 4,000 species inhabit the tidal pools, 450 square miles of reefs, bays, and the few marshes and brackish ponds of Bermuda. (Figure 9). The Challenger and Argus banks, located south of Bermuda, each approximately 35 square miles in area, are the home to the many grouper species (Family Serranidae) that prefer shallow water. Farther out, in deeper waters are rockfish, snapper, hamlet, mackerel, whiplay and yellowtail. Open sea species include tuna, dolphin, sharks and barracuda. Twenty-seven taxa were identified from the Hill House faunal assemblage. (See Appendix I - Table 5) As noted in Chapter 4, fish represented 73.5% of the total estimated biomass, clearly illustrating the importance of this resource in the occupants' diets. Of those twenty-seven taxa identified, seventeen of

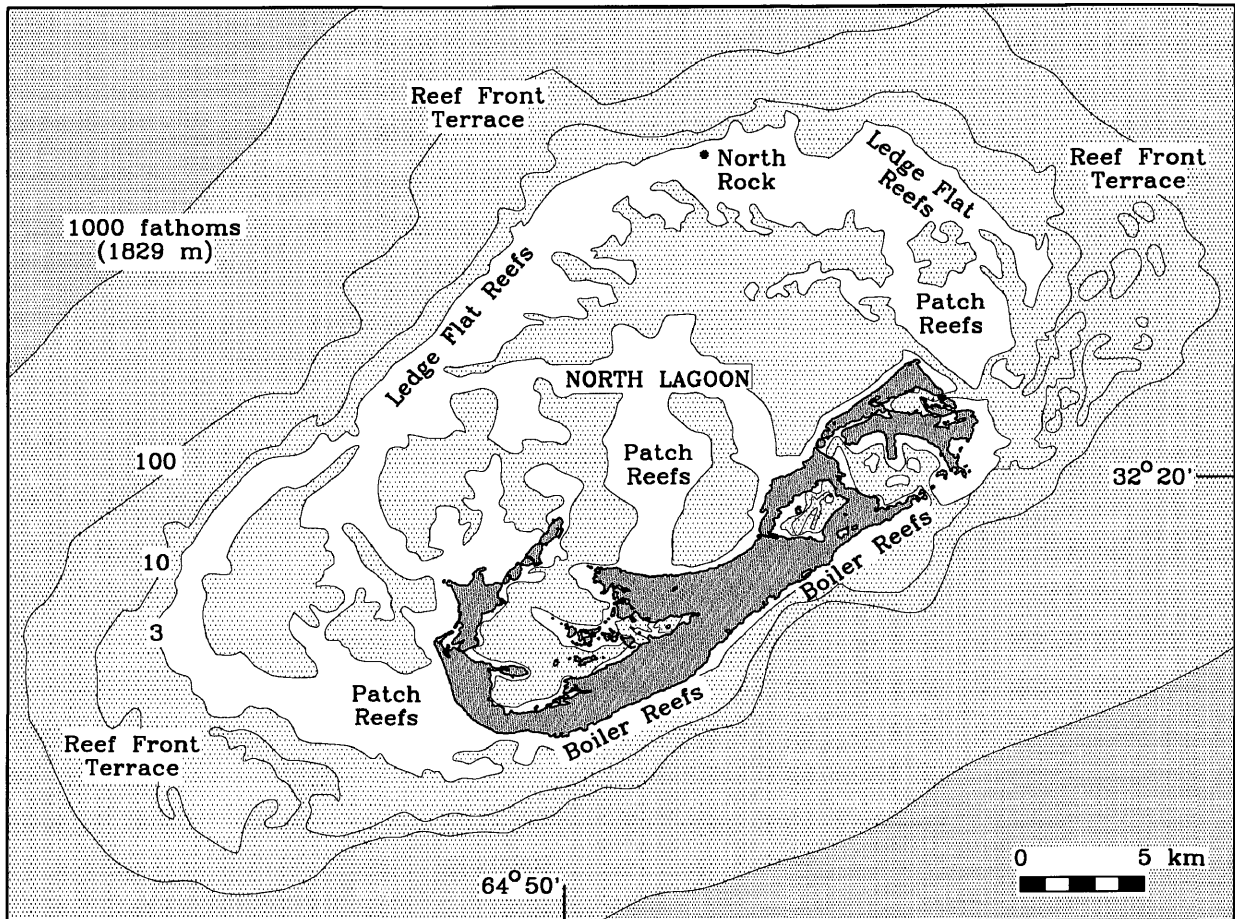


Figure 9 Bermuda and surrounding reefs (after Sterrer and Schoepfer-Sterrer 1986).

them represented cartilaginous and bony fish. The cartilaginous fish (Class Chondrichthyes) were represented by the Family Carcharinidae. Bony fishes (Class Osteichthyes) were represented by nine families, representing approximately one hundred species.

Unfortunately, the identification of the fish to the species level was not possible due to an incomplete tropical fish comparative collection and the idiosyncrasies of fish bone. Therefore, to gain a greater appreciation for the types of fish that MAY be represented within the Hill House assemblage, Appendix I - Table 6 was created. Table 6 is simply a compilation of the IDENTIFIED fish families represented in the faunal assemblage. Under each family grouping is a listing of the genera and species that are known to exist in the waters around Bermuda today. The list of species is by no means

conclusive and undoubtedly contains some inaccurate information. The sources used to compile this list – fish identification guides, reports, identified archaeological faunal remains and museum data bases – tended to be overly general, limited by collection size or grievously out of date. Despite these biases, the list of species, their habitat and method of procurement should give some indication as to where and how the Hill House occupants obtained their fish food. The following section provides a brief description of each identified taxon.

### **Class Chondrichthyes**

Family Carcharhinidae, the Requiem sharks, contains more species of modern sharks than any other family. The family contains seventy or more species in sixteen genera. Approximately twenty-two of these species occur in the Western Atlantic with eight species found in Bermudian waters. Generally speaking, Requiem sharks are similar in appearance and difficult to identify. Most species are oceanic although some are found close to shore (Bohlke and Chaplin 1968). The Requiem sharks that are found around Bermuda tend to be shallow water sharks, although the Oceanic Whitetip shark (*Carcharhinus longimanus*) and the Dusky shark (*Carcharhinus obscurus*) tend to be found in the open sea. The method of procurement is either hook and line or on long lines.

### **Class Osteichthyes**

A majority of present day fishes constitute the Class Osteichthyes (Bony fishes). Sterrer (1986) estimates that the class contains about 425 families, 3,800 genera and more than 18,000 species, with approximately 4,000 species recorded from Bermuda. Within the Hill House faunal assemblage, fish were identified to three levels – Class Osteichthyes (100 NISP), Family (271 NISP) and spp. (92 NISP). The families represented were Family Clupeidae (Herring and Sardines), Family Carangidae (Jack or Pompano), Family Serranidae (Groupers and Sea Basses), Family Lutjanidae (Snappers),

Family Sparidae (Porgies), Family Labridae (Wrasses), Family Sphyraenidae (Barracudas), Family Holocentridae (Squirrelfishes) and Family Haemulidae (Grunts).

#### **Family Clupeidae (Herring and Sardines)**

Four species of herring and sardines are known to inhabit the waters around Bermuda, the Redear Sardine (*Harengula humeralis*), the Spanish sardine (*Sardinella anchovia*), the Dwarf herring (*Jenkinsia lamprotaenia*) and the Atlantic Thread herring (*Opisthonema oglinum*). These fish tend to school both inshore, in harbors and bays, and offshore, in the open sea or over patch reefs. Large quantities can be procured with seines.

#### **Family Carangidae (Jacks and Pompanos)**

Jacks and Pompanos are for the most part schooling fish, known for their fast swimming (Boschung *et al* 1983:593). Most species can be found inshore in the shallow waters of bays, estuaries and the surf zone of sandy beaches. Others are found in the open ocean (*Caranx* spp., *Seriola* spp., *Decapterus* spp. and *Elagatis* spp.). Spawning for most Carangids occurs offshore. The young, especially the Yellow jack (*Caranx bartholomaei*), have been known to live under floating wood and debris, or in association with jellyfish and floating sargassum (Bohlke and Chaplin 1968:321). Carangids tend to be taken primarily by seines, although the Horse-eye jack (*Caranx latus*) and the Almacojack (*Seriola rivaliana*) will take a hook. Jacks and Pompanos are considered good fish food although a few have been linked to ciguatera poisoning<sup>36</sup>. Those suspected of causing ciguatera poisoning are the Greater amberjack, the Almacojack, the Yellow jack, the Horse-eye jack and the Black jack.

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<sup>36</sup> Ciguatera, tropical fish poisoning, can occur after eating any of more than four hundred species of fish that have an accumulation of *Gambierdiscus toxicus*, a toxin produced by a dinoflagellate, in their tissues. Symptoms include abdominal cramps, nausea, vomiting and diarrhea (Berkow 1992; Dorland 1994).

### **Family Serranidae (Groupers and Sea Basses)**

Groupers and sea basses represent the largest fish family within the Hill House assemblage, accounting for over 71% of the total fish collection (calculated on NISP). Serranids are bottom dwellers, found either sitting in caves or reef crevices or roaming just above the bottom (Bohlke and Chaplin 1968; Goodson 1976). The habitats of the twenty-seven species found in Bermuda range from the continental shelf, patch and offshore reefs to rocks around jetties, pilings and reefs. Due to their dietary preferences for small fish, crustaceans and cephalopods, sea basses tend to be taken by hook and line and traps.

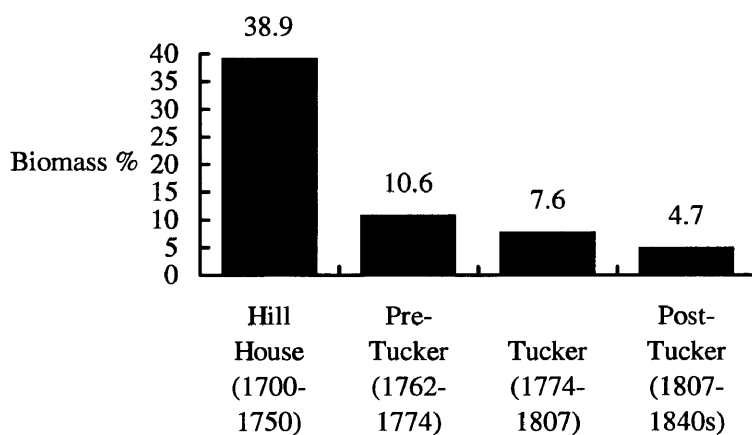
Perhaps the most impressive aspect about the Hill House faunal assemblage was the prominent position of fish (73.5% of the estimated biomass) in the diet. Of that 73.5% of estimated fish biomass, the Family Serranidae contributed 38.9%. Why did the Hill House occupants eat such an incredible amount of sea bass? Was this the result of preference? Or was it that Serranids were the most abundant fish on the reefs surrounding Bermuda?

The prominence of sea bass in the Hill House diet can be explained in part by a comparison to the Serranid remains found at the Henry Tucker House in St. George's. Although the Tucker House assemblages are not contemporary with the Hill House and represent a wealthier socio-economic status, they demonstrate that Serranids were the predominant fish consumed during the second half of the eighteenth and early nineteenth centuries. The Tucker House assemblage was divided into three phases. The Pre-Tucker assemblage (1762 - 1774) shows an estimated biomass of 10.6% for serranids; the Tucker assemblage (1774 - 1807) shows 7.6%; and the Post-Tucker assemblage (1807 - 1840s) shows 4.7% (Bowen 1992b). (Graph 4) Although the occupants at the Tucker House ate considerably less sea bass than the Hill House occupants, the Family Serranidae was the most prominent fish family consumed. Thus, this evidence may indicate that the prominent position of Serranids in Bermudian diets was their being the most populous

fish on the reefs. As for the decrease in the use of sea bass at the Tucker House through time, this can be attributed to either an increase in household wealth (allowing for greater consumption of mammal) or a reduction of the sea bass population due to overfishing.

## Graph 4

Dietary Importance of Sea Bass in Bermuda Through Time



### Family Lutjanidae (Snappers)

Eleven species of snapper are known to inhabit the waters surrounding Bermuda. Most snappers live around reefs, although some prefer deeper waters such as Red snappers (*Lutjanus campechanus*), Blackfin snappers (*L. buccanella*) and Silk snappers (*L. vivanus*) (Goodson 1976; Boschung *et al* 1983). The snappers of Bermuda live around coral reefs, shallow banks, flats, grassy areas and pier pilings. The young of some species, the Blackfin snapper, the Gray snapper (*L. griseus*) and the Dog snapper (*L. jocu*), are found inshore while the adults are found offshore near patch reefs, over rocks and to depths of 180m. Today snappers are very important economically as commercial and sport fishes (Boschung *et al* 1983) and are taken by hook and line.

### **Family Sparidae (Porgies)**

In Bermuda the family Sparidae is represented by six species. Porgies tend to school and inhabit a wide range of environments. Some porgies, typically the young, are found inshore near reefs, rocky bottoms, shallow vegetation areas and pier and bridge pilings. Others, mostly adults, are found over offshore reefs. Porgies are caught using seines, hook and line and traps. The Jolthead porgy (*Calamus bajonado*) has been implicated in ciguatera poisoning. In the Hill House assemblage four NISP were identified as *Calamus* spp.. They either represent the Jolthead porgy, whose young are found in grassy areas, while the adults are found over offshore reefs; the Saucereye porgy (*C. calamus*), which are found over coral and sand with vegetation to depths of 40 fathoms; or the Sheepshead porgy (*C. penna*), which are found in estuaries and bays, often around pilings. All three species are captured with hook and line and traps.

### **Family Labridae (Wrasses)**

Wrasses are the most active during the day and many species, especially the smaller ones, bury themselves in the sand at night (Randall 1968:199; Boschung *et al* 1983: 649). Labrids occupy a wide range of habitats. Many are found over coral and rocky reefs both inshore and offshore, while some are found over grassy and sandy areas. Wrasses can be caught using a variety of methods including traps, hook and line and spears. Of the sixteen Labridae species found around Bermuda only one (*Lachnolaimus* spp.) was identified in the Hill House assemblage. This specimen probably represented the Hogfish (*Lachnolaimus maximus*). The Hogfish tends to be found inshore around the bases of patch reefs and offshore reefs to 30m. It has also been known to cause ciguatera poisoning.

### **Family Sphyraenidae (Barracudas)**

Barracudas, in general, are found along tropical sea coasts. During the summer months they migrate to northern or southern temperate seas (Grzimek 1973:147).

Barracudas are considered to be good food fish. Although they are not poisonous themselves, the larger barracudas, especially those of a darker color, have been known to be poisonous. This is attributed to a build up of toxins in their system from feeding on fish which already carried the poison (Bohlke and Chaplin 1968:199). The two species found in Bermuda, the Great barracuda (*Sphyraena barracuda*) and the Southern sennet (*S. picudilla*), inhabit inshore waters and lagoon areas out to the reefs and near the surface in the open ocean. The Great barracuda changes its habitat as it grows in size. Those specimens measuring up to a foot prefer sandy and weedy shallows, while those two feet or longer are found offshore or on the reefs (Bohlke and Chaplin 1968:198). Both species are caught with seines (inshore) and hook and line (offshore).

#### **Family Holocentridae (Squirrelfishes)**

Squirrelfishes are generally nocturnal, schooling fishes. They tend to be found in small or large schools in tidepools, around coral reefs, rocky areas and wrecks to a depth of 90m. Quite often they are found in association with Grunts and small Snappers (Took 1978:24). In Bermuda, eight species are represented, with Dusky squirrelfishes (*Holocentrus ascensionis*) and Reef squirrelfishes (*H. coroscus*) reported to being the most common inshore species (Boschung *et al* 1983:524). Their small size and spiny bodies reduce their appeal as a food fish but they may be taken with traps and hook and line (Goodson 1976; Greenburg and Greenburg 1986).

#### **Family Haemulidae (Grunts)**

Grunts are generally inshore species, found over sand, grass beds and reefs to 40m. Many species congregate during the day near reefs and docks, while during the night they disperse to feed individually over sand and grass beds (Randall 1968:128; Boschung *et al* 1983:610). Young grunts are often found in seagrass beds. Eight species are found in the waters surrounding Bermuda. They may be taken by a variety of methods including traps, hook and line, seines and hand lines.

The species found in Table 6 came from a wide variety of habitats – from the surf zone of beaches to depths of more than one hundred meters over the continental shelf. But in all likelihood, the Hill House occupants did not venture very far to obtain their fish, since to the north, east and west were bays of varying size and depth, where a multitude of jacks, groupers, snappers and porgies could be caught with either hook and line or traps. Today an afternoon of the local dock could produce quite a catch of Black sea bass, Gray snappers, Sheepshead or French Grunts. If the Hill House occupants were indeed slaves, then it was possible that they were out in their Master's sailboat to procure some of the offshore species (Jarvis 1992b:46). If they were poor whites, then they may have been able to obtain the offshore species from kin or the local market (Bowen and Jarvis 1994). Whether these individuals were restricted to fishing from the land or out over the reefs, they definitely had a wide range of fish to pick from.

### **Preservation**

The preservation of fish for future use further enhances the reliability of the food resource. The methods employed to preserve fish include salting, pickling, smoking and drying. The fat content of the fish is the determining factor as to which method is used. Lean fish (watery-fleshed), such as cod, are dried or salted; while fattier fish (oily-fleshed), such as mackerel, are smoked. Unfortunately, current zooarchaeological techniques cannot distinguish between fresh, locally caught fish and preserved and/or imported fish.

Ironically, the use of fish ultimately aided in the development of one of the most lucrative economic ventures in Bermudian history – the raking of salt in the Turk and Caicos Islands. In 1623 “there are daily complaints made of the great want of salt to save fish for the preservation of the lives of the inhabitants” (Tucker 1974: 80). Attempts to recover the salt residue from evaporated sea-water were made at Salt Kettle, Paget Parish, but high humidity prevented rapid evaporation and attempts to find a suitable alternative

led Bermudians to the Turks and Caicos Islands (Tucker 1974:80). Once the Bermudians established a colony in the Turks and Caicos Islands, they raked salt between March and October, when the sun was sufficiently hot enough to dry the water out from the shallow pans (Bell 1920:76). After the raking season was over many returned to Bermuda to grow corn and onions, while others sailed to America or Nova Scotia to trade the salt for food and lumber (Strode 1932:47; Jarvis 1992b:47).

The persistence of fish in the Bermudian diet can be attributed to the economic strategies of the time and the nature of fish themselves. During the years of commercial agriculture and livestock herding, the Bermudians came the closest to self-sufficiency (Bowen and Jarvis 1994:92). However, the conversion of agricultural land to cedar forests and the increase in commercial trading led to the importation of many basic foods. 'With pauperism so much to the fore' (Wilkinson 1950:97), the majority of Bermudians were unable to compensate for the loss of valued resources. With no land to farm, no livestock to exploit and the extraordinary prices of imported goods, the less fortunate had to rely upon the one dependable subsistence resource – fish. Often times, availability, price and convenience are the critical determinants of a resources' use (Rozin 1987:183). For as long as a food continues to provide essential nutrients to a population, its' position within the subsistence strategy is ensured.

## Conclusion

Results from the analysis of the faunal remains recovered from the Hill House site demonstrate that these unknown occupants subsisted on a diet that was composed primarily of fish and supplemented with domestic animals and fowl. The persistence of fish in the diet throughout the eighteenth century suggests that variability in food resources prevented the development of a subsistence system similar to those found in the mainland British colonies. The distinctly Bermudian subsistence system evolved in keeping with the local environmental limitations and the economic considerations of the time.

The findings at the Hill House support the adaptive subsistence model proposed by Honerkamp and Reitz. Essentially, this model predicts that the colonists' diet would reflect a heavy reliance on local resources until the population stabilizes. Their research, carried out at the Hird site, Fort Frederica, Georgia clearly refuted the long held assumption that colonists were able to transfer the 'British Barnyard Complex' to the New World without having to make adaptations to the new environment. The inclusion of wild resources in the diet of both the Hird site and the Hill House site was an adaptive response to situations where traditional resources were not predictable or were in limited supply.

Traditional wisdom held that once a colonizing population has become established, its subsistence system would begin to resemble traditional (British) practices. The colonization model assumes that change on the frontier was directional and

regularized. Henry Miller found this to be true when he evaluated the subsistence strategies in the Chesapeake Bay region of Virginia and Maryland through time. He noted a heavy reliance upon wild meat resources with a lesser dependence on domesticates. By the late seventeenth and early eighteenth centuries, the diet of the colonists began to resemble the 'traditional British foodways' model – high proportion of domesticates supplemented by fewer wild resources, especially fish. This contrasts the findings at the Hill House site in Bermuda: fish maintained a prominent position within the subsistence system associated with Occupation Period 4. Prevalent variables specific to Bermuda prevented the subsistence system at the Hill House from resembling traditional British practices.

A subsistence system is shaped by variables derived from natural and cultural sources. Not only do these variables define the means by which a population obtains foodstuffs and the subsistence resources exploited, but they greatly influence the availability of the various resources. To circumvent the possibility of failing to satisfy its subsistence needs, a population will adopt strategies (buffering mechanisms) to lessen the impact of variability (Halstead and O'Shea 1989; Stein 1989). The type(s) of buffering mechanisms used by a population – mobility, diversification, storage and exchange – depend upon the severity of the shortages and the allocation of resources – land, labor and capital (Bogucki 1988; Leatherman *et al* 1988; Messer 1988; Halstead and O'Shea 1989; Jongman and Dekker 1989; Stein 1989). In Bermuda, buffering mechanisms were utilized in response to the loss of a subsistence resource due to shifts in the economic strategies of the time.

The prospects for success of agricultural pursuits in Bermuda was suspect from the inception of the colony. Subsistence farming was impacted by the environmental risks (natural variability) of Bermuda. Foremost, the total area of Bermuda is little more than twenty-two square miles. Within this area the lands suitable for agricultural purposes are limited to the areas surrounding marshes and the floors and sides of the

depressions between hills. The soils found in these areas, characterized by a fairly good supply of organic and mineral nutrients, were initially ideal for the raising of crops. However, the insistence of the Somers Island Company that the early settlers plant Indian corn and tobacco (cultural variability) resulted in the depletion of soil nutrients, thus reducing the productivity of the land. Universally, agricultural pursuits are susceptible to a multitude of environmental risks and Bermuda is no different, more often than not, the early agriculturists were unable to cope with the damage inflicted by plant diseases, pests and adverse weather conditions.

The buffering mechanisms used by Bermudian farmers to alleviate these risks included: (i) the addition of fertilizers to the soil to extend its productivity; (ii) the placement of small plots up against a hill for shelter from harmful winds and salt spray; (iii) the replanting of cedar trees provided a natural wind break which protected what little agriculture was being practiced in Bermuda during the end of the seventeenth century; and (iv) the diversification of crops. This last buffering mechanism ultimately had an adverse affect upon the subsistence system in Bermuda. For any decision made regarding the nature of the commodities produced often indicated a shift in the economic strategy.

The motivating force behind the directional changes of agricultural pursuits was the profit motive (cultural variables). During the first years of settlement, Bermudians were raising commercial crops to benefit the Somers Island Company. When the production of these crops was no longer viable, Bermudians began to raise commodities that promoted their own interests. The conversion of fields and pastures to cedar forests during the advent of the maritime era was an extension of this process. Prevalent throughout the economic strategies practiced in Bermuda during the seventeenth and eighteenth centuries was the finite amount of land that could be devoted to the raising of subsistence crops. If a choice had to be made between raising crops for monetary gain or for the satisfaction of dietary needs, Bermudians frequently sacrificed self-sufficiency.

An additional source of variability affecting agricultural pursuits was the social stigmatism attached to it (cultural variability). The Bermudian's aversion to agriculture may have arisen from (i) the inability of an individual to make a profit from the small land holdings; (ii) the reluctance to grow crops that were predestined for failure; (iii) the association of farming with socially inferior individuals; and (iv) the emphasis placed on commercial enterprises (such as the raising of cedar trees rather than subsistence crops).

To compensate for the inadequacies of agricultural pursuits, Bermudians utilized adaptive strategies that were based upon diversification and exchange. To a certain extent, much of the population would have been able to supplement their diet with vegetables and fruits grown in household gardens (diversification) (Miller 1984). Others would have had to continue their reliance upon fish (passive diversification) (Halstead and O'Shea 1989). However, the most dominant adaptive strategy effected was the importation of provisional goods from Britain and her colonies (exchange).

Most of the risks affecting the availability and reliability of imported goods were steeped in cultural variability. During the first seven decades of the colony, the settlers were restricted to trading solely with the Somers Island Company's magazine ship. The company made quite a profit by charging exorbitant prices for British manufactured goods. The dissolution of the company in 1684, may have resulted in an expansion of the market, but it had very little affect upon the price of imported goods. This was due in part by the Bermudian merchants' desire to make a profit and the restrictive nature of the Acts of Trade and Navigation. Although foreign goods were easier to obtain, and quite often available at a lower price, the colonists could only purchase British manufactured goods .

Other variables that directly affected the availability of imported goods resulted from the onset of war. England was at war with either France or Spain for a greater part of the early eighteenth century. In response to the hostilities, Bermuda saw a dramatic increase in privateering. Privateering offered the "thrilling adventure of piracy without

the crime, and the usefulness of the navy without the discipline” (Wilkinson 1950:24). A successful privateering raid could result in the availability of additional subsistence goods in the islands. However, an increase in privateering activities ultimately strained the reliability of the subsistence resource. The outfitting of a privateer significantly reduced the labor force left in the islands while placing additional strain on the available food supply. The greatest risks Bermudians faced was the possibility that supplies might be delayed by either Bermudian or foreign privateers. Collectively, war related activities affected the availability of imported goods and kept prices at a level that many consumers could not afford.

Although access to this subsistence resource was at times restrictive, there were a variety of strategies in which Bermudians could obtain necessity items. Those individuals who lacked ready cash could purchase such items through lines of credit or in exchange for future labor. Strategies that were more opportunistic than adaptive were smuggling, wrecking and stealing. The smuggling of sundry goods can be interpreted as a response to governmental restrictions. Not only did this strategy allow for a considerable profit to be made, but illegitimate trade increased the variety of goods available with a possible reduction in price. Wrecking, a form of negative exchange, was an unscrupulous manner in which the poorer sorts could obtain highly desirable goods. Success in wrecking was dependent upon pure luck and the value of the goods salvaged from the unfortunate vessel. Another form of negative exchange was the act of theft. According to the historical documents, this was a method that the slaves resorted to when they were hungry. The exact extent to which the aforementioned strategies were utilized in the seventeenth and eighteenth centuries cannot be determined. However, their mere mention in the historical documents suggests that they made at least a small contribution to the subsistence strategies of Bermudians.

The examination of a few of the subsistence strategies available to Bermudians during the seventeenth and eighteenth centuries suggests that the ability to sustain an

adequate supply of foodstuffs was not easy. The distribution of land, labor and capital played a major role in determining the availability of subsistence strategies and resources to the various levels of society. Although access to a subsistence resource was often restrained by economic variables, there was one resource base that all could partake – fish. The Bermudian reliance upon fish has been continuous since the arrival of the first settlers in 1612. The high percentage of fish remains recovered from three Bermudian sites, King’s Castle, a seventeenth century fort, the Henry Tucker House and the Hill House, as well as historical documents, provide the evidence for this continued reliance. The incorporation of fish into their ‘traditional British’ diet suggests that the threat of starvation was enough to surmount the prejudiced attitude that the settlers had towards fish.

Fish maintained their prominent role in the Bermudian diet due to their reliability. The incredible diversity of fish found in the waters surrounding the islands guaranteed that the loss of one species would be compensated for by the exploitation of another. Additionally, fish are available during times of the year when other subsistence resources – agricultural crops, livestock, imported goods – are the least productive or the least accessible. The preservation of fish, a form of storage, provides additional security against subsistence failure.

The analysis of the Hill House faunal remains has enhanced our knowledge about the foodways of poor-to-middling individuals in rural Bermuda during the seventeenth and eighteenth centuries. This overview of the available subsistence strategies, resources and their associated risks and uncertainties should provide a base from which future research can start. Of particular interest would be an examination into the specific nature of imported goods in the eighteenth century. What variables affected the procurement, distribution and availability of these goods throughout the islands? Complimenting this research would be a comparative study between an urban site in St. George’s, one in the vicinity of Hamilton (mid-island), and a rural site at the west end of the island, such as

the Hill House. The analysis of archaeologically derived artifacts and faunal remains would help to understand the distribution of resources within Bermuda. The excavation efforts at the Hill House should be expanded – especially to the southeast, towards the cistern and the outhouse. Not only would this add to our knowledge about an eighteenth century household, but it could also validate the existence of an earlier structure, as the Construction/Destruction occupational level indicates. Within Hog Bay Park itself, future research should investigate the tract of land as a whole. What was the relationship between the Hill House and the Zuill and Mayor Cottages? Is there evidence for a mansion house? Works such as these will greatly enhance our understanding of Bermudian life in the eighteenth century.

The application of the Risk Aversion Theory, as a means in which to explain the high percentage of fish in the faunal collection, has clearly demonstrated the need to examine all the variables affecting cultural process and change. The analysis of these variables had led to a much more insightful explanation for the heavy reliance upon fish other than simply stating ‘...because it’s an island.’ The analysis of the faunal remains from the Hill House site has provided an opportunity to observe how the Bermudian subsistence system evolved. The risks and uncertainty associated with the various subsistence strategies, as well as the economic constraints had a profound affect upon the availability of subsistence resources. However, it was the allocation of resources – land, labor and capital – that determined which adaptive strategies (mobility, storage, diversification, and exchange) would best compensate for the loss of a resource. The low socio-economic status of the Hill House occupants suggests that they would have had restricted access to available subsistence resources. The predominance of fish in their diet confirms this statement. For when there is nothing better to eat, fish will do quite adequately.

## APPENDIX

### Table 5

Summary of Faunal Remains  
Hill House Site, Sandys Parish, Bermuda

Taxon	NISP	Pct.	Weight (grams)	Pct.	Biomass (kg)	Pct.
Phylum Arthropoda						
(Arthropod)	1	0.2	1.6	0.6	0.000	0.0
Family Carcharinidae						
(Requiem Shark)	5	1.0	0.5	0.2	0.069	1.7
Class Osteichthyes						
(Bony Fish)	99	20.4	36.0	13.7	0.538	13.4
cf. Class Osteichthyes						
(Bony Fish)	1	0.2	0.3	0.1	0.011	0.3
cf. Family Clupeidae						
(Herring)	1	0.2	0.1	0.0	0.007	0.2
Family Carangidae						
(Jack or Pompano)	4	0.8	0.4	0.1	0.007	0.2
Family Serranidae						
(Sea Bass)	249	51.2	89.1	34.0	0.986	24.6
<i>Epinephelus</i> spp.						
(Grouper)	72	15.0	32.8	12.5	0.393	9.8
cf. <i>Epinephelus</i>						
(Grouper)	1	0.2	0.1	0.0	0.002	0.0
<i>Mycteroperca</i> spp.						
(Grouper)	5	1.0	14.2	5.4	0.182	4.5
<i>Lutjanus</i> spp.						
(Snapper)	4	0.8	1.8	0.7	0.027	0.7
Family Sparidae						
(Porgy)	9	1.9	6.2	2.4	0.128	3.2
<i>Calamus</i> spp.						
(Porgy)	4	0.8	2.8	1.1	0.068	1.7
Family Labridae						
(Wrasse)	8	1.7	8.2	3.1	0.185	4.6
<i>Lachnolaimus</i> spp.						
(Hogfish)	1	0.2	18.8	7.2	0.341	8.5

Table 5, continued

Taxon	NISP	Pct.	Weight (grams)	Pct.	Biomass (kg)	Pct.
<i>Sphraena</i> spp. (Barracuda)	1	0.2	0.5	0.2	0.023	0.6
<i>Holocentrus</i> spp. (Squirrel Fish)	3	0.6	0.9	0.3	0.036	0.9
<i>Haemulon</i> spp. (Grunt)	1	0.2	0.2	0.1	0.012	0.3
Class Aves (Bird)	2	0.4	1.1	0.4	0.022	0.5
Class Mammalia (Mammal)	1	0.2	0.4	0.2	0.012	0.3
Class Mammalia II (Medium Mammal)	1	0.2	3.0	1.1	0.071	1.8
Class Mammalia III (Small Mammal)	1	0.2	0.1	0.0	0.003	0.1
<i>Felis domesticus</i> (Domestic Cat)	1	0.2	2.9	1.1	0.069	1.7
<i>Sus scrofa</i> (Domestic Pig)	6	1.2	18.9	7.2	0.371	9.3
<i>Bos taurus</i> (Domestic Cow)	2	0.4	13.3	5.1	0.270	6.7
<i>Ovis aries/Capra hircus</i> (Domestic Sheep/Goat)	2	0.4	6.4	2.4	0.140	3.5
<i>Homo sapiens</i> (Human)	1	0.2	1.4	0.5	0.036	0.9
<b>Totals</b>	<b>486</b>	<b>100.0</b>	<b>262.0</b>	<b>100.0</b>	<b>4.009</b>	<b>100.0</b>

## Table 6

Representative Fish Found in the Waters of Bermuda,  
Habitat and Method of Procurement<sup>37</sup>  
(Based upon Families Identified in the Hill House Assemblage)

### Class Chondrichthyes (Cartilaginous fishes)

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CARCHARHINIDAE	(Requiem sharks)	(8 spp. from Bermuda)
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*Carcharhinus galapagensis* (Galapagos shark)

**Habitat:** Found inshore around shallow reefs and offshore.

**Method of procurement:** Hook and line and on long lines.

*Carcharhinus longimanus* (Oceanic Whitetip Shark)

**Habitat:** Found far out at sea, occasionally near islands and rocks.

**Method of procurement:** Hook and line.

*Carcharhinus obscurus* (Dusky Shark)

**Habitat:** Found along the outer continental shelf, but will enter shallow waters.

**Method of procurement:** Hook and line.

*Carcharhinus perezii* (Reef Shark)<sup>38</sup>

**Habitat:** Found mostly offshore around islands.

**Method of procurement:** Hook and line.

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<sup>37</sup> Adapted from (Bohlke and Chaplin 1968; Randall 1968; Grzimek 1973, 1974; Goodson 1976; McClane 1978; Took 1978; Boschung *et al* 1983; Greenburg and Greenburg 1986; Robins and Ray 1986; Sterrer and Schoepfer-Sterrer 1986).

<sup>38</sup> Richard Ellis (1976:131) notes that common names for the sharks of the Carcharhinidae family are rather confusing. Quite often the same common name is applied to a gray shark without having taken into consideration variations due to location. Hence the name Reef Shark refers to both *Carcharhinus plumbeus* and *C. springeri*.

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CARCHARHINIDAE (Requiem sharks) (8 spp. from Bermuda)

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*Carcharhinus plumbeus* (Sandbar Shark)

**Habitat:** Bottom-dwelling in coastal and offshore waters.

**Method of procurement:** Hook and line.

*Carcharhinus springeri* (Reef Shark)

**Habitat:** Found around deep reefs.

**Method of procurement:** Hook and line.

*Galeocerdo cuvieri* (Tiger shark)

**Habitat:** Found in coastal and offshore waters near the surface.

**Method of procurement:** Hook and line.

*Prionace glauca* (Blue shark)

**Habitat:** Found in shallow waters over mud and sand and far out at sea.

**Method of procurement:** Sport fishing and on long lines.

**Class Osteichthyes (Bony fishes)**

---

CLUPEIDAE (Herring and Sardines) (4 spp. from Bermuda)

---

*Harengula humeralis* (Redear sardine)

**Habitat:** Inshore, open sea, over lagoon and in harbors and bays.

**Method of procurement:** Seines.

*Jenkinsia lamprotaenia* (Dwarf herring)

**Habitat:** Found around patch reefs and rocky shorelines.

**Method of procurement:** Seines.

*Opisthonema oglinum* (Atlantic thread herring)

**Habitat:** Inshore, open sea, schooling around patch reefs and in harbors and bays.

**Method of procurement:** Seines.

*Sardinella anchovia* (Spanish sardine)

**Habitat:** Inshore, open sea, schooling around patch reefs offshore to breakers.

**Method of procurement:** Seines.

---

CARANGIDAE (Jack or Pompano) (20 spp. from Bermuda)

---

*Caranx bartholomaei* (Yellow jack)

**Habitat:** Adults found over outer reefs, either solitary or in small groups; young often found near floating sargassum and jellyfish.

**Method of procurement:** Seines.

Note: May cause ciguatera poisoning.

*Caranx dentex* (White Trevally)

**Habitat:** Found over sandy bottoms adjacent to patch reefs and wrecks.

**Method of procurement:** Seines.

*Caranx fusus* (Blue runner jack)

**Habitat:** Schools offshore and occasionally over shallow reefs.

**Method of procurement:** Seines.

*Caranx hippos* (Crevalle jack)

**Habitat:** Inshore in shallow bays and estuaries to the deep waters of the continental shelf.

**Method of procurement:** Seines.

*Caranx latus* (Horse-eye jack)

**Habitat:** Open sea.

**Method of procurement:** Hook and line.

Note: May cause ciguatera poisoning.

*Caranx lugubris* (Black jack)

**Habitat:** Found in deep waters, often around isolated or offshore islands.

**Method of procurement:** Hook and line.

Note: May cause ciguatera.

*Caranx ruber* (Barjack)

**Habitat:** Common over reefs.

**Method of procurement:** Seines.

*Decapterus macarellus* (Mackerel scad)

**Habitat:** Offshore in 20 - 200 m.

**Method of procurement:** Seines.

*Decapterus punctatus* (Round scad)

**Habitat:** Inshore to about 50 fathoms.

**Method of procurement:** Seines.

Note: Primarily used as bait.

---

CARANGIDAE (Jack or Pompano) (20 spp. from Bermuda)

---

*Elagatis bipinnulatus* (Rainbow runner)

**Habitat:** Open seas, occasionally near shore or over reefs.

**Method of procurement:** Seines.

*Naucrates ductor* (Pilotfish)

**Habitat:** Open seas, often associated with mantas and sharks.

**Method of procurement:** Seines.

*Pseudocaranx dentex* (Gwelly)

**Habitat:** Common over open sand or mud bottoms inshore and on reefs and banks offshore.

**Method of procurement:** Seines.

*Selar crumenophthalmus* (Bigeye scad)

**Habitat:** Found schooling inshore in shallow water.

**Method of procurement:** Seines.

Note: Primarily used as bait.

*Selene setapinnis* (Atlantic moonfish)

**Habitat:** Found schooling inshore on the bottom.

**Method of procurement:** Seines.

*Selene vomer* (Lookdown)

**Habitat:** Over sand or mud in shallow coastal waters.

**Method of procurement:** Seines.

*Seriola dumerili* (Greater amberjack)

**Habitat:** Open seas to 200 fathoms.

**Method of procurement:** Seines.

Note: May cause ciguatera poisoning.

*Seriola rivoliana* (Almacojack)

**Habitat:** Inshore.

**Method of procurement:** Hook and line and beach seines.

Note: May cause ciguatera poisoning.

*Trachinotus goodei* (Palometa)

**Habitat:** Schools in surf zone of sandy beaches, reefs and rocky areas.

**Method of procurement:** Seines.

---

CARANGIDAE (Jack or Pompano) (20 spp. from Bermuda)

---

*Trachinotus falcatus* (Permit)

**Habitat:** Found in the surf zone of sandy beaches, reefs and rocky areas.

**Method of procurement:** Seines.

*Trachurus lathami* (Rough scad)

**Habitat:** Found schooling inshore in shallow water.

**Method of procurement:** Seines.

---

SERRANIDAE (Groupers and Sea Basses) (27 spp. from Bermuda)

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*Centropristis striata* (Black sea bass)

**Habitat:** Found over the continental shelf and rocks around jetties, pilings and wrecks.

**Method of procurement:** Hook and line.

*Diplectrum formosum* (Sand perch)

**Habitat:** In coastal waters over sand and mud or near reefs or depressions on the floor to about 40 fathoms.

**Method of procurement:** Hook and line.

*Epinephelus adscensionis* (Rock hind)

**Habitat:** Rocky and coral reef areas in shallow water and offshore to 50 m; most common at 25 - 35 m.

**Method of procurement:** Traps and hook and line.

*Epinephelus afer* (Mutton hamlet)

**Habitat:** Shallow reefs or rocky areas and grass flats from shorelines to 50 m.

**Method of procurement:** Traps and hook and line.

*Epinephelus cruentata* (Graysby)

**Habitat:** Shallow water near shore, over coral reefs and rocks, but also to depths of 60 m.

**Method of procurement:** Traps and hook and line.

Note: Probably the most abundant grouper on coral reefs.

*Epinephelus drummondhayi* (Speckled hind)

**Habitat:** Over coral reefs and rocks, usually in deep water.

**Method of procurement:** Traps and hook and line.

---

**SERRANIDAE**

(Groupers and Sea Basses)

(27 spp. from Bermuda)

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*Epinephelus fulva* (Coney)**Habitat:** On patch reefs and offshore reefs to 90 m.**Method of procurement:** Traps and hook and line.*Epinephelus guttatus* (Red hind)**Habitat:** On patch reefs and deeper reefs offshore to 100 m.**Method of procurement:** Traps and hook and line.*Epinephelus morio* (Red grouper)**Habitat:** Inshore around patch reefs and offshore to 150 m, more often on rocky outcrops than coral reefs.**Method of procurement:** Traps and hook and line.*Epinephelus mystacinus* (Misty grouper)**Habitat:** Over rocky ledges, usually in deep water at depths between 150 and 300 m.**Method of procurement:** Traps and hook and line.*Epinephelus niveatus* (Snowy grouper)**Habitat:** Adults found in water to depths of 240 to 485 m. Young usually found in shallow water near coral reefs.**Method of procurement:** Traps and hook and line.*Epinephelus striatus* (Nassau grouper)**Habitat:** Found from shallow patch reefs inshore to 100 m offshore; young on grass flats and rocky outcrops inshore.**Method of procurement:** Traps and hook and line.*Hypoplectrus puella* (Butter hamlet)**Habitat:** In rocky areas and patch reefs from shore to 30 m.**Method of procurement:** Hook and line.*Hypoplectrus unicolor* (Hamlet)**Habitat:** Found over reefs, some at depths 100 - 140 feet.**Method of procurement:** Hook and line.

Note: Not much is known about this species.

*Liopropoma mowbrayi* (Cave basslet)**Habitat:** Found in caves and crevices of coral reefs and rocky areas, at depths of 100 - 180 feet.**Method of procurement:** Hook and line.

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SERRANIDAE (Groupers and Sea Basses) (27 spp. from Bermuda)

---

*Liopropoma rubre* (Peppermint basslet)

**Habitat:** Found in crevices of coral reefs, at depths ranging from 10 - 140 feet.  
**Method of procurement:** Hook and line.

*Mycteroperca boncai* (Black grouper)

**Habitat:** Over rocky bottom and coral reefs from shore to 90 m. Young in shallow water, adults in deeper water up to depths of 70 feet.  
**Method of procurement:** Traps and hook and line.  
 Note: May cause ciguatera.

*Mycteroperca interstitialis* (Yellowmouth grouper)

**Habitat:** From shoreline to 75 m offshore, around rocky or coral reef areas.  
**Method of procurement:** Traps and hook and line.

*Mycteroperca microlepis* (Gag grouper)

**Habitat:** In shallow and grassy areas or in deeper water near rock outcroppings, rarely on offshore reefs.  
**Method of procurement:** Traps and hook and line.

*Mycteroperca phenax* (Scamp)

**Habitat:** Occurs commonly at 13 - 25 fathoms on banks around obstructions.  
**Method of procurement:** Traps and hook and line.

*Mycteroperca tigris* (Tiger grouper)

**Habitat:** In shallow water from surface to about 30 m; most common on shallow coral reefs in ledge flat area.  
**Method of procurement:** Traps and hook and line.

*Mycteroperca venenosa* (Yellowfin grouper)

**Habitat:** From shoreline to about 100 m, around reefs and rocky outcroppings.  
**Method of procurement:** Traps and hook and line.  
 Note: May cause ciguatera.

*Paranthias furcifer* (Creole fish)

**Habitat:** On the outer reefs and rocky ledges, 10 - 60 m, in schools.  
**Method of procurement:** Traps and hook and line.

*Serranus annularis* (Orangeback bass)

**Habitat:** In rocky and reef areas between 30 and 67 m.  
**Method of procurement:** Hook and line.

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SERRANIDAE (Groupers and Sea Basses) (27 spp. from Bermuda)

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*Serranus tabacarius* (Tobaccofish)

**Habitat:** Near shore to 70 m.

**Method of procurement:** Hook and line.

*Serranus phoebe* (Tattler)

**Habitat:** Over sand in deep water offshore.

**Method of procurement:** Hook and line.

*Serranus tigrinus* (Harlequin bass)

**Habitat:** Shallow offshore reefs to about 36 m.

**Method of procurement:** Hook and line.

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LUTJANIDAE (Snappers) (11 spp. from Bermuda)

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*Lutjanus analis* (Mutton snapper)

**Habitat:** Around coral reefs, in channels at depths of 10 - 30 feet. Supposedly introduced to Bermuda.

**Method of procurement:** Hook and line.

*Lutjanus apodus* (Schoolmaster)

**Habitat:** Ranges from shallow banks, flats, around pier pilings, under overhung banks and in holes along mangrove shores. Associates with Gray snapper during the day but feeds alone at night.

**Method of procurement:** Hook and line.

*Lutjanus buccanella* (Blackfin snapper)

**Habitat:** Young occur on reefs, especially below 9 m. Adults on rocky ledges in depths up to 60 - 91 m.

**Method of procurement:** Hook and line.

*Lutjanus campechanus* (Red snapper)

**Habitat:** Found in schools over rocks and reefs at 5 - 100 fathoms.

**Method of procurement:** Hook and line.

*Lutjanus griseus* (Gray snapper)

**Habitat:** Young common in grass beds, mangroves and rocky areas; Adults found offshore near patch reefs, over rocks and to depths of 180 m, but many aggregate near wharves and jetties.

**Method of procurement:** Hook and line.

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LUTJANIDAE (Snappers) (11 spp. from Bermuda)

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*Lutjanus jocu* (Dog snapper)

**Habitat:** Young found inshore and around estuaries; adults around coral reef over continental and island shelves. Supposedly introduced to Bermuda.

**Method of procurement:** Hook and line.

Note: May cause ciguatera.

*Lutjanus mahogoni* (Mahogany snapper)

**Habitat:** Found around coral reefs.

**Method of procurement:** Hook and line.

*Lutjanus synagris* (Lane snapper)

**Habitat:** Usually found over grassy areas or open sandy areas between patch reefs. Bottom feeding, shallow water species. Accessible from shore, piers and bridges.

**Method of procurement:** Hook and line.

*Lutjanus vivanus* (Silk snapper)

**Habitat:** Deep water species, 6 - 120 fathoms, found on the bottom along rocky ledges. Moves to shallower water at night.

**Method of procurement:** Hook and line.

*Ocyurus chrysurus* (Yellowtail snapper)

**Habitat:** Found in open water, over coral reefs and rocks and to depths of 60 feet. Feeds at night.

**Method of procurement:** Hook and line.

*Rhomboplites aurorubens* (Vermilion snapper)

**Habitat:** Found over hard bottoms and deep reefs.

**Method of procurement:** Hook and line.

Note: Often caught with the Red snapper.

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SPARIDAE (Porgies) (6 spp. from Bermuda)

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*Calamus bajonado* (Jolthead porgy)

**Habitat:** Young often found in grassy areas inshore; Adults most common on offshore reefs to 100 fathoms.

**Method of procurement:** Traps and hook and line.

Note: May cause ciguatera.

*Calamus calamus* (Saucereye porgy)

**Habitat:** Over coral and sand with vegetation to 40 fathoms.

**Method of procurement:** Traps and hook and line.

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 SPARIDAE

(Porgies)

(6 spp. from Bermuda)

*Calamus penna* (Sheepshead Porgy)**Habitat:** Found in bays and estuaries, often around pilings.**Method of procurement:** Hook and line.*Diplodus bermudensis* (Bermuda bream)**Habitat:** Found near shore and on patch reefs in schools.**Method of procurement:** Traps.*Diplodus holbrooki* (Spottail Pinfish)**Habitat:** Found in the surf zone and over near shore reefs.**Method of procurement:** Hook and line.*Lagodon rhomboides* (Pinfish)**Habitat:** Found in harbors and bays in shallow grassy and mangrove areas in aggregations.**Method of procurement:** Traps.

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 LABRIDAE

(Wrasses)

(16 spp. from Bermuda)

*Bodianus pulchellus* (Spotfin hogfish)**Habitat:** Found around rocky and coral areas between 50 and 400 feet.**Method of procurement:** Traps and hand lines.*Bodianus rufus* (Spanish hogfish)**Habitat:** Shallow reefs or rocky areas to depths of about 16 fathoms.**Method of procurement:** Traps and hand lines.*Clepticus parrai* (Creole wrasse)**Habitat:** On offshore reefs from breakers to 40 m.**Method of procurement:** Rarely caught since seldom take a hook or enter pots.*Doratonotus megalepis* (Dwarf wrasse)**Habitat:** Found in shallow beds of turtle grass out to depths of 50 feet.**Method of procurement:** Seldom caught since it can change its coloration to exactly match the green of the turtle grass.*Halichoeres bathyphilus* (Greenband wrasse)**Habitat:** Found over reefs at depths between 90 and 500 feet.**Method of procurement:** Traps and hand lines.

## LABRIDAE

(Wrasses)

(16 spp. from Bermuda)

*Halichoeres bivittatus* (Slippery dick)

**Habitat:** Found in both rocky and muddy inshore waters to reefs, sand and coral rubble offshore.

**Method of procurement:** Traps and hook and line.

*Halichoeres garnoti* (Yellowhead wrasse)

**Habitat:** Found on patch reefs offshore to 80 m.

**Method of procurement:** Hook and line.

*Halichoeres maculipinna* (Clown wrasse)

**Habitat:** Abundant on reef tops and in shallow rocky areas.

**Method of procurement:** Hook and line.

*Halichoeres pictus* (Painted wrasse)

**Habitat:** Over coral reefs at depths ranging from 20 - 70 feet. Stays well off the bottom.

**Method of procurement:** Hook and line.

*Halichoeres radiatus* (Puddingwife)

**Habitat:** Found on shallow patch reefs offshore to 40 m.

**Method of procurement:** Traps and on hooks.

*Hemiblemaria simulus* (Wrasse Blenny)

**Habitat:** Over coral and rocky reefs.

**Method of procurement:** Hook and line.

*Hemipteronotus martinicensis* (Straight-tail razorfish)

**Habitat:** Found over grassy and sandy areas from ledge flats to 30 m.

**Method of procurement:** Hook and line.

*Hemipteronotus novacula* (Pearly Razorfish)

**Habitat:** Found in clear water, often over open, sandy areas.

**Method of procurement:** Hook and line.

Note: Will burrow into the sand or its nest of coral fragments if threatened.

*Hemipteronotus splendens* (Green razorfish)

**Habitat:** Common in sandy areas in and around seagrass beds.

**Method of procurement:** Hook and line.

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LABRIDAE (Wrasses) (16 spp. from Bermuda)

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*Lachnolaimus maximus* (Hogfish)

**Habitat:** Inshore, around bases of patch reefs and offshore reefs to 30 m; most common over open bottoms where gorgonian corals are abundant.

**Method of procurement:** Traps, hook and line and spears.

Note: May cause ciguatera.

*Thalassoma bifasciatum* (Bluehead wrasse)

**Habitat:** Inshore on patch reefs or grass flats and reefs offshore to 40 m.

**Method of procurement:** Hook and line.

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SPHYRAENIDAE (Barracudas) (2 spp. from Bermuda)

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*Sphyraena barracuda* (Great barracuda)

**Habitat:** Smaller fish found inshore over grass flats; Larger ones found over reefs or near the surface in the open ocean.

**Method of procurement:** Seines (inshore) and hook and line (offshore).

Note: May cause ciguatera.

*Sphyraena picudilla* (Southern sennet)

**Habitat:** Shallow waters and in lagoon areas.

**Method of procurement:** Seines and hook and line.

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HOLOCENTRIDAE (Squirrelfishes) (8 spp. from Bermuda)

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*Holocentrus ascensionis* (Squirrelfish)

**Habitat:** Near shore rocky areas to patch reefs offshore to more than 90 m. Hide in crevices or under coral ledges by day and feed by night over sand and grass.

**Method of procurement:** Traps and hook and line.

*Holocentrus bullisi* (Deepwater squirrelfish)

**Habitat:** Found at depths between 25 and 60 fathoms. Nocturnal.

**Method of procurement:** Traps and hook and line.

*Holocentrus coroscus* (Reef squirrelfish)

**Habitat:** Tidepools, coral reefs and rocky areas. Nocturnal.

**Method of procurement:** Traps and hook and line.

Note: Most common squirrelfish in Bermuda along with the Dusky squirrelfish.

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HOLOCENTRIDAE	(Squirrelfishes)	(8 spp. from Bermuda)
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*Holocentrus rufus* (Longspine squirrelfish)

**Habitat:** Near shore to patch reefs and offshore to 90 m. Inhabiting caves or crevices of reefs by day, over sand and grass by night.

**Method of procurement:** Traps and hook and line.

*Holocentrus tortugae* (Tortuga squirrelfish)

**Habitat:** Found near coral reefs.

**Method of procurement:** Traps and hook and line.

Note: Not much is known about this rare species.

*Holocentrus vexillarius* (Dusky squirrelfish)

**Habitat:** Tidepools, coral reefs and rocky areas. Nocturnal.

**Method of procurement:** Traps and hook and line.

*Myripristis jacobus* (Blackbar soldierfish)

**Habitat:** Found inside holes and crevices of reefs.

**Method of procurement:** Traps and hook and line.

*Plectrypops retrospinis* (Cardinal soldierfish)

**Habitat:** Lives on patch reefs, at depths of 30 to 80 feet. Rather secretive.

**Method of procurement:** Traps and hook and line.

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HAEMULIDAE	(Grunts)	(8 spp. from Bermuda)
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*Haemulon album* (Margate)

**Habitat:** Over sand and grass flats near offshore reefs and breakers.

**Method of procurement:** Traps and hand lines.

*Haemulon aurolineatum* (Tomtate)

**Habitat:** Common inshore, near reefs or docks during the day but scatters over grass beds at night.

**Method of procurement:** Hook and line.

*Haemulon carbonarium* (Caesar grunt)

**Habitat:** Offshore reefs to 40 m.

**Method of procurement:** Traps and hand lines.

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**HAEMULIDAE**

(Grunts)

(8 spp. from Bermuda)

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*Haemulon flavlineatum* (French grunt)

**Habitat:** Common inshore, near reefs or docks during the day but scatters over grass beds at night.

**Method of procurement:** Hook and line.

*Haemulon macrostomus* (Spanish grunt)

**Habitat:** Found in clear water, often feeding on the bottom near coral reefs.

**Method of procurement:** Traps and hook and line.

*Haemulon melanurum* (Cottonwick grunt)

**Habitat:** Lives in coral reef areas to 40 m.

**Method of procurement:** Traps and hook and line.

*Haemulon plumieri* (White grunt)

**Habitat:** Grass beds, sand flats and reefs.

**Method of procurement:** Hook and line.

Note: Introduced to Bermuda.

*Haemulon sciurus* (Blue-striped grunt)

**Habitat:** Common inshore and on reefs to 30 m.

**Method of procurement:** Traps, hook and line and seines.

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## **VITA**

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