SUBSISTENCE, SETTLEMENT, AND LAND-USE CHANGES DURING THE MISSISSIPPIAN PERIOD ON ST. CATHERINES ISLAND, GEORGIA

by

SARAH GREENHOE BERGH

(Under the Direction of Elizabeth J. Reitz)

ABSTRACT

This research examines the human-environment interactions on St. Catherines Island, Georgia, during the late Woodland through the Mississippian period (AD 800–1580). Results from multiple analyses indicate that socio-political, demographic, and economic changes during this period were associated with changes in subsistence, settlement, and land-use patterns. Archaeofaunal collections of vertebrates and invertebrates are examined from three sites in a single locality, representing human occupation during the entire Mississippian period—9LI21, 9LI229, and 9LI230. Two additional late Mississippian archaeofaunal collections of vertebrates are examined from different island locations—9LI207 and 9LI1637. Fine-grained recovery techniques, not previously used for Mississippian deposits on St. Catherines Island, produced collections dominated by estuarine resources, especially oysters, clams, stout tagelus, sea catfishes, mullets, killifishes, and drums. Previous methods used to recover faunal remains produced collections dominated by deer. This study suggests that, though deer contributed large amounts of meat to the diet, estuarine resources were more abundant and contributed the most meat.

A Mississippian chiefdom developed on the island during the Irene phase (AD 1300–1580), with social inequality, large and dense populations living in communities of multiple, integrated settlements, and maize farming. Zooarchaeological evidence presented in this study suggests these socio-political changes led to new human-environment interactions, compared to the early Mississippian period. Irene peoples used a larger number and wider variety of shellfishing and fishing locations than early Mississippian folk. The Irene fishing strategy caught more large fishes and may have involved a shift to larger-scale mass-capture techniques, such as weirs. Irene settlements were occupied for longer periods of time and waste disposal was more organized than in earlier periods. These land-use and subsistence changes affected animal populations. Increased exploitation of estuarine resources influenced growth rates of clams and catfishes. Over time, the landscape became more open and heterogeneous, affecting the foraging habits of deer. These subtle changes are observed because of the fine-grained recovery and multiple analyses of multiple taxa. Yet, overall, the St. Catherines Island subsistence-settlement strategy, focusing on a specific suite of estuarine resources, supplemented with the occasional deer, was stable for thousands of years.

INDEX WORDS: Zooarchaeology, Mississippian period, Coastal archaeology, Georgia, Stable isotope analysis, Optimal foraging theory, Resource depression, Subsistence, Land-use patterns, Environmental change

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SARAH GREENHOE BERGH

BA, Skidmore College, 2000

MA, Hunter College, City University of New York, 2006

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SARAH GREENHOE BERGH

Major Professor:	Elizabeth Reitz
Committee:	Stephen Kowalewski Byron Freeman David Hurst Thomas

Electronic Version Approved:

Maureen Grasso
Dean of the Graduate School
The University of Georgia
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INTRODUCTION

To date, the overwhelming story of human resource use on the Georgia coast, USA, throughout 5,000 years of aboriginal occupation, is one of continuity and stability. This is in spite of cultural, socio-political, and economic changes, especially in the later part of the prehispanic period (AD 1000–1580) when human populations grew, maize cultivation began, and social hierarchies became more structured. It seems counterintuitive that patterns of animal use were the same as in earlier periods. This volume presents evidence that, in fact, the late Mississippian subsistence-settlement system on St. Catherines Island, Georgia was different from those of earlier periods and that late Mississippian societies had a greater impact on plant and animal communities.

Previous recovery methods for zooarchaeological materials were designed to ask general questions about subsistence. The research presented in this volume is based on more fine-grained recovery techniques and uses multiple analytical methods to examine change over time in a single locality. Although the suite of animal resources exploited did not change over time, there were subtle changes in where people collected these resources, in the intensity and organization of settlement occupation, and in the effects of island-wide patterns of land use on the environment. All these had implications for animal behavior and animal population dynamics.

St. Catherines Island Mississippian Period

St. Catherines Island is one of a series of barrier islands off the coast of Georgia (Figure 1.1). Human occupation began soon after the sea islands and marshes formed, in the Late

Archaic period (2500–1000 BC), and continued throughout the Woodland (1000 BC–AD 1000), Mississippian (AD 1000–1580) and Spanish Mission (AD 1580–1700) periods. A 20 percent transect survey in the 1970s documented the island's settlement history and is the basis for most of our knowledge about subsistence (Thomas 2008). Human remains were excavated and analyzed from Woodland and Mississippian burial mounds and from the Spanish Mission Santa Catalina de Guale (Larsen 1982, 1990, 2002; Larsen and Thomas 1982; Thomas and Larsen 1979). This research established most of what we know about socio-political relationships and living conditions, including the development of social inequality and the adoption of maize farming.

The Mississippian period encompasses the time from circa AD 1000 (all dates in this volume are in calibrated radiocarbon years unless otherwise noted), when large-scale farming societies first developed along the Mississippi River, until Spanish exploration began in the sixteenth century. Mississippian societies were chiefdoms (Anderson 1994; Hally 1993; King 2003; Knight and Steponaitis 1998; Milner 1998; Smith 1978), a term that refers to politically centralized regional polities (Carniero 1981:37; Earle 1987; Spencer 1991:372–374; Wright 1977). The emergence of chiefdoms in the Southeast was marked by population increase, increased maize production, and greater social stratification. Mississippian polities shared many features, including chiefly centers with platform mounds, burial mounds, extensive use of floodplains for farming, and Southeastern Ceremonial Cult (SECC) iconography. Many researchers note, however, variations among these societies (Beck 2003; Cobb 2003; Scarry and Scarry 2005), likely due to different historical processes leading to chiefdom formation and development (Pauketat 2007:85–87).

Societies with many of the trappings of Mississippian chiefdoms developed on the Georgia coast during the Mississippian period. There is at least one mound center on the Georgia coast, the Irene site (9CH1) located just south of the Savannah River (Caldwell and McAnn 1941). Platform and burial mounds were constructed and used at Irene during the Savannah phase (AD 1200–1300) and early in the Irene phase (AD 1300–1580), until replaced by a mortuary structure and council house during the middle part of the Irene phase (Caldwell and McAnn 1941:69–72). Populations on the coast appear to have increased during the Irene phase if not earlier. On St. Catherines Island (Thomas 2008:1035, 1051) there was a higher percentage of large sites, as well as more total sites, occupied during the Irene phase than earlier; suggesting larger and denser populations. An increase in the frequency of periosteal lesions in human bones on St. Catherines Island suggests concentrated, sedentary populations during the Irene phase (Larsen 2002:46–54; Larsen et al. 2001). This is consistent with the development of a Mississippian-style regionally integrated polity. Mortuary evidence indicates that Mississippian coastal societies had ascribed ranking. During the St. Catherines phase (AD 800–1300) on St. Catherines Island, burial of subadults and juveniles increased and some were accorded special burial treatment (Thomas 2008:1075–1077). Social inequality at the individual level may have been even more formalized during the subsequent Irene phase, when, in addition to inclusion of juveniles and subadults in burial mounds, grave goods were more often associated with individual interments than during the earlier phase (Thomas 2008:1037).

Maize farming, central to subsistence and tribute systems in most interior southeastern chiefdoms, was probably not as central to coastal Georgia chiefdoms. Little direct evidence of maize cultivation is known for the coast before the arrival of Europeans, but this is possibly due to the lack of archaeobotanical studies in the region. One exception is Grove's Creek on

Skidaway Island, where an Irene-phase midden produced evidence for cultivation of maize, as well as beans, squash, and sunflowers (Keene 2004). Single, burned maize kernels were found at two Irene-phase sites (9LI21 and 9LI207, both discussed later in this volume) on St. Catherines Island (Ruhl 2008).

Stable isotope analysis of human bone collagen from Mississippian-period coastal Georgia suggests there was variability in terms of the dietary importance of maize. Individuals buried in the Savannah-phase mound at the Irene site consumed maize (Schoeninger et al. 1990:82–92). Individuals buried on St. Catherines Island during this same time period, however, did not (Schoeninger et al. 1990:82–92). Maize was not a part of the diet of St. Catherines Islanders until the Irene phase (Larsen 2002:44–45; Schoeninger et al. 2009). The bones that were both dated and analyzed for stable isotope ratios, suggest that maize was not a dietary staple until the mid-late fifteenth century (Schoeninger et al. 2009). Stable isotope analysis on bone collagen, however, is only useful in detecting the addition of dietary maize if maize replaced much of the meat consumed by people, since collagen derives carbon from dietary proteins (Ambrose and Norr 1993:19–29; Harrison and Katzenberg 2003; Hedges et al. 2004; Jim et al. 2004; Tieszen and Fagre 1993a:131–153). If maize was simply added to the existing diet, then the carbon values in human bones are unlikely to be altered. Therefore, people may have grown and consumed maize on St. Catherines Island before the mid-fifteenth century, but maize was not a major focus of the subsistence strategy or diet.

Archaeological evidence from the region suggests that interactions among coastal and interior chiefdoms occurred throughout the Mississippian period. During the Savannah phase, ceramics from the northern Georgia coast were similar to those of the interior Georgia piedmont (Braley 1990; Crook 1986:43). Complicated-stamp motifs, such as concentric circles and concentric-circles-with-crosses, are found at both coastal and piedmont sites. This may indicate that coastal societies were part of an interaction network that included interior societies on the Savannah, Oconee, and Etowah Rivers during the Savannah phase. Irene ceramics on the coast appear to be a regional variant of the Lamar tradition of northern Georgia, suggesting continued interactions among these societies. The Irene variety appears at the same time as other Lamar varieties and probably developed in situ (Braley 1990; Crook 1986:43).

Another feature of this interaction sphere was the exchange of SECC objects during the late Irene phase (Larson 1958). Objects associated with this tradition were found in burials at Etowah and at sites in the Savannah and Oconee River basins at this time. At the Irene site, a rattlesnake gorget, some stippled gorgets depicting sun symbols and crosses, a monolithic ax pipe, and some undecorated conch shell cups were found. Further down the coast more cases of SECC symbolism have been found. The eagle warrior, forked eye, sun, and rattlesnake motifs are common on clay pipes, pots, and figurines, and shell gorgets, stone celts, copper celts, and decorated conch shell vessels are all found (Larson 1958). St. Catherines Island, too, was linked into the larger Mississippian material culture network; a pipe bowl with a circle-in-square motif and cross-in-circle motif was found at Back Creek Village (Thomas 2008:602), a pipe with a possible bird motif was found at Meeting House Field (Thomas 2008:713), and a shell gorget similar to one found at the Irene site was found at another Irene-phase site on the island (Thomas 2008:604).

Chiefdoms are inherently unstable, with fluctuations in political power and centralized authority within chiefdoms, and periodic collapses of entire chiefdoms and abandonment of centers of power (Anderson 1990, 1994; Hally 1993, 1996). Hally (1993, 1996), in a study of Mississippian chiefdoms in northwest Georgia and neighboring Alabama and Tennessee, found that chiefdoms tended to last for about 100 years, after which the region was essentially abandoned. Anderson (1994:235–245) also found that mound centers in the Savannah River Valley were only occupied for around 100 years at a time and then abandoned. The center of power within the river valley fluctuated. The greatest amount of activity in the valley was during the Hollywood phase (AD 1250–1350), throughout the middle and lower part of the valley (Anderson 1994:235–245; Wood 2009:431–435). After AD 1350–1400, most of the centers in the middle portion of the valley were abandoned, and mound centers were founded in the headwaters (Anderson 1994:235–245; Wood 2009:431–435). Occupation at the Irene site near the coast continued until 1400–1450 (Anderson 1994:235–245; Wood 2009:431–435). Anderson et al. (1995) suggest that the abandonment of the middle and lower Savannah River basin was related to climatic conditions—the Hollywood phase is associated with years during which climatic extremes were rare, but after 1350 there were more years with rainfall shortages, poor maize harvests, and inadequate maize stores. As maize was a major political currency, allowing chiefs to support populations in times of need and to negotiate intra- and inter-chiefdom relations, sustained deficits of maize would have weakened chiefly power (Anderson et al. 1995; Worth 1999). This abandonment of the middle and lower Savannah River precedes the late Irene phase (AD 1450–1580) and this empty region may have served as a buffer between powerful chiefdoms that developed along the South Carolina and Georgia coasts (Anderson 1994:249) by the time Europeans arrived in the region.

This shift in power might be related to the incorporation of maize into the fifteenth-century diet on the coast (Thomas 2008:1104–1110). Documentary evidence suggests that maize was an important feature of societies by the time Europeans arrived on the coast (Worth 1999, 2002, 2004). Contact-period Guale chiefs on the Georgia coast had access to maize surpluses large enough to supply the earliest French and Spanish explorers, while still retaining enough to fulfill community needs. Worth (2004) suggests that chiefs had rights to maize and labor tribute from subordinates because chiefly lineages owned the land on which people farmed and lived. Maize fields were a major target of warfare activities, indicating that crops were so important to chiefs and local economies that their loss would undermine chiefly power (Worth 1999). Maize, therefore, was an important feature of the coastal subsistence strategy by the mid-sixteenth century, and given the extensive knowledge and success of maize cultivation at this time, maize was likely grown on the coast before this time.

Using sixteenth-century accounts of coastal societies in the region, including Guale, societies north of the Altamaha River on the Georgia coast (Jones 1978:189–202; Saunders 2001:28–34; Thomas 2008:22–25; Worth 2004), Timucua, societies living south of the Altamaha River on the Georgia and Florida coast and the interior (Worth 1998:13–25), and Apalachee, societies living in the Florida panhandle (Hann 1988:96–117) as models, the Irene-phase polities of which the residents of St. Catherines Island residents were part, were regionally organized, with centralized political leadership inherited through ascribed rank. Societies were matrilineal and social and political status was derived from an individual's kinship relationship to one (or possibly multiple) noble lineage. Chiefs were drawn from the noble lineage and appear to have had some authority over redistribution of food stores, warfare activities, labor pools, community events, and inter-chiefdom relations. Many decisions, however, were made by a council of community lineage heads, who also may have had some responsibility for determining chiefly succession. Chiefs resided in a principle town, but the majority of the population lived in dispersed villages. These villages, or clusters of households and farmsteads, had their own community councils, and an administrator, either drawn from the paramount chief's lineage or from a local noble lineage with kinship ties to the chief. Paramount and local chiefs collected tribute from subordinates to support the chief's household, individuals with other important roles in society such as warriors and ball-players, and people without means to support themselves, such as widows, as well as for community feasts. Tribute took the form of food stuffs such as maize, nuts, and meat, as well as of exotic items and manufactured goods (Hann 1988:96–117; Jones 1978:189–202; Saunders 2001:28–34; Thomas 2008:22–25; Worth 1998:13–25; Worth 2004).

Chiefdoms involved new social relationships and political obligations for people at all levels of society. Larger, denser communities meant more daily interactions with neighbors, and cooperation among larger, possibly unrelated, groups of people. Negotiations for access to resources, both within and among settlements, likely were more common and more heated. Although chiefs, by definition, did not have coercive powers (Carniero 1981:41–43; Earle 1987; Service 1962:145–155) they were leaders sanctified by tradition and by the functions they served. Chiefs probably could call on subordinates for warfare, communal building projects, surplus food to help support public officials, and for contributions towards intra- and inter-chiefdom feasts and ceremonies (e.g., Hann 1988). All these factors influenced household subsistence activities and community land-use practices.

Theoretical Framework

Historical ecology provides a framework for investigating interactions among socio-political systems, non-human biotic communities, and climate. The integrating concept is the landscape, a temporal and spatial context in which the consequences of human actions, non-human population dynamics, and climatic events play out. Landscapes are, by definition, shaped by the history of human activity in a region (Balée 1998:2; Crumley 1994:6). The relationship between humans and the environment is dialectical; humans may change aspects of their environment, but they also react to environmental changes of anthropogenic and non-anthropogenic origin (Crumley 1994:5). These interactions play out on a variety of scales: from daily decisions about which food sources to harvest, to annual decisions about which forest patches to burn, and which cultigens to plant and where, to longer-term decisions about settlement location, travel routes, and fallow periods. The long-term effects of these interactions result in transformed landscapes (Balée 2006).

Landscape, as used in historical ecology, is the manifestation of the human-environment relationship. As such, studies of landscapes rely on ecological concepts, in addition to concepts drawn from social sciences such as anthropology. Ecology, in general, is the study of the distribution and abundance of organisms, and their relationship with their environment, but such studies can be undertaken at a variety of scales. Changes in the landscape, in the terms of landscape ecology, means changes in the structure, or spatial distribution of energy, materials, and species among the ecosystems in the landscape, and in the function, or flows of energy, materials, and species (Forman 1983; Turner et al. 2001:2–19). Landscapes are, therefore, composed of multiple ecosystems, and change in ecosystems refers to changes in the quantity and flow of energy and materials among organisms and their abiotic environment (Chapin et al. 2002:4). Population ecology focuses on the abundance and distribution of inter-breeding populations of a single species over time and space, and community ecology examines the population dynamics resulting from inter-specific interactions (Morin 1999:4-6; Rockwood 2006:5–7). This volume touches on ecological changes at all these levels.

Human activity has influenced the structure and function of most of the biosphere, and even small-scale societies have the potential to transform landscapes (Balée 1998:14; 2006).

While it is readily accepted that humans today are responsible for environmental change, it is only more recently becoming clear that earlier human societies also influenced their environments. The concept of the "Noble Savage" pervaded anthropological and popular thought for a long time (Denevan 1992). The idea that there was a time when nature was pristine and humans lived in harmony with it supported the worldview that modern human society was more advanced, with the technology to manipulate the environment to fit our needs, and, in some circles, morally inferior for doing so. This perception also coincided with a focus on stable, closed systems in anthropology and ecology (e.g., Flannery 1968; Rappaport 1968). From an anthropological perspective, small-scale societies established subsistence-settlement systems that fit their environment, and the natural and social realms worked together to form a self-sustaining system. In ecology, ecosystems were seen as stable systems, progressing through a series of successional stages until reaching a final state (Odum and Barrett 2005:337). Disturbances would perturb the system, but it would recover and proceed with its successional progress.

Neither social nor ecological systems are seen as stable anymore (Moran 1990:19–24). In ecology, disturbance is viewed as a driving force in both maintaining and achieving species diversity. Stability, as it applies to landscapes, does not mean unchanging, but oscillation around a central position (Turner et al. 2001:188–196). In anthropology, it has become apparent that small-scale societies, such as those in the prehispanic Americas, did not form self-perpetuating stable systems. People in the past, like today, influenced the structure and processes of their environment. Unlike today, environmental degradation was generally on a local scale so that environments were able to recover and allow reuse by humans (e.g., Butzer 1996).

Historical ecologists postulate that different types of societies will have qualitatively different interactions with the environment (Balée 1998:22), and changes in the socio-political system of a resident population will transform the landscape (Balée 2006). The Irene-phase population living on St. Catherines Island was part of a chiefdom that, itself, was part of the larger Mississippian interaction sphere. The shift from an egalitarian, hunter-fisher-gatherer society to one with a hierarchical socio-political organization that incorporated maize cultivation and a regional ritual and political ideal, likely changed the human-environment relationship, and by extension, the landscape. Landscape patchiness probably increased as a consequence, with the addition of more, and larger, occupied and abandoned settlements, as well as the addition of cultivated and fallow fields as patch types. The increased number of mouths to feed, in addition to the need to produce a surplus to support public figures and community functions, increased the amount of food harvested and may have led to a shift in which taxa, patches, and procurement techniques were emphasized. Increasing the amount of time spent on non-household production and maize cultivation might influence the scheduling of subsistence activities. All these social, political, and economic factors likely encouraged longer-term occupation in the same locations and a more formal settlement organization. Historical ecology, therefore, sets up the expectation that the human-environment relationship during the Irene phase was different than during preceding periods on St. Catherines Island.

Research Design

Zooarchaeological data can address choices people make about which foods to collect and consume, and how long and during which seasons they occupied settlements, as well as the effects these choices have on the environment and animal populations. The social and political contexts of these choices can also be addressed. The goal of this research is to examine faunal collections recovered using fine-grained methods for evidence of change over time in the human-environment relationship during the Mississippian period. Both vertebrate and invertebrate taxa are examined from contexts spanning the Mississippian period from a single locality on St. Catherines Island: Meeting House Field. Faunal collections from three sites from this locality, 9LI21 (Irene phase), 9LI229 (St. Catherines/early Irene phase), and 9LI230 (Savannah phase), are the basis of the research presented in this volume (Figure 1.2). Vertebrate collections from two other Irene-phase sites, Back Creek Village (9LI207) and 9LI1637, supplement the Meeting House Field collections so a fuller understanding of late Mississippian subsistence on St. Catherines is possible (Figure 1.2).

Through analyses of relative abundance, size distributions, shell morphology, growth increments, and bone stable isotope values performed on collections of vertebrates and invertebrates recovered using .32-cm water-screens, four research objectives within the realm of human-environment relationships, are investigated. These objectives are: 1) to characterize the late Mississippian subsistence strategy, 2) to examine these collections for change over time in subsistence and settlement patterns during the Mississippian period, 3) to find out if Irene-phase subsistence and settlement patterns depressed animal populations, and 4) to look for evidence of environmental changes associated with human activities and the impacts these had on terrestrial animals.

Previous Zooarchaeological Research

The first objective of this volume is to use faunal collections recovered with fine-grained methods to characterize Irene-phase subsistence. Previous interpretations of Mississippian and Woodland subsistence were based on small sample sizes of vertebrates and coarse-grained recovery methods. Faunal data from all time periods were obtained during the 1970s transect survey (Reitz 2008; Thomas 2008). One-by-one meter units were placed in a small sample (generally 1-5) of middens, and deposits primarily screened using .64 cm shaker screens. These collections indicated that the vertebrate taxa, and relative abundances of these, did not change over time (Reitz 2008:625–659). Deer dominated these collections, suggesting they were the most commonly consumed animal and contributed most of the meat (Reitz 2008:657). Turtles, alligators, other wild mammals, and sharks and fishes together contributed less than half the estimated meat obtained from deer, except at one site, 9LI21, where turtle contributed almost as much meat as deer (Reitz and Dukes 2008).

Screen size and recovery techniques affect the representation of small animals (such as fishes) in a collection (Cannon 1999, 2001; Shaffer 1992; Shaffer and Sanchez 1994; Thomas 1969). Experiments with .64-cm (Shaffer 1992) and .32-cm (Shaffer and Sanchez 1994) mesh sizes clearly demonstrate that small species consistently fail to be recovered with the larger screen size. The .32-cm mesh captures more elements and more species than the .64-cm mesh (James 1997). This affects sample size and estimates of relative abundance (Cannon 1999, 2001; Gordon 1993). When a .32-cm screen is used instead of a .64-cm screen, the number of identified specimens (NISP) will be larger, and minimum number of individuals (MNI) may be higher. The weight of each taxon will increase as more specimens of each are recovered, and estimates of meat contribution from each taxon (biomass), which are derived from specimen weight, will be higher for smaller taxa. This will also change estimates of richness, diversity, and equitability (Gordon 1993; Zohar and Belmaker 2005). Screen size, therefore, influences interpretations of human subsistence strategies and makes comparisons among collections recovered in different mesh sizes difficult.

Recent work at two Late Archaic shell rings (9LI231 and 9LI1648) on St. Catherines Island used .32-cm water-screens and recovered much larger collections of vertebrates than recovered during the transect survey. This is due to the larger number of excavated units and capture of far more specimens in the small mesh. Fishes dominate the individuals, at 90 percent or more in these collections, though deer do contribute disproportionately to the biomass—64 percent in the 9LI231 (St. Catherines Shell Ring) collection and 40 percent in the 9LI1648 (McQueen Shell Ring) collection (Colaninno 2010:120, 156). Sea catfishes contribute the most biomass of all fishes in collections from both sites, while mullets and drums contribute the most individuals (Colaninno 2010:121, 157). Therefore, Late Archaic people focused their subsistence on small, estuarine fishes, mostly sea catfishes, drums, and mullets, probably captured using mass-capture techniques. Hunting was a less common activity, but deer, a large animal, contributed a fair amount of meat to the diet (Colaninno 2010:120, 156). Comparing the Late Archaic fine- and water-screened samples with the .64-cm and .32-cm dry-screened transect samples leads to the conclusion that recovery methods have likely biased the interpretations of subsistence patterns on St. Catherines Island.

This volume presents results of analyses of Mississippian-period collections recovered using fine-grained recovery methods, providing a chance to examine Mississippian diet in greater detail than before; the first research objective. Collections are drawn from multiple middens from three Irene-phase sites, as well as earlier Mississippian contexts, thereby compensating for the bias associated with single-unit excavations. Deposits were water-screened through .32 cm mesh and all vertebrates retained for analysis. The largest sample size from any previously examined Irene-phase site on St. Catherines Island is 6,193 specimens recovered from four middens (at 9LI21) using a mix of shaker-screen mesh sizes (Reitz and Dukes 2008). The vertebrate samples from all three Irene-phase sites presented in this volume are larger than this (over 11,000 specimens), and the samples from two sites (9LI21 and 9LI207) are drawn from more middens than previously examined from any Irene-phase site. This allows for a more complete description of the Irene-phase vertebrate diet on site- and island-wide scales and these results can be compared with the Late Archaic collections recovered using the same methods. This will lead to a better understanding of change and continuity in subsistence patterns over time.

Further, the research presented in this volume examines the invertebrate component of the subsistence strategy for the Mississippian period, something that has not previously been done on St. Catherines Island. The invertebrate samples presented in this volume are from more contexts and span a longer time frame from a single locality than other studies on the Georgia coast that have included invertebrates in their recovery methods. The archaeofaunal collections discussed in this volume, therefore, are better suited for characterizing, and addressing changes in, subsistence patterns than other collections from the Mississippian Georgia coast.

Subsistence Patterns and Subsistence-Settlement Pattern Change

The second research objective is to evaluate the zooarchaeological collections for changes in the subsistence-settlement system during the Mississippian period. Despite the long history of zooarchaeological research, few models have been offered for addressing subsistence patterns and subsistence change. Economic and behavioral ecology concepts provide the basis for existing models. Economic approaches to archaeological subsistence patterns are based on the assumption that humans are rational beings (Bettinger 1991:83–84; Jochim 1976:5–6; Kaplan and Hill 1992). People make choices about which foods to procure by weighing the costs of procuring that food versus the benefits of that food, within a specific environmental, cultural, and settlement context. Jochim (1976) proposed a model that addresses the costs and benefits that hunter-gatherers might consider on a long-term and daily basis to solve problems of resource use, demographic arrangement, and site location.

Optimal foraging theory, derived from behavioral ecology, is often used to operationalize subsistence strategies (e.g., Barlow 2002; Broughton 2002; Hawkes et al. 1982; Kelly 1995; Lupo 2007; Nagoaka 2002; Thomas 2008; Winterhalder and Smith 1981). Due to its origin in evolutionary theory, optimal foraging theory defines subsistence strategies as adaptations to environmental conditions that optimize individual survival and reproductive fitness (Kaplan and Hill 1992; Smith 1983). Natural selection favors the ability to read environmental cues and, through cost-benefit analysis, with energy as the primary currency, design an optimal strategy.

In this volume, Jochim's approach to hunter-gatherer subsistence will be used to characterize Mississippian-period subsistence patterns, as it incorporates facets of resource use, social relationships, and site placement without assuming optimal levels of energy efficiency. Optimal foraging theory, however, provides a methodology for addressing subsistence change over time, and diet-breadth and patch-choice models are used in this volume to evaluate changes in the subsistence strategy between the early and late Mississippian periods. The applicability of a diet-breadth model constructed for St. Catherines Island (Thomas 2008:75–197) is evaluated using the Mississippian collections presented in this volume.

Jochim's Model

Jochim defined subsistence-settlement systems as "the patterning of behavior as a result of solutions to problems" (Jochim 1976:11). The archaeological record is an amalgamation of individual behavior over time. However, individuals in the same society have similar goals and perceptions of the environment, and similar methods of achieving goals, which means that individuals will often have similar solutions to problems and therefore similar behavior (Jochim 1979). This is what allows us to consider subsistence-settlement systems and not just individual behavior. Using ethnographic data on hunter-gatherers, Jochim (1976:16) suggested that the basic function of economic activities is to provide the calories necessary to sustain the population, while other economic needs are culturally defined. In choosing how to meet these needs, hunter-gatherers seek solutions that lead to a secure source of food and manufacturing/trade materials, while allowing some degree of population aggregation, and minimizing effort (Jochim 1976:19). Other considerations, mostly culturally defined, include desire for a variety of foods, establishing prestige through subsistence activities, and structuring and maintaining social and sex differentiation.

Jochim (1976:11) identified three general problem areas within the subsistence-settlement system that need to be solved: resource-use schedule, site placement, and demographic arrangement. Food selection, as described in ethnographic literature, often is based on weight, density, abundance, mobility, fat content, and nonfood yields (Jochim 1976:23). These variables are related to goals and desires: density, abundance, and mobility affect the likelihood that an animal will be found and caught, weight and abundance affects the amount of calories available, fat content affects taste, and nonfood yields provide raw materials for manufacturing needs (Jochim 1976:24). These factors also speak to sex differentiation, as dense, sedentary, and small food resources are often targeted by female-children foraging groups and mobile, rare, and large animals are often the domain of male hunting groups. The latter types of resources may also bring prestige to the person who obtains them. Economic factors play a large role in the location and movement of settlements; specifically, settlements are located near resources (Jochim 1976:48). Other factors are important too, such as access to water and shelter and other communities (Jochim 1976:48–49). Movement among settlement locations is affected by the availability of resources. In an environment where resource availability is highly organized by seasonal conditions, settlement locations might be expected to vary on a seasonal basis. Population size is subject to some environmental constraints; populations cannot be larger than the food sources available to feed them. Therefore the abundance and spatial distribution of resources are important factors in determining group size and group size is maintained at a level that can be sustained by the resource base (Jochim 1976:66–67). Resources, however, can be managed to support larger populations. Storage, cooperative hunts and sharing, technological innovations, changes in procurement strategies, introducing new food sources, and trade with other communities, may increase the amount of available resources.

Optimal Foraging Theory

Diet breadth describes the range and proportions of food items (taxa) that make up the diet of, in this case, a human group (Hames and Vickers 1982). A model for an optimal diet breadth is created by ranking the resources available in the environment in terms of net energy gained after accounting for time and energy spent in acquiring food (Bettinger 1991:84–87; Kaplan and Hill 1992; Smith 1983; Thomas 2008:64–69). Net energy is defined as the number of calories gained per time less the calories expended to search for, capture, and process the food item, also referred to as the post-encounter return rate (Bettinger 1991:84; Thomas 2008:64). These resources are added to the diet, from highest to lowest rank, until the net energy gained from a new prey item would be less than the average returns of all higher-ranked prey. A forager is expected to always select the highest-ranking prey items when encountered. The addition of a new prey item to the diet depends on the availability of all higher-ranked prey types, so if the preferred, high-ranked prey types become less abundant (and therefore search time becomes greater), lower-ranked prey items will be added to the diet. The diet-breadth model assumes that resources are evenly distributed in the environment (Bettinger 1991:84–87; Kaplan and Hill 1992; Smith 1983; Thomas 2008:64–69).

Diet-breadth models are constructed by archaeologists using ethnohistorical, ethnographic, and experimental research (e.g., Braje et al. 2007; Broughton 1997, 1999; Butler 2001; Erlandson et al. 2005; Kennett 2005; Lindström 1996; Lupo and Schmitt 2005; Smith 1991; Thomas 2008:74–197; Ugan 2005; Winterhalder 1981). Generally, large-bodied taxa are considered high-ranking prey items because they provide the greatest number of calories per effort. Some researchers suggest, however, that animals that aggregate, even small-bodied ones, can yield higher post-encounter return rates than single large-bodied animals (Grayson and Cannon 1999; Kennett 2005:24; Madsen and Schmitt 1998; Rick et al. 2001). Aggregation behavior by prey items allows for mass capture of individuals, and a large number of calories gained in a shorter amount of time than if each individual had to be searched for, captured, and processed separately. In marine and estuarine environments, many prey items show aggregation behavior—especially bivalves and schooling fishes—therefore, it is likely that many estuarine taxa may be highly ranked despite being small-bodied (Kennett 2005:24; Rick et al. 2001; Ugan 2005).

The patch-choice model is a special-case of the diet-breadth model that accounts for the fact that resources are often unevenly distributed in the environment (Bettinger 1991:87–90; Kaplan and Hill 1992; Smith 1983). Patches (habitats where a suite of resources would be targeted) are ranked according to the net energy to be gained from exploitation after taking into account search, capture, and processing time. Instead of encountering individual prey items as in the diet-breadth model, people encounter a range of prey items in each patch. Patches are added to the repertoire in descending rank order until they no longer provide more energy than the average energy provided by the higher-ranking patches. A forager is expected to exploit the highest-ranking patches first. New patches are added to the diet if the productivity of higher-ranked patches decreases (Bettinger 1991:87–90; Kaplan and Hill 1992; Smith 1983).

In this volume, patches are considered locations in space exploited by people for a single or multiple resources. For example, an oyster bed located along a tidal creek provides access to a variety of invertebrates besides oysters, as well as fishes in the creeks and over the oyster bed, diamondback terrapins, and the occasional bird or mammal utilizing the same location for foraging or residential purposes. A single oyster bed is a patch or habitat, but there are many oyster beds in the estuary, and each is its own patch. In addition, oysters, other invertebrates, fishes, birds, and mammals can also be found in other types of patches or habitats.

Thomas (2008:75–197) developed a diet-breadth model for St. Catherines Island using hunt-types to predict which prey items would be the most important in the prehispanic subsistence strategy. The hunt-type model, like the patch-choice model, also addresses the uneven distribution of resources in the environment (Smith 1991:197–244), but allows greater flexibility in grouping targeted taxa. Hunt-types can be defined by capture technology, a particular prey taxon, a particular patch or set of patches, seasons, or other such factors (Smith 1991:156). The prey-choice model can then be applied to each hunt-type (Smith 1991:197–244) or the hunt-types themselves can be ranked according to estimated post-encounter return rates (Thomas 2008:258–260). Thomas (2008:72) defines two marine hunt-types for St. Catherines Island, shellfish collecting and saltwater fishing, and three terrestrial animal hunt-types—terrestrial hunting, sea turtle harvesting in summer, and small turtle hunting. The model predicts that saltwater fishing should be the most productive hunt-type, followed by terrestrial hunting (Thomas 2008:258–260). Within the terrestrial hunting hunt-type, bear and alligator are predicted to be the highest-ranking prey items because of their large size, followed by deer (Thomas 2008:148).

Settlement Patterns

Zooarchaeological data, derived from shell middens, can address changes in settlement patterns; specifically changes in when and how long a settlement is occupied and changes in the formality of site structure. Shell middens on the Georgia coast are the result of processing and discard of food remains—the matrix is generally oyster shell, with a variety of less abundant bivalves, gastropods, and crustaceans. Within the shell matrix, vertebrate remains, burned plant materials, pottery sherds, lithic flakes, and occasional tools or decorative items are found. These middens are generally considered permanent or seasonal residential deposits (Crook 1978, 1984; Quitmyer et al. 1997; Reitz 1982, 2008). Andrus and Thompson (2012) argue that the presence of animals caught from a variety of different habitats and during multiple seasons suggests a residential site. People brought the spoils of their fishing and hunting trips from many island (and possibly mainland) locations back to these sites and deposited the remains in the same garbage piles (Andrus and Thompson 2012). Given the likelihood that people had boats, this would not be a particularly costly behavior.

The shell middens investigated for this project are likely the result of garbage disposal by a household or related group of households living at a site. No evidence for houses has been found at Irene-phase sites on St. Catherines Island, to date; however, little excavation has been done between middens. There is evidence that a house/midden or houses/communal-midden model is appropriate for at least some Irene settlements, as the structures at the Irene-phase Grove's Creek site (9CH71) on Skidaway Island had midden material associated with them

(Keene 2004), as did the Irene house structure at Red Bird Creek (9BN9), on the mainland (Pearson 1984).

The archaeological record for the Irene phase suggests that human populations were larger, there were more settlements on the island, and settlements were larger than during earlier periods (Larsen 2002:46–54; Larsen et al. 2001; Thomas 2008: 1035, 1051). Although people were likely relatively sedentary throughout aboriginal times on St. Catherines Island (Thomas 2008:859–935), the fact that more of the island was occupied during the Irene phase probably meant that people could not relocate entire settlements and settlements could not fission as readily as previously. There was less land available for relocation, and more resource patches were probably controlled by other communities. Thomas (2008:1089), following Carniero (e.g., 1970) and Kennett (2005:332) suggests that this circumscription might be related to the development of chiefdoms on the island, and on the coast in general. Whether this was the case or not, the socio-political environment of the Irene phase probably meant that larger numbers of people remained in the same place for longer periods of time.

Larger numbers of people create more food and household waste, and the longer a settlement is occupied the more waste accumulates. The structure of chiefdoms provides mechanisms for more formally organizing settlement layouts, including waste disposal locations (Kelly 1992). In an ethnographic case study of a Kalinga village in the Philippines, waste disposal was more formal in the center of the village where public structures and the densest occupation were located (Beck and Hill 2004). Middens near the village center were less numerous, but larger, and were used by more than six households as well as by communal work groups. On the outskirts of the village, middens were smaller and associated with single households. In the zone between, middens were used by two to six households (Beck and Hill

2004). Mikea, in Madagascar, travel greater distances to discard trash when living in longer-term settlements than in short-term camps (Kelly et al. 2005). In an archaeological case of increased settlement organization, likely associated with more formalized collective decision-making among the pre-contact Iroquois, refuse disposal changed from being associated with households or groups of households and located within the palisade walls, to being concentrated in a single location outside the palisade walls (Birch 2010:136). This occurred as population aggregation increased—people leaving their smaller villages and congregating in a single village (Birch 2010:136). Concentrations of people not only create more waste within a community, but decrease the amount of space available for disposal. Focusing waste disposal in a single location, even though it involved more work, may be recognized as a necessity or desirable for the good of the community.

The second research objective of this volume is addressed using collections from early and late Mississippian contexts in a single locality on St. Catherines Island: Meeting House Field. Diet-breadth and patch-choice models predict that increased rates of foraging for preferred prey, both because of larger overall populations and longer-term occupation of the same settlement locations, will result in the addition of more prey items and patches to the subsistence strategy. Aspects of resource use, following Jochim (1976), are likely to be affected if people are operating as part of a larger social group, remaining in the same place for longer periods, and competing with a greater number of other communities for access to resources. Additionally, it is expected that as people remained at the same settlements for longer periods of time, site structure is likely to become more formalized during the late Mississippian; this might be evident in the zooarchaeological record as a change in waste disposal practices.

Human Impacts on Animal Resources

The third research objective is to examine the zooarchaeological collections for evidence of human impacts on animal resources. Animal populations are directly and indirectly influenced by human activities. Animal physiology and population structure can be directly affected by hunting, fishing, and gathering for subsistence, ritual, or craft production purposes. If predation pressure is great enough, some species may be extirpated. Animal behavior is indirectly affected by humans when activities such as clearing, burning, cultivation, and waste disposal create new foraging habitats that attract certain animals and cause them to alter their foraging behavior (e.g., Bird et al. 2005; Neusius 2008; Quirt-Booth and Cruz-Uribe 1997). The combined effects of habitat changes and predation may exacerbate impacts on animal populations. Human effects on animals, therefore, depend on the specific set of activities in which a human society engages, and the scale of these activities in space and time. The greater the scale of these activities, in terms of how much of the landscape is exploited and for how long, the more likely it is that animal populations will be affected.

Resource Depression

Another aspect of optimal foraging models is the prediction that, over time, people depress populations of preferred resources, causing changes in the availability of these resources (Broughton 1997, 2002, 2004; Butler 2000, 2001; Nagoaka 2002). Studies of resource depression combine patch-choice and prey-choice models to address changes in the prey structure within patches. Over time, high-ranking prey populations become less abundant or less productive because of human harvesting pressure, and later peoples utilizing the environment must obtain the same amount of food by adding lower-ranked prey-types or patches to the subsistence strategy (Broughton 2002). Harvesting pressure, in these studies, may be related to long-term exploitation by humans or to changes in human demography or technology that increases the rate at which high-ranked animals are captured (Lupo 2007).

Resource depression has been demonstrated in the archaeological literature. On the Polynesian island of Mangaia (Butler 2001), the relative abundance of large freshwater and marine fishes (considered high-ranked prey) decreased in the archaeological record over time. In prehistoric New Zealand, the larger taxa from each patch (inshore marine and terrestrial) decreased in relative abundance over time (Nagoaka 2002). At the same time, smaller taxa became more abundant and more diverse and offshore resources were added (Nagoaka 2002). At a site on Kaua'i, Hawaii, the largest shellfish taxon from the coral reef patch, which dominated the early collection, decreased in relative abundance over time and a smaller taxon became more abundant (Morrison and Hunt 2007). In addition, the reef patch played a reduced role in the subsistence strategy over time, with people focusing more on the shoreline patch (Morrison and Hunt 2007). Broughton (2002) went beyond size of prey to incorporate animal behavior in evaluating evidence for resource depression in the Emeryville Shellmound, California. Resource depression in sea otter, deer, and cormorant populations was demonstrated by a decrease in females and young in the archaeological collections over time. These species segregate by age and sex, with groups of females and young residing separately from males in response to predation. Hence, a decrease in females and young in the archaeological record was evidence that people put enough pressure on the animal populations that they responded behaviorally, and people had access to fewer individuals (Broughton 2002). In the St. Catherines collections, sex and age segregation are difficult to assess because most mammals and birds are rare in the collections; the specimens present rarely represent many individuals and the age and sex of most individuals is unknown.

Human Impacts and Population Ecology

For estuarine resources on the Georgia coast, models derived from population ecology that predict changes in fin-fish and shellfish growth patterns as responses to harvesting pressure are a good way to assess human impacts. Fisheries are particularly responsive to harvesting activities. Removing large numbers of adults leads to a decrease in population density. Models of density-dependent growth suggest that decreased density results in increased individual and population growth rates (Begon et al. 1996:29–31; Wootton 1998:198–201). Harvesting adults reduces intra-specific competition and increases recruitment because more juveniles survive to adulthood, juveniles grow faster and reach sexual maturity faster, and adults attain larger sizes and produce larger numbers of offspring. These assumptions were long used to model maximum sustainable yield (Rose et al. 2001; Schaefer 1954). Modern fisheries, however, are in decline because removing too many reproductive-age adults or disproportionate removal of large individuals reduces the breeding stock necessary to replenish populations. The population size at which this happens may change annually due to environmental fluctuations (Mace 2001). Fisheries biologists are currently attempting to establish more realistic and sustainable yield goals. The data used to study population dynamics come from trawls and landings made since the 1800s. These data likely do not represent a complete picture of a species' population dynamics in regions where estuarine waters were commercially fished in pre-modern times (Amorosi et al. 1996; Barrett et al. 2004; Morales-Muñiz and Roselló-Izquierdo 2008). For instance, in the case of North Atlantic cod, post-1850 trawls rarely caught individuals >100 cm, but fish of this size were regularly taken during the Norse and Medieval periods (Amorosi et al. 1996).

Overfishing is a major problem for modern global fisheries management. The average trophic level of global fishery catches has decreased over the past hundred years, suggesting a shift in the marine community towards small piscivorous and herbivorous fishes (Pauly et al. 1998, 2000; Secretariat of the Convention on Biological Diversity 2006). Mean trophic level of catches, however, may not be a direct reflection of the mean trophic level of the marine community (Branch et al. 2010). For instance, the trophic decline may be partly a result of increasing use of low-trophic level fisheries for reasons other than declining high-trophic level fisheries (Essington et al. 2006). Hutchings and Reynolds (2004) studied modern fin-fish populations, however, and found a significant reduction in breeding-population size for multiple populations of multiple species. The ability to recover after collapse depends on life-history traits and ecological dynamics, not simply on reducing fishing pressure. Jackson et al. (2001) took an historical look at global marine fisheries and suggested that people have had an impact on fisheries since fishing first began. Prehistoric fishers did put some pressure on fish populations, but overfishing was unlikely a major problem until the large-scale fishing for global markets began. Additional factors such as disease, pollution, eutrophication, introduced species, habitat destruction, and other factors increased vulnerability to collapse (Jackson et al. 2001).

Predation pressure in archaeological fin-fisheries is a common topic in zooarchaeological research. Hales and Reitz (1992) found that growth rates in Atlantic croakers increased and life-spans decreased in response to increasing human predation over time on the Florida coast. In a study of sites from four Caribbean islands, Wing (2001) suggested that although the range of fish species exploited in the reef and inshore habitats remained stable over time, overfishing effects are visible in the change in emphasis from large carnivorous reef fishes to smaller, herbivorous or omnivorous reef fishes and in an increase in offshore fishing. Steadman and Jones (2006) found a similar decrease in the use of pelagic/inshore and reef fishes and an increase in the use of offshore fishes on Caribbean island sites. Fitzpatrick and Keegan (2007) put these findings in a climatological, technological, and land-use context, and suggested that prehispanic human impacts on the Caribbean islands were small-scale and temporary compared to the impacts of post-European colonization. Reitz (2004) and Quitmyer and Reitz (2006) found evidence for similar decreases in mean trophic level of marine resources targeted during the Mississippian and historic periods on the Georgia and Florida coasts.

Evidence also indicates that shellfish populations were affected by human predation in the past. Quitmyer and Jones (2000) found that the age distribution of clams from archaeological sites on the Georgia and Florida coasts is similar to that found in heavily exploited modern clam beds and they suggest prehispanic clam populations were over-exploited. Milner et al. (2007) examined an Orkney midden from the Viking to Medieval period and found that the most common mollusc species decreased in mean size and abundance over time while the less common species increased in abundance. There also appears to be an increased use of the lower-shore mollusc beds over time. Whitaker (2008), on the other hand, suggested that shellfish can be harvested sustainably over time. Using models that predict impacts of different harvesting strategies for mussels on the California coast, Whitaker found that the archaeological data from Punta Gorda rockshelter matches the curve for a strategy that strips beds every 24 months, allowing mussel populations to recover and individual animals to grow to a size worth harvesting, but not the maximum size attainable.

To address the third objective of this volume size and age of selected fishes and shellfishes are estimated to assess evidence for resource depression and harvesting pressure during the Mississippian period on St. Catherines Island. A growing human population would have necessitated a higher rate of harvesting. People may have expanded the number of patches in their subsistence strategy to compensate for decreasing productivity of preferred patches. Depending on the life-history traits of species, one might expect that increased harvesting pressure caused a change in the mean growth rate, mean size, or mean age of individuals in some estuarine populations. Additionally, abundance of deer may have decreased as a result of increased harvesting rates, since they are the largest, common, terrestrial animal.

Land-Use Patterns

The fourth research objective is to evaluate the archaeofaunal collections for evidence of environmental changes associated with human activities. Humans utilize the abiotic and biotic environment on a daily basis. In small-scale societies, fire is one of the most common anthropogenic disturbances that transform landscapes (Pyne 1998:64, 76–78). Fire is a tool for clearing new house sites, razing old settlements, clearing fields for planting, removing undergrowth for easier hunting and gathering, and encouraging early successional plants that attract deer and provide seeds, greens, and berries for humans. The park-like forests encountered by seventeenth-century English colonists in New England were the result of long-term maintenance by Indians through burning (Cronon 2003:25–33). Humans also affect the frequency and distribution of plant and animal taxa by intentionally moving plants (Posey 1998:110–114), altering soil chemistry (Graham 1998:125–126), and creating artificial substrates (Kidder 1998:152–157). Landscape heterogeneity is increased through the repeated use of travel routes (corridors), clearing new settlements and fields, and burning undergrowth (patches). Long-term, this may increase or reduce connectivity of patches.

Anthropogenic environmental change can enhance biodiversity or degrade the biosphere (Balée 1998:19; Stahl 1996:114–115). Historical ecologists do not view human nature as innately destructive or conservationist. Transformation of the landscape is inevitable, as humans must interact with their environment and the effects of these interactions are cumulative (Balée 2006). In many cases, however, human activities enhance the biological diversity of regions over time. Black-earth patches in the Amazon are the result of human occupation, and are the most fertile soils in the region (Neves et al. 2003). Anthropogenic forests in Africa (Fairhead and Leach 1995) and the Amazon (Posey 1985) are higher in plant diversity than are surrounding habitats. Use of marginal, upland sections of the Mediterranean region for pastoralism encouraged vegetative growth, which in turn deterred erosion (Butzer 1996). On the other hand, especially in the case of human colonization of oceanic islands, human activity leads to long-term degradation of environments. In Iceland, grazing animals and cultivation created an essentially treeless landscape and a persistent erosion problem (Dugmore et al. 2005). After colonizing the islands of Polynesia, many native species were extirpated and large portions of the island were deforested, leading to massive erosion (Kirch 1997). The eroded alluvial and colluvial sediments, however, filled lakebeds and formed soils excellent for agriculture. In the theory of island biogeography (MacArthur and Wilson 1967; Morin 1999:171–180), the smaller an area is and the farther away it is from other areas (in the case of islands, from the mainland) the harder it is for plants and animals to recolonize. Hence, island ecosystems recover more slowly from human impacts because animal and plant populations cannot easily recruit from nearby, less-impacted populations.

To address the fourth research objective of this volume stable carbon and nitrogen isotope analysis was performed on samples of modern and archaeological deer and raccoon bones. A greater portion of the island was occupied by people during the Irene phase, so human-caused disturbance events affected a greater portion of the island. Such disturbances include clearing sites for settlement, burning forest undergrowth for hunting, gathering, and travelling purposes, burning clearings for gardens and fields, and planting maize in clearings. The long-term result of such disturbances is a more heterogeneous landscape of anthropogenic patches with different soil and vegetation compositions than found in non-anthropogenically disturbed patches. Stable carbon and nitrogen isotope analyses shed light on environmental changes associated with Irene-phase land-use patterns. Deer and raccoons are common in the archaeological record, and, today, are drawn to human-disturbed habitats, including fields, occupied and abandoned settlements, and garbage dumps. Changes in soils and vegetation caused by human land-use activities are passed up the food chain to these animals. Deer and raccoon behavior, such as foraging more often in anthropogenic patches, or avoiding them, will, therefore, be recorded in the stable isotope values of bone collagen.

Overview of Volume

This first chapter sketched the theoretical framework used in this volume to address changes in the human-environment relationship during the Mississippian period on St. Catherines Island. Given the socio-political changes in the region during this period, it is expected that changes also occurred in subsistence, settlement, and land-use patterns and that these might affect the population dynamics of the animals people exploited. Recovery methods used in earlier zooarchaeological studies on the Georgia coast were not adequate for evaluating change over time, and the archaeofaunal collections examined in this volume compensate for many of the earlier biases. Four research objectives were presented to examine different aspects of these collections for evidence of change.

Chapter 2 situates Mississippian-period St. Catherines Island within its environmental and cultural context. A review of the geomorphology and ecology of the island and surrounding estuary is followed by a brief history of human occupation on St. Catherines, emphasizing the archaeological evidence for Mississippian settlement patterns and socio-political systems.

The third chapter reviews the materials and methods used to address the research objectives. The archaeological sites, and previous research at each, are described, followed by a description of the methods used to excavate and recover the vertebrates and invertebrates used in this study. Then the zooarchaeological, incremental, and stable isotope methods are presented.

The fourth chapter presents the results of the zooarchaeological analysis for each analytical unit, including identified taxa, relative abundances, modifications, and deer element summaries. These data are used to address the first, second, and third research objectives, which examine the evidence for changes in Mississippian subsistence strategies and settlement patterns in Chapters 5, 6, and 7.

Chapter 5 addresses the first research objective, and characterizes the late Mississippian subsistence strategy, following Jochim's model, using data from three sites in three different parts of the island. Seasonal resource use, fishing strategy, the relative importance of vertebrates and invertebrates, demographic arrangement, and site location are described. Social and political factors that influence these solutions also are discussed. The data are also evaluated in terms of Thomas' (2008:75–197) diet-breadth model for St. Catherines Island.

Chapter 6 addresses the second research objective: change in subsistence and settlement patterns. The zooarchaeological results from early and late Mississippian contexts from a single locality are examined for evidence of changes in seasonal patterns of resource use, fishing strategy, shellfishing strategy, length of site occupation, waste management, and social and political relationships. The vertebrate collection from a Late Archaic shell ring in the same locality provides greater time depth.

The seventh chapter addresses both the second and third research objectives, by examining oyster shell morphology, clam growth rates and survivorship curves, and sea catfish growth patterns. The implications of these data for human subsistence strategies and harvesting pressure are discussed. Diet-breadth and patch-choice models predict that with increasing human populations, the number of prey taxa and patches exploited will increase. Resource depression may also be evident in changing population dynamics of common shellfishes and fishes. These predictions are tested.

Chapter 8 addresses the fourth research objective: to examine changes in land-use patterns over time, drawing on the results of carbon and nitrogen stable isotope analysis of deer and raccoon bone collagen. The isotope samples are primarily from Mississippian contexts, but specimens from Late Archaic and Mission-period contexts are included for comparison. The Late Archaic specimens provide an example of deer and raccoon diet before maize was introduced, just as anthropogenic impacts on the island environment began. The Mission specimens provide an example of deer and raccoon diet during a period when maize was grown on the island and human populations were large and dense. The results of a comparative study of modern deer and raccoon isotopic values and the values of known food items are also presented. These data augment interpretation of the archaeological results.

The final chapter reviews the evidence for changes in the human-environment relationship during the Mississippian period, discusses the significance of this evidence for anthropological, archaeological, and ecological research, and suggests avenues for future research. The archaeofaunal collections presented in this volume are larger, drawn from a greater number of contexts and sites, and include a greater range of taxa (i.e., shellfish) than other studies of Mississippian subsistence on the Georgia coast. Applying multiple analytical techniques to these collections provides data to address multiple aspects of the human-environment relationship: subsistence, settlement and land-use patterns, the impacts humans had on animal populations, and the socio-political contexts in which the relationship played out.

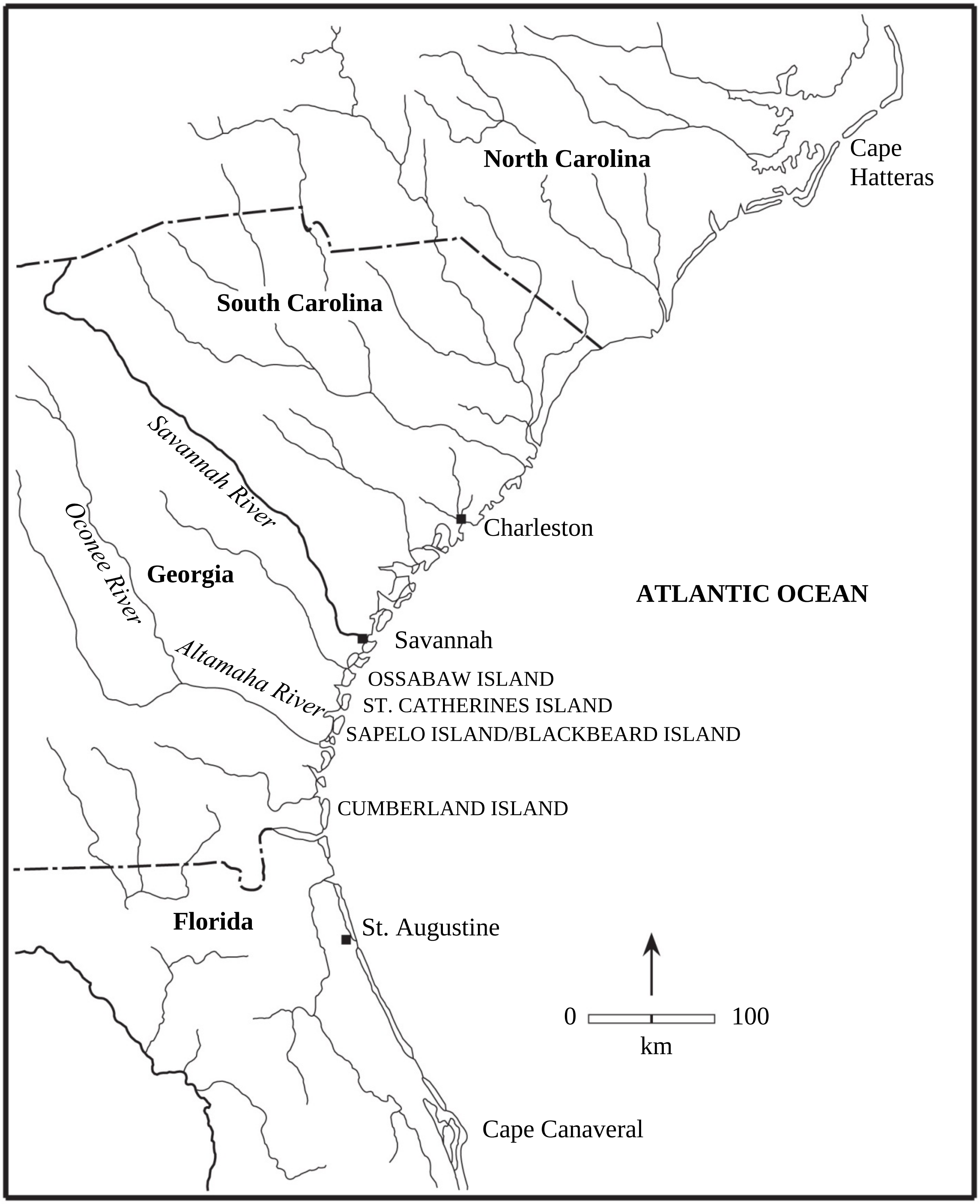


Figure 1.1: Map of the Georgia Bight, Southeast Coast, USA

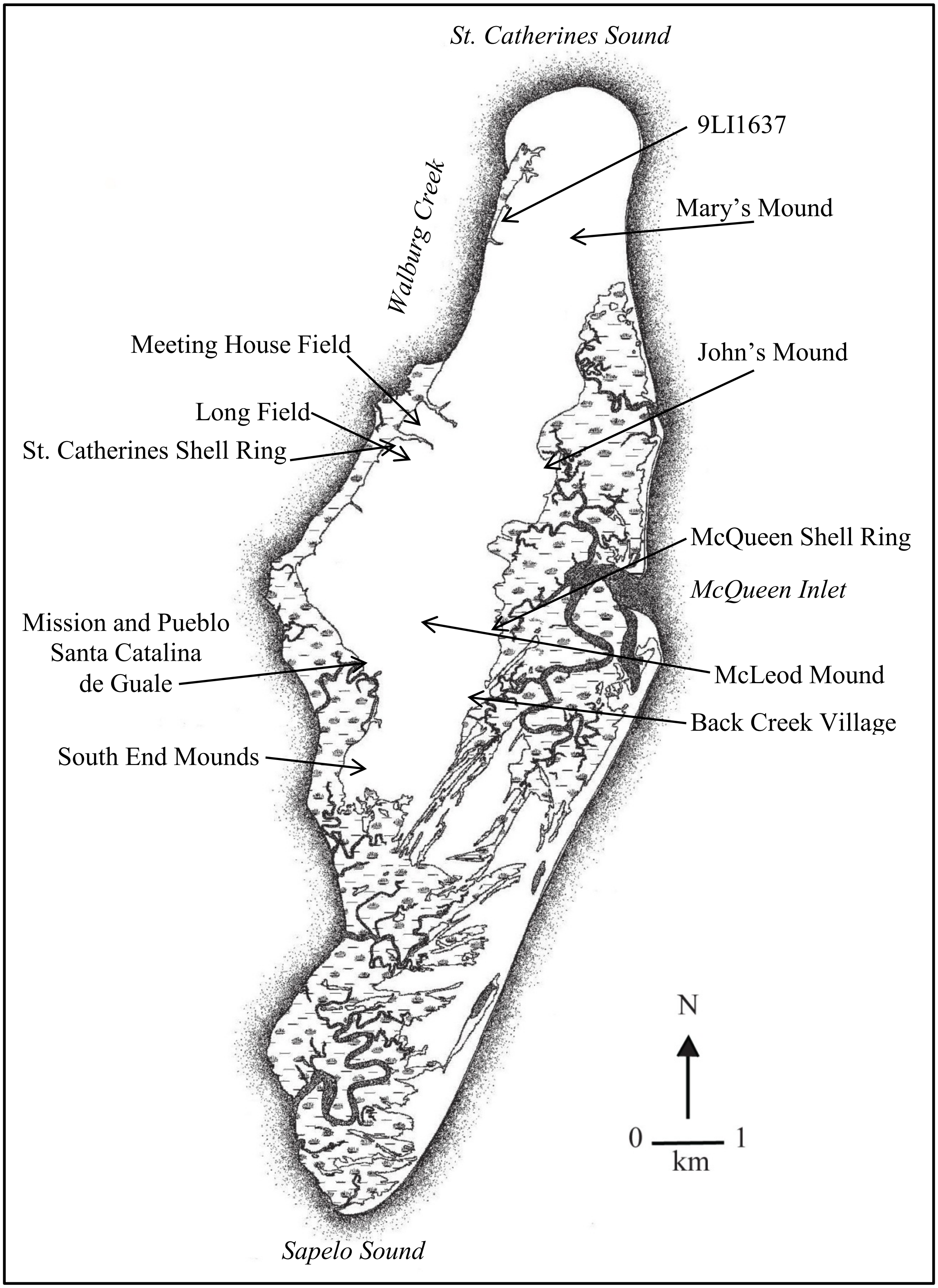


Figure 1.2: Map of St. Catherines Island landmarks and sites mentioned in the text

CHAPTER 2:

NATURAL AND CULTURAL HISTORY OF ST. CATHERINES ISLAND

St. Catherines Island, one of a series of barrier islands along the Georgia coast (Figure 1.1), is a productive, yet changing place; enduring daily and long-term changes to its shorelines and marshes. It is located near the center of the Georgia Bight, an embayment stretching from Cape Hatteras, North Carolina to Cape Canaveral, Florida. The Georgia Bight, with a broad continental shelf, has large tidal ranges, diminished wave energy, and wide marshes between the mainland and the islands. The resulting productive and dynamic estuary provides abundant food resources for human societies, both today and in the past.

Geomorphology

The present Georgia barrier islands have two major origins. The stable, higher elevation island cores are the remnants of dune ridges from the Silver Bluff shoreline formed as sea levels fluctuated during the Pleistocene (Bishop et al. 2011:82; Linsley et al. 2008:39–40; Reitz et al. 2008:50–51). As sea levels rose after the last glacial maximum (~19,000 years BC), the continental shelf was inundated. The Silver Bluff dunes became islands around 3,000 years BC (DePratter and Howard 1977; Linsley et al. 2008:39–40). Adjacent to the eastern boundaries of the Pleistocene cores of these islands are Holocene dune ridges thought to be the product of erosional sediments from migrating sound channels (Bishop et al. 2011:85; Linsley et al. 2008:39–40).

St. Catherines Island has a Pleistocene core with an elevation of roughly 5 m above sea level; Holocene ridges with an elevation of about one meter above sea level are appended to its southeastern and northern margins (Bishop et al. 2011:85). It also seems likely that there was once another Pleistocene island east of St. Catherines. This island is called Guale Island and its existence is attested to by the extensive marsh system along the middle and southern sections of the eastern margin of St. Catherines and by relict marsh along the northeastern beaches today (Bishop et al. 2011:95–97; Linsley et al. 2008:40–41; Thomas 2008:46). Guale Island would have protected much of the eastern margin from ocean waters so that this marsh system could form. Several other sea islands have a double-island formation such as that hypothesized for St. Catherines.

The Pleistocene core of St. Catherines became an island ca. 3780-2530 BC, as sea waters flooded the freshwater lagoons at the mouth of mainland rivers and promoted marsh formation; sea levels were roughly 1-3 m below current levels (DePratter and Howard 1977; Rollins and Thomas 2011:320). There appears to have been a sea level high stand at ca. 2200 BC when sea levels were 1.2 m below their present levels (Gayes et al. 1992; Thomas 2010a:179), and a subsequent regression resulting in a low stand at ca. 1600 BC when sea levels dropped 3-4 m below modern levels (Gayes et al. 1992; Rollins and Thomas 2011:321; Thomas 2010a:179). Since then, sea levels have risen at a rate of about 10 cm per century, enough to overtop and submerge the hypothesized Guale Island by AD 1400 (Rollins and Thomas 2011:321, 336–337; Thomas 2008:1035). A recent (Turck 2011:Figure 1.4) reconstruction of sea levels during the aboriginal period from the marsh islands between Sapelo Island and the mainland, largely agrees with the reconstruction of Gayes et al. (1992).

Changing sea levels influenced the development and location of estuarine environments and the availability of their associated resources. During the 1600 BC regression, the shoreline was likely so far east of the island, that St. Catherines Island and its surrounding low areas were purely terrestrial or freshwater in nature. The subsequent transgression and over-topping of Guale Island resulted in marsh deterioration on the northeastern island margin. As Holocene dunes accreted and stabilized on the southeastern margin, marsh and forest formed in this portion of the island.

The Floridan Aquifer underlies Georgia and parts of South Carolina, Florida, and Alabama (Hayes and Thomas 2008:56–58; Thomas 2011:53). This groundwater reservoir has been tapped for modern residential and industrial purposes, lowering the water pressure. Before deep drilling began, however, there were numerous places on the coast where this water came to the surface, providing abundant freshwater to the low areas (sloughs) on St. Catherines Island. A central depression running the length of the Pleistocene core held water, sustaining green meadows, freshwater swamps, and freshwater ponds at the time of European contact (Hayes and Thomas 2008:56–58). There were likely other freshwater swamps and ponds where the aquifer reached the surface in other low elevations, yielding a higher freshwater output into marshes than today. The central depression coincides with the distribution of Mandarin and Rutledge soils—poorly drained, acidic, and sandy soils (Hayes and Thomas 2008:56–58; Thomas 2011:53). Most of the soils on St. Catherines are acidic and low in organic content; in other words, not well suited for plant cultivation (Reitz et al. 2008:53–54). Foxworth and Echaw and Centenary soils, however, are well-drained and can support some plant cultivation. These soils are located along the periphery of the Pleistocene core (Reitz et al. 2008:53–54).

Climate

The climate in the region is subtropical humid. The coolest months are December through February, when minimum temperatures average around 5-10° C (Johnson et al. 1974:5–6; Southeastern Regional Climate Center 2011). The warmest months are July and August, when maximum temperatures average around 32° C. Frost-free days number over 260 per year along the Georgia coast (Johnson et al. 1974:6). Average precipitation for the year is 132 cm. The wettest months are August and September, when more than 15 cm of rain falls on average (Johnson et al. 1974:5–6; Southeastern Regional Climate Center 2011). This heavy rainfall is often associated with the hurricane season. The El Niño-La Niña (ENSO) cycle is responsible for inter-annual variation in temperatures and precipitation (Dame et al. 2000). El Niño years bring colder and wetter winters, which leads to increases in freshwater discharge from rivers, a higher water table, and reduced frequency of hurricanes in the Atlantic. La Niña years bring warmer, drier winters (Dame et al. 2000).

Estuarine and Terrestrial Environments

Two types of estuaries are found along the Georgia Bight (Dame et al. 2000; Frey and Howard 1986). Riverine estuaries are fed by extensive watersheds, often originating in the piedmont. These are more open and have more freshwater input. Lagoonal estuaries, like the St. Catherines estuary, form behind barrier islands, and are fed by small, slow-moving, coastal plain rivers that bring less freshwater and sediment. These estuaries have wide, extensive wetlands and tidal action is more important than river action in controlling water and nutrient circulation (Dame et al. 2000). Both these types of estuaries are highly productive. Calcium, magnesium, sulfur, potassium, trace elements from ocean water, and fixed-nitrogen and phosphorus from rivers get trapped in the water column and sediments of the estuary, providing a constant supply of nutrients for estuarine organisms (Correll 1978). Smooth cordgrass (*Spartina alterniflora*) is the dominant primary producer, providing roughly 84 percent of the total annual primary production; microalgae contribute the rest. Stable isotope tracer studies suggest that phytoplankton and smooth cordgrass, in the form of detritus, contribute equally to the food web

(Peterson and Howarth 1987), but the transfer of energy is more efficient in the phytoplankton chain (Dame et al. 2000).

A variety of vegetative communities are found on St. Catherines Island. These are influenced largely by the presence of salt water and soil types. On the seaward dunes, seaoats (*Uniola paniculata*) and panic grass (*Panicum amarum*) are two of the most important stabilizing plants. Just behind the dunes grow many of the common terrestrial plants, including live oak (*Quercus virginiana*), yaupon (*Ilex vomitoria*), wax myrtle (*Morella cerifera*), prickly pear (*Opuntia* sp.), and juniper (*Juniperus virginiana*; Johnson et al. 1974:33). Further from the salt spray, behind the rear dunes, these plants are joined by other trees and shrubs, such as saw palmetto (*Serenoa repens*), cabbage palm (*Sabal palmetto*), and red bay (*Persea borbonia*; Johnson et al. 1974:33). On the Holocene dune ridges, where soils are not well-developed and sea spray may still be a factor, live oaks dominate the forest, and there may be dense undergrowth of saw palmettos (Johnson et al. 1974:45). On the higher, more stable, Pleistocene cores, the forests are composed of magnolias (*Magnolia grandiflora*), laurel oaks (*Quercus laurifolia*), live oaks, pignut hickory (*Carya glabra*), red bay, and American holly (*Ilex opaca*), with understory species such as yaupon, wax myrtle, cabbage palm, saw palmetto, and sparkleberry (*Vaccinium arboretum*; Johnson et al. 1974:46; Larson 1980:17). Pine forests are also common on the island, mostly of loblolly pine (*Pinus taeda*), but also slash pine (*Pinus elliottii*) and longleaf pine (*Pinus palustris*; Johnson et al. 1974:49). The dominant vegetation in the marshes is smooth cordgrass. Saltmarsh cordgrass (*S. patens*) grows along the edge of the marsh where marsh meets forest.

These plant communities, both terrestrial and estuarine, support many animals that were used by people for 5,000 years. Previous zooarchaeological studies show that subsistence strategies focused on taxa from estuarine habitats—brackish water marshes and tidal creeks—although terrestrial and freshwater habitats were also exploited (Braley et al. 1986:65–71; Colaninno 2010:72–178; Keene 2004; Quitmyer 1985a:73–88; Quitmyer and Reitz 2006; Reitz 2008:625–659). The following provides a brief description of the animals most commonly identified in St. Catherines archaeological collections.

Maritime forests provide habitat for many terrestrial animals. White-tailed deer (*Odocoileus virginianus*) is the dominant terrestrial mammal in archaeological collections. Large populations of deer occupy many of the sea islands today. Mast is a major component of their diet, but they also forage for fruits, leaves, and woody stems (Osborne et al. 1992:20–28). They frequent marsh edges and dunes when other food is scarce and in the spring when there is new growth on plants. Raccoons (*Procyon lotor*) are another common animal in archaeological collections and very common on the islands today. Mast is a large component of raccoon diet, though they also eat fruits and grasses (Harman and Stains 1979:6–21). Marsh resources, such as crustaceans and bivalves are major components of raccoon diet in spring and summer. Raccoons commonly range between forests and marshes (Anderson and Hudson 1980:8). Other taxa inhabit the island interiors but are less common in the archaeological record, including opossums (*Didelphis virginiana*), squirrels (*Sciurus* sp.), eastern cottontail rabbits (*Sylvilagus* sp.), shrews (Soricidae), moles (*Scalopus aquaticus*) mice and rats (Sigmodontidae), song birds (Passeriformes), turtles (Testudines), snakes (Serpentes), lizards (Lacertilia), and frogs and toads (Anura).

Freshwater ponds and sloughs, in low-lying parts of the island, provide habitat for alligators, turtles, water snakes, and waterfowl. Migrating ducks (*Anas* sp.) use the ponds and sloughs on their way north and south or for over-wintering (Johnson et al. 1974:50–52). Herons, egrets, and ibis (Ciconiformes) form nesting colonies in the ponds. Snapping turtles (*Chelydra serpentina*) are freshwater inhabitants, and mud turtles (*Kinosternon* sp.), cottonmouths (*Agkistrodon piscivorus*), and water snakes (*Nerodia* sp.) inhabit both fresh and brackish water bodies (Johnson et al. 1974:50–52). The American alligator (*Alligator mississippiensis*) is the largest predator on the sea-islands and lives primarily in freshwater habitats, though it also frequents brackish marshes and swamps.

Salt marshes support invertebrates and vertebrates. Eastern oysters (*Crassostrea virginica*) are the most common bivalve, forming reefs in the intertidal zone along the banks of tidal creeks and marsh edges. Oyster beds provide habitat for other invertebrates. Whelks (Melongenidae) and blue crabs (*Callinectes sapidus*), for example, prey on oysters. Clam and mussel larvae settle on oyster beds. Clams (*Mercenaria* sp.) also occupy subtidal and intertidal muddy or sandy bottoms in tidal creeks, and ribbed mussels (*Geukensia demissa*) form their own colonies on the muddy intertidal flats. Stout tagelus (*Tagelus plebeius*) burrows deep into intertidal and subtidal regions of creeks with stable sand/mud bottoms (Holland and Dean 1977). Other common marsh invertebrates are periwinkles (*Littorina irrorata*), eastern mudsnails (*Nassarius obsoletus*), and eastern melampus (*Melampus bidentatus*), all gastropods that live on the mud flats and cordgrass stalks. Mammals, such as marsh rabbits (*Sylvilagus palustris*), minks (*Neovison vison*), and river otters (*Lontra canadensis*) inhabit brackish environments including marshes and tidal channels. Birds, including rails (Rallidae), seaside sparrows (*Ammodramus maritimus*), egrets, herons, and ducks use the marshes for habitat or foraging (Johnson et al. 1974:76–77). Diamondback terrapins (*Malaclemys terrapin*) inhabit brackish waters and are common in the archaeological record.

The waters around St. Catherines Island used by aboriginal populations are part of the inshore zone and include the seaward beaches, open sounds, tidal creeks, marshes, and estuaries. Tidal range is high, up to 3 m, though wave energy is moderate to low. Tidal action continuously reshapes the seaward island margin and brings marine nutrients and saline water to the estuarine waters and marshes behind the island. Because the rivers feeding the system from the mainland are slow-moving and contribute little freshwater input, tidal action is critical in structuring the salinity gradients and nutrient supply in the estuary. Three estuarine zones have been defined based on salinity levels: lower, middle, and upper reaches (Dahlberg 1972, 1975). The lower reaches are the waters closest to the open ocean and have the highest salinity levels, while the upper reaches are where the freshwater from rivers and saltwater from tides begin mixing and salinity is lowest.

Open water and beach animals are rare in archaeological collections. Loggerhead turtles (*Caretta caretta*) nest on the beaches during the summer months and both the large females and the large numbers of eggs laid would be productive resources in season. Bottlenose dolphins (*Tursiops truncatus*) are common off the beaches and in tidal creeks throughout the year. Whales may be present off the beaches during the summer months (Larson 1980:159–160). Sharks (Lamniformes) often prefer warm waters, and during the warmer months they are usually in shallow waters off beaches or in the deep waters of sounds (Dahlberg 1975:23–31). They leave coastal waters during the winter.

Estuarine fishes are common in archaeological collections. Many species are found in these collections, but a few families dominate (Ariidae, Cyprinodontidae, Mugilidae, and Sciaenidae). Individuals from these families are present in the estuary year round (Nelson et al.

1991:41–90; Reitz et al. 2012), though age cohorts move among different habitats throughout the year.

Catfishes are ubiquitous in archaeological deposits (Reitz 2008; Reitz et al. 2012). Freshwater catfishes (Ictaluridae) are occasionally found in estuarine waters when salinities and temperatures are low (Dahlberg 1975:42). Sea catfishes (Ariidae), until recently, were very common in the estuary, and are considered trash fish by anglers and commercial fishermen (Muncy and Wingo 1983:2–4). Two species of sea catfish are found on the coast: hardhead catfish (*Ariopsis felis*) and gafftopsail catfish (*Bagre marinus*), which is less abundant, but larger, than the hardhead (Muncy and Wingo 1983:6–9). Both species spawn in shallow estuarine waters, prefer warm temperatures and high salinities, and typically migrate offshore in colder months (Muncy and Wingo 1983:6), though it is likely some part of the population stays in the estuary year round. Smaller individuals (up to ~70 mm) are more common in the fall, and larger individuals (up to ~280 mm) are more common in the summer (Dahlberg 1972). Catfish diet is generalized, consisting of organic detritus, crustaceans, molluscs, and vertebrates (Muncy and Wingo 1983:9).

Cyprinodontidae is a family of small-bodied fishes common in shallow waters. Sheepshead minnows (*Cyprinodon variegatus*), mummichogs (*Fundulus heteroclitus*), and striped killifishes (*F. majalis*) are all abundant in tidal creeks, tidal pools, and high marsh habitats throughout the year (Dahlberg 1972). At spring high tide levels, mummichogs deposit eggs, often in dead shells or on cordgrass stalks (Abraham 1985:6). Juveniles remain in the intertidal zone for a couple months, and then move into the tidal creeks and marsh surfaces frequented by adults. Adults have small ranges; many range no more than 40 m along a creek bank (Abraham 1985:8). In the colder months they burrow into the mud or migrate to the mouth of the tidal creek. Mummichogs and striped killifishes are surface feeders, though they may feed on the bottom or in the mid-water column. They consume all available potential foods, and are important in controlling insect populations, and possibly in controlling some gastropod and bivalve populations (Abraham 1985:10). Killifishes are also major prey for wading birds and larger fishes (Abraham 1985:11).

Two species of mullets (Mugilidae) are found in the estuary, both in shallow waters, near the surface. Striped mullets (*Mugil cephalus*) have greater temperature and salinity tolerances and are common in most estuarine habitats. White mullets (*M. curema*), though present in the same habitats, are only common along the beach and in high-salinity pools (Dahlberg 1972). Striped mullets, in fact, are one of the most abundant and widespread inshore fishes (Collins 1985). The species is thought to spawn offshore in winter months, though many juveniles remain in estuarine waters (Collins 1985:3). Mullets are schooling fishes and can be caught in nets (Collins 1985:5). Juveniles consume zooplankton, insect larvae, and detritus. Adults consume detritus and plant matter and, although usually bottom feeders, do feed at the surface and in the water column (Collins 1985:7). They are an important prey of birds and larger fishes.

The drum family (Sciaenidae) is important in modern and earlier fisheries. Silver perches (*Bairdiella chrysoura*) appear to use most habitats of the estuary as nursery grounds (Dahlberg 1972). Younger individuals have a higher salinity tolerance, and inhabit many habitats. Adults are most common in the lower and middle reaches (Dahlberg 1972). The species is present in the estuary year round (Dahlberg 1972; Reitz et al. 2012). Spotted seatrouts (*Cynoscion nebulosus*) are also present all year, though they may be more abundant in the fall and winter. They occupy a range of habitats, from the lower and middle reaches to high-salinity pools and high marsh (Dahlberg 1975:70). Silver seatrouts (*C. nothus*) may only be present in the summer months

(Dahlberg 1972). Weakfishes (*C. regalis*) are more common in summer months and tend to be in the lower and middle reaches of the estuary, though juveniles may tolerate lower salinities (Dahlberg 1972). Spots (*Leiostomus xanthurus*) are common in most estuarine habitats. Adults prefer deeper waters; juveniles are more widespread, and tolerate lower salinities (Dahlberg 1972). Juveniles are present year round, but adults are rare during cold months (Nelson et al. 1991:81; Reitz et al. 2012). Kingfishes (*Menticirrhus* sp.) also prefer the lower reaches and beaches (Dahlberg 1972; Reitz et al. 2012). Juveniles of southern kingfishes (*M. americanus*) also are found in lower salinities. Adults may migrate offshore to spawn in the spring, but the species is present year round (Dahlberg 1972; Reitz et al. 2012). Gulf kingfishes (*M. littoralis*) may only present in the estuary during the warmer months (Dahlberg 1972) but are present in water off the beaches year round (Reitz et al. 2012). Northern kingfishes (*M. saxatillis*) are relatively rare and may only be present in the warmer months (Dahlberg 1972). Atlantic croakers (*Micropogonias undulatus*) are widespread in the estuary, but adults are primarily found in the lower and middle reaches. Croakers spawn offshore in the fall and winter months, but the species is present throughout the year. Black drum (*Pogonias cromis*) adults prefer the lower reaches of the estuary (Dahlberg 1972); juveniles inhabit a wide variety of estuarine habitats, including tidal creeks and marshes (Dahlberg 1975:72). Both adults and juveniles are present in the estuary throughout the year (Nelson et al. 1991:81). Red drum (*Sciaenops ocellatus*) adults are caught in the lower reaches and off beaches year round (Dahlberg 1975:72; Reitz et al. 2012). Juveniles are found in lower salinity habitats (Dahlberg 1975:72) and are present year round (Nelson et al. 1991:81). Star drums (*Stellifer lanceolatus*) are abundant in the lower reaches during the warmer months (Dahlberg 1972). They are present off the beaches, though not abundant, year round (Reitz et al. 2012)

During the past two centuries humans have used these same estuarine waters and the animal resources therein. Fishing activities and land-use practices since the aboriginal period likely impacted shellfish, fin-fish, and sea turtle (among many others) populations to such a degree that modern distributions of these animals do not represent their distributions in the past. Large-scale oyster harvesting for canneries was a major industry on the Georgia coast during the late nineteenth and early twentieth centuries (Thomas 2008:74–79). Productivity decreased after 1908 (Thomas 2008:79). Recent surveys of oyster beds suggest that distribution has changed little since the late nineteenth century, but that the number of live oysters has decreased (Thomas 2008:79–81; Walker and Cotton 2001). Changes in salinity levels due to falling aquifer levels, increased pollution, and high rates of harvesting probably contributed to these declines (Thomas 2008:81; Walker and Cotton 2001). Colaninno's (2010:283–289) comparison of modern and Late Archaic hardhead catfish and Atlantic croaker growth patterns suggests that modern fishes reach larger sizes at earlier ages. Twentieth-century fishing activities have tended to catch large numbers of catfishes, though they are considered trash fish (Muncy and Wingo 1983:2–4). Recently the catfishes have declined drastically in the Georgia estuaries (Lambert 2007), possibly as a result of over-harvesting or other environmental factors such as disease or pollution (Colaninno 2010:290–296). The number of sea turtles nesting on St. Catherines Island (and worldwide) beaches has declined since the 1970s when records were first kept (Bishop and Meyer 2011; Committee on Sea Turtle Conservation 1990; Thomas 2008:158). Human activities, such as development and heavy use of beaches, trawling, and dredging, increase the mortality of sea turtles (Committee on Sea Turtle Conservation 1990). In addition, sea level rise and beach erosion are affecting nesting activities (Bishop and Meyer 2011). Therefore, sea turtles may have been far more common on Georgia beaches during aboriginal times.

Cultural History

The American Museum of Natural History has supported archaeological research on St. Catherines Island for over 35 years (Figure 1.2). Much of our knowledge about the cultural history of the island is from a 20 percent transect survey of the island performed in the 1970s and published in *Native American Landscapes of St. Catherines Island*, *Georgia* (Thomas 2008). In this survey, 10 crew members, spaced 10 m apart, walked transects 100 m apart from the western to eastern island margins, probing for shell deposits every few steps. One hundred twenty-two sites were located and 1-x-1-m test pits were placed in a sample of middens at each. These sites are classified as small (<50 m^2), medium (50-500 m^2), and large (>500 m^2; Thomas 2008:520). Although 500 m^2 is not a particularly large area (a Mesoamerican domestic unit might occupy an area this size; Flannery 2009), on St. Catherines it is simply a relative measure. In other words, during the Irene phase, there were more large sites on the island than during earlier periods. Most of the sites from which archaeological data are interpreted in this volume are much larger than 500 m^2. Sites are also divided into temporal components; these are defined as culturally homogenous units based on ceramic traditions—sites can have single (more than 75 percent of diagnostic sherds) components, or major (over 50 percent of diagnostic sherds) and minor (over 20 percent of diagnostic sherds) components (Thomas 2008:520).

Other research has focused on specific sites. Meeting House Field was excavated in the 1970s, as an example of a late prehistoric village (Figure 1.2; Thomas 2008), and further excavations were performed in the 1980s (Saunders 2000; Reitz and Dukes 2008). In the 1980s, Mission Santa Catalina and the associated Pueblo were located and excavated (Figure 1.2; Blair et al. 2009; May 2008; Reitz et al. 2010). Another research program focused on the mortuary complexes and bioarchaeology of the island (Larsen 1982, 1990, 2002; Larsen and Thomas

1982; Thomas and Larsen 1979). Since 2006, the focus has been on geophysics and excavation at two Late Archaic shell rings (Colaninno 2010; Sanger and Thomas 2010).

The research described in the above publications provides us with a good idea of settlement history and some hypotheses about changes in social organization. Subsistence patterns are fairly well understood for the Late Archaic and Mission periods, though those for the intervening periods are less well known.

The record for human occupation begins soon after the Silver Bluff dunes became islands, in the Late Archaic period (2500–1000 BC). Eleven Late Archaic components are known from the island (Thomas 2008:990), two of which are the St. Catherines Shell Ring located on the western marsh and the McQueen Shell Ring on the eastern marsh (Figure 1.2). Both are medium-sized sites in the island typology; the other Late Archaic sites are more ephemeral. Seasonality studies suggest the shell-ring sites were occupied in all seasons, though whether populations resided at these locations year round or intermittently is unclear (Colaninno 2010:263–264). Subsistence activities focused on capturing estuarine fishes, with deer and other mammals providing a major supplement (Colaninno 2010:72–179). Andrus and Thompson (2012) found that molluscs from a variety of locations within the estuary during multiple seasons were brought back to a single site on Sapelo Island. This could be evidence of residential use—people fished in a variety of locales and returned with their catches to a residential site (Andrus and Thompson 2012). St. Catherines Island folk were involved in regional interactions or movement, at least within the Coastal Plain. Pottery styles are similar in the region. Late Archaic shell rings—roughly circular, oval, or U-shaped mounds of shell-midden material with a clear center—are common along the southeast coast, suggesting similar intentions and behaviors guided their construction.

The Woodland period consists of two phases: Refuge-Deptford (1000 BC–AD 350) and Wilmington (AD 350–800). An archaeological gap in occupation occurred during the late Late Archaic and early Woodland. This may be related to the sea-level regression that resulted in a low stand at ~1600 BC and probably dried up much of the marsh as the shoreline and estuarine environments moved eastward. The shell rings were abandoned during this time, around 2000 BC, and there is minimal evidence for human occupation of the island (Thomas 2010a:184). People may have lived on the island, but they were not depositing estuarine resources.

Fifteen Refuge-Deptford-phase components were found in the St. Catherines transect survey (Thomas 2008:1003). Shell middens reappear again around 200 BC, the earliest ones located along the western island margin, and the later ones along the eastern margin (Thomas 2008:1003–1009). Multiple seasons are represented at most sites (Thomas 2008:1009), and estuarine resources, such as fishes, turtles, and alligators make up about half the animal individuals (Reitz 2008:633). About 50 percent of the sites from this phase are small and the rest are equally divided between medium and large classifications (Thomas 2008:877).

Three Refuge-Deptford mortuary complexes have also been excavated. The activity at these burial mounds dates from 350 BC to AD 500 (Thomas 2008:1009–1012). The burials are a mix of extended, bundle, and cremation. Both males and females are present, and most are adults, with a few subadults included (Thomas 2008:1012–1014). The mortuary evidence does not suggest there was social inequality, unless burial in mounds was reserved for select sections of society. No juvenile burials were found; burial of juveniles is usually associated with inherited status.

A break in human occupation occurred between the Deptford and Wilmington phases. The number of components per century in the Wilmington phase is double that of the Refuge-

Deptford, but the proportion of small sites is higher (about 60 percent), perhaps suggesting smaller groups of people or shorter periods of occupation (Thomas 2008:876–877). Multiple seasons are represented at most sites (Thomas 2008:906). Mortuary activity is similar to that during the Refuge-Deptford, with extended, bundle, cremation, and flexed burials of both males and females, and only one burial of a subadult (Thomas 2008:1023). Refuge-Deptford mortuary-complex sites were reused by Wilmington peoples, either by constructing new mounds for burials or by adding burials to existing mounds (Thomas 2008:1026–1027). There appears to have been contact with the mainland interior, either through movement of whole groups or just individuals, as two out of five females buried in the central tomb of McLeod Mound (Figure 1.2) have carbon isotope values indicative of terrestrial diets while the rest have values indicative of a diet that includes marine foods (Thomas 2008:1026–1027).

The St. Catherines phase (AD 800–1300) encompasses the very late Woodland and early Mississippian periods. Some coastal Georgia chronologies include a Savannah phase between the St. Catherines and Irene phases that is dated to AD 1200–1300/1350 (Saunders 2000:40). Although Savannah pottery has been found at some sites on St. Catherines Island, the radiocarbon dates for these sites overlaps with the dates for the St. Catherines and subsequent Irene phases (Thomas 2008:425–428). Precipitation reconstructions from bald cypress tree-ring sequences in the Altamaha River Basin to the south, indicate a severe drought occurred at the end of the St. Catherines phase, coinciding with a dearth of radiocarbon dates on St. Catherines Island (Blanton and Thomas 2008:801–803). This suggests the island was unoccupied for a short period of time. In the St. Catherines Island chronology, site with Savannah pottery are assigned to the St. Catherines or Irene phase, depending on other ceramic evidence and radiocarbon dates.

Archaeological evidence indicates changes in the subsistence-settlement system during the St. Catherines phase. Sixteen St. Catherines-phase components are known (Thomas 2008:1029). Large and medium sites dominate, with only about 20 percent of the sites being considered small (Thomas 2008:1051). The number of components per century is twice that of the Wilmington phase (Thomas 2008:1049). Some of this increase is on the southern Holocene beach ridges, considered secondary habitats. Again, sites were generally utilized in multiple seasons (Thomas 2008:1031). Stable isotope analysis suggests a diet relatively similar to the diet during the Refuge-Deptford period (Schoeninger et al. 1990:88–90). Savannah-phase people at the Irene Mound, on the Savannah River, however, appear to have consumed maize on a regular basis (Schoeninger et al. 1990:88–90).

Evidence from two St. Catherines-phase mortuary complexes provides hints of changes in socio-political organization. Mary's Mound (Figure 1.2) contained seven individuals: at least two adult females, one subadult, and two children (Larsen and Thomas 1982:325). Seventy individuals were recovered from John's Mound (Figure 1.2), including adults, subadults, and children (Larsen and Thomas 1982:325). A central log-lined pit contained a child and some adult bones (Larsen and Thomas 1982:293). Most burials in these mounds were extended or flexed, but some were cremations and bundles (Larsen and Thomas 1982:325). Burial goods were rare. The inclusion of children in the burial mounds, especially in the central tomb, might suggest that hereditary status characterized certain portions of society.

The archaeological evidence for the Irene phase (AD 1300–1580) suggests that the settlement, subsistence, and socio-political changes that began in the St. Catherines phase became more dramatic during the Irene. Fifty-two Irene-phase components have been identified (Thomas 2008:1035). This represents an increase in number of components per century, from four in the St. Catherines phase to 17 in the Irene (Thomas 2008:1049–1051). The percentage of large sites increases slightly, but this masks the fact that the Irene phase is shorter (2.5 centuries vs. 4 centuries) and the number of large Irene sites (18) is much larger than the number of large St. Catherines sites (8; Thomas 2008:877). Occupation on the Holocene dunes also increased, fourfold (Thomas 2008:848–850). Artifact collections from Irene sites also are larger (Thomas 2008:1035). All these measures suggest a larger and more concentrated population, as does an increase in the presence of periosteal lesions in human bones (Larsen 2002:46–47).

Only one Irene mortuary site is known on the island. Burials are primarily flexed, though some are urn burials (Thomas 2008:1037). A high proportion of the burials are juveniles and subadults, including at least three infants under one year (Larsen 2002:17). Grave goods tend to be associated with individual interments, rather than with group interments as seen in the St. Catherines phase (Thomas 2008:1037). These practices suggest that status was inherited and associated more with individuals than earlier, when status may have been associated with kin groups. Using other Mississippian societies as a model, the role of chief was likely inherited during the Irene phase. The high incidence of dental caries (Larsen 2002:50–51) and high stable carbon isotopic values (Larsen 2002:44–45) suggest that maize became a significant part of the diet, at least by the late-fifteenth century (Schoeninger et al. 2009).

As discussed in the first chapter, the developments of the Irene phase on St. Catherines Island may be related to a shift in political power in the region. After AD 1400–1450, the lower and middle portions of the Savannah River Valley were mostly abandoned (Anderson 1994:235–245; Wood 2009:431–435), likely related to an increased frequency of years with low rainfall (Anderson et al. 1995), the instability of chiefly power (Anderson 1990, 1994; Hally 1993, 1996), and regional power relationships (Anderson 1994:249). This is the same time frame when maize first became important as a food item on St. Catherines Island (Schoeninger et al. 2009). It is possible that the other Irene-phase changes occurred about this time as well. Although the earlier societies might have been ranked (Thomas 2008:1037), the increased populations, dense settlements, and SECC trade may have been features of post-1400 Irene St. Catherines Island. Further, the use of sixteenth-century coastal societies as models for prehistoric societies—the farming, regional polities described by Worth (1999, 2002, 2004), Saunders (2000, 2001), and Jones (1978)—might only directly apply to this post-1400 time period. By the mid-sixteenth century, however, coastal societies produced great quantities of maize that supported large, but dispersed, populations and the public officials and political activities of a chiefdom with at least two levels of administration, with enough surplus to provision Spanish and French explorers (Worth 1999).

The time of Spanish missionization on St. Catherines is referred to as the Altamaha period (AD 1580–1680). Human occupation was concentrated around the sixteenth- and seventeenth-century Spanish missions on the western margin of the island (Thomas 2008:1039). Only six components are known, and 80 percent of these are considered large (Thomas 2008:1051). The first mission was built on the island in the 1590s, though native Guale had intermittent contact with Jesuit and Franciscan missionaries and French and Spanish colonists and explorers since at least the 1520s (Thomas 2009:18–24; Worth 2004). The first mission was destroyed in the Guale Rebellion of 1597, and a new one built around 1604 (Thomas 2009:24). The mission was abandoned in 1680, and missionized Indians followed the missionaries to more southerly locations (Worth 2002, 2004).

Spanish missions functioned in Spanish colonies, in this case La Florida, as permanent settlements to resettle, restructure, and convert native societies (Thomas 2009:22–24). La Florida lacked a large number of colonists, as it was relatively poor in mineral resources, so the government used natives, consolidated around missions, to support the colonial system. Natives were expected to contribute labor to the daily workings of the missions as well as to projects in the capital of St. Augustine (Thomas 2009:22–24). Spanish officials worked with the existing native hierarchical system, relying on chiefs to organize and coerce their subordinates (Worth 2002). Chiefs, in turn, were able to strengthen their status as supreme leaders, using the support and legitimacy offered by Spanish officials and trade goods (Worth 1998:38–40, 2002).

On St. Catherines Island, the archaeological data are consistent with the process of *reducción*, as settlements are large and concentrated in a single location (Thomas 2008:1042), and suggest that the daily life at the mission was different than daily life in earlier periods. The cemetery under the mission church floor contained 431 burials of missionized Guale (Larsen 1990:19). Stable isotope analysis of human bones suggests an increase in maize and a marked decrease in marine resources in the diet compared to prehispanic islanders (Schoeninger et al. 1990:90–91). Variation among individuals indicates that wild resources continued to be part of the diet, for some more than others, and this may be a result of the aggregation of native groups from a wider region into a single location. The incidence of enamel hypoplasias was higher in the mission population than earlier, suggesting an increase in childhood dietary stress (Larsen 1990:57–61). Biomechanical analysis shows an increase in body size for males and females, possibly due to a greater quantity of food consumed, though probably not better-quality food (Larsen 1990:108). Lower-body strength of both sexes and the upper-body strength of females increased, probably as a result of a new set of daily activities (Larsen 1990:109–113). Osteoarthritis increased, suggesting these new activities put excessive loads on articular joints (Larsen et al. 1996:107).

Natives living at the mission retained many of their own traditions (Thomas 2010b). Although domestic animals were consumed by natives, the estuarine resources that dominated prehispanic diets remained dietary staples for Guale (Reitz et al. 2010:175–178). The diet of missionaries similarly emphasized native plants and animals, supplemented by European domesticates such as chickens and pigs (Reitz et al. 2010:175–178). The individuals buried beneath the Church, all converted natives, in many cases were buried with grave goods, including majolica vessels, projectile points, a rattlesnake gorget, and glass trade beads (Thomas 2010b). This was counter to Franciscan doctrine, which did not approve of grave goods. Over 67,000 glass beads were recovered from burials and many of these came from the glass-making centers of Europe and were likely obtained as a result of trade of deer skin and maize (Blair et al. 2009:170–171; Reitz et al. 2010:125; Thomas 2010b). They would have been markers of status and success in life and in death. Inclusion of these goods in Church burials is a testament to the ability of Guale to negotiate their own interests with Church and government officials (Thomas 2010b).

Chapter Summary

The story of the physical, natural, and cultural environment on St. Catherines Island is one of change and continuity over the past 5,000 years. Sea level and climatic conditions have fluctuated, influencing the shape of the island, the location and structure of estuarine habitats, and the composition of plant and animal communities. The archaeological record demonstrates a trend of increasing human population, social inequality, and maize consumption over time. Sites became more frequent, larger, and increasingly located in second-tier habitats. Evidence for hereditary inequality is found in the archaeological record for the Irene phase. Maize, though not necessarily a major dietary component until the sixteenth century, was likely present on the island earlier. Despite all this evidence for change, the same suite of animal species was abundant in the estuarine waters and terrestrial habitats surrounding the island and dominated the subsistence of human societies for those 5,000 years. The rest of this volume is concerned with demonstrating that subtle changes in subsistence, settlement, and land-use patterns did occur, though the estuarine resource base of St. Catherines Island is overall highly resilient in the face of anthropogenic impacts, and subsistence patterns highly resilient in the face of socio-political changes.

CHAPTER 3:

MATERIALS AND METHODS

Over the past half century or so, zooarchaeologists have standardized methods for recovering, identifying, and analyzing animal remains from archaeological sites. These methods attempt to minimize biases associated with recovery techniques, taphonomy, and data aggregation. This chapter presents the materials and methods used to derive the primary and secondary data interpreted in subsequent chapters. The following topics are addressed: 1) description of the sites from which the zooarchaeological materials were excavated, 2) sampling strategy and excavation methods, 3) zooarchaeological methods of identification, aggregation, and summary, 4) methods for addressing aspects of the life history of oysters, clams, and sea catfishes, and 5) methods used in stable isotope analysis of deer and raccoon bones.

A list of the collections and proveniences included in the zooarchaeological analysis is presented in Appendix A. Appendix B is a list of taxonomic names for identified taxa used in the subsequent chapters. The reader should consult Appendix B for scientific names, as common names will be used for the remainder of the volume.

The Sites

The goal of this project was to look for evidence of change in resource use during the Mississippian period—between the St. Catherines phase and Irene phase. To do so, it was necessary to identify a locality on the island where both St. Catherines and Irene sites are located. Meeting House Field and Long Field are antebellum fields that are currently forested. They are located along the island’s landward margin and separated from each other by a narrow creek outlet (Figures 1.2 and 3.1). There is a large Irene site, large Savannah-phase site, and medium-size St. Catherines/Savannah site in this locality. The Late Archaic St. Catherines Shell Ring is located in Long Field and provides a chance to address long-term subsistence-settlement changes in the same locality. This will be referred to as the Meeting House Field locality in the rest of the volume, not to be confused with the Meeting House Field site, the Irene site in this locality. Keeping location constant minimizes the chances that the location of exploited habitats would explain differences in animal populations or human diet. Barring major environmental or climatic events, very similar habitats would have been available in both the St. Catherines and Irene phases. In order to flesh out the subsistence-settlement system of the Irene phase, two additional Irene sites were studied. Back Creek Village is a large site on the southeastern margin of the island core, near McQueen Inlet (Figures 1.2 and 3.1). 9LI1637 is a smaller site on the northwestern island margin, along Walburg Creek (Figures 1.2 and 3.1).

Meeting House Field Locality

The Meeting House Field site (9LI21) is a large Irene-phase site in the antebellum field of the same name, extending west outside the field boundary to the marsh (Figure 3.2). There are upwards of 50 semi-discrete Irene-phase shell middens over an area of at least 500 x 200 m. The site was first mapped and excavated by an American Museum of Natural History (AMNH) crew led by David Hurst Thomas in 1975 (Thomas 2008). Further mapping and excavation were undertaken in 1988 (Saunders 2000). In 2008, an AMNH crew surveyed and mapped the site after a fire in the area cleared the undergrowth, offering an ideal survey opportunity (Semon et al. 2008).

In 1975, Thomas and his crew excavated four middens (B, D, E, J) at the Meeting House Field site, and in 1988, Saunders excavated four additional middens (12, 21, H, and M). The materials from both excavations were recovered with .64-cm-mesh screens. Their work here produced 18 radiocarbon dates. The one-sigma limits of the probability distribution date the occupation to AD 1300–1520, which coincides with the Irene phase, and the two-sigma limits date the site to AD 1190–1670 (Thomas 2008:712–713). Although these dates suggest some occupation during the Mission period, no material culture evidence has been found to corroborate this. All diagnostic ceramics are Irene. Surface treatment and rim attributes suggests the middens can be divided into two clusters (Saunders 2000:69–73). Middens 12, 21, and J may date to the middle Irene phase (AD 1350–1450), and Middens B, D, E, H, and M may date to the late Irene phase (AD 1450–1580). A pipe with Southeastern Ceremonial Complex designs from Midden M suggests a very late Irene date for that midden (Saunders 2000:72). The pottery recovered during 2008 and 2009 excavations verifies the Irene date.

9LI230 is a single, large shell midden, approximately 250 m wide, at the southwest corner of Meeting House Field, along the edge of the marsh (Figure 3.2). Two units excavated in this midden during the transect survey yielded 14 sherds, seven of which are typical of the Savannah phase (Thomas 2008:558). The radiocarbon dates confirm this—giving a pooled two-sigma range of AD 910–1140. Occupation at this site, therefore, falls within the St. Catherines phase, pre-dating the Irene phase. The pottery recovered during the 2009 excavations supports a St. Catherines/Savannah-phase occupation.

9LI229 is a large Irene site, along the northern edge of the marsh bordering Long Field, across a tidal, marshy area from Meeting House Field (Figure 3.2). Analysis of the 372 sherds from five test pits in the transect survey suggests the site may be early Irene, because no Irene-incised sherds were identified (Thomas 2008:557). During the 2010 excavations, St. Catherines-phase pottery was recovered from all three of the test pits, though there was also an ephemeral Irene occupation on the surface (Matt Napolitano, personal communication 2011).

Back Creek Village and 9LI1637

Back Creek Village (9LI207) is located on the seaward side of the island, just inland from the marsh formed by McQueen Inlet (Figure 3.1). Discrete shell middens surround a depression that likely held water before the modern drop in aquifer levels. Middens vary in size—most are several meters in diameter, though others are more amorphous and cover a larger area. All middens are about 30-40 cm deep. Test pits were excavated in five of the middens during the transect survey (Thomas 2008:584) and an additional midden was excavated in the 1990s. The materials recovered in those excavations indicate the site was occupied during the Irene phase; 87 percent of the ceramics were Irene. This was confirmed by the 2008 excavations.

9LI1637 is located on the northern, landward island margin, along a bluff bordering Walburg Creek (Figure 3.1). The site has not been mapped. The site is composed of at least five large middens, each at least a meter deep and several meters or more in diameter. The site was not encountered during the transect survey, and no work was done at the site prior to the 2008 excavations, which recovered Irene pottery (Semon et al. 2008).

Excavation Methods and Sampling Strategy

The data reported in this volume were recovered in 2008 and 2009 as part of a larger project investigating the Mississippian period on St. Catherines Island. Previous work at the sites described above served as a guide for selecting middens. In order to flesh out our understanding of subsistence patterns during the Mississippian period, multiple middens from each site were re-excavated for this project. In some cases new middens that had not been investigated previously were also excavated. As the contribution of invertebrates to the diet had never been addressed for the time period, they were included in the new sampling strategy and analysis of the Meeting House Field locality. This sampling strategy is described below.

Meeting House Field Locality

Twelve middens were excavated in the Meeting House Field locality for this project (Figure 3.2; Table 3.1). Eight previously excavated middens were re-excavated for this study at the Meeting House Field site (12, 21, J, B, D, E, H, and M). Only one midden is known for 9LI230, and this was re-excavated. Three middens were selected for excavation at 9LI229. Two of these were excavated during the transect survey and yielded ceramics suggesting an early Irene date, as well as faunal materials. The other three middens excavated in the transect survey had either completely eroded off the edge of the marsh by 2008 or were covered with large palmettos and could not be resampled. One previously untested midden was chosen to increase the sample of early material from the locality.

One 1-x-1-m unit was excavated in each of the selected middens. Excavation was in arbitrary, 10-cm levels, using trowels. One 10-liter sample was saved from each level for future botanical analysis. A 40-liter bulk sample, taken from across the vertical and horizontal extent of each level, was retained for analysis for this project. The rest of the materials from each level were water-screened through nested screens (2.54-cm, .64-cm, .32-cm). Material culture was sent to AMNH for analysis. All vertebrate materials were retained for zooarchaeological analysis. A sample of 30 left oyster valves was saved for future study. All whole clam valves were saved for analysis for this project. In cases where a feature was encountered, the feature was removed separately from the general level in 10-cm levels. The 40-liter bulk sample for levels with features included some materials from the feature and some from the general level.

The 40-liter bulk sample from across the vertical and horizontal extent of a 1-x-1-m unit is a compromise between studying a column sample, which only samples 25 cm^2 of the midden, and studying all the materials from each unit, or 1 m^2 of the midden. Column samples often are used to sample invertebrates and small vertebrates (e.g., Braley et al. 1986; Quitmyer 1985a; Quitmyer and Reitz 2006). Larger vertebrates are traditionally recovered from general levels, screened through .64-cm or .32-cm mesh. The use of column samples is not adequate for recovering rarer taxa, such as large mammals, as they sample a small area. The 40-liter bulk samples represent a slightly larger volume and recover both vertebrates and invertebrates in the same manner, so these two taxonomic groups are directly comparable. Processing these samples is time consuming. Identifying the invertebrates and vertebrates from the entire unit is not feasible, and neither is storage, in perpetuity, of so much material. The 40-liter samples allow large samples of invertebrates to be collected the same way and from the same contexts as the vertebrates in a reasonable amount of time.

The data from the Meeting House Field locality units were aggregated into two analytical units. This decision reflects the difficulty of assigning exact dates to middens and the problem of sample size. Ceramic analysis and radiocarbon dates indicate some St. Catherines-phase contexts, a Savannah-phase midden, and early, middle, and late Irene contexts. It is difficult to distinguish among the different Irene contexts, and the St. Catherines contexts may be partially mixed with early Irene contexts. A conservative decision was made to aggregate the data from the Meeting House Field site into a single Irene analytical unit and the data from 9LI229 and 9LI230 into an "earlier" analytical unit. They will be referred to in the rest of the volume as "late Meeting House Field" and "early Meeting House Field," respectively. Sample size was also a factor in this decision. The fewer excavation units included in an analytical unit, the smaller the sample size for each becomes. By using two analytical units, which was necessary to examine change over time, the problem of sample size is minimized. Since the question under investigation is whether Irene-phase animal use patterns are different from those of earlier periods on the island, the two analytical units proposed here (Irene vs. St. Catherines/Savannah) are appropriate. The analytical units also provide a framework for more detailed studies with larger samples in the future.

Back Creek Village and 9LI1637

Similar excavation strategies were followed at Back Creek Village and 9LI1637. Seven middens were selected for excavation at Back Creek Village, six of which had been previously investigated, and two 1-x-1-m units were placed in each (Figure 3.3; Table 3.1). After the 2008 excavations, all investigated middens at the site were given letter designations; middens A–D and F–H were excavated in 2008 (E was excavated in the 1970s, but not in 2008). At 9LI1637, two middens were selected for excavation and a 1-x-1-m unit placed in each (Table 3.1). All units were excavated in arbitrary 10-cm levels. A 10-liter sample was taken from each level for future botanical analysis. Deposits were water-screened through nested screens (2.54-cm, .64-cm, .32-cm). All vertebrate materials were sorted in the field and retained for analysis for the research described in this volume. All material culture was sent to AMNH for analysis. All whole clam valves were saved from both sites; though only clams from Back Creek Village were analyzed for this project. A sample of 30 left oyster valves was saved for future study. Each site was treated as a single, Irene-phase, analytical unit for the purposes of this study.

Taphonomy

Various post-depositional factors influence the relative abundances of taxa in middens. Shell middens are our primary source of information about subsistence patterns on the Georgia coast. Coastal soils are acidic, which leads to poor bone preservation (Lubinski 1996; Nicholson 1996). The shell matrix in shell middens, however, neutralizes soil pH so that bone is well preserved (Reitz and Wing 2008:140–141). If refuse is not quickly buried, it can be trampled (fragmenting bones and moving them horizontally or vertically), scavengers such as dogs, rodents, and birds can move or destroy refuse, and wind and water processes can erode refuse, as can humans in their reuse of sites or materials (Lyman 1994; Rick et al. 2006). Once buried, microbial activity increases porosity and, thereby, surface area of bone, leaving it open to chemical changes and additional bone loss (Hedges 2002; Nicholson 1996). Changes in the depositional environment, such as periodic wet and dry or hot and cold cycles will increase microbial activity, mechanical damage, and poor preservation (Hedges 2002, Nicholson 1996; Rick et al. 2006). Fluctuations in the water table and in water drainage through the shell matrix from the surface erode shell and promote microbial activity (Stein 2008). Roots and burrowing animals mix materials among strata (bioturbation) and cause mechanical damage to bone and shell. Nonetheless, there was little evidence for major shell weathering, bioturbation, rodent or carnivore activity, or trampling in the middens excavated for this project though they likely did occur.

Midden Context

All the middens excavated for this project appear to be primary, residential deposits. Although they varied in terms of relative amounts of all types of artifacts, all middens contained broken ceramics from multiple decoration types (suggesting multiple vessels)—some units had upwards of 200 sherds (Anna Semon, personal communication 2012)—and multiple animal taxa from a variety of habitats are represented in each midden. Analysis of non-faunal remains from these excavations is not yet complete or published, so it is difficult to address functional or social variation among middens. Unfortunately, unless entire middens are excavated, it is impossible to establish whether excavated collections represent the full variability of material in each midden. Crook (1978:229) suggested that the ceramic collections he obtained from each midden at Kenan Fields, Sapelo Island, did not represent the full internal variability of each midden. Although the middens excavated for this project may be the result of multiple occupation events, little evidence for this was encountered during excavation, as there are no examples of soil formation between shell layers.

Zooarchaeological Methods

Sorting

The 40-liter samples collected during excavation of Meeting House Field locality units were processed in the field and brought back to the Zooarchaeology Laboratory at the Georgia Museum of Natural History, University of Georgia. Each 40-liter sample was water-screened through nested 2.54-cm, .64-cm, .32-cm and .16-cm screens. The samples were dried in the sun and bagged for transport to the laboratory. A test of the .16-cm fraction indicated it did not contain taxa beyond those in the .32-cm materials. The .16-cm fractions, therefore, were stored for future study as they may be able to answer research questions not part of the present study. The 2.54-cm fraction was sorted in the field, before transport to the lab for study. Left and right oyster valves were counted and weighed. Up to 80 whole left valves were retained for measurements; the rest of the oysters were discarded. The shell fragments that did not have an identifiable landmark were weighed as a general "Mollusca" category and discarded.

The remainder of the 2.54-cm fraction (non-oyster, identifiable specimens) and the .64-cm and .32-cm fractions from the 40-liter samples were sorted separately in the laboratory. All vertebrate fragments were separated for identification. All invertebrate fragments that had identifiable landmarks were separated for identification. In most cases, identifiable landmarks on shell valve fragments were in the umbo region. With some species, however, such as mussels, clams, and stout tagelus, a fragment from any part of the valve is identifiable. Because oysters are so common and the hinge region preserves well, only hinges were identified. Only identifying the hinges of mussels, clams, and stout tagelus, however under-estimates the contribution of these taxa. All valve fragments of these three species were identified and weighed. Clam valve fragments were counted as well as weighed. The mussel and tagelus non-umbo fragments were more fragile, breaking into additional fragments; these were not counted, though they were weighed. Except for whelks, which break into identifiable fragments, only whole gastropods (those with both apex and aperture present) were identified and quantified. The remaining shell debris was weighed as a general "Mollusca" category and discarded. Material culture was sent to AMNH for analysis. All other materials, such as charcoal, seeds, concretions, and twigs, were bagged as "root matter." These were saved in case they are of interest to other researchers in the future.

Identifications and Primary Data

All vertebrate and invertebrate animal remains were identified using standard zooarchaeological methods (Reitz and Wing 2008). Identifications were made using the comparative collection of the Zooarchaeology Laboratory, Georgia Museum of Natural History, University of Georgia by Sarah Bergh. Some identification support was provided by Carla Hadden and lab assistance in the form of sorting, counting, weighing, or measuring was provided by Anna Semon, Maran Little, Amber Knowles, Megan Fowler, and Victor Iminjili.

A number of primary data classes are recorded. Archaeological specimens are identified to the lowest possible taxonomic classification by comparing them to known reference taxa.

Specimens are further identified in terms of element, the portion recovered, and symmetry. Number of identified specimens (NISP) refers to the number of identified specimens in the sample. Specimens that cross-mend are counted as single specimens. Specimens identified as indeterminate vertebrate or invertebrate are not counted because they tend to be highly fragmented. All specimens are weighed to provide additional information about relative abundance.

Anatomical features that indicate sex and age at death are recorded. Few unambiguous indicators of sex or age exist, and those that are unambiguous are often rare in zooarchaeological collections. Features that indicate male individuals include antlers on deer, the baculum in those species that have one, spurs on the tarsometatarsus of gallinaceous birds, and a depression on the plastron of turtles. Females can be identified by the absence of these features. Female birds can also be recognized by medullary bone. Many vertebrates are sexually dimorphic in size. With large zooarchaeological collections it is possible to establish male and female size ranges using measurements of identified specimens. Georgia Bight zooarchaeological collections rarely contain enough of these taxa to use this method, however.

In mammals, anatomical features indicative of age are generally those associated with epiphyseal fusion of diagnostic elements, tooth eruption, and tooth wear (Gilbert 1980:102; Reitz and Wing 2008:172–178; Severinghaus 1949). The relative age of deer in the collections reported here is estimated from the degree of epiphyseal fusion of diagnostic elements. As animals mature, cartilaginous plates separating the shaft (diaphysis) of the element from the ends of the element (epiphyses) gradually ossify. Growth in the element is complete when the plates are completely ossified. Elements fuse in a regular temporal sequence, though environmental factors may influence the rate at which this occurs (Gilbert 1980; Purdue 1983; Reitz and Wing

2008:173–174; Schmid 1972). During the identification process, specimens are recorded as fused or unfused, within one of three categories based on the relative age at which fusion of the specific element generally occurs. Unfused elements in the early-fusing category are interpreted as evidence for juveniles, unfused elements in the middle-fusing and late-fusing categories are interpreted as evidence for subadults, and fused elements in the late-fusing category are evidence of adults. Fused specimens from the early-fusing and middle-fusing categories are indeterminate; these animals could have died just after fusion was complete or many years later. The ambiguity inherent in age grouping is somewhat reduced by recording each element under the oldest category possible. Tooth eruption data are recorded; deciduous teeth can indicate a juvenile or a subadult (e.g., Severinghaus 1949).

Modifications can indicate butchering methods as well as site formation processes. Modifications are classified as burned, calcined, cut, rodent-gnawed, worked, and pathological. While NISP for specimens identified as indeterminate vertebrata is not included in the species lists, modified indeterminate vertebrate specimens are included in the modification tables.

Some modifications likely took place as the carcass was dismembered or as meat was removed from the bone before or after cooking. Cuts are small incisions across the surface of specimens. These marks were probably made by knives as meat was removed before or after the meat was cooked. Cuts may also be left on specimens if attempts are made to disarticulate the carcass at joints. Some marks that appear to be made by human tools may actually be abrasions inflicted after the specimens were discarded, but distinguishing this source of small cuts requires access to higher powered magnification than is currently available at the Georgia Museum of Natural History (Shipman and Rose 1983).

Burned and calcined specimens are the result of exposure to fire during roasting or during intentional or unintentional burning after they are discarded. Burning results from the carbonization of bone collage and is identified by charred-black coloration (Lyman 1994:384–385). Calcined specimens are usually indicated by white or blue-gray discoloration (Lyman 1994:385–386). This discoloration can be the result of heating at extreme temperatures (greater than or equal to 600° C) or leaching of calcite. Both processes likely occurred in these collections, but no attempt was made to distinguish between them. Experimental studies suggest that the color of bone may be a poor indicator of the type of modification because it is difficult to precisely describe color variations, and other diagenic factors may alter bone color (Lyman 1994:385).

Gnawing by rodents, carnivores, and herbivores indicates that specimens were not immediately buried after disposal. While burial would not prevent gnawing, exposure of specimens for any length of time would likely result in gnawing. Rodents would include such animals as mice, rats, and squirrels. Carnivores would include such animals as dogs and raccoons. Herbivores, in this case, are deer. Gnawing by these animals may result in loss of an unknown quantity of discarded material. Kent (1981) demonstrates that some bone gnawed by carnivores such as dogs may not necessarily leave any visible sign of such gnawing and yet the specimens would likely be removed from their original context. Bones gnawed by herbivores may look similar to those gnawed by carnivores, but carnivores tend to choose bones with high nutrient value and herbivores choose dried bones that will easily fit in their mouths (Cáceres et al. 2011)

Other modifications are noted when present; specifically, worked and pathological specimens were recorded. Worked specimens can be grooved and snapped, flaked, or polished, and are evidence of human modification for reasons probably not associated with butchery. Worked specimens are described in more detail in the results section in Chapter 4. Pathologies occur when bone has been exposed to trauma, either biological or physical. Biological trauma includes disease or infection and physical trauma includes broken bones. When broken bones heal, a swollen area of additional bone grows over the break (Baker and Brothwell 1980; Greig 1931). Although there are many forms of identifiable pathologies, no attempt was made to attribute them to a cause.

Measurements of archaeological specimens are important primary data and are recorded when complete measureable features are present. For fishes, greatest anterior width of atlases, and greatest length, greatest width, and thickness for otoliths are recorded following Reitz and Wing (2008:187). For sea catfishes, an additional dimension, breadth, is taken, following Colaninno (2010:Figure 3). These measurements are presented in Appendix C and dimensions are abbreviated as follows: length as Len, breadth as Brt, width as Wdh, and thickness as Th. Measurements for mammals and birds are recorded following Driesch (1976) and are reported in Appendix D. Measurements of oysters follow Kent (1992:25) and are reported in Appendix E. Measurements of clams follow Quitmyer (1985b:47) and are reported in Appendix F.

Secondary Zooarchaeological Measures

The primary data recorded during identification provide the basis for a number of secondary data estimates. These secondary measures include: minimum number of individuals (MNI), biomass, richness, diversity, equitability, mean trophic level, utility, and back-calculated standard length of archaeological fishes.

MNI refers to the minimum number of individuals necessary to account for all the specimens of a given taxon in a collection (Grayson 1979:203–224; Reitz and Wing 2008:205–

210; White 1953). MNI is estimated for the lowest taxonomic level possible; usually this is at the species or genus level, except in cases where more individuals are present at the family level. When MNI is estimated at the family level, the estimates of MNI for lower taxonomic levels are included in the species lists in parentheses. Estimates in parentheses are not included in the total for each list or in subsequent calculations. MNI is estimated based on paired elements, size, and age. Barnacles are a special case; for this taxon, the number of plates identified is divided by 6 (the number of plates in an individual) and added to the number of whole individuals present.

Although MNI is a standard zooarchaeological quantification method, the measure has several well-known biases. For example, MNI emphasizes small species over larger ones. This can be demonstrated in a hypothetical sample consisting of twenty catfish and one deer. Although twenty catfish indicate emphasis on catfish, one whole deer would, in fact, supply more meat. Biases are also associated with identification. Some elements are more readily identifiable than others. The taxa represented by these elements may therefore be incorrectly perceived as more significant to the diet than animals with less distinctive elements. Hardhead catfish neurocranial fragments, readily identified from very small fragments, exemplify this situation. Conversely, some taxa represented by large numbers of specimens may present few paired elements and hence the number of individuals for these species may be underestimated. For example, deer elements in these collections are fragmented, and it is rare that the same portion of the same side of an element is present in a collection. Gars are another example; gars are represented in these collections by scales and vertebrae, elements which are abundant in a single skeleton. MNI for these animals will usually be under-estimated relative to the number of specimens. Basic to MNI is the assumption that the entire individual was used at the site. From ethnographic evidence, it is known that this is not always true (O’Connell et al. 1990, 1992;

Perkins and Daly 1968). This is particularly the case for larger individuals, animals used for special purposes, and where food exchange was an important economic activity (Thomas 1971; White 1953).

In addition to these primary biases, MNI is also subject to secondary bias introduced by the way samples are aggregated during analysis. The aggregation of archaeological samples into analytical units allows for a conservative estimate of MNI, while the "maximum distinction" method, applied when analysis discerns discrete sample units, results in a much larger MNI (Grayson 1973). For the Meeting House Field locality, Back Creek Village, and 9LI1637, each midden was treated as a distinct analytical unit and the data merged for each site. It is possible that individual animals were shared throughout each site. Individuals reported for one midden might be the same individual as reported for another midden.

Biomass estimates attempt to compensate for some of the problems encountered with MNI. Biomass refers to the quantity of tissue which a specified taxon might supply. Predictions of biomass are based on the allometric principle that the proportions of body mass, skeletal mass, and skeletal dimensions change with increasing body size. This scale effect results from a need to compensate for weakness in the basic structural material, in this case bones and teeth. The relationship between body weight and skeletal weight is described by the allometric equation:

$$Y = aX^b$$

(Simpson et al. 1960:397). In this equation, X is specimen weight, Y is the biomass, b is the constant of allometry (the slope of the line), and a is the Y-intercept for a log-log plot using the method of least squares regression and the best fit line (Reitz et al. 1987; Reitz and Wing 2008:238–239). Many biological phenomena show allometry described by this formula (e.g., Gould 1966, 1971) so that a given quantity of skeletal material or a specific skeletal dimension represents a predictable amount of tissue or body length due to the effects of allometric growth. Values for *a* and *b* are derived from calculations based on data at the Florida Museum of Natural History, University of Florida, and the Georgia Museum of Natural History, University of Georgia. Allometric formulae for biomass estimates are not currently available for amphibians, lizards, and barnacles so biomass is not estimated for these groups. The allometric formulae used here to estimate biomass are presented in Appendix G.

One method of assessing variety and degree of specialization is to measure the richness, diversity, and equitability of the species (Reitz and Wing 2008:245–247). These estimates permit discussion of subsistence in terms of the variety of animals (diversity) and the evenness (equitability) with which those species were used. Richness is the number of taxa for which MNI is estimated. Although MNI was estimated for commensal taxa, these taxa are not included in richness, diversity, or equitability estimates, as they are not considered part of the subsistence strategy. Diversity measures the number of individuals in terms of the overall collection. Equitability measures the degree of dependence and the effective variety of species based on the even, or uneven, use of individual species. Biases associated with these indices are discussed elsewhere (Grayson 1981; Hardesty 1975; Magurran 2004; Pielou 1966).

To measure diversity, the Shannon-Weaver Index is used. Diversity is calculated using the formula:

$$H' = -\Sigma\, (p_i)\, (\log_e p_i)$$

where p_i is the number of the *i*th species, divided by the sample size (Shannon and Weaver 1949:14). p_i is actually the evenness component since the Shannon-Weaver Index measures both how many species were used and how much each was utilized. Diversity ranges from zero to five with the lower values indicating the lowest diversity. Diversity increases as both the number of species and the equitability of species use increases. A sample with many species and in which the number of individuals slowly declines from most abundant to least abundant will be high in diversity. Diversity can be increased by adding a new taxon to the list, but if another individual of an already present taxon is added, diversity is decreased. A low diversity can be obtained either by having a few species or by having a low equitability, where one species is considerably more abundant than others.

The Sheldon Index is used to measure equitability. Equitability is calculated using the formula:

$$V' = H' / \log_e S$$

where H' is the Diversity Index and $\log_e S$ is the natural log of the number of observed species, or richness (Pielou 1966; Sheldon 1969). Equitability ranges from zero to one. A low equitability value indicates that one species was more heavily used than other species. A high equitability index, approaching 1.0, indicates an even distribution of species, following a normal pattern in which there are a few abundant species, a moderate number of common ones, and many rare ones.

Diversity and equitability are estimated for both MNI and biomass. In the case of MNI, estimates of individuals were taken directly from the species lists. Biomass represents a different problem because biomass was estimated for more taxonomic levels than MNI. It is considered important to calculate biomass diversity and equitability using the same taxonomic units used to calculate these values for MNI. For this reason, only those biomass estimates for taxa for which MNI was estimated, except for commensals, are included in the biomass diversity and equitability calculations.

Marine trophic levels can be used to demonstrate change in the parts of the estuarine community people were targeting (Pauly et al. 1998, 2000; Quitmyer and Reitz 2006; Reitz 2004). This may also speak to changes in the community structure of an estuarine system. Trophic levels range from 1 for primary producers and detritus to 4.6 for particularly long-lived, piscivorous fishes. There is a loss of energy at each higher trophic level. Organisms at the top of the food chain tend to be larger and less numerous, while those in the lower levels are smaller and more numerous. Average trophic level was estimated using the trophic levels assigned to the relevant taxa in FishBase (Froese and Pauly 2011). The mean trophic level is calculated with the following formula:

$$TL_i = \Sigma(TL_{ij})(MNI_{ij})/\,\Sigma MNI_i$$

where TL_{ij} is the mean trophic level of each taxon (*j*) in a collection (*i*). Only those biomass estimates for for taxa for which MNI was estimated, except for commensals, were included in the biomass trophic-level calculations.

A logged ratio diagram is used to clarify which portions of the deer skeleton were transported from the kill or butchery site to the midden site (Purdue et al. 1989; Reitz and Wing 2008:223–224). The archaeological deer element data are classified into high-, medium-, and low-utility categories following Purdue et al. (1989). Elements placed in the high-utility category include the sternum, femur, tibia, and tarsal. Vertebra, pelvis, sacrum, scapula, rib, humerus, radius, ulna, and metatarsal are in the medium-utility category. Elements placed in the low-utility category include antler, skull, mandible, tooth, atlas, axis, metacarpal, carpal, and phalanx. The distribution of archaeological specimens among these categories is compared to the distribution of these elements in a standard deer using a ratio diagram (Purdue et al. 1989). The formula is as follows:

$$d = (\log_e X) - (\log_e Y)$$

where d is the logged ratio, Y is percentage of each element category in the standard deer, and X is the same percentage of this category in the archaeological collections. The percentages of each element category for the standard deer are converted into logarithms, subtracted from the logged value of the same element category for the archaeological percentages, and plotted against the standard deer represented by the vertical line in the figure. Values on the positive side of the standard's vertical line are overrepresented and those on the negative side of the line are underrepresented compared to an intact, complete skeleton.

Patterns of skeletal element distribution provide evidence for butchering practices and transportation decisions. White-tailed deer elements are summarized into categories by body parts. The head category includes only skull fragments, including antlers and teeth. The atlas and axis, along with other vertebrae and ribs, are placed into the vertebra/rib category. It is likely the head and vertebra/rib categories are under-represented because of recovery and identification difficulties. Forequarter includes the scapula, humerus, radius, and ulna. Carpal and metacarpal specimens are in the forefoot category. The hindquarter category includes the innominate, sacrum, femur, and tibia. Tarsal and metatarsal specimens are considered the hindfoot. Metapodials and podials which could not be assigned to one of the other categories, as well as sesamoids and phalanges, are assigned to the foot category. The distribution of deer elements among these categories is presented as a histogram for each analytical unit—the percentage of elements belonging to each category (relative to the total deer NISP) is graphed.

White-tailed deer elements are summarized visually to illustrate their number and location in a carcass. Although the atlas and axis fragments are accurately depicted; other cervical, thoracic, lumbar, and caudal vertebrae are placed approximately on the illustration. The last lumbar location is used to illustrate vertebrae not otherwise classified. The last rib location is used to illustrate all ribs. Specimens identified only as sesamoids, metapodiae, podials, or phalanges are illustrated on the right hindfoot.

To evaluate the relative importance of white-tailed deer over time, a deer abundance index is calculated. Abundance indices (AI) are used in resource depression studies to demonstrate a decreased abundance of preferred prey over time (Broughton 2002; Butler 2000; Nagoaka 2002; Thomas 2008:943; Ugan and Bright 2001). The AI formula is as follows:

$$AI_{(DEER)} = \Sigma\, Deer_{(NISP,\ MNI,\ Biomass)} / \Sigma\, All\ vertebrate\ taxa_{(NISP,\ MNI,\ Biomass)}$$

Values range from zero to one; the higher the value the more common deer were in the subsistence strategy (when AI is calculated using NISP and MNI) or in the diet (when AI is calculated using biomass).

Allometric regression is used to back-calculate the standard length of fishes from three families—sea catfishes, mullets, and drums. Standard length (SL) is the distance from the snout to the posterior end of the last vertebra. This method is based on the scaled relationship between skeletal dimensions and living body dimensions. In this analysis, SL was estimated allometrically from otolith width for sea catfishes, otolith width or length for drums (whichever dimension was most commonly obtained from the sample), and atlas anterior centrum width for mullets and some drums (when atlases of a drum species were more common than otoliths). The regression formula used to back-calculate SL from measurements of otoliths and atlases is:

$$Y = aX^b$$

Where Y is the SL in mm, X is the otolith or atlas measurement, a is the Y-intercept, and b is the slope of the line (Reitz and Wing 2008:187). Values for the allometric constants a and b are derived from biological data of modern specimens from the Florida Museum of Natural History, University of Florida and the Georgia Museum of Natural History, University of Georgia (Appendix H). Histograms were constructed to illustrate the percentage of fishes in each size class. Following Reitz et al. (2010:235), small-bodied individuals are considered those less than 250 mm in length and large-bodied individuals are those greater than 250 mm in length.

Summary of the Archaeofaunal Collections

The species identified are summarized into faunal categories in order to compare the percentage of various groups of taxa. The 40-liter samples of vertebrates and invertebrates from early and late contexts from the Meeting House Field locality are summarized into the following categories: Ribbed mussels, Eastern oysters, Oyster spat, Stout tagelus, Hard clams, Other bivalves, Whelks, Other gastropods, Crabs, Commensal invertebrate taxa, Deer, Other wild mammals, Birds, Snakes, Pond turtles, Mud turtles, Sea catfishes, Mullets, Killifishes, Drums, Other fishes, and Commensal vertebrate taxa. The vertebrates from the Meeting House Field locality, Back Creek Village, and 9LI1637 (including vertebrates from the 40-liter samples and those recovered from the rest of each level) are summarized into the following categories: Deer, Other wild mammals, Birds, Snakes, Turtles, Sharks, rays, and fishes, and Commensal taxa. In order to make comparisons of MNI and biomass estimates possible, the summary tables include biomass estimates only for those taxa for which MNI is estimated.

Taxa classified as commensal are animals that, although they might be consumed, likely became part of the midden for other reasons. Vertebrate taxa classified as commensals include mice, rats, shrews, moles, frogs, toads, lizards, newts, and salamanders. These animals tend to be found in close association with humans and the disturbed habitats humans create. People probably do not actively encourage or discourage these animals. The animals might utilize middens for food and die there or they may be caught by humans and tossed onto the middens.

There is a chance that some of these animals were used for food or other purposes. Dogs are also classified as commensals since they may have been pets. Small birds, such as song birds, are classified here as food, in the Bird category, but may have been commensals. Invertebrate taxa classified as commensals include terrestrial gastropods, oyster drills, indeterminate gastropods (all of which are tiny terrestrial or marine taxa), tellins, and surf clams. The terrestrial gastropods are likely to be found on calcareous soils, such as those near shell middens, and unlikely to be consumed. The commensal marine taxa were all likely acquired adhering to food items collected in the estuary. Killifishes are considered food items in this study, but it is possible that they too were collected as byproducts of fishing and shellfishing. Killifishes are abundant over oyster beds. Oyster spat (attached oyster larvae) are given their own classification. These individuals likely were riders on larger oyster shells, though if oysters were tossed in a stew pot, instead of individually shucked, spat would have contributed some calories and nutrients.

Oyster Analysis

A height-to-length ratio (HLR) is the most common method for evaluating oyster shape (Kent 1992:25). Height is the distance from the umbo to the ventral edge of the valve, and length is perpendicular to this, the maximum anterior-posterior distance. The HLR is indicative of substrate. Elongated oysters from soft bottoms and reefs will have a HLR greater than 2.0 and uncrowded oysters growing on hard surfaces will have a HLR of less than 1.3 (Gunter 1938; Kent 1992:25). Intermediate ratios are indicative of oysters on a mixed mud and sand bottom in loose clusters (Kent 1992:25). The degree of clustering can be evaluated by scars where the valve was attached to another oyster (Kent 1992:26). Reef oysters may also be somewhat ornamented if exposed to the sun, so a strong purple coloring could be additional evidence of reef growth (Kent 1992:26). Boreholes suggesting predator and parasite activity may indicate that the oyster population experienced stresses from sources other than humans (Kent 1992:27). Large numbers of oyster spat may indicate a healthy population, since these are the new recruits.

The whole oysters caught in 2.54-cm-mesh screens are counted, weighed, and their symmetry recorded. Eighty of the whole left valves from each level are used in this analysis; if there are fewer than 80, then all left valves are used. Valves are selected haphazardly by sticking a hand into the bag of left valves, pulling one out, and determining if it was whole. If whole, it is measured; if not, it is discarded. This is repeated for each level until 80 valves are measured. The bag is laid on its side, so the valves at the top and bottom of the bag all have a chance to be selected, in case the valves had sorted by size in the bag (probably not a major factor as the bags were packed tightly and movement was unlikely). The average height, length, and HLR are calculated for each unit. In addition, the frequency distributions of height, length, and HLR are graphed as histograms for each analytical unit. Evidence for oyster, barnacle, and mussel scars is noted for each valve and the frequency of each scar type calculated for each unit. Evidence for predator activity and epibionts is also noted for each valve, and the frequency calculated for each unit. Large boreholes may be indicative of bivalve or gastropod predation. Small boreholes are indicative of sponges (*Cliona* sp.) and worm holes are indicative of polychaete worms (*Polydora* sp.). The percentage of oyster individuals recovered in the .32-cm screen is also noted. These are considered spat, attached oyster larvae, and usually measure under an inch in length. The spat could indicate that the oyster bed was healthy, as these are the new recruits.

Incremental Analysis

Shells of molluscs and skeletal elements of fishes generally have indeterminate growth; they grow throughout organisms' lives, with new shell or bone layers growing on top of old ones as the animal gets older. Growth rate declines as an individual gets older, which means that the new shell or bone layers get smaller as the animal ages. Growth rates are also influenced by environmental conditions, often on a seasonal basis. Important environmental factors include temperature, salinity, food availability, dissolved oxygen, water turbidity, competition, and predation (Andrus and Crowe 2008:507–516; Rollins et al. 2008:25–27; Wootton 1998:122–126). Animals grow faster when environmental conditions are most favorable and slower at times when conditions are less favorable (Andrus and Crowe 2008:507–516; Jones 1980; Quitmyer et al. 1985; Wootton 1998:122–126). Growth can cease if conditions deteriorate enough (e.g., Jones 1980). Physiological events and animal condition also affect growth rates. During the spawning season, animals put more energy into reproduction than into growth (Wootton 1998:57–58). Some animals may stop feeding during this time, reducing the energy available for growth. Studies of modern populations establish yearly growth patterns for individuals, including environmental and physiological conditions that favor growth and those that cause it to cease, and times of year when these conditions occur (Andrus and Crowe 2008:507–516; Colaninno 2010:255; Quitmyer et al. 1997; Quitmyer and Jones 2012). The models generated from modern populations can then be applied to archaeological populations to estimate age and season of death.

Clam Growth

Studies of modern southeastern clam populations, based on monthly collections of clams, established that these animals grow faster during the winter and slower during the summer (Andrus and Crowe 2008:507–516; Jones 1980; Mayer O’Brien and Thomas 2008:477–487; Quitmyer and Jones 2012; Quitmyer et al. 1985; Quitmyer et al. 1997). Stable oxygen isotope analysis of modern clams, suggests that temperature is the most important environmental factor determining growth patterns—the high summer water and air temperatures are less favorable for clam growth than the colder temperatures of the winter months. In the Northeast, clams grow faster in the warmer months, and cold winter temperatures often cause a period of growth cessation (Jones 1980; Quitmyer et al. 1985). There is no similar pattern of growth cessation in southeastern clams, though weather events may generate particularly unfavorable conditions that cause individuals or whole beds to cease growth briefly (Andrus and Crowe 2008:507–516; Quitmyer et al. 1985). Southeastern clams, therefore, add calcium carbonate to the margin of their shell throughout the year. During the colder months, the layer of calcium carbonate is broad and white, or opaque in reflected light. During the warmer months, the layer is narrow and dark, or translucent in reflected light (Figure 3.4). Together, the broad, light (opaque) and narrow, dark (translucent) bands form an annulus, or one year of growth. An even finer sequence has been established that divides the cold season (opaque) growth and warm season (translucent) growth into three stages, designated as O1-O3 and T1-T3 (Jones 1980; Jones and Quitmyer 1996; Quitmyer et al. 1985; Quitmyer et al. 1997). O1 and T1 represent the initial appearance of the growth band at the margin of the valve and the umbo, O2 and T2 indicate that the bands are about half complete (close to half the length of the previous band of the same color), and O3 and T3 indicate that the increments are complete (about the length of the previous same color band) but the next increment has not started. In a recent study of modern clams from St. Catherines island, Quitmyer and Jones (2012:Figure 7.5) found that opaque growth was dominant during the winter and spring months and translucent growth dominant during the summer and fall months.

Samples of clams were chosen from Back Creek Village, early Meeting House Field, and late Meeting House Field for a study of seasonality and growth rates. Seventy-five percent of the left valves from each unit at Back Creek Village were selected for analysis, using a random number table. In units with ten or fewer left valves, all left valves were selected. Far fewer clams were recovered from the Meeting House Field locality units, so each unit was considered separately; the most common valve side was determined for a unit, and then all the valves from that side in that unit were selected. Each valve is sectioned radially from the umbo to the edge, along the margin of greatest growth, with a Buehler Isomet Low Speed saw. Sections are polished with fine-grained sandpaper, and scanned using an Epson Perfection 4490 scanner at 12,800 dpi resolution in gray-scale. Based on the scans and visual inspection of each section itself, the growth phase of the final increment is recorded, and the season of death estimated. The frequency of individuals in each phase of growth (number in that phase/total sample size for the site) is graphed as a histogram. The annuli are counted to estimate the age in years of the clam. Measurements are taken following Quitmyer (1985b:48) to establish size of the clam at death. These measurements are used to construct the size-at-age curves. The shell height from the umbo to the end of each increment also is measured, along the exterior curve of the shell, to establish the amount of shell added after each growth phase. These measurements are used to model the von Bertalanffy growth curves.

Fish Growth

A similar pattern of incremental growth characterizes fish otoliths. Otoliths are calcium carbonate structures in the inner ear of fishes (Wootton 1998:111). A light or opaque band is laid down during periods of rapid growth and a dark or translucent band is laid down during periods of slow growth (Figure 3.5). Using stable oxygen isotope analysis of modern hardhead catfish otoliths collected in multiple months from St. Catherines Island, Colaninno (2010:255) found that the broad, light band was generally formed during the colder months and the narrow, dark band during the warmer months. Surge and Walker (2005) found this to be the case for hardhead catfishes from Florida. A dark band plus a light band, therefore, equals an annulus, or one year of growth. As with clams, many factors influence growth, such as food availability, reproductive activity, and events that cause major changes in the environmental conditions of the estuary (Devereaux 1967; Epstein et al. 1953; Panella 1971, 1980; Patterson et al. 1993; Thorrold et al. 1997; Van Neer et al. 1999; Van Neer et al. 2004; Wootton 1998:111–116). During spawning and gestation periods, energy is devoted to reproduction instead of growth. Male catfishes may not feed while they carry juveniles in their mouths (Muncy and Wingo 1983:6). At some times of the year food availability may be higher, such as after the autumn rains, or at particularly high and active tidal cycles. Temperature appears to be the major determining factor in increment formation, as faster growth occurs in the colder months and slower growth during the warmer months.

A sample of hardhead catfish and gafftopsail catfish otoliths was selected from each site to compare growth rates. These two species were targeted for study because of their abundance in zooarchaeological collections from the Georgia coast. Growth rates have been estimated for hardhead catfishes from four Late Archaic sites on the coast, including the two St. Catherines Island shell rings, and for modern St. Catherines Island hardhead catfishes (Colaninno 2010:284–288). Few hardhead catfish otoliths were recovered from the St. Catherines period contexts at the Meeting House Field locality, so it was decided to include gafftopsail catfishes in the study because they are present in both Irene- and St. Catherines-phase contexts. Since many aspects of hardhead and gafftopsail catfish life histories are similar (Muncy and Wingo 1983), it is assumed that the light and dark bands form an annulus in gafftopsail catfishes as well.

In selecting otoliths for analysis, each unit from the Meeting House Field locality was treated as a separate analytical unit. All whole, unburned otoliths were sided, and the most abundant side determined for each unit. All the otoliths from the most abundant side in each unit were selected for analysis. In cases where size could be used to increase the sample size (the size difference being great enough that the otoliths were unlikely to be from the same individual), otoliths of the less common side were included.

Otoliths from Back Creek Village and 9LI1637 were also analyzed in order to examine differences among island habitats. The same selection process as described for the Meeting House Field locality was used for 9LI1637. Because of the larger number of hardhead catfish otoliths in the Back Creek Village collection, a sample of 10 otoliths of this species was selected using a random number table.

Each otolith is sectioned on the transverse plane with a Buehler Isomet Low Speed saw. Sections are polished with fine-grained sandpaper, and scanned using an Epson Perfection 4490 scanner at 12,800 dpi resolution in gray-scale. The number of annuli was counted in order to estimate the age in years. The Adobe Illustrator measure tool is used to measure the length of each otolith after each annulus. This gives the total length of the otolith at each age.

Incremental Analytical Methods

Growth rates for bivalves and fishes are commonly modeled using the von Bertalanffy method (e.g. Hales and Reitz 1992; Henry and Nixon 2008; Jones et al. 1989). Size-at-age data are obtained for clams and fishes by measuring the amount of total growth after each year, and then averaging the measurements for each year class. The parameters ($L\infty$, k, and t_0) for a von Bertalanffy growth rate equation are obtained by entering the averaged size-at-age data into PAST software. The parameters then are applied to the equation in Excel as follows:

$$L_t = L\infty(1-e^{-k(t-t0)})$$

where L_t is the length at time t, $L\infty$ is the asymptotic length, k is a growth constant, and t_0 is the time at which length is 0. This equation is used to create a graph of the expected values for size-at-age for each species and each analytical unit.

Size-at-age charts also are created for each species and analytical unit. For clams, the length of each valve at death is used to find an average for that archaeological population (analytical unit) at each age. Average length versus age is graphed in Excel, using a line chart layout. For both catfish species, the measurements for size after each year of growth are averaged for each year class. Average length versus age is graphed in Excel using a line chart layout.

Survivorship curves are a way to represent visually the probability of death at each age interval in a population. Survivorship curves are constructed for archaeological clam populations in this study. The number of individuals in each population alive at each age is standardized by converting it to the number alive if the starting population was 1000 (Begon et al. 1996:15; Rockwood 2006:80–83). The $\log_{10}$ of these numbers is then graphed against age in Excel to get a constant probability of death per age interval.

Stable Carbon and Nitrogen Isotope Analysis

Carbon and nitrogen stable isotope values in animal bone collagen are derived from dietary protein. As such, isotope values of collagen reflect environmental conditions that affect the isotope values of the foods in the animals' diets. This makes collagen isotope values of animals, such as deer and raccoons, indicators of landscape change over time. These animals are common in the archaeological record and well-studied on the Georgia coast in recent decades. Carbon values are dependent on the photosynthetic pathway of plants at the bottom of the food chain and forest cover (Cormie and Schwarcz 1994; Drucker et al. 2008; Stevens et al. 2006).

Maize, a tropical cultigen introduced to the island during the Irene phase, has a different photosynthetic pathway than the native terrestrial plants on St. Catherines Island. Deer and raccoons eating maize should have higher carbon values than animals living on the island before maize was introduced. Soils and plants under heavy forest canopies tend to have lower carbon values (Drucker et al. 2008; Van der Merwe and Medina 1991). Deer and raccoons foraging in more open environments should have higher carbon values than animals foraging in heavily forested environments.

Nitrogen values are dependent on the degree of nitrogen-fixation in plants at the bottom of the food chain, the levels of nitrogen in the soils, and the degree to which marine resources are part of the food chain (Cormie and Schwarcz 1994, 1996; Schoeninger and DeNiro 1984; Stevens et al. 2006). Human activities often increase soil-nitrogen inputs through waste disposal and burning of forests, undergrowth, or grasslands (Commisso and Nelson 2008; Grogan et al. 2000). Deer and raccoons foraging in an environment used by a larger human population are likely to have higher nitrogen values than animals feeding in environments with small human populations. Marine plants and animals have higher nitrogen values than most terrestrial plants and animals (Schoeninger and DeNiro 1984). Deer and raccoons foraging in marsh or beach habitats are likely to have higher nitrogen values than animals feeding in terrestrial locations.

To establish a modern baseline for interpreting deer and raccoon diets in the past, a stable isotope study of modern deer and raccoon bones and a sample of their common food sources was conducted. Deer diet has been studied on Blackbeard Island by Osborne et al. (1992) and on Cumberland Island by Warren et al. (1990). Raccoon diet on St. Catherines Island was studied by Harmon and Stains (1979). By correlating known diets with the stable isotope values in modern animals and then comparing these to archaeological values, it is possible to determine if animal diets were different during the aboriginal period, and explore reasons for the differences.

Archaeological deer and raccoon specimens were selected from the Mississippian sites reported in this volume: the three Meeting House Field locality sites (9LI21, 9LI230, and 9LI229), Back Creek Village, and 9LI1637. Specimens were also analyzed from the Late Archaic St. Catherines Shell Ring and from the Mission-period Pueblo for comparison with animals who did not have access to maize and with animals who did have access to maize, respectively. There were few instances in which there was more than one of any single element for either deer or raccoon in any of these collections. For the Mississippian-period sites, a deer and a raccoon specimen were selected from each midden in which specimens of these taxa were present. When more than one of the same element was present in a midden, suggesting more than one individual, all of these elements were selected from that midden. This yielded 20 deer and 7 raccoon specimens from the Mississippian period. Four deer and 2 raccoon specimens were selected from the Late Archaic- and Mission-period sites. The total sample size for all time periods is 28 archaeological deer and 9 archaeological raccoons.

For comparison, modern deer and raccoon specimens were obtained from the Mammalogy Department, American Museum of Natural History. The specimens were collected from St. Catherines Island in the 1970s and provide isotope values reflecting the modern diet of these animals (these animals did not have access to maize). Ten specimens of each taxon were selected. Preference was given to skeletons for which sex was known. Ten raccoon skeletons met this criterion, and left or right mandibles of nine of these animals, and an ilium of one, were analyzed. There were only four deer skeletons for which sex was known and mandibles (or post-cranial bones) were present; left mandibles from these four specimens were analyzed. Six other left mandibles were also analyzed, though sex was not known.

Modern plant and animal specimens representing deer and raccoon dietary sources were collected on St. Catherines Island in May, 2011 by Sarah Bergh, with the assistance of Christa Frangiamore. The taxa were chosen from among those listed as food items for deer on Blackbeard Island in Osborne et al. (1992) and for raccoons from St. Catherines Island in Harman and Stains (1979). These studies identified food items from scat and stomach contents from multiple animals at multiple times of year. Plants consumed by more than one individual and during more than one part of the year by both deer and raccoon were given preference. Most of the selected were plants, as both deer and raccoons consume plant matter. Raccoons, however, are omnivorous, so a few marsh invertebrates common in raccoon diets were added to the plant sample.

All deer and raccoon bone samples were prepared for isotopic analysis in the Bone Chemistry Laboratory in the Department of Anthropology, University of Florida (UF) and analyzed using isotope ratio mass spectrometry in the Light Stable Isotope Mass Spec Laboratory in the Department of Geological Sciences, University of Florida. Archaeological bone specimens were first measured, weighed, and photographed. Using the facilities at University of Georgia's Stable Isotope/Soil Biology Laboratory, Odum School of Ecology, under the direction of Tom Maddox, archaeological specimens were cleaned with distilled H_2O and oven dried at 80° C for 24 hours. All archaeological and modern bone specimens were ball-milled to a powder using a Spec Industries 8000 mill.

The samples were then sent to the University of Florida for further preparation. Powdered bone samples were weighed (~0.2-0.25 g) and placed into 15 ml test tubes. To demineralize the samples and secure purified bone collagen, ~12-13 ml of 0.1 molar (M) hydrochloric acid (HCl) were added to each tube for the prehistoric samples and 0.2 M HCl was used for the modern samples. Because of small fraction size (powder), reaction time was quite fast, and acid was refreshed only for the modern samples. Most samples were completely demineralized after 24 hours. After all samples reached similar status they were rinsed 3 times to neutral pH with deionized distilled H_2O and ~12-13 ml of 0.125 M sodium hydroxide (NaOH) was added to each sample to remove organic contaminants. After 16 hours in solution, samples were rinsed to neutral 3 times with distilled H_2O, samples were transferred to labeled and weighed glass scintillation vials, and ~10 ml of 10^{-3}M HCl (pH3) was added to each. Vials were loosely covered and placed in a 95° C oven for 4-5 hours, after which ~30-40µl 1M HCl was added to each vial to completely dissolve the collagen. Samples remained in the 95° C oven for another 4-5 hours, and a few squirts of 10^{-3}M HCl were used to replace the evaporated solution if necessary. The solution was then transferred back to the original (cleaned) 15 ml test tube, centrifuged, and the solution only was transferred back to its original scintillation vial. The vial without lid was then placed in a drying oven at 65° C and reduced to a ~2 ml solution. Once this was achieved, purified bone collagen samples were frozen at -80° C to prepare for freeze drying (lyophilization). After samples were freeze dried, vials with collagen were weighed to calculate % collagen yield. Samples were then brought to Geological Sciences where elemental C:N ratio was assessed for each sample using a Carla Erba 1500 elemental analyzer. Fifty-five of the 57 samples had excellent yields and produced good C:N ratios. Samples were then weighed into tin capsules and loaded for analysis. Stable isotope ratio analysis was performed by Dr. Jason Curtis using a Finnigan MAT DeltaPlus XL mass spectrometer and corrected using the USGS40 standard.

Preparation of modern plant and animal dietary specimens for stable isotope analysis was conducted at the Light Stable Isotope Mass Spec Laboratory, Department of Geological Sciences under the direction of Jason Curtis. Plant and animal food items were dried in an oven at 45° C and homogenized using a Spex 6700 cryogenic mill.

To analyze total carbon and nitrogen of all samples, samples were loaded into tin capsules and placed in a 50-position automated Zero Blank sample carousel on a Carlo Erba NA1500 CNHS elemental analyzer and flash combusted in a quartz column containing chromium oxide and silvered cobaltous/cobaltic oxide at 1020° C in an oxygen-rich atmosphere. The sample gas was then transported in a He carrier steam and passed through a hot reduction column (650° C) consisting of reduced elemental copper to remove oxygen. The effluent steam was then passed through a magnesium perchlorate trap to remove water, and then through a 2 m gas chromatographic column at 45° C that separates the N_2 and CO_2 gases. The gases are finally passed through a thermal conductivity detector that measures the pulses of N_2 and CO_2.

To analyze the carbon and nitrogen isotope values, samples were loaded into tin capsules and placed in a 50-position automated Zero Blank sample carousel on a Costech ECS 4010 elemental analyzer and combusted in a quartz column at 1020° C in an oxygen-rich atmosphere. The sample gas was then transported in a He carrier steam and passed through a hot reduction column (650° C) consisting of reduced elemental copper to remove oxygen. The effluent steam was then passed through a magnesium perchlorate trap to remove water, and then through a 3-m gas chromatographic column at 55° C that separates the N_2 and CO_2 gases. The steam then passed into a ConFlo III preparation system and into the inlet of a Thermo Finnigan DeltaPlus XL mass spectrometer running into continuous flow mode where the sample gas was measured relative to a laboratory reference gas.

Results of this analysis yield raw carbon and nitrogen isotopic values that are processed and reported as delta (δ) values in parts per thousand (‰) relative to international standards: Vienna Pee Dee Belemitella (VPDB) for carbon, and atmospheric nitrogen or Ambient Inhalable Reservoir (AIR) for nitrogen. The formulae for deriving delta values are as follows:

$$\delta^{13}C = [({}^{13}C/{}^{12}C_{sample}/{}^{13}C/{}^{12}C_{standard})-1] \times 1000$$

$$\delta^{15}N = [({}^{15}N/{}^{14}N_{sample}/{}^{15}N/{}^{14}N_{standard})-1] \times 1000.$$

Precision for reported $\delta^{13}C$ values is 0.12‰ and for reported $\delta^{15}N$ values is 0.10‰.

Chapter Summary

Zooarchaeological data are subject to biases associated with sampling, recovery, quantification, and aggregation. This research project uses multiple standardized methods of analysis in order to minimize the effects of these biases. The results of these analyses are used in the following chapters to evaluate the late Mississippian subsistence strategy (Chapter 5) and examine changes in the Mississippian subsistence-settlement system associated with the formation of a farming chiefdom on St. Catherines Island (Chapters 6 and 7). These methods also yield data that address environmental impacts of these changing resource-use patterns. Chapter 7 uses incremental data to examine impacts on clam and catfish growth patterns and Chapter 8 uses stable carbon and nitrogen isotope analysis to look for environmental changes that affected deer and raccoon foraging habits. These methods provide a diverse and detailed data set that contributes to our understanding of human-environment relationships on St. Catherines Island during the Mississippian period.

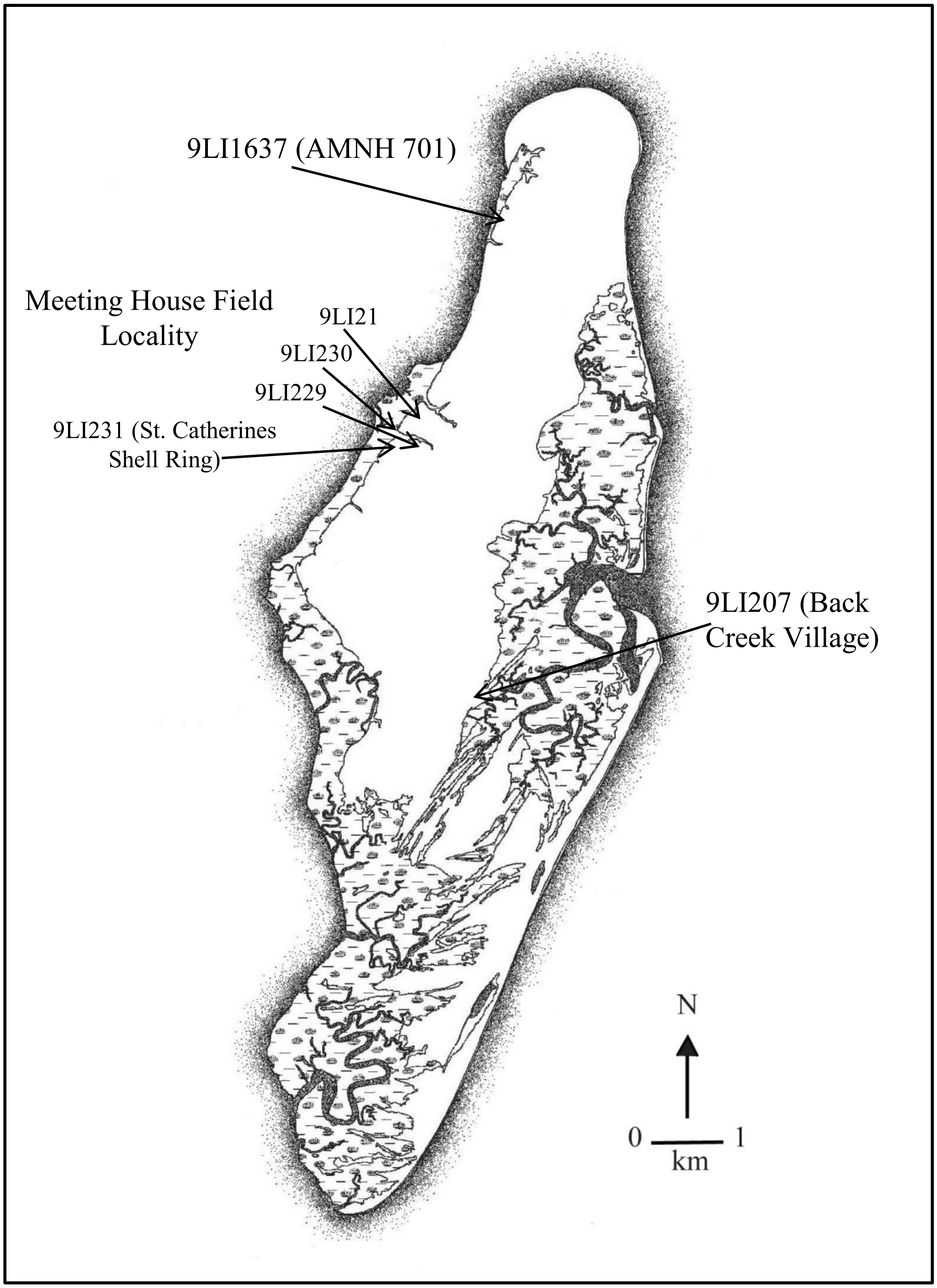


Figure 3.1: Map of St. Catherines Island sites from which collections discussed in this volume are drawn

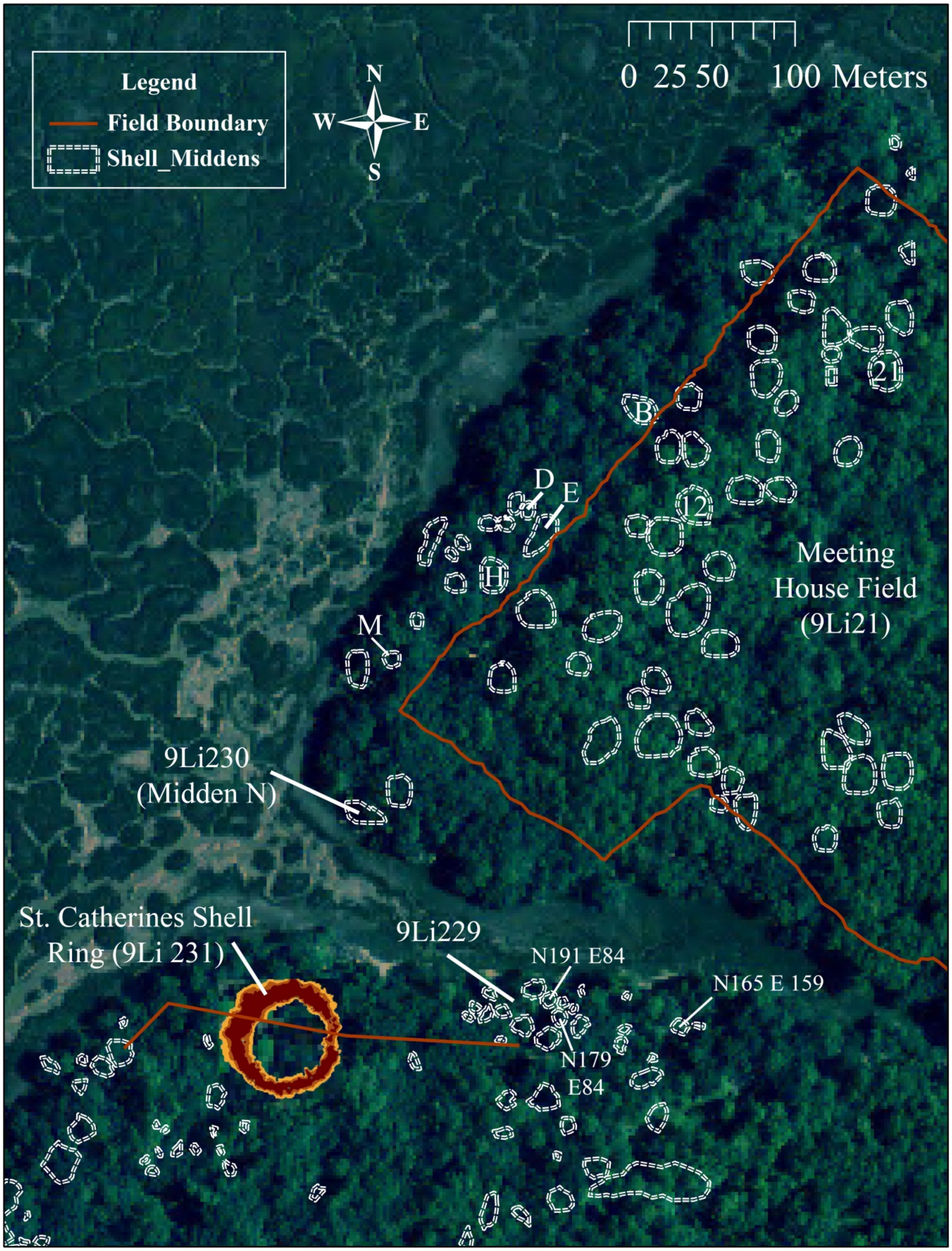


Figure 3.2: Map of the Meeting House Field Locality, showing the location of 9LI21, 9LI229, 9LI230, and 9LI231, and the location of middens at these sites (Courtesy of Elliot Blair 2012)

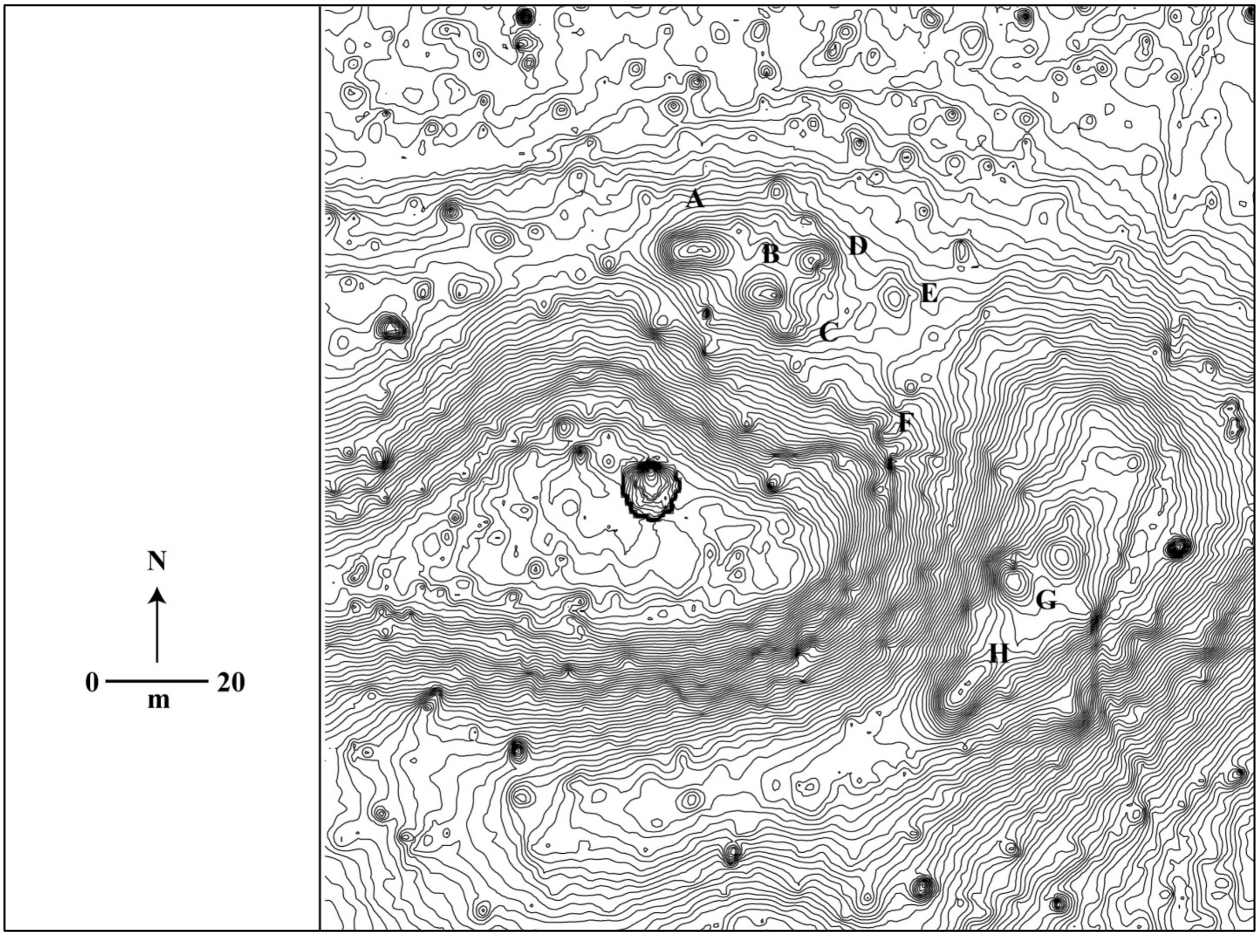


Figure 3.3: Map of Back Creek Village (9LI207) showing location of studied middens (Basemap courtesy of Elliot Blair 2011)

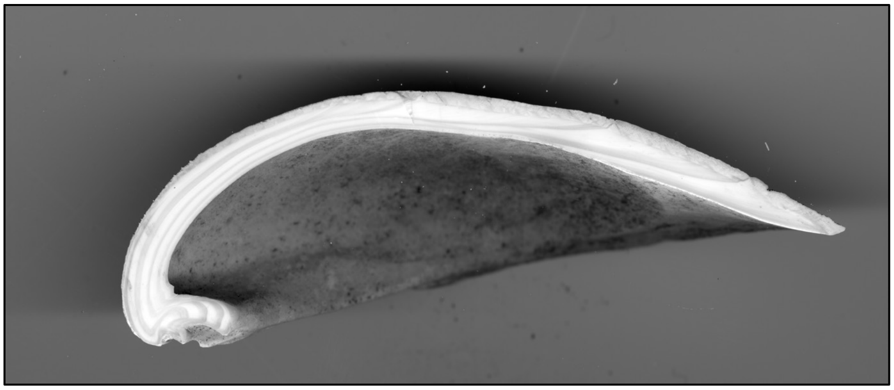


Figure 3.4: Scanned image of sectioned clam valve; dark, or warm season growth, and light, or cold season growth, bands are visible

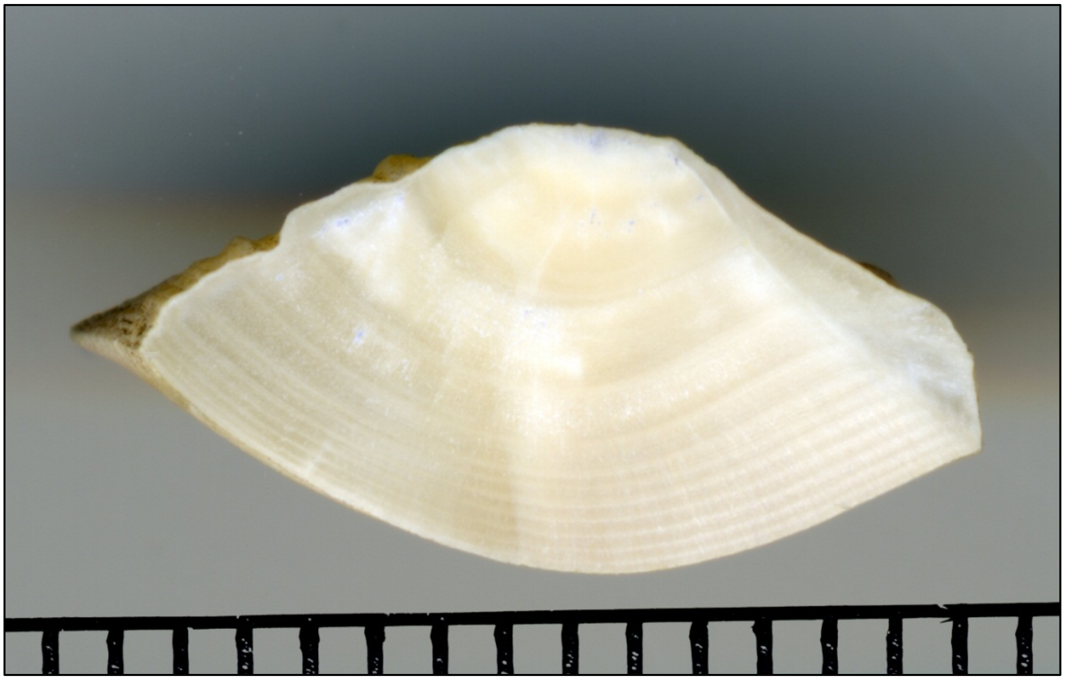


Figure 3.5: Scanned image of gafftopsail catfish otolith thick section showing the light and dark growth bands (scale in mm)

Table 3.1

Site Information and Analytical Units

Site Name	State Number	cal ^{14}C AD (2 sigma)	Ceramic Chronology	Invertebrate Sample	Vertebrate Sample	Analytical Units	Units Included
Meeting House Field	9LI21	1300-1520	Middle, Late Irene	40 liter bulk	40 liter bulk; whole level	Late MHF; Irene	Alpha, Beta, Gamma, Delta, Eta, Zeta, Theta, N501 E80
Midden N	9LI230	910-1140	Savannah/ St. Catherines	40 liter bulk	40 liter bulk; whole level	Early MHF	Iota
AMNH 502	9LI229		St. Catherines/ Early Irene	40 liter bulk	40 liter bulk; whole level	Early MHF	N179 E84, N191 E84, N165 E159
Back Creek Village	9LI207	1280-1670	Irene		whole level	Irene	N586 E441, N587 E437, N575 E453, N576 E453, N569 E458, N584 E466, N557 E482, N513 E507, N488 E495, N493 E499, TP VI, TP VII, TP VIII, TP IX
AMNH 701	9LI1637	1420-1690	Irene		whole level	Irene	TP I, TP II

CHAPTER 4:

RESULTS OF ZOOARCHAEOLOGICAL ANALYSIS

Previous zooarchaeological analyses of Mississippian-period collections on St. Catherines Island suggest that deer dominated subsistence. This chapter presents the results of zooarchaeological analysis of the 2008 and 2009 collections from the Meeting House Field locality, Back Creek Village, and 9LI1637. Although most of these sites have been studied previously, these new collections were recovered using fine-screen and water-screen methods that yielded larger sample sizes representing a wider range of animal taxa than recovered in earlier studies of Mississippian sites on St. Catherines Island (Reitz 2008; Reitz and Dukes 2008). The samples from the Meeting House Field locality include both invertebrates and vertebrates, which no other study of Mississippian sites on St. Catherines Island has done. A total of 329,392 vertebrate and invertebrate specimens were identified from the Meeting House Field locality, Back Creek Village, and 9LI1637. The specimens represent a minimum of 123,519 individuals from 94 taxa. The results of this analysis suggest that, like the Late Archaic folk reported by Colaninno (2010), Mississippian people primarily focused on a suite of estuarine resources, occasionally supplementing it with terrestrial mammals such as deer.

Meeting House Field Locality

The archaeofauna collections from the Meeting House Field locality are divided into two analytical units: early and late Mississippian. Because there were essentially two recovery strategies for the locality—40-liter samples that included vertebrates and invertebrates and vertebrate material recovered from the remainder of each level in the field—four species lists are presented for this locality. Two present the identifications for the early and late 40-liter bulk samples, including both vertebrates and invertebrates, and two are lists that combine all vertebrates recovered from the 40-liter samples with those from the remainder of each level.

Early Units 40-Liter Sample: Invertebrates and Vertebrates

A total of 100,440 specimens, weighing 314,920.435 g, are identified from the 40-liter samples from the four early units. These specimens represent a minimum of 43,785 individuals from 64 taxa (Table 4.1). Oysters dominate the collection, contributing 85 percent of the individuals (Table 4.2). Thirty-five percent of the oyster individuals are represented by spat. The only other food taxa to contribute more than 1 percent of the individuals are shellfishes, specifically mussels and stout tagelus. Commensal invertebrate taxa, mostly terrestrial gastropods and barnacles, contribute 8 percent of individuals. Fishes are the most abundant vertebrate class. Of these, drums are the dominant family, but killifishes, mullets, and sea catfishes are also common. Biomass is dominated by shellfishes. Oysters contribute 70 percent of the biomass, stout tagelus contributes 13 percent of the biomass, and mussels and clams 3 percent. Deer is the only vertebrate to comprise a similar portion of biomass (6 percent).

Late Units 40-Liter Sample: Invertebrates and Vertebrates

A total of 187,864 specimens, weighing 714,124.868 g, are present in the 40-liter samples from the eight late units. These specimens represent a minimum of 78,721 individuals from 65 taxa (Table 4.3). Oysters dominate the collection, contributing 84 percent of the individuals and 80 percent of the biomass (Table 4.4). Thirty percent of the oyster individuals are spat. Of the other food taxa, only mussels and stout tagelus contribute more than 1 percent of the individuals. Commensal invertebrate taxa, mostly terrestrial gastropods and barnacles, contribute 11 percent of the individuals. Fishes are the most abundant vertebrate class and killifishes are the most common fishes. Mullets, sea catfishes, and drums contribute roughly the same number of individuals, but each is only about one-fifth as abundant as killifishes. Shellfishes dominate the biomass as well as the individuals. Clams and stout tagelus are the only taxa, besides oysters, to contribute more than 5 percent of the biomass—both contribute about 7 percent. Fishes, as a class, contribute more biomass than any of the other vertebrate categories. Deer comprise only 1 percent of the biomass.

Early Units Combined Field-Picked and 40-Liter Sample Specimens: Vertebrates

A total of 23,641 vertebrate specimens, weighing 850.481 g, are present in the four early units. A minimum of 453 individuals are represented by 45 taxa (Table 4.5). The collection is dominated by sharks, rays, and bony fishes, which constitute 80 percent of the individuals and 34 percent of the biomass (Table 4.6). Deer, although comprising a small portion of individuals, contribute 42 percent of the vertebrate biomass. Turtles and snakes contribute 20 percent of the biomass, but a small portion of the individuals. After fishes, commensal taxa are the most abundant vertebrate category, contributing 13 percent of the individuals. Ten of the 45 taxa are present in all early units and an additional 13 taxa are present in 75 percent of the units.

Twenty-one taxa of cartilaginous and bony fishes from 13 families are present (Table 4.7). Of these families, sea catfishes, mullets, killifishes and drums contain 94 percent of the fish individuals and 88 percent of the fish biomass (biomass of fishes for which MNI was estimated). Drums are the dominant family, contributing 55 percent of fish individuals and 49 percent of the fish biomass. Killifishes are the second in abundance, contributing 24 percent of fish individuals. Sea catfishes, although ranking low in terms of fish individuals, rank second as a source of fish biomass (23 percent). Mullet individuals are more abundant than sea catfishes, but contribute only 12 percent of the fish biomass. Ten other taxa are present in the collection, but, combined, they represent only 6 percent of the individuals and 12 percent of the fish biomass.

A total of 36 deer specimens are present in the early units, representing minimally four individuals. All parts of the skeleton are present (Table 4.8; Figure 4.1). Foot elements dominate the collection; 40 percent of the deer specimens are from either the fore- or hind-foot. Axial and forequarter elements are also common (19 percent and 22 percent respectively). Evidence for epiphyseal fusion is limited (Table 4.9). Based on an unfused distal tibia, which is considered a middle-fusing specimen, and an unfused distal radius and proximal ulna, which are considered late-fusing specimens, there is at least one subadult in the collection. There is also a fused distal radius, suggesting both another individual and an adult animal. The age of the other two individuals is indeterminate.

Late Units Combined Field-Picked and 40-Liter Sample Specimens: Vertebrates

A total of 23,958 vertebrate specimens, weighing 693.919 g, are present in the eight late units. These specimens represent a minimum of 414 individuals and 48 taxa (Table 4.10). Sharks, rays, and bony fishes dominate the vertebrate collection, contributing 66 percent of the MNI and 37 percent of the biomass (Table 4.11). Deer contribute equally to the vertebrate biomass, 36 percent, but there are few deer individuals. Turtles contribute 20 percent of the biomass, though they comprise only 4 percent of the vertebrate individuals. Commensal taxa are abundant, constituting 23 percent of the individuals. Other wild mammals, birds, and snakes contribute minimally to the collection. Four of the 48 taxa are present in all late units and an additional 11 taxa are present in 75 percent of the units.

Twenty cartilaginous and bony fish taxa, representing 13 families, are present (Table 4.12). Of these families, sea catfishes, mullets, killifishes, and drums represent 93 percent of the fish individuals and 94 percent of the fish biomass. Killifishes are the most abundant, contributing 55 percent of the individuals. Though sea catfish individuals are relatively rare in the collection compared to other fish taxa, they contribute 46 percent of the fish biomass. Drums and mullets are more common than catfishes, but contribute less biomass, 23 percent and 15 percent of the biomass respectively. The nine taxa of other fishes contribute only 7 percent of the fish individuals and 6 percent of the biomass.

A total of 49 deer specimens are present in the late units, representing a minimum of seven individuals. All parts of the skeleton are present (Figure 4.2; Table 4.13). Head elements, teeth in particular, dominate, at 45 percent of the elements. Axial elements rank second, representing 27 percent of the total elements. Hindquarter elements (10 percent) are more common than forequarter (4 percent). Few identified elements offer evidence of epiphyseal fusion (4.14). The one unfused first phalanx epiphysis, an early-fusing element, suggests one deer individual was a juvenile. An unfused distal femur, a late-fusing element, suggests a subadult. The recently fused distal radius could be from that same individual or it may represent another, adult, individual. The age of the other five individuals is indeterminate.

Modifications

The most common modification in the early and late collections of invertebrates and vertebrates is burning; 1355 specimens in the early units are burned and 758 specimens from the late units are burned (Tables 4.15 and 4.16). Many fewer specimens are calcined: 50 specimens in the early units and 13 specimens in the late units. Both vertebrates and invertebrates are burned in both collections. The most commonly burned specimens in the early units are indeterminate fishes, turtles, mammals, and vertebrata. The most commonly burned specimens in the late units are oysters, decapods, and barnacles. Specimens from commensal vertebrates are less likely to be burned than are those from vertebrates that were likely food. The burned invertebrate commensals, mostly barnacles and marine gastropods, were probably once attached to burned oysters or other food bivalves.

The only other modifications in the early and late collections are cut marks on one deer element from the early collection, probably associated with butchering, and one worked clam valve fragment with a round hole in the collection from the late units. The clam valve fragment was likely being worked into a bead, but it was never finished.

Back Creek Village

A total of 14,881 vertebrate specimens, weighing 2049.296 g, are present in the 14 units from seven middens at Back Creek Village (Table 4.17). These specimens represent a minimum of 449 individuals from 46 taxa. Sharks, rays, and bony fishes dominate, contributing 74 percent of the individuals and 37 percent of the biomass (Table 4.18). Deer, however, contribute 43 percent of the biomass, though they contribute few individuals. Turtles contribute 14 percent of the biomass though only 5 percent of the individuals. Commensal taxa are abundant, contributing 12 percent of the individuals. Other wild mammals, birds, and snakes represent relativity small portions of the individuals and biomass. Seven of the 46 taxa are present in all Back Creek middens and an additional 11 taxa are present in 50 percent of the middens.

Twenty-five taxa of cartilaginous and bony fishes from 16 families are represented (Table 4.19). Of these families, sea catfishes, mullets, killifishes, and drums contribute 91 percent of the fish individuals and 98 percent of the fish biomass. Sea catfishes dominate the biomass, contributing 66 percent. Killifishes, however, are the most abundant taxa, representing 34 percent of individuals. Drums, similar in numbers to sea catfishes and mullets, represent 21 percent of the biomass. Fourteen other fish taxa are identified, but they comprise only 9 percent of the individuals and 2 percent of the fish biomass.

A total of 102 deer specimens were identified from the seven Back Creek Village middens, representing a minimum of nine individuals. All parts of the skeleton are present (Figure 4.3; Table 4.20). Head and foot elements are most common (25 percent and 40 percent respectively). Hindquarter (12 percent), forequarter (10 percent), and axial (14 percent) elements are about equally represented. Few elements have evidence of epiphyseal fusion (Table 4.21). An unfused distal radius and an unfused proximal tibia, both late-fusing elements, suggest one subadult individual. A fused proximal tibia suggests another individual was an adult. The remaining six individuals are indeterminate.

The most common modification is burning—621 specimens are burned (Table 4.22). Burning is evenly spread among fishes, turtles, and mammals. Only five specimens are calcined. Ten specimens, mostly mammals, have cut marks, though one fish and one turtle specimen are cut. One mammal specimen is rodent-gnawed. Three frog or toad specimens have pathologies.

9LI1637

A total of 11,145 vertebrate specimens, weighing 424.322 g, are present in the two units at 9LI1637 (Table 4.23). These specimens represent a minimum of 240 individuals from 35 taxa. The collection is dominated by sharks, rays, and bony fishes, which represent 91 percent of the individuals and 64 percent of the biomass (Table 4.24). Deer individuals are rare and only contribute 27 percent of the biomass. Other wild mammals, birds, snakes, turtles and commensal taxa contribute little to either individuals or biomass. Seventeen of the 35 taxa are present in both middens.

Twenty-two taxa of cartilaginous and bony fishes from 15 families are represented (Table 4.25). Of these families, sea catfishes, mullets, killifishes, and drums represent 93 percent of the fish individuals and 97 percent of the fish biomass. Sea catfishes contribute 53 percent of this biomass, though sea catfish individuals are relatively rare. Drums are the most abundant taxa, representing 37 percent of the individuals. Drums also contribute 25 percent of the biomass. Mullets and killifishes are common, representing 22 percent and 24 percent of the individuals respectively. Mullets contribute 15 percent of the biomass. The other 12 fish taxa only represent 7 percent of the fish individuals and 3 percent of the fish biomass.

Fifteen deer specimens were identified from the two units at 9LI1637, representing two individuals. All parts of the skeleton are present (Figure 4.4; Table 4.26). Hindquarter and hindfoot elements are most common (27 percent each). Forequarter and head elements both contribute 20 percent of the specimens. One unfused proximal calcaneus, a middle-fusing element, suggests at least one subadult individual (Table 4.27). The other individual died at an indeterminate age.

The most common modification in the 9LI1637 collection is burning—148 specimens, mostly turtles and fishes, are burned (Table 4.28). Only 14 specimens, mostly fishes, are calcined. One mammal specimen has cut marks.

Chapter Summary

The faunal collections from Meeting House Field, Back Creek Village, and 9LI1637 presented in this chapter, are dominated by estuarine resources. Oysters, mussels, stout tagelus, and hard clams are the most abundant shellfishes and sea catfishes, mullets, killifishes, and drums are the most common fishes. Deer are rare in all collections, but contribute over 25 percent of the biomass and, in two cases, over 40 percent. A wide range of other estuarine and terrestrial taxa supplement these resources, but are generally small contributors in terms of individuals and biomass. Commensal invertebrate and vertebrate taxa are abundant, representing over 10 percent of the individuals in all but one collection.

These results demonstrate that Mississippian subsistence was similar to that of the Late Archaic period (Colaninno 2010). The recovery techniques used in previous studies of Mississippian diet led to an erroneous emphasis on deer. The fine-screened and water-screened samples of vertebrates and invertebrates described in this chapter, however, show that shellfishes and small-bodied fin-fishes contribute the most individuals to the Mississippian diet and, in cases where shellfishes are quantified, contribute the most meat. The Irene-phase subsistence strategy will be elaborated on in Chapter 5, including a discussion of how these results relate to the foraging models proposed by Thomas (2008:75–197). In Chapter 6 the Meeting House Field locality collections will be used to address subsistence-settlement change from the early Mississippian to the Irene-phase. Evidence for resource depression and human impacts on estuarine animals is discussed in Chapter 7 using relative abundance, morphological, and incremental data. Chapter 8 presents the stable isotope results and the implications of these for land-use and environmental changes throughout the aboriginal period. The results of multiple analytical approaches to Mississippian-period collections recovered using fine- and water-screening methods suggest that change over time can be detected, though the same general subsistence strategy was utilized for thousands of years on the Georgia coast.

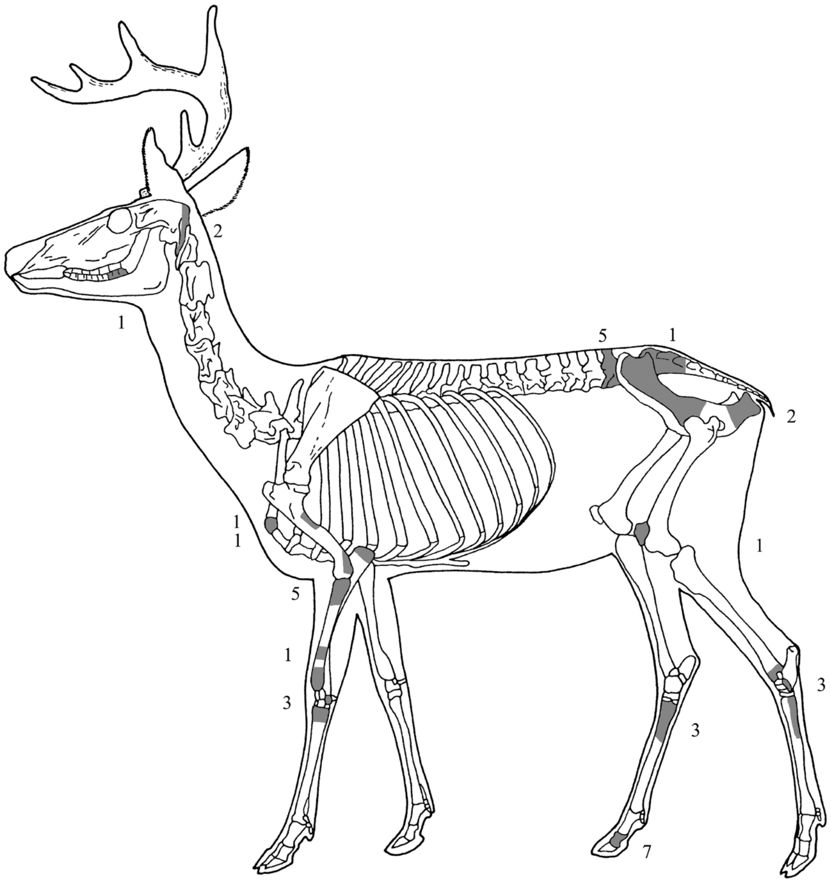


Figure 4.1: Deer elements from Meeting House Field early units (NISP=36)

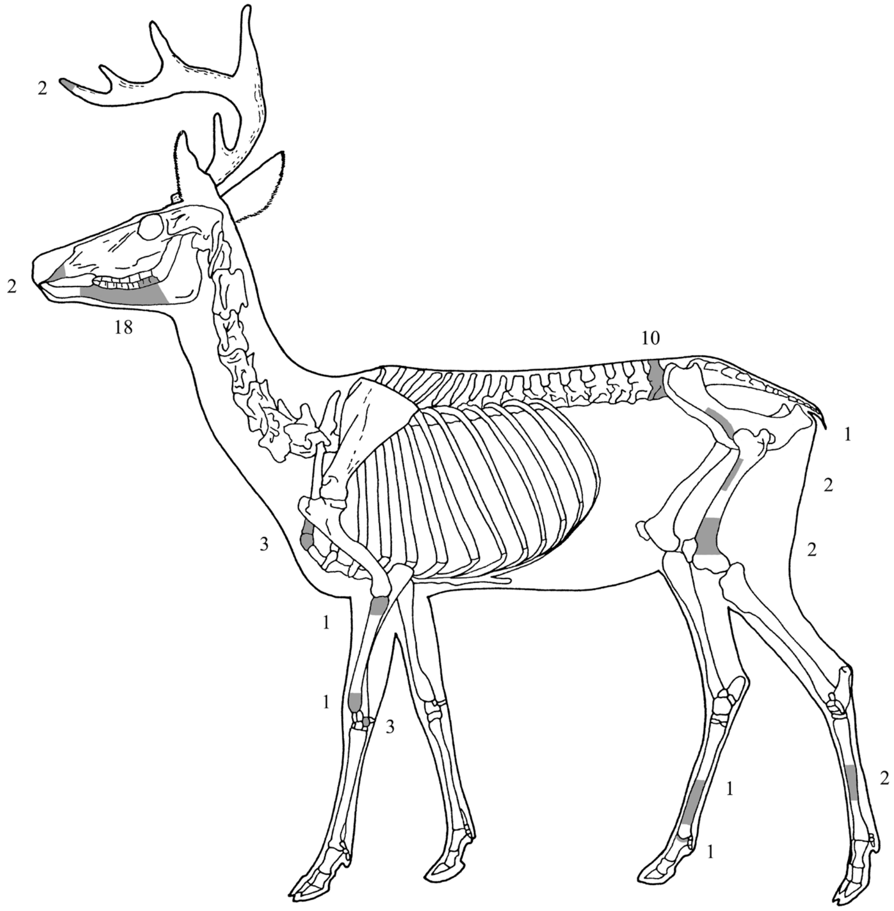


Figure 4.2: Deer elements from Meeting House Field late units (NISP=49)

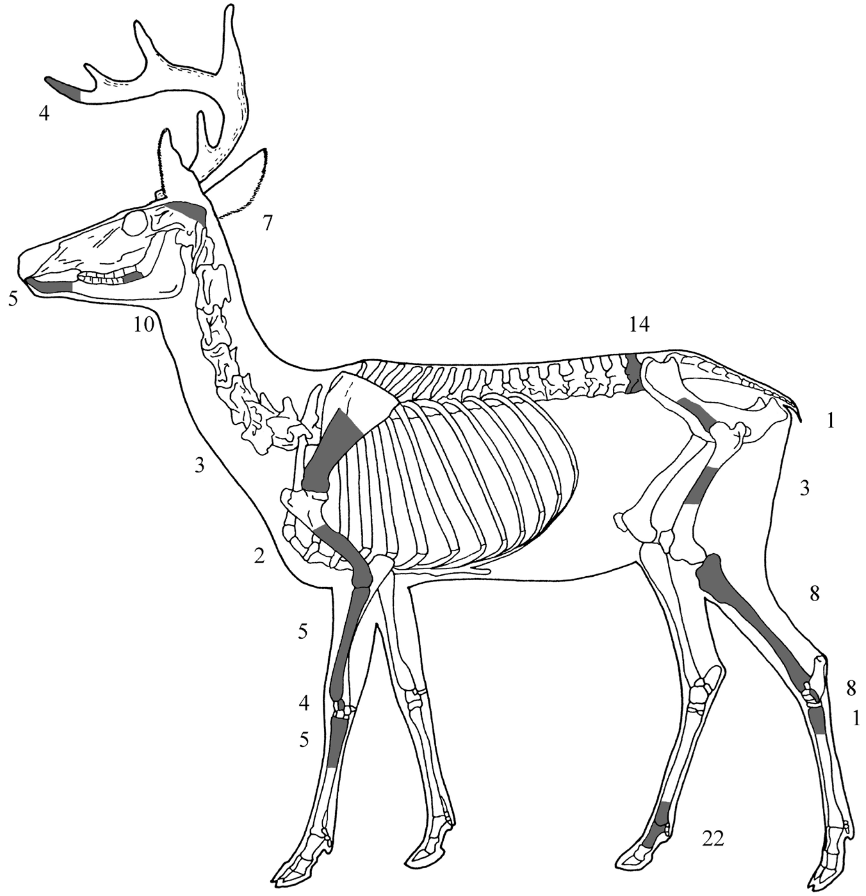


Figure 4.3: Deer elements from Back Creek Village (NISP=102)

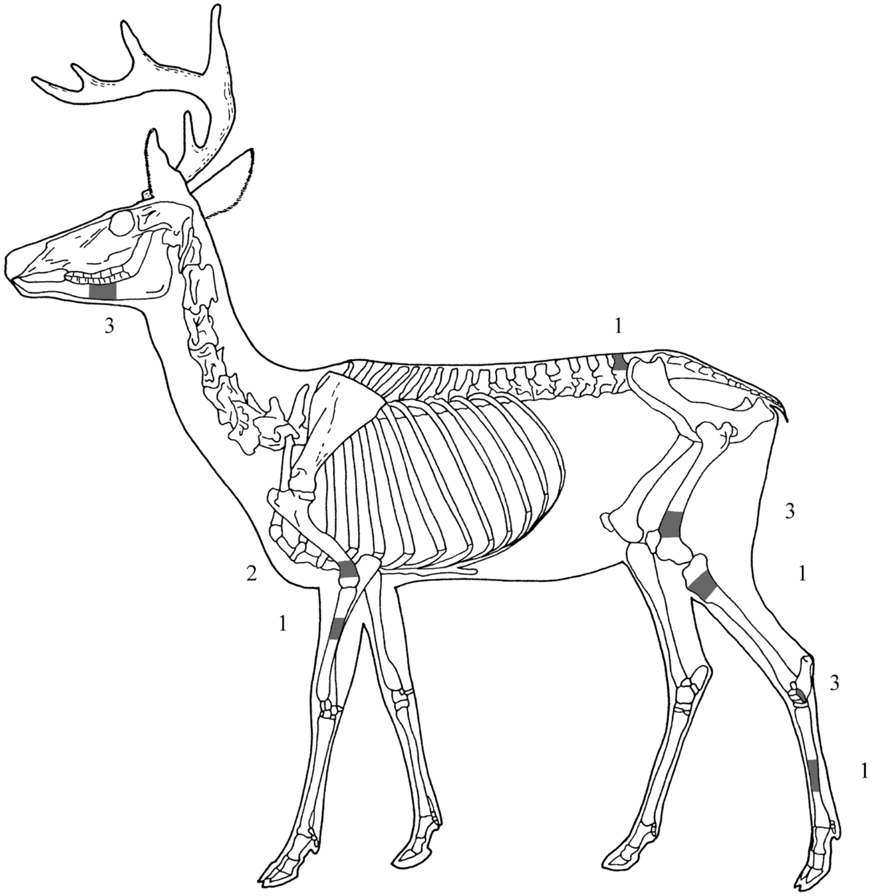


Figure 4.4: Deer elements from 9LI1637 (N=15)

Table 4.1

Meeting House Field Early Units: 40-Liter Sample Species List

Taxa		NISP	MNI	%	Weight, g	Biomass, g
Mollusca	Indeterminate molluscs	—	—	—	97806.25	—
Anadara ovalis	Blood ark	1	1	0.002	0.021	0.0007
Geukensia demissa	Ribbed mussel	3131	1599	3.652	8401.77	1069.25
Crassostrea virginica	Eastern oyster	68174	37197	84.954	199238.1	24451.07
Veneroida	Tellins and surf clams	41	21	0.048	0.584	1.04
Dinocardium robustum	Atlantic giant cockle	2	1	0.002	4.060	2.70
Tagelus plebeius	Stout tagelus	1968	1004	2.293	2433.038	4414.21
Mercenaria mercenaria	Northern quahog	2064	101	0.231	5588.378	1109.62
Gastropoda	Gastropods	391	391	0.893	3.302	2.25
Melampus bidentatus	Eastern melampus	18	18	0.041	0.451	0.34
Crepidula spp.	Slipper snails	6	6	0.014	0.227	0.20
Littorina irrorata	Marsh periwinkle	31	31	0.071	12.982	6.03
Polygyridae	Terrestrial snails	955	955	2.181	54.145	30.17
Polygyra spp.	Terrestrial snails	59	59	0.135	1.734	1.25
Succineidae	Amber snails	6	6	0.014	0.085	0.07
Euglandina spp.	Wolf snails	8	8	0.018	1.366	0.97
Zonitidae	Glass snails	241	241	0.550	1.389	1.05
Acteocina candei	Candé's barrel bubble	1	1	0.002	0.027	0.02
Prunum apicinum	Common Atlantic marginella	1	1	0.002	0.13	0.11
Melongenidae	Whelks	18	—	—	31.441	16.41
Busycon carica	Knobbed whelk	2	1	0.002	19.987	9.39
Busycoptycus canaliculatus	Channeled whelk	1	1	0.002	0.654	0.04
Urosalpinx spp.	Oyster drill	2	2	0.005	0.048	0.08
Nassarius obsoletus	Eastern mudsnail	110	110	0.251	40.152	17.18
Decapoda	Crabs	199	—	—	8.645	63.93
Brachyura	Crabs	9	—	—	0.635	6.73
Callinectes sapidus	Eastern blue crab	4	1	0.002	1.499	15.39
Menippe spp.	Stone crabs	6	2	0.005	0.602	7.65
Balanus spp.	Barnacle	11042	1785	4.077	856.804	—
Dasyatidae	Stingrays	2	1	0.002	0.02	4.35

Table 4.1—(*Continued*)

Taxa		NISP	MNI	%	Weight, g	Biomass, g
Actinopterygii	Indeterminate bony fishes	8368	—	—	37.466	697.84
Lepisosteus spp.	Gar	14	1	0.002	0.728	26.56
Anguilla rostrata	American eel	5	1	0.002	0.052	3.37
Clupeidae	Herrings and shads	20	1	0.002	0.094	5.37
Siluriformes	Catfishes	51	—	—	1.484	30.00
Ariidae	Sea catfish	40	11	0.025	11.21	202.37
Ariopsis felis	Hardhead catfish	2	(2)	—	0.162	3.65
Bagre marinus	Gafftopsail catfish	67	(3)	—	4.952	86.66
Opsanus spp.	Toadfish	2	2	0.005	0.013	1.13
Mugil spp.	Mullet	454	17	0.039	6.459	166.53
Belonidae	Needlefishes	2	2	0.005	0.058	3.48
Cyprinodontidae	Killifishes	405	55	0.126	2.667	81.90
Archosargus probatocephalus	Sheepshead	1	1	0.002	0.306	5.33
Lagodon rhomboides	Pinfish	1	1	0.002	0.911	0.25
Sciaenidae	Drums	68	—	—	1.45	71.60
Bairdiella chrysoura	Silver perch	120	33	0.075	3.735	134.46
Cynoscion spp.	Seatrout	41	12	0.027	3.306	121.82
Leiostomus xanthurus	Spot	76	17	0.039	0.898	49.12
Menticirrhus spp.	Kingfish	2	2	0.005	0.141	10.91
Micropogonias undulatus	Atlantic croaker	74	27	0.062	6.115	161.39
Pogonias cromis	Black drum	1	1	0.002	0.094	6.76
Stellifer lanceolatus	Star drum	3	1	0.002	0.114	7.80
Paralichthyidae	Flounders	7	4	0.009	0.673	21.04
Anura	Frogs and toads	29	6	0.014	0.279	—
Anaxyrus spp.	North American toads	7	(1)	—	0.174	—
Anaxyrus terrestris	Southern toad	3	(1)	—	0.033	—
Scaphiopus holbrookii	Eastern spadefoot toad	8	(1)	—	0.078	—
Rana spp.	Bullfrog	2	(1)	—	0.02	—
Caudata	Newts and salamanders	38	4	0.009	0.105	—
Testudines	Indeterminate turtles	792	—	—	70.04	644.94
Kinosternon spp.	Mud turtles	57	3	0.007	9.11	138.96

Table 4.1—(*Continued*)

Taxa		NISP	MNI	%	Weight, g	Biomass, g
Emydidae	Pond turtles	3	—	—	0.638	29.37
Malaclemys terrapin	Diamondback terrapin	17	2	0.005	11.123	199.55
Lacertilia	Indeterminate lizards	91	13	0.030	0.522	—
Serpentes	Indeterminate snakes	819	4	0.009	17.947	253.78
Aves	Indeterminate birds	3	—	—	0.028	0.84
Passeriformes	Perching birds	2	2	0.005	0.01	0.32
Mammalia	Indeterminate mammals	179	—	—	46.577	932.85
Didelphis virginiana	Opossum	1	1	0.002	0.147	4.68
Soricidae	Shrews	9	2	0.005	0.085	3.06
Scalopus aquaticus	Eastern mole	1	1	0.002	0.14	4.48
Sylvilagus sp.	Cottontail rabbit	1	1	0.002	0.231	7.04
Sigmondontinae	New World mice and rats	16	—	—	0.175	5.84
Ochrotomys nuttalli	Golden mouse	5	2	0.005	0.114	3.89
Peromyscus spp.	Deer mouse	4	2	0.005	0.066	2.28
Sciurus spp.	Squirrels	11	3	0.007	1.873	48.88
Procyon lotor	Raccoon	6	3	0.007	8.895	189.71
Odocoileus virginianus	White-tailed deer	19	3	0.007	109.495	1932.96
Vertebrata	Indeterminate vertebrates	—	—	—	50.914	—
Total		100440	43785	100	314920.4	37534.23

Table 4.2

Meeting House Field Early Units: 40-Liter Sample Summary Table

	NISP	MNI	%	Biomass, g	%
Ribbed mussels	3131	1599	3.652	1069.25	3.04
Eastern oysters	44307	24263	55.414	24335.52	69.22
Oyster spat	23867	12934	29.540	115.55	0.33
Stout tagelus	1968	1004	2.293	4414.21	12.56
Hard clams	2064	101	0.231	1109.62	3.16
Other bivalves	3	2	0.005	2.7007	0.01
Whelks	21	2	0.005	25.84	0.07
Other gastropods	161	161	0.368	23.68	0.07
Crabs	10	3	0.007	23.04	0.07
Commensal invert taxa*	12751	3474	7.934	37.08	0.11
Deer	19	3	0.007	1932.96	5.50
Other wild mammals	19	8	0.018	250.31	0.71
Birds	5	2	0.005	1.16	0.00
Snakes	819	4	0.009	253.78	0.72
Pond turtles	20	2	0.005	228.92	0.65
Mud turtles	57	3	0.007	138.96	0.40
Sea catfishes	109	11	0.025	292.68	0.83
Mullets	454	17	0.039	166.53	0.47
Killifishes	405	55	0.126	81.9	0.23
Drums	385	93	0.212	563.86	1.60
Other fishes	54	14	0.032	70.88	0.20
Commensal vertebrate taxa*	213	30	0.069	19.55	0.06
Total	90842	43785	100	35157.98	100

*Biomass not calculated for barnacles, frogs, toads, lizards and salamanders

Table 4.3

Meeting House Field Late Units: 40-Liter Sample Species List

Taxa		NISP	MNI	%	Weight, g	Biomass, g
Mollusca	Indeterminate molluscs	—	—	—	179025.710	—
Lampsilis dolabraeformis	Altamaha pocketbook	1	1	0.001	1.253	1.21
Arcidae	Arks	1	1	0.001	0.294	0.02
Geukensia demissa	Ribbed mussel	11798	1853	2.354	8072.601	1117.30
Crassostrea virginica	Eastern oyster	127700	66374	84.315	515113.137	62665.20
Veneroida	Tellins and surf clams	2	1	0.001	0.014	0.06
Cardiidae	Cockles	3	3	0.004	3.612	3.51
Tagelus plebeius	Stout tagelus	3101	1299	1.650	3138.814	5737.71
Mercenaria spp.	Quahogs	2140	112	0.142	6048.480	1267.34
Gastropoda	Gastropods	499	499	0.634	4.816	3.43
Melampus bidentatus	Eastern melampus	7	7	0.009	0.386	0.32
Crepidula spp.	Slipper shells	25	25	0.032	1.673	1.20
Littorina irrorata	Marsh periwinkle	80	80	0.102	37.573	14.91
Polygyridae	Terrestrial snails	4224	4224	5.366	158.557	85.52
Polygyra spp.	Terrestrial snails	255	255	0.324	8.819	5.56
Succineidae	Amber snails	91	91	0.116	1.069	0.77
Euglandina spp.	Wolf snails	13	13	0.017	4.269	2.86
Zonitidae	Glass snails	663	663	0.842	8.703	5.74
Melongenidae	Whelks	65	—	—	72.403	36.34
Busycon carica	Knobbed whelk	8	7	0.009	470.577	157.12
Eupleura caudata	Thick-lipped drill	1	1	0.001	0.173	0.14
Urosalpinx spp.	Oyster drill	8	8	0.010	8.583	5.40
Nassarius obsoletus	Eastern mudsnail	155	155	0.197	44.354	18.48
Olivella spp.	Olives	19	19	0.024	1.043	0.72
Decapoda	Crabs	1111	—	—	48.934	313.54
Callinectes sapidus	Eastern blue crab	83	10	0.013	26.970	173.96
Menippe spp.	Stone crabs	12	6	0.008	2.334	24.23
Balanus spp.	Barnacles	16530	2713	3.446	1486.781	—
Carcharhinidae	Sharks, rays, and skates	1	1	0.001	0.015	3.40
Actinopterygii	Indeterminate bony fishes	16147	—	—	50.394	971.40

Table 4.3— (*Continued*)

Taxa		NISP	MNI	%	Weight, g	Biomass, g
Lepisosteus spp.	Gar	6	2	0.003	0.232	9.95
Elops saurus	Ladyfish	1	1	0.001	0.008	0.67
Anguilla rostrata	American eel	2	1	0.001	0.031	1.94
Clupeidae	Herrings and shads	6	4	0.005	0.037	1.75
Siluriformes	Catfishes	145	—	—	5.718	112.78
Ariidae	Sea catfish	85	—	—	8.811	168.97
Ariopsis felis	Hardhead catfish	112	14	0.018	11.737	221.71
Bagre marinus	Gafftopsail catfish	43	6	0.008	5.966	113.03
Opsanus spp.	Toadfish	5	2	0.003	0.050	3.11
Mugil spp.	Mullet	526	24	0.030	6.502	194.44
Belonidae	Needlefish	1	1	0.001	0.053	2.97
Cyprinodontidae	Killifishes	779	116	0.147	4.941	159.31
Sciaenidae	Drums	7	—	—	0.215	12.47
Bairdiella chrysoura	Silver perch	17	8	0.010	0.323	25.96
Cynoscion spp.	Seatrout	44	12	0.015	6.727	259.85
Leiostomus xanthurus	Spot	4	4	0.005	0.018	2.80
Menticirrhus spp.	Kingfish	12	3	0.004	0.493	26.52
Micropogonias undulatus	Atlantic croaker	2	2	0.003	0.119	8.74
Stellifer lanceolatus	Star drum	3	1	0.001	0.042	3.73
Paralichthyidae	Flounders	3	1	0.001	0.252	8.00
Anura	Frogs and toads	59	—	—	0.702	—
Anaxyrus spp.	North American toads	27	9	0.011	0.076	—
Anaxyrus americanus	American toad	1	(1)	—	0.107	—
Anaxyrus terrestris	Southern toad	2	(2)	—	0.227	—
Scaphiopus holbrookii	Eastern spadefoot toad	35	10	0.013	0.291	—
Rana sp.	Bullfrog	1	1	0.001	0.035	—
Caudata	Newts and salamanders	8	3	0.004	0.024	—
Testudines	Indeterminate turtles	436	—	—	48.853	649.56
Emydidae	Pond turtles	5	—	—	0.611	28.40
Malaclemys terrapin	Diamondback terrapin	74	8	0.010	43.987	550.44
Lacertilia	Indeterminate lizards	78	19	0.024	0.554	—

Table 4.3— (*Continued*)

Taxa		NISP	MNI	%	Weight, g	Biomass, g
Anolis carolinensis	Green anole	14	(9)	—	0.103	—
Serpentes	Indeterminate snakes	163	7	0.009	2.295	31.53
Aves	Indeterminate birds	8	—	—	0.127	3.34
Anas sp.	Ducks	1	1	0.001	0.012	0.16
Passeriformes	Perching birds	6	4	0.005	0.088	2.53
Mammalia	Indeterminate mammals	289	—	—	40.585	881.93
Soricidae	Shrews	38	14	0.018	0.350	12.35
Scalopus aquaticus	Eastern mole	8	1	0.001	0.912	24.21
Vespertilionidae	Bats	1	1	0.001	0.010	0.42
Sylvilagus spp.	Cottontail rabbit	3	2	0.003	3.101	74.07
Sciurus spp.	Squirrels	2	2	0.003	0.043	1.66
Sigmodontinae	New World mice and rats	24	—	—	0.573	8.42
Neotoma floridana	Eastern woodrat	2	1	0.001	0.070	2.40
Ochrotomys nuttali	Golden mouse	2	1	0.001	0.046	1.65
Oryzomys palustris	Marsh rice rat	4	2	0.003	0.065	2.37
Peromyscus spp.	Deer mouse	3	2	0.003	0.086	3.08
Sigmodon hispidus	Hispid cotton rat	3	2	0.003	0.019	0.79
Lontra canadensis	River otter	1	1	0.001	0.645	17.73
Neovison vison	Mink	1	1	0.001	0.013	0.53
Odocoileus virginianus	White-tailed deer	19	6	0.008	38.314	773.19
Vertebrata	Indeterminate vertebrates	—	—	—	47.328	—
	Total	187864	78721	100	714124.868	77026.85

Table 4.4

Meeting House Field Late Units: 40-Liter Sample Summary Table

	NISP	MNI	%	Biomass, g	%
Ribbed mussels	11798	1853	2.35	1117.3	1.42
Eastern oysters	89010	46215	58.71	62484.18	79.22
Oyster spat	38690	20159	25.61	181.02	0.23
Stout tagelus	3101	1299	1.65	5737.71	7.27
Hard clams	2140	112	0.14	6048.48	7.67
Other bivalves	5	5	0.01	4.74	0.01
Whelks	73	7	0.01	193.46	0.25
Other gastropods	261	261	0.33	34.43	0.04
Crabs	95	16	0.02	198.19	0.25
Commensal invert taxa*	22311	8493	10.79	110.68	0.14
Deer	19	6	0.01	773.19	0.98
Other wild mammals	7	6	0.01	93.99	0.12
Birds	15	5	0.01	6.03	0.01
Snakes	163	7	0.01	31.53	0.04
Pond turtles	79	8	0.01	578.84	0.73
Mud turtles	—	—	—	—	—
Sea catfishes	240	20	0.03	503.71	0.64
Mullets	526	24	0.03	194.44	0.25
Killifishes	779	116	0.15	159.31	0.2
Drums	89	30	0.04	340.07	0.43
Other fishes	25	13	0.02	31.79	0.04
Commensal vertebrate taxa*	310	66	0.08	55.69	0.07
Total	169736	78721	100	78878.78	100

* Biomass not calculated for barnacles, frogs, toads, salamanders, newts, lizards

Table 4.5

Meeting House Field Early Units: Vertebrate Species List

Taxa		NISP	MNI	%	Weight, g	Biomass, g
Dasyatidae	Stingrays	6	1	0.2	0.086	15.26
Actinopterygii	Indeterminate bony fishes	16039	—	—	111.314	1691.3
Lepisosteus spp.	Gar	71	3	0.7	3.031	92.54
Anguilla rostrata	American eel	6	3	0.7	0.065	3.96
Clupeidae	Herrings and shads	92	3	0.7	0.476	18.47
Brevoortia spp.	Menhaden	2	(1)	—	0.019	1.32
Siluriformes	Catfishes	81	—	—	2.647	52.11
Ictalurus punctatus	Channel catfish	1	1	0.2	6.663	120.91
Ariidae	Sea catfish	135	18	4.0	22.672	416.46
Ariopsis felis	Hardhead catfish	15	(3)	—	0.733	15.56
Bagre marinus	Gafftopsail catfish	112	(5)	—	7.949	143.18
Opsanus spp.	Toadfish	3	3	0.7	0.03	1.78
Mugil spp.	Mullet	930	34	7.5	15.113	311.03
Belonidae	Needlefishes	4	2	0.4	0.08	3.73
Cyprinodontidae	Killifishes	668	88	19.4	4.757	120.54
Archosargus probatocephalus	Sheepshead	3	2	0.4	0.749	12.28
Lagodon rhomboides	Pinfish	1	1	0.2	0.011	0.25
Sciaenidae	Drums	81	—	—	1.946	89.17
Bairdiella chrysoura	Silver perch	243	68	15.0	8.138	240.23
Cynoscion spp.	Seatrout	75	22	4.9	7.463	222.24
Leiostomus xanthurus	Spot	156	33	7.3	1.85	82.43
Menticirrhus spp.	Kingfish	8	5	1.1	0.432	24.34
Micropogonias undulatus	Atlantic croaker	176	61	13.5	15.76	346.42
Pogonias cromis	Black drum	11	5	1.1	12.817	315.1
Stellifer lanceolatus	Star drum	11	4	0.9	0.388	20.04
Paralichthyidae	Flounders	21	4	0.9	1.129	33.9
Anura	Frogs and toads	54	—	—	0.485	—
Anaxyrus spp.	North American toads	13	5	1.1	0.308	—
Anaxyrus americanus	American toad	3	(1)	—	0.058	—
Anaxyrus terrestris	Southern toad	3	(1)	—	0.033	—

Table 4.5—(*Continued*)

Taxa		NISP	MNI	%	Weight, g	Biomass, g
Scaphiopus holbrookii	Eastern spadefoot toad	9	2	0.4	0.082	—
Hyla spp.	Tree frogs	3	2	0.4	0.016	—
Rana spp.	Bullfrog	3	2	0.4	0.025	—
Caudata	Newts and salamanders	67	4	0.9	0.182	—
Siren spp.	Sirens	3	2	0.4	0.074	—
Testudines	Indeterminate turtles	1698	—	—	177.208	1281.52
Chelydra serpentina	Snapping turtle	7	1	0.2	1.771	46.38
Kinosternon spp.	Mud turtles	116	5	1.1	22.727	256.38
Emydidae	Pond turtles	7	—	—	1.741	54.28
Malaclemys terrapin	Diamondback terrapin	52	4	0.9	51.248	562.74
Terrapene carolina	Box turtle	1	1	0.2	0.514	20.25
Lacertilia	Indeterminate lizards	214	27	6.0	1.66	—
Serpentes	Indeterminate snakes	1834	7	1.5	45.78	653.69
Aves	Indeterminate birds	3	—	—	0.028	0.84
Rallidae	Rails and coots	1	1	0.2	0.014	0.42
Passeriformes	Perching birds	3	2	0.4	0.029	0.85
cf. *Ammodramus maritimus*	Seaside sparrow	1	(1)	—	0.016	0.47
Mammalia	Indeterminate mammals	457	—	—	96.281	1814.61
Didelphis virginiana	Opossum	1	1	0.2	0.147	4.68
Soricidae	Shrews	17	4	0.9	0.222	7.53
Scalopus aquaticus	Eastern mole	6	2	0.4	0.269	8.45
Sylvilagus sp.	Cottontail rabbit	1	1	0.2	0.231	7.04
Sciurus spp.	Squirrels	16	4	0.9	2.219	58.62
Sigmondontinae	New World mice and rats	29	2	0.4	0.3	9.79
Ochrotomys nuttalli	Golden mouse	5	2	0.4	0.114	3.89
Peromyscus spp.	Deer mouse	4	2	0.4	0.066	2.28
Canis familiaris	Dog	7	1	0.2	0.714	19.42
Procyon lotor	Raccoon	16	4	0.9	11.17	233.2
Odocoileus virginianus	White-tailed deer	36	4	0.9	196.067	3298.46
Vertebrata	Indeterminate vertebrates	—	—	—	12.364	—
Total		23641	453	100	850.481	12740.34

Table 4.6

Meeting House Field Early Units: Vertebrate Summary Table

	NISP	MNI	%	Biomass, g	%
Deer	36	4	0.9	3298.46	41.7
Other wild mammals	34	10	2.2	303.54	3.8
Birds	8	3	0.7	2.58	0.0
Snakes	1834	7	1.5	653.69	8.3
Turtles	183	11	2.4	940.03	11.9
Sharks and fishes	2831	361	79.7	2651.14	33.6
Commensal taxa*	440	57	12.6	51.36	0.7
Total	5366	453	100	7900.80	100

*Biomass not calculated for frogs, toads, lizards and salamanders

Table 4.7

Meeting House Field Early Units: Fish Summary Table

	# of taxa	MNI	%	Biomass, g	%
Sea catfishes	2	18	5.0	575.2	21.7
Mullets	—	34	9.4	311.03	11.7
Killifishes	—	88	24.4	120.54	4.5
Drums	7	198	54.8	1339.95	50.5
Other fishes	10	23	6.4	304.4	11.5
Total	19	361	100.0	2651.12	100.0

Table 4.8

Meeting House Field Early Units: Deer Element Distribution

Skeletal Element	NISP	%
Head	3	8
Axial	7	19
Forequarter	8	22
Hindquarter	4	11
Forefoot	2	6
Hindfoot	2	6
Foot	10	28
Total	36	100

Table 4.9

Meeting House Field Early Units: Deer Epiphyseal Fusion Table

	Unfused	Fused	Total
Early Fusing:			
Humerus, distal	—	—	—
Scapula, distal	—	—	—
Radius, proximal	—	3	3
Acetabulum	—	1	1
Metapodials, proximal	—	2	2
1st/2nd Phalanx, proximal	—	6	6
Middle Fusing:			
Tibia, distal	1	—	1
Calcaneus, proximal	—	1	1
Metapodials, distal	—	—	—
Late Fusing			
Humerus, proximal	—	—	—
Radius, distal	1	1	2
Ulna, proximal	1	—	1
Ulna, distal	—	—	—
Femur, proximal	—	—	—
Femur, distal	—	—	—
Tibia, proximal	—	—	—
Total			17

Table 4.10

Meeting House Field Late Units: Vertebrate Species List

Taxa		NISP	MNI	%	Weight, g	Biomass, g
Carcharhinidae	Sharks, rays, and skates	2	2	0.5	0.048	10.10
Actinopterygii	Indeterminate bony fishes	18834	—	—	70.831	1296.40
Lepisosteus spp.	Gar	22	3	0.7	1.078	38.58
Elops saurus	Ladyfish	2	2	0.5	0.023	1.76
Anguilla rostrata	American eel	3	1	0.2	0.035	2.14
Clupeidae	Herrings and shads	6	4	1.0	0.037	38.55
Siluriformes	Catfishes	270	—	—	9.682	244.21
Ariidae	Sea catfish	140	—	—	15.516	367.44
Ariopsis felis	Hardhead catfish	198	17	4.1	25.069	320.17
Bagre marinus	Gafftopsail catfish	65	8	1.9	11.072	214.25
Opsanus spp.	Toadfish	7	2	0.5	0.064	3.00
Mugil spp.	Mullet	932	37	8.9	13.863	297.52
Belonidae	Needlefishes	3	2	0.5	0.078	3.69
Cyprinodontidae	Killifishes	993	149	36.0	7.086	194.38
Lepomis sp.	Sunfish	1	1	0.2	0.011	0.39
Sciaenidae	Drums	13	—	—	0.360	21.25
Bairdiella chrysoura	Silver perch	21	9	2.2	0.452	33.18
Cynoscion spp.	Seatrout	56	16	3.9	8.221	279.78
Leiostomus xanthurus	Spot	7	6	1.4	0.038	5.25
Menticirrhus spp.	Kingfish	9	4	1.0	0.523	29.43
Micropogonias undulatus	Atlantic croaker	5	4	1.0	0.293	20.66
Pogonias cromis	Black drum	5	1	0.2	1.667	56.79
Stellifer lanceolatus	Star drum	4	2	0.5	0.049	4.72
Paralichthyidae	Flounders	5	2	0.5	0.553	15.80
Anura	Frogs and toads	100	—	—	1.350	—
Anaxyrus spp.	North American toad	40	10	2.4	1.155	—
Anaxyrus americanus	American toad	7	2	0.5	0.407	—
Anaxyrus terrestris	Southern toad	3	3	0.7	0.323	—
Scaphiopus holbrookii	Eastern spadefoot toad	59	12	2.9	0.775	—
Rana sp.	Bullfrog	1	1	0.2	0.035	—

Table 4.10—(*Continued*)

Taxa		NISP	MNI	%	Weight, g	Biomass, g
Caudata	Salamanders	30	5	1.2	0.087	—
Testudines	Indeterminate turtles	739	3	0.7	120.515	1215.48
Kinosternon spp.	Mud turtles	2	2	0.5	0.429	21.52
Emydidae	Pond turtles	5	—	—	0.611	28.40
Malaclemys terrapin	Diamondback terrapin	166	10	2.4	109.074	1012.01
Lacertilia	Indeterminate lizards	150	36	8.7	1.037	—
Serpentes	Intederminate snakes	386	7	1.7	6.614	80.74
Aves	Indeterminate birds	10	—	—	0.185	4.85
Anas spp.	Ducks	2	1	0.2	0.357	8.00
Rallus sp.	Rails	1	1	0.2	0.232	5.40
Passeriformes	Perching birds	9	4	1.0	0.146	4.09
Corvus ossifragus	Fish crow	1	1	0.2	0.045	1.21
Turdus migratorius	American robin	1	1	0.2	0.103	2.58
Mammalia	Indeterminate mammals	466	—	—	99.113	1992.46
Soricidae	Shrews	51	14	3.4	0.464	15.67
Scalopus aquaticus	Eastern mole	11	1	0.2	1.111	28.92
Vespertilionidae	Bats	2	1	0.2	0.024	0.92
Sylvilagus spp.	Cottontail rabbit	11	2	0.5	5.855	141.24
Sciurus spp.	Squirrels	2	3	0.7	0.043	1.66
Sigmodontinae	New World mice and rats	27	—	—	0.272	9.48
Neotoma floridana	Eastern woodrat	2	1	0.2	0.070	2.40
Ochrotomys nuttalli	Golden mouse	3	2	0.5	0.097	3.45
Oryzomys palustris	Marsh rice rat	6	3	0.7	0.147	5.14
Peromyscus spp.	Deer mouse	5	3	0.7	0.151	5.33
Sigmodon hispidus	Hispid cotton rat	3	2	0.5	0.019	0.80
Procyon lotor	Raccoon	3	2	0.5	0.778	21.21
Lontra canadensis	River otter	1	1	0.2	0.645	17.73
Neovison vison	Mink	1	1	0.2	0.143	4.57
Odocoileus virginianus	White-tailed deer	49	7	1.7	96.462	1861.86
Vertebrata	Indeterminate vertebrates	—	—	—	78.396	—
Total		23958	414	100	693.919	9996.53

Table 4.11

Meeting House Field Late Units: Vertebrate Summary Table

	NISP	MNI	%	Biomass, g	%
Deer	49	7	1.7	1861.86	35.5
Other wild mammals	18	9	2.2	186.41	3.6
Birds	24	8	1.9	26.13	0.5
Snakes	386	7	1.7	80.74	1.5
Turtles	173	15	3.6	1061.93	20.2
Sharks and fishes	2499	272	65.7	1958.83	37.3
Commensal taxa*	500	96	23.2	72.11	1.4
Total	3649	414	100	5248.007	100

*Biomass not calculated for frogs, toads, lizards and salamanders

Table 4.12

Meeting House Field Late Units: Fish Summary Table

	# of taxa	MNI	%	Biomass, g	%
Sea catfishes	2	25	9.2	901.86	46.0
Mullets	—	37	13.6	297.52	15.2
Killifishes	—	149	54.8	194.38	9.9
Drums	7	42	15.4	451.06	23.0
Other fishes	9	19	7.0	114.01	5.8
Total	18	272		1958.83	

Table 4.13

Meeting House Field Late Units: Deer Element Distribution

Skeletal Element	NISP	%
Head	22	45
Axial	13	27
Forequarter	2	4
Hindquarter	5	10
Forefoot	3	6
Hindfoot	2	4
Foot	2	4
Total	49	100

Table 4.14

Meeting House Field Late Units: Deer Epiphyseal Fusion Table

	Unfused	Fused	Total
Early Fusing:			
Humerus, distal	—	—	—
Scapula, distal	—	—	—
Radius, proximal	—	1	1
Acetabulum	—	—	—
Metapodials, proximal	—	—	—
1st/2nd Phalanx, proximal	1	—	1
Middle Fusing:			
Tibia, distal	—	—	—
Calcaneus, proximal	—	—	—
Metapodials, distal	—	—	—
Late Fusing			
Humerus, proximal	—		—
Radius, distal	—	1	1
Ulna, proximal	—	—	—
Ulna, distal	—	—	—
Femur, proximal	—	—	—
Femur, distal	1	—	1
Tibia, proximal	—	—	—
Total			4

Table 4.15

Meeting House Field Early Units: Modifications

Taxon	Burned	Calcined	Cut
Indeterminate bony fishes	235	2	—
Gar	1	—	—
Eels	2	—	—
Catfishes	14	1	—
Sea catfishes	17	—	—
Hardhead catfish	2	2	—
Gafftopsail catfish	17	—	—
Mullet	52	—	—
Killifishes	4	—	—
Drums	3	—	—
Silver perch	10	—	—
Seatrout	13	—	—
Spot	8	—	—
Atlantic croaker	9	—	—
Star drum	1	—	—
Flounder	5	1	—
North American toads	2	—	—
Indeterminate turtles	398	—	—
Mud turtles	2	—	—
Pond turtles	2	—	—
Diamondback terrapin	5	—	—
Indeterminate snakes	1	—	—
Indeterminate mammals	100	20	—
Squirrel	5	—	—
Deer	4	2	1
Indeterminate vertebrates	106	22	—
Mussel	53	—	—
Oyster	54	—	—
Stout tagelus	12	—	—
Clams	58	—	—

Table 4.15—(*Continued*)

Taxon	Burned	Calcined	Cut
Gastropods	2	—	—
Whelks	11	—	—
Eastern mudsnail	23	—	—
Crabs	39	—	—
Stone crab	1	—	—
Barnacles	84	—	—
Total	1355	50	1

Table 4.16

Meeting House Field Late Units: Modifications

Taxon	Burned	Calcined	Worked
Sharks, rays, and skates	1	—	—
Indeterminate bony fishes	28	1	—
Catfishes	17	1	—
Hardhead catfish	7	4	—
Gafftopsail catfish	2	—	—
Mullet	9	—	—
Killifishes	1	—	—
Drums	1	—	—
Flounder	4	—	—
Frogs and toads	2	—	—
Indeterminate turtles	78	1	—
Diamondback terrapin	3	—	—
Indeterminates lizards	2	—	—
Indeterminate snakes	2	—	—
Indeterminate mammals	38	3	—
Mole	1	—	—
Deer	2	—	—
Indeterminate vertebrates	37	3	—
Mussel	25	—	—
Oyster	160	—	—
Stout tagelus	8	—	—
Clams	27	—	1
Gastropods	2	—	—
Periwinkle	1	—	—
Whelks	1	—	—
Oyster drill	1	—	—
Eastern mudsnail	2	—	—
Crabs	166	—	—
Blue crab	4	—	—
Stone crab	1	—	—

Table 4.16—(*Continued*)

Taxon	Burned	Calcined	Worked
Barnacles	125	—	—
Total	758	13	1

Table 4.17

Back Creek Village: Species List

Taxa		NISP	MNI	%	Weight, g	Biomass, g
Actinopterygii	Indeterminate bony fishes	5572	—	—	82.63	1054.06
Lepisosteus spp.	Gars	19	3	0.7	0.816	27.74
Elops saurus	Ladyfish	12	3	0.7	0.097	4.78
Anguilla rostrata	American eel	6	2	0.4	0.101	4.94
Clupeidae	Herrings and shads	62	6	1.3	0.285	11.20
Cyprinidae	Carp and minnows	1	1	0.2	0.014	1.04
Siluriformes	Catfish	954	—	—	31.368	526.81
Ameiurus cf. *natalis*	Yellow bullhead	1	1	0.2	0.039	0.92
Ariidae	Sea catfishes	484	6	1.3	97.534	1547.70
Ariopsis felis	Hardhead catfish	654	36	8.0	91.677	1459.27
Bagre marinus	Gafftopsail catfish	232	12	2.7	25.376	430.72
Opsanus sp.	Toadfish	1	1	0.2	0.023	1.53
Mugil spp.	Mullets	2043	73	16.3	31.627	462.40
Belonidae	Needlefishes	1	1	0.2	0.013	0.98
Cyprinodontidae	Killifishes	883	115	25.6	6.484	132.23
Pomatomus saltatrix	Bluefish	1	1	0.2	0.021	1.12
Carangidae	Jacks	1	1	0.2	0.033	1.93
Orthopristis chrysoptera	Pigfish	1	1	0.2	0.021	1.01
Archosaurgus probatocephalus	Sheepshead	4	1	0.2	0.618	10.18
Lagodon rhomboides	Pinfish	2	2	0.4	0.011	0.25
Sciaenidae	Drums	127	—	—	4.942	126.92
Bairdiella/Stellifer	Small drums	25	—	—	0.265	14.56
Bairdiella chrysoura	Silver perch	54	15	3.3	2.154	68.65
Cynoscion spp.	Seatrout	281	23	5.1	31.068	494.70
Leiostomus xanthurus	Spot	30	8	1.8	0.315	16.55
Menticirrhus spp.	Kingfish	43	4	0.9	2.092	67.18
Micropogonias undulatus	Atlantic croaker	10	4	0.9	1.805	60.23
Pogonias cromis	Black drum	16	3	0.7	8.492	189.45
Sciaenops ocellatus	Red drum	7	4	0.9	2.158	68.74
Paralichthyidae	Flounders	25	7	1.6	1.609	40.16

Table 4.17—(*Continued*)

Taxa		NISP	MNI	%	Weight, g	Biomass, g
Anura	Frogs and toads	154	—	—	3.273	—
Anaxyrus spp.	North American toads	65	12	2.7	1.25	—
Scaphiopus holbrookii	Eastern spadefoot toad	68	14	3.1	2.266	—
Rana spp.	Bullfrog	2	2	0.4	0.043	—
Caudata	Newts and salamanders	19	3	0.7	0.171	—
Testudines	Indeterminate turtles	1228	—	—	224.24	1188.46
Kinosternidae	Mud and musk turtles	29	6	1.3	4.845	91.02
Emydidae	Pond turtles	73	—	—	63.937	512.70
Malaclemys terrapin	Diamondback terrapin	285	15	3.3	282.279	1386.64
Lacertilia	Indeterminate lizards	85	12	2.7	0.984	—
Serpentes	Indeterminate snakes	424	2	0.4	9.63	135.98
Colubridae	Non-venomous snakes	62	3	0.7	10.692	151.13
Nerodia spp.	Water snakes	16	2	0.4	2.289	31.86
Viperidae	Venomous snakes	1	1	0.2	0.012	0.16
Aves	Indeterminate birds	34	2	0.4	2.898	53.77
Rallidae	Coots and rails	4	2	0.4	0.492	10.71
Zenaida macroura	Mourning dove	1	1	0.2	0.052	1.39
Passeriformes	Perching birds	8	3	0.7	0.144	3.50
Mammalia	Indeterminate mammals	566	—	—	262.332	3953.49
Didelphis virginiana	Opossum	2	2	0.4	0.402	11.58
Soricidae	Shrews	11	2	0.4	0.261	7.85
Scalopus aquaticus	Eastern mole	27	3	0.7	1.534	38.66
Sylvilagus spp.	Cottontail rabbit	13	7	1.6	5.695	125.88
Sciurus spp.	Squirrels	4	2	0.4	1.21	31.23
Sigmodontinae	New World mice and rats	15	2	0.4	0.202	6.23
Peromyscus spp.	Deer mice	20	2	0.4	0.377	10.93
Sigmodon hispidus	Hispid cotton rat	2	2	0.4	0.055	1.93
Procyon lotor	Raccoon	9	4	0.9	7.052	152.58
Odocoileus virginianus	White-tailed deer	102	9	2.0	424.214	6093.13
Vertebrata	Indeterminate vertebrates	—	—	—	312.777	—
Total		14881	449	100.0	2049.296	20828.76

Table 4.18

Back Creek Village: Summary Table

	NISP	MNI	%	Biomass, g	%
Deer	102	9	2.0	6093.13	43.2
Other wild mammals	28	15	3.3	321.27	2.3
Birds	47	8	1.8	69.37	0.5
Snakes	503	8	1.8	319.13	2.3
Turtles	387	21	4.7	1990.36	14.1
Sharks and fishes	5026	334	74.4	5247.71	37.2
Commensal taxa*	468	54	12.0	65.60	0.5
Total	6561	449	100	14106.57	100

*Biomass not calculated for frogs, toads, lizards and salamanders

Table 4.19

Back Creek Village: Fish Summary Table

	# of taxa	MNI	%	Biomass, g	%
Sea catfishes	2	54	16.2	3437.69	65.5
Mullets	—	73	21.9	462.4	8.8
Killifishes	—	115	34.4	132.23	2.5
Drums	7	61	18.3	1106.98	21.1
Other fishes	14	31	9.3	108.41	2.1
Total	23	334	100.0	5247.71	100.0

Table 4.20

Back Creek Village: Deer Element Distribution

Skeletal Element	NISP	%
Head	26	25
Axial	14	14
Forequarter	10	10
Hindquarter	12	12
Forefoot	9	9
Hindfoot	9	9
Foot	22	22
Total	102	100

Table 4.21

Back Creek Village: Deer Epiphyseal Fusion Table

	Unfused	Fused	Total
Early Fusing:			
Humerus, distal	—	—	—
Scapula, distal	—	1	1
Radius, proximal	—	3	3
Acetabulum	—	2	2
Metapodials, proximal	—	4	4
1st/2nd Phalanx, proximal	—	6	6
Middle Fusing:			
Tibia, distal	—	2	2
Calcaneus, proximal	—	—	—
Metapodials, distal	—	—	—
Late Fusing			
Humerus, proximal	—	—	—
Radius, distal	1	—	1
Ulna, proximal	—	—	—
Ulna, distal	—	—	—
Femur, proximal	—	—	—
Femur, distal	—	—	—
Tibia, proximal	1	1	2
Total			21

Table 4.22

Back Creek Village: Modifications

Taxon	Burned	Calcined	Cut	Rodent Gnawed	Pathology
Indeterminate bony fishes	70	1	1	—	—
Herrings and shads	8	—	—	—	—
Catfishes	24	—	—	—	—
Sea catfishes	19	—	—	—	—
Hardhead catfish	22	1	—	—	—
Gafftopsail catfish	10	—	—	—	—
Mullet	41	—	—	—	—
Killifishes	2	—	—	—	—
Bluefish	1	—	—	—	—
Drums	1	—	—	—	—
Silver perch	2	—	—	—	—
Seatrout	5	—	—	—	—
Spot	1	—	—	—	—
Atlantic croaker	1	—	—	—	—
Red drum	11	—	—	—	—
Frogs and toads	—	—	—	—	3
Indeterminate turtles	200	1	—	—	—
Mud turtles	1	—	—	—	—
Pond turtles	2	—	—	—	—
Diamondback terrapin	36	—	—	—	—
Indeterminate lizards	5	—	—	—	—
Indeterminate snakes	13	—	—	—	—
Non-venemous snake	26	—	—	—	—
Water snake	3	—	—	—	—
Indeterminate mammals	68	1	—	1	—
Rabbit	1	—	1	—	—
Raccoon	1	—	—	—	—
Deer	11	—	7	—	—
Indeterminate vertebrates	36	1	1	—	—
Total	621	5	10	1	3

Table 4.23

9Li1637: Species List

Taxa		NISP	MNI	%	Weight, g	Biomass, g
Dasyatidae	Stingrays	1	1	0.4	0.027	5.64
Actinopterygii	Indeterminate bony fishes	7507	—	—	70.363	1006.98
Elops saurus	Ladyfish	1	1	0.4	0.01	0.79
Clupeidae	Herrings and shads	20	1	0.4	0.105	5.09
Siluriformes	Catfish	429	—	—	17.934	320.53
Ariidae	Sea catfishes	129	—	—	12.366	225.23
Ariopsis felis	Hardhead catfish	280	16	6.7	36.661	615.96
Bagre marinus	Gafftopsail catfish	33	5	2.1	17.727	315.35
Mugil spp.	Mullets	1177	48	20.0	18.454	321.55
Belonidae	Needlefishes	5	1	0.4	0.042	2.47
Cyprinodontidae	Killifishes	436	53	22.1	3.703	92.57
Centropristis sp.	Sea bass	1	1	0.4	0.011	0.14
Centrachidae	Sunfishes	1	1	0.4	0.039	1.14
Pomatomus saltatrix	Bluefish	2	1	0.4	0.05	1.40
Carangidae	Jacks	1	1	0.4	0.018	1.13
Archosaurgus probatocephalus	Sheepshead	17	3	1.3	2.157	32.35
Lagodon rhomboides	Pinfish	4	1	0.4	0.05	1.01
Sciaenidae	Drums	97	—	—	2.996	92.23
Bairdiella chrysoura	Silver perch	183	28	11.7	5.061	140.32
Cynoscion spp.	Seatrout	27	4	1.7	3.046	88.71
Leiostomus xanthurus	Spot	158	32	13.3	1.674	60.37
Menticirrhus spp.	Kingfish	15	3	1.3	0.61	26.99
Micropogonias undulatus	Atlantic croaker	20	6	2.5	1.612	61.07
Stellifer lanceolatus	Star drum	107	8	3.3	2.253	82.18
Peprilus spp.	Harvest and butter fishes	9	1	0.4	0.042	1.98
Paralichthyidae	Flounders	12	2	0.8	0.465	13.99
Anura	Frogs and toads	7	1	0.4	0.034	—
Anaxyrus spp.	North American toads	1	1	0.4	0.007	—
Testudines	Indeterminate turtles	256	—	—	61.663	585.30
Kinosternon spp.	Mud turtles	3	2	0.8	0.542	25.79

Table 4.23—(*Continued*)

Taxa		NISP	MNI	%	Weight, g	Biomass, g
Sternotherus sp.	Musk turtle	1	1	0.4	0.179	9.99
Malaclemys terrapin	Diamondback terrapin	21	2	0.8	11.652	195.00
Lacertilia	Indeterminate lizards	14	4	1.7	0.114	—
Serpentes	Indeterminate snakes	13	2	0.8	0.176	2.38
Aves	Indeterminate birds	15	1	0.4	2.255	45.39
Zenaida macroura	Mourning dove	1	1	0.4	0.028	0.79
Agelaius phoeniceus	Redwinged blackbird	1	1	0.4	0.032	0.89
Mammalia	Indeterminate mammals	117	—	—	55.514	1044.81
Sylvilagus sp.	Cottontail rabbit	1	1	0.4	0.087	2.92
Neotoma floridana	Eastern woodrat	2	1	0.4	0.43	12.31
Procyon lotor	Raccoon	4	1	0.4	0.491	13.87
Lynx rufus	Bobcat	1	1	0.4	0.085	2.86
Odocoileus virginianus	White-tailed deer	15	2	0.8	48.956	919.53
Vertebrata	Indeterminate vertebrates	—	—	—	44.601	—
Total		11145	240	100	424.322	6379.00

Table 4.24

9Li1637: Summary Table

	NISP	MNI	%	Biomass, g	%
Deer	15	2	0.8	919.53	26.9
Other wild mammals	6	3	1.3	19.65	0.6
Birds	17	3	1.3	47.07	1.4
Snakes	13	2	0.8	2.38	0.1
Turtles	25	5	2.1	230.77	6.7
Sharks and fishes	3165	218	90.8	2189.67	64.0
Commensal taxa*	24	7	2.9	12.31	0.4
Total	3265	240	100.0	3421.38	100.0

*Biomass not calculated for frogs, toads, lizards and salamanders

Table 4.25

9Li1637: Fish Summary Table

	# of taxa	MNI	%	Biomass, g	%
Sea catfishes	2	21	9.6	1156.55	52.8
Mullets	—	48	22.0	321.55	14.7
Killifishes	—	53	24.3	92.57	4.2
Drums	6	81	37.2	551.86	25.2
Other fishes	12	15	6.9	67.14	3.1
Total	20	218	100.0	2189.67	100.0

Table 4.26

9Li1637: Deer Element Distribution

Skeletal Element	NISP	%
Head	3	20
Axial	1	7
Forequarter	3	20
Hindquarter	4	27
Forefoot	—	—
Hindfoot	4	27
Foot	—	—
Total	15	100

Table 4.27

9Li1637: Deer Epiphyseal Fusion Table

	Unfused	Fused	Total
Early Fusing:			
Humerus, distal	—	—	—
Scapula, distal	—	—	—
Radius, proximal	—	—	—
Acetabulum	—	—	—
Metapodials, proximal	—	—	—
1st/2nd Phalanx, proximal	—	—	—
Middle Fusing:			
Tibia, distal	—	—	—
Calcaneus, proximal	1	—	1
Metapodials, distal	—	—	—
Late Fusing			
Humerus, proximal	—	—	—
Radius, distal	—	—	—
Ulna, proximal	—	—	—
Ulna, distal	—	—	—
Femur, proximal	—	—	—
Femur, distal	—	—	—
Tibia, proximal	—	—	—
Total			1

Table 4.28

9Li1637: Modifications

Taxon	Burned	Calcined	Cut
Indeterminate bony fishes	25	5	—
Herrings and shads	—	—	—
Catfishes	14	1	—
Sea catfishes	7	2	—
Hardhead catfish	6	3	—
Gafftopsail catfish	4	—	—
Mullet	6	—	—
Drums	1	—	—
Silver perch	1	—	—
Seatrout	2	—	—
Atlantic croaker	1	—	—
Indeterminate turtles	51	—	—
Diamondback terrapin	1	—	—
Indeterminate snakes	1	—	—
Indeterminate mammals	8	1	1
Indeterminate vertebrates	20	2	—
Total	148	14	1

CHAPTER 5:

IRENE-PHASE SUBSISTENCE

Subsistence strategies are among the most important ways in which humans interact with their environment. Procuring adequate nutrition allows individuals to invest energy in social and political endeavors. Zooarchaeology, as the study of animal remains from archaeological sites, is the methodology for identifying the animal foods people targeted (subsistence strategy) and those they ate (diet) and the framework for interpreting this behavior in time and space. Previous zooarchaeological studies of the Mississippian period on St. Catherines Island have lacked large, fine-screened samples of vertebrates and lacked samples of invertebrates altogether. This has hampered understanding of Mississippian coastal subsistence patterns, and led researchers to emphasize the importance of deer. This chapter addresses the first research objective of this volume—to characterize Irene-phase subsistence using fine-grained recovery methods. Use of such methods at two Late Archaic sites suggested that small, mass-captured fishes were a primary focus of subsistence, an interpretation not reached when coarse-grained methods were used on these materials (Bergh 2007; Colaninno 2010; Reitz 2008). The results of zooarchaeological analysis of the vertebrate and invertebrate materials from the late Meeting House Field locality, as well as the vertebrate materials from Back Creek Village and 9LI1637 provide the basis for a description of Irene-phase subsistence patterns, following Jochim (1976). These same data also are used to address the applicability of Thomas' (2008:75–197) diet-breadth model to this time period. Instead of the deer, sea turtle, or large fishes predicted to be the focal point of Irene strategies by the model, it is clear from this study that subsistence strategies emphasized shellfish collection and mass capture of small estuarine fishes.

Subsistence

Subsistence describes the foods people harvest and consume and the methods they use to acquire the foods (Reitz and Wing 2008:27–28). Generally a wide variety of potentially edible plants and animals are available in the environment. Subsistence strategies are the result of the choices individuals and groups of individuals make about which of these to target and how to procure them (Jochim 1976:2–10). Choices are based on tradeoffs among ecological and socio-political variables. Ecological variables include the distribution and abundance of food sources across space on an intra- and inter-annual basis, animal behavior as it influences the ease with which a species, or even a specific age or sex cohort of a species, can be obtained, and sensitivity of resources to human predation and environmental variability (Reitz and Wing 2008:257–266). Socio-political variables include cultural value placed on capture and use (or avoidance) of food species, diverse diets, taste, and fashion; preferred hunting, gathering, fishing, and residential locations, movement, and aggregations of people and settlements; responsibilities of households to produce for communal purposes; and differential access or preference based on gender and status, among many others (Jochim 1976:18–22). Characterization of Irene-phase subsistence must take these ecological and socio-political factors into account.

Ecological Setting

In Georgia Bight estuaries, variation in resource availability occurs on many scales, including daily, monthly, seasonal, and inter-annual scales (Dame et al. 2000). Tides change at least twice a day. Receding tides expose intertidal oyster reefs, clam and mussel beds, mud flats, and marsh grasses. Rising tides flood tidal creeks, mix sediments, and bring an influx of marine animals, nutrients, and plant material. This regenerates the resources available to estuarine residents. The timing and amplitude of tides change on a monthly cycle, affecting the time of day and location where specific resources are available. Productivity in the estuary fluctuates on a seasonal basis. Productivity may be greater in the fall due to an influx of organic materials from rivers draining the mainland interior during and after the rainy season and the die-off of marsh grasses which are broken down by bacteria into forms useable by filter feeders and zooplankton (Dame et al. 2000). On an inter-annual basis, El Niño/Southern Oscillation (ENSO) cycles influence seasonal temperatures and the amount of rainfall (Dame et al. 2000). The North Atlantic Oscillation (NAO), although more influential on the weather in Europe, also can affect the weather on the Atlantic seaboard of the United States (Dunbar 2000:64–65). When the NAO is positive, there can be warmer and drier winters on the east coast of North America, and when the NAO is negative, the opposite can occur. The interaction of ENSO and NAO cycles can alter the usual weather patterns associated with each. When the Azores High, the position of which is controlled by NAO strength, occupies a more northerly location, Atlantic hurricanes track up the east coast instead of entering the Gulf of Mexico (Elsner et al. 2000). Because temperature and rainfall affect the influx of fresh water and sea surface temperatures, these weather patterns influence the distribution of resources within the estuary. Large and/or intense storms, such as hurricanes, can move large amounts of sediment, changing the physical structure of estuaries and islands as well as the distribution of animals and plants.

The abundance, distribution, and biomass of fishes, molluscs, and crustaceans vary on all these scales. Individual species, and even age cohorts of species, have their own tolerances and preferences for salinity, temperature, substrate, water depth, current velocity, and food types, among other conditions (Wootton 1998:122–126). Different combinations of these conditions create habitats in which animals prefer to reside or forage. Species can generally utilize more than one habitat, though some habitats may be more favorable for individual or population growth. These conditions are influenced by the physical and climatic forces described above, and are therefore variable. For example, some animals cannot live in the intertidal zone, so if tidal ranges are lower, the location of subtidal and intertidal animals will change, and in seasons or years with greater precipitation amounts, the salinity gradients within the estuary will change, as will the location of animals that prefer certain salinity levels.

Life histories of many animal species involve behavioral and physiological events that occur in response to seasonal changes in temperature, vegetation, sunlight, and rainfall, among other factors (Monks 1981). Some species follow seasonal rounds, occupying estuarine waters only during certain seasons. Sea turtles, for example, spend most of the year off-shore, but females lay their eggs on the beaches during the summer months (Bishop and Meyer 2011; Bishop et al. 2011). Sharks, too, tend to stay off-shore except for the warmer months when they enter estuaries and near-shore waters (Dahlberg 1972). Some migratory birds stop along the Georgia coast in the spring and fall to rest and refuel (Johnson et al. 1974:59–61). Reproductive cycles of many species are driven by seasonal events, and these affect the condition, location, and abundance of populations. White-tailed deer on the Georgia coast breed between October and February, and, after a roughly 200-day gestation period, young are born from April to August (Warren et al. 1990:57). Fishes and molluscs have specific spawning seasons, which vary by species. Mollusc growth is mostly dependent on environmental conditions, such as temperature and salinity, and these often change on a seasonal basis (Andrus and Crowe 2008; Jones and Quitmyer 1980; Quitmyer and Jones 2012). These are general patterns; there will always be individual variation within a population.

By affecting the environmental conditions of habitats and seasonal patterns of fluctuations in these conditions, climate change and major storm events have serious impacts on estuarine and marines systems (e.g., Atkinson et al. 2004; Drinkwater 2005; Wespestad et al. 2000) and the humans that utilize the system. By churning up sediments, changing the channel and marsh morphology, and altering salinity levels (Dame et al. 2000), major storms dramatically affect animal habitats and reproduction. Changes in temperature and precipitation regimes and storm frequency, in the short-term, may disrupt the usual timing of phenological events and the location and availability of food sources for estuarine animals.

Socio-political Setting

Spanish and French officials and explorers describe powerful chiefs, large villages, and maize surpluses on the Georgia coast during the sixteenth century, and suggest that St. Catherines Island was occupied by communities that were part of the Guale chiefdom (Jones 1978:179; Worth 2004). The Guale chiefdom was likely a complex chiefdom, with at least two distinct levels of hierarchy (Worth 1998:13–25, 1999, 2004). Worth (1999, 2004) suggests that the Guale chiefdom occupied a territory of 60-75 km. The paramount chief resided in a principal town (Thomas 2008:23), but Guale territory was divided into five or six jurisdictions, each with its own chief (Worth 1999, 2004). These chiefs were either drawn from the paramount chief's lineage, such as a brother or nephew, or had a fictive kin relationship with the chief (Worth 1999, 2004). In total, there may have been as many as 50 Guale communities, each with perhaps 100 people (Worth 1999). The Guale settlement pattern was dispersed, both on the community scale with a series of hamlets or farmsteads forming a community or village, and on a regional scale, with communities spaced across a large area (Jones 1978:198–200; Worth 1999, 2004). Chiefs may have had ultimate decision-making authority over certain functions of society, such as warfare, but did not have coercive authority over most daily activities (e.g., Hann 1988:96–117). Chiefs did collect tribute from their subordinates in the form of labor and food stuffs. Community decisions were made by a council of important men, who met in a council house, an important structure in southeastern towns (Hann 1988:96–117; Worth 2004).

Maize was a major currency in southeastern chiefdoms. It provided a way for households to produce extra food to support chiefly households and other important individuals in the society (honored warriors, ballplayers) or people in need of welfare (widows; Hann 1988:96–117). Scarry and Scarry (2005) describe two different strategies for maize production. In one, households cultivated small plots for themselves and contributed labor to communal fields. In the other, households cultivated larger plots and contributed some of their own produce to communal, chiefly, stores. In the former, maize may not have been a major part of the daily diet, but was grown for communal purposes. In the latter, maize was probably important at the household and community level. Maize fields also provided a target of warfare activities. Through burning a rival chiefdom's fields, it was possible to disrupt the functioning of those villages. Ethnohistoric documents describe the burning of maize fields and storage facilities during raids (Worth 1999). Wild resources remained part of the diet in all chiefdoms, and there is some evidence that they also were part of the chiefly tribute system (Jackson and Scott 2003; Kelly 2001; VanDerwarker 1999).

Archaeological evidence provides some support that chiefdoms such as those described in Spanish and French accounts were present on St. Catherines Island by the late Irene phase. The population increased, with a greater number of settlements and more people living in many of them (Larsen 2002:46–54; Thomas 2008:1035, 1051). Mortuary evidence for the Irene phase suggests social inequality existed and that status was hereditary; subadults and adults are both included in burial mounds and grave goods are associated with individuals of all ages (Thomas 2008:1037). Stable carbon and nitrogen isotope analysis of Irene phase human bones indicates that people incorporated maize into their diet, though perhaps not until the late fifteenth or early sixteenth century (Schoeninger et al. 2009). The St. Catherines society was linked into the Mississippian regional interaction sphere; the Irene ceramic tradition has links with the Lamar pottery of northwest Georgia chiefdoms, and Southeastern Ceremonial Cult items have been found on the island (Braley 1990; Thomas 2008:602, 604, 713).

Resource Use

The subsistence strategy indicated by the vertebrate collections at Meeting House Field (Table 4.11), Back Creek Village (Table 4.18), and 9LI1637 (Table 4.24) is strongly based on estuarine resources. Fishes dominate the MNI in all three collections (65 percent, 74 percent, and 90 percent respectively). Fishing was an important procurement activity, and provided most of the vertebrate individuals consumed by Irene people. Fishes also contribute significantly to the biomass. In the 9LI1637 collection, they contribute over half the biomass. In the Meeting House Field and Back Creek Village collections fishes contribute 37 percent of the biomass. Deer are much less common than fishes in all collections, but contribute about the same amount of biomass as fishes in the Meeting House and Back Creek collections. In the 9LI1637 collection, deer contribute only 27 percent of the biomass, but that is still more than any other category except fishes. Deer hunting was an important source of meat, but not more than fishing. Turtles are the only other category to contribute significantly to biomass in all collections, though they are more prominent in those from Meeting House Field and Back Creek Village.

Three ways to characterize the variety of resources and degree of specialization of this subsistence strategy are richness, diversity, and equitability. Richness is the number of taxa in the diet. For these three collections, richness ranges from 33 taxa at 9LI1637 to 36 taxa at Back Creek Village (Table 5.1). Richness is generally dependent on sample size—as sample size increases so does the likelihood that rare taxa are encountered. The collection with the smallest NISP, that from 9LI1637, has the lowest richness. Back Creek and Meeting House Field (richness of 35) have similar richness values. Because the Meeting House collection contains 5,000 more specimens, one would expect the Meeting House collection to be more rich. The similar richness values may be related to the fact that the Back Creek collection is from a larger number of contexts (14 units) than the Meeting House collection (8 units). In addition, almost half of each Meeting House unit was sorted in the lab instead of the field, under better working conditions (more time, better lighting, etc.). This means more specimens are likely to be recovered, but many of these are probably not identifiable or only identifiable to fish. Regardless, the richness for all these collections suggests that a wide range of taxa were part Irene-phase subsistence.

Diversity and equitability estimate the degree of specialization of a subsistence strategy (when estimated from MNI) and of a diet (when estimated from biomass). Equitability is a measure of the evenness with which resources were used and diversity takes into account evenness and richness. The Irene collections described here are moderately diverse and equitable (Table 5.1), similar to other collections from the Georgia Bight (Reitz et al. 2010:62–63). This basically describes a subsistence strategy and diet in which a few taxa dominate, many are common, and a few are rare. In the Meeting House, Back Creek, and 9LI1637 collections, diversity and equitability estimated from MNI is consistently higher than diversity estimated from biomass, suggesting that the hunting-fishing strategy was less dominated by a single taxon than the diet. In other words, several fish taxa were caught regularly, supplemented by a large variety of other animals, but deer contributed more meat to the diet than any other single taxon.

Fishing Strategy

The Irene-phase fishing strategy targeted a range of taxa, but specifically targeted members of four families. Sea catfishes are the most important fish taxa in terms of meat contribution, as they dominate fish biomass in all three collections (Tables 4.12, 4.19, and 4.25). Drums (6 or 7 species in each collection) contribute about half as much biomass as catfishes. The most abundant taxa at Meeting House Field and Back Creek Village, however, are small killifishes. Mullets, also small fishes, are also common in these collections, ranking second in individuals in the Back Creek Village collection. In the 9LI1637 collection, drums are the most abundant taxa, though mullets and killifishes are also common. Other fishes (9-14 species in each collection) play a minor role in both MNI and biomass in all three collections.

Most of these fishes are small-bodied, or young of large-bodied taxa. Size was reconstructed from atlases and otoliths of sea catfishes, mullets, and drums. Some of these catfishes, kingfishes, seatrouts, and black drums are larger than 250 mm in reconstructed standard length (Figures 5.1 and 5.2). The mullets, Atlantic croakers, red drums, spots, silver perches, and star drums, and the remainder of the sea catfishes, kingfishes, seatrouts, and black drums, are all smaller than 250 mm reconstructed standard length (Figures 5.2 and 5.3). It was not possible to reconstruct the size of the other identified taxa because regression formulae have not been established to estimate size. Species' life histories and the size of the identified specimens provide some clues as to the size of the living fish. Killifishes are small-bodied taxa (Reitz et al. 2012). Sheepsheads and channel catfishes can be large-bodied, and the specimens in the archaeological collections are from large individuals. It is also possible that some of the sharks, gars, eels, and jacks in these collections were large, but the elements in these collections are small and more likely from small-bodied individuals. Hence, the fishing strategy focused on small-bodied fishes in terms of numbers of individuals captured. Occasionally, large-bodied catfishes and other fishes were used.

Sixty-four percent of the fishes for which size was reconstructed are between 100-200 mm in standard length (Figure 5.4). This suggests a capture technique that was size selective, capturing small fishes. Thirty-one percent of the fishes are larger than 200 mm standard length, ranging up to 550 mm in standard length. This suggests people used multiple capture techniques, capture techniques sometimes caught a wide range of fish sizes, people fished in locations where large fishes were uncommon, or large fishes usually eluded capture. Weirs, fences, and traps, all described in the ethnohistoric literature for Florida and Carolina coasts (Thomas 2008:122–123), catch a range of fish sizes (Tveskov and Erlandson 2003; Wheeler and Jones 1989:163–176). Weirs and fences are set up across a waterway and block passage of fishes (Wheeler and Jones 1989:163–176). They are usually constructed in places where tidal action causes fish to be caught against the fishing structure as the tide recedes. Traps are often used in conjunction with fences and weirs, and are structures that allow fish to enter, but limit their ability to exit (Wheeler and Jones 1989:163–176). The mesh size of these structures determines the minimum size of fishes caught—fishes smaller than the mesh size will swim through and all other sizes will be caught. Because weirs and fences trap live fishes, other methods may be used to remove fishes from the water. These include baskets for scooping smaller fishes and spears for the larger fishes. In addition, if the structures block a waterway that does not completely drain during low tide, they can be used as live storage of fishes—when fishes are needed, a fisher can go out and collect them (Thomas 2008:123). Weirs, fences, and traps, while not requiring constant monitoring, do require frequent repair.

The pattern of large numbers of small fishes and fewer, but consistent, larger fishes could also be explained by a strategy that mixes nets with trot-lines or individually operated hook-and-lines. Dip nets are held by single fishers, and consist of a netted end and a long handle. These tend to capture small fishes near the surface of the water or in shallow areas. Gill nets are set across water-bodies or are attached to boats. They tend to capture medium-sized fishes, as fishes smaller than the mesh size can swim through and larger fishes can often back out of the net (Greenspan 1998). The fishes of the target size attempt to swim through and their gills are caught in the net. Seine nets will catch a wider range of fish sizes—however, each catch is likely to capture a single school of a fish species. Only the fishes smaller than the mesh are likely to escape. These nets are operated by people wading, or in boats, at both ends of the net drawing it close around a group of fishes. Nets are particularly useful for capturing schooling, small fishes such as mullets, killifishes, and small drums.

Individually operated hook-and-line or trot-line methods involve the use of bait to capture individual fishes. These methods work best with larger, carnivorous fishes (Butler 1994). Herbivorous and omnivorous fishes often do not have the jaw structure to take a hook, and they may not be interested anyway (Butler 1994). Therefore, these methods would have worked with high trophic level fishes such as catfishes, large drums, sheepsheads, and gars.

Remains of fishing technologies have not been found on the Georgia coast. Most of the materials used in constructing fishing gear were likely organic and probably degraded in situ. The materials that did make it back to settlement sites, such as net weights, hooks, baskets, spear tips, and dip nets, would either not preserve well or would be difficult to identify as fishing technology. Spear tips can be used for hunting as well as fishing, and other stone or bone artifacts would need to be heavily modified to be recognizable as fishing tools. Remains of fine-meshed nets were recovered at a waterlogged site on Key Marco, Florida, providing direct evidence for gill and dip nets in the pre-contact Southeast (Gilliland 1975). No sites with such excellent preservation are known for the Georgia coast, however.

The archaeological record is the result of multiple fishing trips, each of which could have involved one or more capture techniques. The prevalence of small fishes suggests use of dip nets at times. Gill and seine nets with small mesh sizes may also have caught these small fishes. Weirs, traps, and fences might account for the wide variety of fish species and wide range of sizes. Some of the larger, high trophic level taxa may have been most effectively taken with live bait or spears. The fish assemblage is dominated by fishes most effectively caught with nets and weirs (killifishes, mullets, small drums) and those likely to be caught in seine nets and weirs (catfishes, large drums). Other fish taxa are each relatively rare in any single collection, suggesting they were not commonly targeted. Depending on the size of the individual, these taxa may have been bycatches (likely the case for herrings and shads, small ladyfishes, pinfishes, needlefishes, sunfishes) or they may have been targeted when they were encountered, though encountered rarely (possibly the case for gars, toadfishes, sheepsheads, eels, flounders, sharks and rays).

Shellfishing Strategy

Shellfishes are the matrix for shell middens on the Georgia coast, yet the contribution of shellfishes to subsistence is rarely addressed. The relative contribution of shellfishes and vertebrates can be evaluated at Meeting House Field, where 40-liter samples were taken from each level and both invertebrate and vertebrate remains identified. Shellfishes were clearly an important part of the diet and of the foraging strategy (Table 4.4). The vast majority of non-commensal individuals are oysters, mussels, stout tagelus and clams. Killifishes are the only vertebrate taxa approaching the number of individuals of these major bivalves. Oysters provided 80 percent of the biomass, and mussels, stout tagelus, and clams another 16 percent. Deer, pond turtles, sea catfishes and drums, the only other taxa to individually contribute over 0.5 percent of the biomass, together contribute only 2.8 percent of the biomass. Previous studies of Irene-phase diet on St. Catherines Island did not take invertebrates into account. In addition to other sampling problems, such as large and/or variable screen sizes, this has led to an interpretation of an Irene diet that emphasized deer exploitation over shellfishes and fishes and an Irene foraging strategy that targeted deer, sea catfishes, and pond turtles (Reitz 2008:625–659; Reitz and Dukes 2008:780–798). When shellfishes are included in faunal analysis, it becomes clear that they were a dietary staple. Granted, a meal of shellfish will require more individuals than a meal of fish, mammal, or turtle, so simply dominating the individuals does not mean that they were the most commonly consumed taxa. However, the fact that they also dominate biomass suggests that they provided a large portion of the meat consumed by people.

Oyster reefs may have been a principal habitat targeted by humans for subsistence purposes. Oyster reefs, in addition to providing habitat to large numbers of oysters, also provide habitat for most of the other estuarine organisms on the species list. Other molluscs, such as mussels and clams, settle in oyster beds. Crabs and whelks are predators of oysters. The commensal marine invertebrate taxa, barnacles and oyster drills, are common on oyster beds. Mud and marsh snails may not live on oyster beds, but do live on the mud flats and cordgrasses adjacent to tidal creeks where oyster beds are located. In a study of North Carolina oyster reefs, among the most common vertebrate species present were young pinfishes, pigfishes, toadfishes, killifishes, bluefishes, seatrouts, two species of sharks, and young as well as adult flounders (Grabowski et al. 2005). In a similar study in Alabama, blue crabs, mullets, anchovies, and pinfishes dominated seine catches over oyster reefs (Geraldi et al. 2009). Red drums, hardhead catfishes, flounders, silver perches, seatrouts, and Atlantic croakers dominated the gill-net catches (Geraldi et al. 2009). In a synthesis of six Atlantic and Gulf coast studies, sheepsheads, stone crabs, sea basses, toadfishes, pinfishes, pigfishes, sheepshead minnows, and anchovies were the most abundant species, other than oysters, over oyster reefs (Peterson et al. 2003). Menhadens, sharks, seatrouts, mummichogs, spots, killifishes, Atlantic croakers, mullets, flounders, butterfishes, black drums, bluefishes, and red drums also were caught on oyster reefs in at least one study (Peterson et al. 2003). In other words, almost all the bony and cartilaginous fish taxa on the Irene-phase vertebrate species lists are associated with oyster reefs. Although these taxa are also present elsewhere in the estuary, the fact that they are all common in the archaeological record and common in the same habitat, does suggest that oyster beds were an important habitat in human subsistence strategies.

The non-oyster bivalves are found in other locations besides oyster reefs. Mussels occur in their own beds in intertidal locations similar to those preferred by oysters. Mussel beds contain abundant and dense populations of mussels, and mussels are easy to find because their valves stick up above the surface by about an inch (Larson 1980:72). Clams occur on subtidal and intertidal muddy and sandy bottoms of tidal creeks (Eversole 1987:8–9). Clam populations can be dense, but clam beds are not as common or as large as oyster beds. Clams burrow into the substrate about 1-2 cm, and so are harder to locate than oysters. Stout tagelus burrows even deeper into intertidal and subtidal regions of creeks with stable sand/mud bottoms (Holland and Dean 1977). Intertidal and subtidal creeks and flats also are habitat for many of the same fish species that frequent oyster beds. Hence, these locations were productive habitats, and the frequency of non-oyster bivalves in the zooarchaeological collections suggests these habitats were an important fosus of the subsistence strategy.

Social Factors

Social factors, such as status, prestige, gender, personal preference, cooperation, sharing, and exchange, influence the relative importance of animals in the diet and in the subsistence strategy. Evidence for the role of these factors is difficult to identify in the archaeological record, because archaeological deposits are the result of multiple foraging trips by multiple family members and possibly multiple families or kin groups. This appears to be the case with the Irene middens. Middens vary in terms of relative contributions of the dominant taxa, and in terms of the numbers of rare taxa. Much of this variation could be explained by chance and sample size. Middens with larger NISPs are more likely to have rare taxa. The faunal collections presented here are from 1-x-1-m units excavated into middens which are several meters in diameter. Spatial variation occurs within each midden as trash is thrown onto the pile after many meals.

In order to observe status differences in the zooarchaeological record, there must be differential access to animal resources and spatial separation of animal remains discarded by households of different social strata. High status in terms of animal remains is often represented by differential access to large, rare, non-local, and/or dangerous animals, for consumption or ritual (Ashby 2002; Crabtree 1990). High-status individuals, such as chiefs and their kin, ritual leaders, warriors, and ball players (e.g., Hann 1998:96–117) might gain access to different taxa or portions of animals through various mechanisms. They may have exclusive rights to certain cuts of meat from hunting or fishing expeditions. Community leaders might be given gifts or tribute in the form of rare or exotic taxa or high-quality cuts of meat. Dangerous or rare animals are commonly used as symbols of elite or community power. Through their function as ritual leaders, elite may use animals not commonly consumed. If status regulated access to resources, it was probably a strong enough social factor to structure settlement arrangements. High-status households might be spatially separate from low-status households, and they might use different middens for discard.

Differential access to large, high-quality, and rare resources has been demonstrated in the archaeological record. In Medieval England zooarchaeological collections, deer, both the largest wild mammal and a relatively rare animal, are seldom found at low-status sites, and high-quality cuts are associated only with elite sites (Sykes 2007). In Medieval Belgium, large game mammals, wild birds, and exotic taxa are exclusively found at castle sites (Ervynck 2004). In the El Morro Valley (New Mexico), high-quality portions of antelope are found only in certain parts of communities, probably the result of redistribution after communal hunts by leaders with the ritual knowledge to organize the hunts (Potter 2004). At Sand Canyon Pueblo (Colorado), remains of birds of prey and lynxes are associated with structures thought to be important in community rituals; over time these taxa are more frequently found at this central place and not in the surrounding, small settlements (Muir and Driver 2004).

Differential access to certain rare, dangerous, and large animals also is characteristic of Mississippian chiefdoms. Carnivorous, dangerous animals, generally taboo for consumption (Hudson 1976:122–169) and possibly used for ritual consumption or the construction of symbolic costumes or objects from the feathers, skins, teeth, and claws of these animals, are found in elite contexts such as mounds and mound-complex sites. At Moundville (Alabama), bobcats, cougars, and bears were found in collections from two mounds (Jackson and Scott 2003). Birds of prey, common in Mississippian iconography, were also found in these collections. Birds in general are common in elite contexts. At the Crenshaw site (Arkansas), passenger pigeons dominate the elite assemblage and are absent from non-elite contexts (Scott and Jackson 1998). Peregrine falcons and swans were common at Cahokia (Illinois), but not at outlying sites (Kelly 2001). The mound contexts at Lubbub Creek (Alabama) contained cardinal, mockingbird, crow, Carolina parakeet, and bluejay remains, which were not found in other contexts (Jackson and Scott 1995). At Moundville, bird remains were the second most common taxonomic category. The assemblage was dominated by turkeys, but included several species of waterfowl, passenger pigeons, peregrine falcons, and red-tailed hawks (Jackson and Scott 2003).

Deer remains are common in elite Mississippian contexts. The most common animal taxon at Moundville was deer and the deer remains were dominated by high-quality cuts—upper fore- and hind-quarter (Jackson and Scott 2003). A similar pattern was found at Lubbub Creek (Jackson and Scott 1995) and Toqua, Tennessee (VanDerwarker 1999). These studies suggest that elite households were often given the highest-quality parts of deer during redistribution after hunting trips. It also suggests elite diet may have been dominated by deer and turkeys, unlike commoner diet, which was more varied.

There is little evidence for such social differentiation during the Irene phase on St. Catherines Island. Some rare taxa are present, including freshwater mussels, sharks, rays, and carnivores. An unmodified freshwater mussel fragment was identified from Midden 21 at the Meeting House Field site. No freshwater mussels are found on the island, but the fragment resembles an Altamaha River species, and could have been obtained within a day's canoe ride. The rarity of the taxon suggests that it was something special, for use in manufacturing special objects, perhaps. Sharks and rays might be considered dangerous animals, and they are rare at these sites. Three unmodified shark or ray vertebrae are identified, one each in Midden M and

Midden E, at Meeting House Field, and in TP I at 9LI1637. The vertebrae are small, and could have been from small animals caught by chance in weirs or nets. An unmodified mink tooth is identified from Midden J at Meeting House Field. Mink is a rare, carnivorous taxon and could have been valued for its fur. An unmodified bobcat tooth is present in TP II at 9LI1637. This is also a rare and carnivorous taxon. Bobcat remains might represent a special purpose—the tooth might have been a talisman or bobcats could have been used for fur. On the other hand, bobcats and minks might have been caught in traps on occasion, and consumed when caught.

Bird remains are present in these collections, but not in large numbers. Bird remains are present in 88 percent of the Meeting House Field middens: song birds in 63 percent and marsh birds (rails, ducks, fish crows) in 38 percent of the middens. Bird remains are present in both of the 9LI1637 middens and in 57 percent of the Back Creek Village middens. Out of the specimens identifiable beyond bird, most are song birds, though two rails were identified from one Back Creek midden. Song birds were likely common in the vicinity of settlements. They might have been eaten or simply tossed on middens. Marsh birds could have been encountered during shellfishing or fin-fishing expeditions.

None of the rare taxa would have been unusual to encounter within a settlement or on a fishing, hunting, or shellfishing expedition, except perhaps the freshwater mussel. It is, therefore, difficult to interpret them as elite or ritual indicators. In addition, these taxa are not concentrated in a single midden, suggesting that all households had access to these taxa.

Deer are a small portion of the NISP from all three sites, though they are found in most contexts. Deer are present in 88 percent of the Meeting House Field middens, though a majority of the deer remains are found in Middens E, B, 21 and 12. Deer specimens are present in 100 percent of the Back Creek Village middens. A majority of the deer specimens are from Middens

A, D, F, and H. At 9LI1637 deer specimens were identified from both middens, though most of the specimens are from TP I. All parts of the deer skeleton are present at all sites (Figure 5.5). The Meeting House collection is dominated by head and axial skeleton specimens, the Back Creek and 9LI1637 specimens are more evenly distributed among the skeletal categories.

Ratio diagrams illustrating the distribution of deer parts of varying utility across each site demonstrate that high-, medium-, and low-utility portions are present in all three collections. In the collection from Back Creek, high-utility portions are overrepresented compared to a standard deer; low- and medium-utility portions are underrepresented (Figure 5.6). High- or medium-utility portions are overrepresented in six of the seven middens. Low-utility portions are only overrepresented in two middens, one of which has a single deer specimen—a mandible fragment. At Meeting House Field, overall, medium-utility portions are overrepresented and high- and low-utility portions underrepresented compared to a standard deer (Figure 5.7). High- and/or medium-utility portions are overrepresented in five of the eight middens. Low-utility portions are overrepresented in two other middens, both of which have only low-utility specimens—teeth. No deer bones were recovered from the other midden. At 9LI1637, high-utility portions are overrepresented at the site as a whole and in both middens (Figure 5.8). Low-utility portions are underrepresented at the site and in both middens (absent in one).

There is little evidence, therefore, for differential access to venison. High- and/or medium-utility deer portions are overrepresented in most middens. It is possible that the few middens that have no deer specimens, or only low-utility deer portions, were utilized by lower status households. It is not possible to rule out other alternatives, however. It is more likely that because deer remains are rare in all middens, and teeth, which are low-utility elements, are the most identifiable deer elements, chance and site formation processes, and not status bias, account for the variation. It is also possible that there are functional differences among middens. Processing, social, or ritual conventions might have regulated disposal of deer remains.

Gender, preference for hunt types, and sharing rules are other social factors involved in choices people make about which animals to target. Gender roles play a major role in structuring subsistence activities (e.g., Bird and Bliege Bird 1997; Meehan 1982; Murphy and Murphy 1974; Nietschmann 1973; Siskind 1973). Hunting is often the responsibility of men, though communal hunts may involve all community members (e.g., Hann 1988; Lupo and Schmitt 2005) and in some societies women hunt (e.g., Noss and Hewlett 2001). In non-communal hunts, men work alone or in small groups, depending on the technology used—spears, traps, snares, bow-and-arrow. Hunting involves a degree of uncertainty and danger that often brings prestige with success (Jochim 1976:24–26). Social and political factors, therefore, are involved in choices about what animals to target and which technology to use. Individual skill may also be involved in choices. In an ethnographic study of Central African foragers, men used a variety of hunting techniques, but individual men preferred specific techniques (Lupo and Schmitt 2005). Some individuals participated in many communal hunts, while some participated in few. Lupo and Schmitt (2005) found that variation among sites in richness and diversity was the result of individual preferences for different hunt types, not of access to technology or animal availability.

The successful procurement of venison may have brought prestige to a hunter. As a relatively rare animal, involving specific hunt types and more search and handling effort, some individuals or households may have focused on other animals instead, thereby explaining some of the variability in deer remains among the middens. Strict social rules often govern sharing of carcasses, with the hunter, the equipment provider, political leaders, ritual leaders, and certain relatives getting specific portions (e.g., Kent 1993; McCormick 2002; Sykes 2007; Thomas

2007; Zeder and Arter 2008). This might lead, over time, to a relatively equal distribution of deer portions across a site, as each household would have different roles or relationships to any given successful hunt.

Women, as caregivers, often work in social groups and focus on exploiting reliable and abundant resources (e.g., Bird and Bliege Bird 1997; Meehan 1982; Murphy and Murphy 1974; Nietschmann 1973; Siskind 1973). Such resources include wild plant foods like nuts, berries, and tubers, and domestic plant foods from gardens. On St. Catherines Island, women may also have exploited shellfish beds and associated marsh resources. Ethnographically, shellfishing is most often done by women and children (Waselkov 1987). Fishing was probably done by both sexes. Women could have used baskets and dip nets while they were in the marsh, and men might have built, maintained, and used weirs and seine and gill nets. Women and children could also have collected the fishes caught behind weirs. Depending on the scale of farming during the Irene phase, this was also probably a joint effort. Small household gardens were probably maintained and harvested by women, but fields were probably cleared by men who might also have helped in other aspects of planting, field maintenance, and harvesting, depending on other obligations (Hudson 1976:295–299). The dominance of shellfishes and small fishes in the Irene-phase middens hints at the daily importance of women’s foraging activities, while the variety and amount of larger fishes and mammals might represent hunting choices, successes, and relationships of male hunters and fishers.

Demographic Arrangement and Site Location

The archaeological evidence for Irene-phase demography suggests that there were more people living on the island than in earlier periods. Fifty-two Irene components were located in the 20 percent transect survey of the island. If this ratio is applied to the whole island, then it is possible that 260 Irene components could be present over an area of approximately 5,665 hectares. Eighty percent of Irene sites are considered large, although they vary in size. Meeting House Field covers at least 100,000 m^2 and Back Creek at least 25,600 m^2. Such large sites could be the result of many people living in a single location at the same time. This type of village would operate as a community on a daily basis, with elders or a chief overseeing communal operations. Alternatively, these sites could be locations where subsets of households from a larger, dispersed community lived. Over time the continued occupation by a small number of households created a large number of middens over a large area. This type of settlement pattern would not be integrated on a daily basis, and households in individual settlements would make daily decisions for themselves, but settlements would cooperate as a single entity for communal functions such as warfare, exchange, and ritual occasions. In either case, a large population lived on the island and needed to be sustained.

In his model, Jochim (1976:50–55) posits that people will place their settlements near sedentary, dense resources. This provides a reliable and abundant resource base on which to add other, less predictable resources. In the estuarine environment of St. Catherines Island, oyster reefs are just such a sedentary and dense resource, and oysters were a major dietary staple. Settlements on St. Catherines Island, in all periods, tend to be located near the estuarine marsh along the western and eastern island margins. These locations may have been preferred because they were close to oyster habitats; however, oyster beds move over time, and it is not possible to identify specific beds that were associated with specific settlements. The estuarine mudflats and channels would also provide abundant fishes and non-oyster molluscs. In addition, the best soils for cultivation are located along the island margins. Using a central-place foraging model, Thomas (2008:234–292) also predicts that settlements should be located along the marsh edge, where people could access estuarine and forest resources and soils with the best agricultural potential. Within a 10 km radius from anywhere on the island, people would have access to all the habitats on the island as well as those on smaller marsh islands and parts of the mainland. Canoes likely increased the area accessible within a day's travel. The settlement pattern was already focused on these areas before the Irene phase, however. The addition of maize cultivation during the Irene phase would have reinforced this preference for marsh edge habitation, near abundant, reliable resources. Back Creek Village and Meeting House Field are both located near marshes, freshwater sources, and soils adequate for cultivation. 9LI1637 is located along Walburg Creek, a deeper water channel, with limited marsh in the vicinity today, but near freshwater sources and adequate soils for cultivation.

Seasonality

Two models have been proposed for residential movement of people on the Georgia coast during the Irene phase. In one model, animal and plant resources are considered inadequate to support large groups and too dispersed to allow permanent settlement; coastal soils are also considered inadequate for productive farming (Crook 1986:11–28; Larson 1980:206–209, 221–228). Crook proposed a seasonal round in which people lived in large settlements during the summer months, when they relied on fishing and domesticated plants from swidden plots, and dispersed in the fall to gather nuts. Dispersal continued through the winter when people lived along tidal creeks and relied on molluscs, fishes, and deer. Dispersal increased further in spring when people experienced subsistence stress and relied on molluscs and fishes. This view is based on ethnohistoric accounts by Jesuit missionaries, who describe coastal populations living in towns only in late-summer and early-fall and dispersing for the rest of the year (Jones 1978:190–191).

Another model suggests there was little residential movement. In the central place foraging model mentioned above, Thomas (2008:234–292) hypothesizes that there was little need to change residential locations for subsistence purposes since all habitat types were within a day's travel. This is supported by Jones' (1978:191–192) reinterpretation of the Jesuit accounts as exaggerations of hardship and his suggestion that, based on other accounts of southeastern Indian groups, St. Catherines Island populations lived year round in dispersed towns surrounded by scattered maize fields. It may also be that sedentism and part-year dispersal were two different strategies for dealing with environmental conditions. During the period described by the Jesuits, the region of the Georgia coast was in the midst of a long drought (Blanton and Thomas 2008:803–805), which may have encouraged more dispersal than during times of adequate rainfall, and European diseases likely depleted populations and perhaps discouraged sedentary villages and farming.

Zooarchaeological data are often used to address seasonality of site occupation. Some taxa or age cohorts are only available during certain seasons and some animals have distinct, seasonal growth patterns. On St. Catherines Island, very few taxa are available only on a seasonal basis. Some birds use the island as a stopover on their northward and southward migrations. Sea turtles lay eggs on the beaches during the summer months. Some shark and fish species are primarily present in the warm or cold months (Nelson et al. 1991:41–90; Dahlberg 1972). Fish age and size are other indicators of season, as some species are only present in the estuary at certain ages and times of year. In the St. Catherines estuary, few species are so highly seasonal. More than one cohort of most taxa is present at any given time of year (Nelson et al. 1991:41–90). Modern, monthly trawl data are available for the landward estuarine waters (Dahlberg 1972), and these can be compared with the size of archaeological fishes to suggest season of capture. Clam growth increments are a more reliable indicator of season. In modern St. Catherines Island clam populations, translucent growth is dominant in the summer and fall months and opaque growth is dominant during the winter and spring (Quitmyer and Jones 2012).

Interpretations of seasonality using zooarchaeological data are limited because the absence of evidence for a specific season is not necessarily evidence that the site was not occupied during that season. In addition, storage of seasonally available resources could complicate the interpretation of the seasonal indicators. Except in very well-stratified and well-dated deposits, it may not be possible to establish whether sites were occupied year round, intermittently during a year, or intermittently over a series of years. Precise contemporaneity within and among sites is difficult to demonstrate.

The estuarine and terrestrial resources of St. Catherines Island are available year round. Mammal populations, including deer, raccoons, opossums, rabbits, and squirrels, are permanent residents on the island. Though close enough to the mainland that there could be some inter-mixing of populations, there are no mass movements on to or off of the island. Shellfish populations, such as oysters, clams, ribbed mussels, and stout tagelus, are relatively stationary. Although environmental and physiological conditions on a seasonal scale may impact the condition of these animals and, on a long-term scale, might alter the location of shellfish beds, they would still be available to human populations in known locations throughout the year. Fishes are available in the estuary year round as well. Some species reside in the estuary permanently, some use it as a nursery-ground for varying amounts of time, and some use it on a more variable basis—juveniles, subadults, and/or adults utilizing it at various times of the year (Nelson et al. 1991:41–90). Such an environment would not necessarily require seasonal movement of residential sites, since all targeted resources are available within easy travel distance from any location throughout the year.

Faunal analysis from Meeting House Field, Back Creek Village, and 9LI1637 combined with clam incremental analysis from Meeting House Field and Back Creek Village indicate that these sites were not single-season occupations. The faunal collections from the three Irene sites are dominated by taxa available in the estuary year round. Seasonally sensitive resources are rare at these sites and in the archaeological record for the island (Reitz 2008:660–663) and the coast (Reitz et al. 2012). Shark or ray remains were found at Meeting House Field and 9LI1637, but contribute few individuals and little biomass. Sea turtle remains were not present in any of these collections. Zooarchaeological analysis of the transect survey fauna identified no shark or ray remains in other Irene collections (Reitz 2008:643, 646), but there are five sea turtle specimens from one Irene collection (Reitz 2008:646). Migratory birds also are rare in archaeological collections here. One Canada goose element was found at an Irene site in the transect survey (Reitz 2008:643), but none were identified at the sites described here. In addition, modern studies of southeastern estuarine fishes (Dahlberg 1972, 1975; DEIS 1978; Nelson et al. 1991; Reitz et al. 2012) demonstrate that juveniles and/or adults of all fish families common in the Meeting House, Back Creek, and 9LI1637 faunal collections are present in the estuary in all seasons of the year. The taxa that are less abundant in these collections are also present in the estuary at all or most times of the year. The same suite of estuarine resources was also identified at sites on other islands and on the mainland (Braley et al. 1986:64–73; Keene 2004; Quitmyer and Reitz 2006). Clearly, people living on the Georgia coast focused their subsistence strategy on those resources available year round; highly seasonal resources appear to have been occasional targets, and may have been opportunistic catches when the animals wandered into established fishing grounds.

Estimates of fish age based on size reconstruction suggest a focus on fishing during the warmer months, though the modern data used to estimate age and seasonality are not precise (Figures 5.1-5.4). The size of one black drum individual from Back Creek Village suggests an age of about half a year. The black drum spawning season is in the late-winter/early-spring (Sutter et al. 1986:3–4), which could suggest a late-summer or fall occupation, though juvenile black drums always are present in the estuary (Nelson et al. 1991:81). The size of three croaker individuals from Meeting House Field suggests they are all under a year old. The spawning season for Atlantic croakers is in the fall through the spring, and young of the year often migrate offshore in the winter months (Lassuy 1983:3–4). This would indicate a summer-fall occupation. Small croakers, however, have been caught year round in the estuary (Dahlberg 1972). All the other fish individuals are over a year old, so age estimates are not as useful as size estimates for evaluating seasonal information.

The fish size data also suggest a focus on fishing during the warmer months, though size could only be estimated for a handful of the fish individuals, and the modern data used to estimate age and seasonality are not precise (Figures 5.1-5.4). Size was estimated for sea catfishes at the family level, since otoliths of the two species are very similar. The individuals from all sites are over a year old. They are all within the size ranges of hardhead catfishes captured during the summer in modern trawls (Dahlberg 1972). Size was estimated for seatrouts at the genus level, as elements of the three species can look very similar. Most of the individuals, however, are probably spotted seatrouts, and all are over one year of age. Juveniles and adults of this species are present in the estuary year round (Nelson et al. 1991:74). Adults of the other species, weakfish, are present from April-December, and juveniles are present all year. The individuals at these sites are all in the size range of weakfishes caught during the summer months, or larger (Dahlberg 1972). The size of all the silver perch individuals from 9LI1637 and most of those from Back Creek Village are as large, or larger, than those caught in trawls during the warmer months (Dahlberg 1972). The rest of the Back Creek and most of the Meeting House Field silver perches are within the size range caught throughout the year (Dahlberg 1972). The size of the spots from all three sites is within the range caught throughout the year (Dahlberg 1972). The size of the kingfishes at Back Creek is larger than those caught in the modern trawls, but is closest to those caught in the fall and early-winter (Dahlberg 1972). The kingfishes at 9LI1637 are within the size range caught in all seasons (Dahlberg 1972). The Atlantic croaker individuals from Back Creek Village and 9LI1637 are all within the range primarily caught during summer and early-fall trawls (Dahlberg 1972).

The modern trawl data reported by Dahlberg (1972, 1975) are from the landward side of the island, from the waterways overlooked by Meeting House Field and 9LI1637. Back Creek, however, is located on the seaward marsh. The trawl data, therefore, may be less applicable to Back Creek than to the other two sites. In addition, trawling as a method of capture may not replicate the methods or locations used by past human populations. The consistency among sites and taxa, however, does suggest fishing was an especially common subsistence activity during the warmer months.

The results from clam incremental analysis indicate that clams were collected during all seasons at Back Creek Village and Meeting House Field (Figures 5.9 and 5.10). Winter-spring clams dominate both collections, so they were particularly important resources during a season when the nut harvest dwindled and mammals became lean. In addition, although the preferred fish species are present in the estuary year round, the density of drums and catfishes is lower (Dahlberg 1975:42–43, 69–72) and the density of fishes in general is lower (Reitz et al. 2012) during the winter months. Since these sites residential, the seasons of clam harvesting also are times of human occupation. Although it is possible that occupation occurred intermittently over a period of years, and not continuously throughout a single year, this does demonstrate that people at both locations had access to and used productive resources throughout the year. Clam incremental data from other Irene sites on St. Catherines Island (Thomas 2008:879, 897), and from other Mississippian coastal Georgia collections (Quitmyer et al. 1997), also suggest multiple seasons of occupation in most locations. Combined with the evidence for exploitation of estuarine resources available year round, these data suggest that sites were not occupied to exploit subsets of resources on a seasonal basis; instead, people exploited the same set of resources from all locations, and all locations were utilized throughout the year. Although this is not proof that people lived in the same location permanently, there is absolutely no suggestion of sites occupied for single seasons or of seasonal residential movement, though there is evidence that fishing may have been common at all sites during the warmer months and clam harvesting more frequent during the colder months.

Optimal Foraging Theory

Thomas (2008:75–197) constructed diet-breadth, patch-choice, and hunt-type models for aboriginal St. Catherines Island. Thomas used post-encounter return rates derived from experimental studies on St. Catherines and experimental and ethnographic studies from the literature to rank individual prey items, patches, and hunt-types. Although prey-size was generally the most important factor used in ranking prey items, the models do account for the fact that some fishes and shellfishes were likely captured using mass-capture techniques. The models also account for differences in gender preferences for hunt-types, and seasonal variation in return rates for hunt-types. Essentially, Thomas predicts that salt-marsh fishing is the highest ranked hunt-type because mass and individual capture of large- and medium-size fishes and mass capture of small fishes are more productive than most other hunt-types. Terrestrial hunting in the maritime forest is the second highest-ranked hunt-type. Black bears, American alligators, white-tailed deer, raccoons, and opossums have the highest return rates for this hunt-type, and all but the bear rates are within the range of rate from fishing of large and medium fishes. Both these hunt-types are productive year round. Sea turtle harvesting is a high-ranked summer activity. The model predicts that shellfishing is a low-ranked hunt-type, and within that hunt-type, clams are the highest-ranked prey, followed by whelks, and oysters collected individually; the lowest ranked shellfishing activities are mass collecting oysters, and collecting mussels (Thomas 2008:75–197).

In her study of the Late Archaic shell rings from St. Catherines Island, Colaninno (2010:182–197) found that this model is only partly supported. The only large-bodied animal common in the archaeological record was deer, and deer did provide a majority of the biomass, especially at the St. Catherines Shell Ring. Therefore, deer was a high-ranked resource. Black bears, alligators, and sea turtles, however, are rare in all coastal collections, including the ones reported here. Like deer, large-bodied fishes, such as red drums, sharks, and stingrays, though not common in the Archaic collections, do contribute a majority of the marine biomass, and were likely a high-ranked resource. The Archaic collections, however, are dominated in terms of NISP and MNI by small-bodied, mass-capture fishes (Colaninno 2010:182–197). This suggests that Thomas' model is correct in ranking salt marsh fishing as the most productive hunt-type, but also that small-bodied animals were more important in subsistence than large-bodied animals within this hunt-type.

The Irene-phase collections, likewise, demonstrate the primacy of the salt marsh patch. Small-bodied fishes dominate the MNI and contribute 37-50 percent of the biomass. Sharks or rays were found in two of the collections (Tables 4.10 and 4.23) and red drums in the other (Table 4.17). These taxa are not common in terms of NISP, MNI, or biomass. The abundance indices calculated for deer are very low for NISP and MNI—under 0.1—and low for biomass—ranging from 0.14 for 9LI1637 to 0.29 for Back Creek Village (Table 5.2). These indices suggest that deer, though they may have been high-ranked resources, were not commonly hunted. The dominance of shellfish, especially oysters, in the Meeting House Field collection, indicates that oysters were a high-ranked resource (Tables 4.2 and 4.3). Thomas (2008:264–265, 981–982) suggests that shellfishing was a female hunt-type and, though not overall a high-ranked hunt-type, might have been high-ranked for females. Oysters were a major part of the Irene-phase diet despite the fact that post-encounter return rates are estimated to be very low (Thomas 2008:192–194), lower than clams, which are far less common in the collection. Hence, the abundance, predictability, and ease of locating oyster beds as opposed to other shellfish beds, may have made the return rate for oysters far higher than for other shellfishes. It is also possible that patch-choice models are more appropriate than hunt-types for shellfishing and fishing activities. Perhaps, as suggested earlier, work-groups of females or both males and females targeted salt marsh patches that included oyster beds and fishing grounds at the same time, making oysters an even more productive resource. Diamondback terrapins, ranked about the same as oysters in terms of return rates (Thomas 2008:192–194), are also common in these collections and would have been available in the salt marsh patch near oyster beds.

Sea turtles are high-ranked resources in the diet-breadth model, but rare in all coastal collections (Bishop et al. 2011); they are absent in all Mississippian collections presented in this volume, though five specimens were found in other Irene collections from the island (Reitz 2008). Bishop et al. (2011) suggest three possible hypotheses to explain the discrepancy between expected and observed patterns: 1) sea turtles were present but not harvested, 2) sea turtles were processed on the beach and primarily meat brought back to the residential site, and 3) sea turtles were rare or absent on St. Catherines beaches during the aboriginal period. It is not possible to test these hypotheses with the Irene-phase collections presented here. However, the fact that the subsistence strategy so clearly focused on resources that were available year round, may indicate that seasonally available resources were rarely targeted. Today, sea turtles only build about 100 nests in three months (females do come ashore and decide not to build nests, as well), which means that along the entire eastern island margin only one or two turtles will come ashore per night (Thomas 2008:158). People may not have considered it worthwhile to watch the beaches for so few animals. Females do leave obvious tracks on the beach, leading to and from nests, however, and searching for nests the next morning may have been a productive hunt-type. Egg shells may not preserve well in archaeological deposits (Sidell 1993:10), and so evidence of such a hunt-type will be under-represented.

Irene-phase Subsistence Solutions

The choices Irene-phase people made to solve the problems of resource use, demographic arrangement, and site placement led to a subsistence-settlement system that was sedentary, and focused on mass-capture, marsh resources along with small-scale production of maize and other cultigens. The availability of the resources they targeted was not seasonal; instead, people harvested animals whose availability was regulated by tidal cycles. Productivity of these animals might vary on a seasonal basis, as life-history traits cause animals' condition to change as a result of breeding activities, temperature tolerances, and food availability (e.g., Thomas 2008:9–100; Wootton 1998:122–126). This may be the reason fishes were a major summer-fall resource, while clams (and possibly other shellfishes) were a major winter-spring resource. Irene settlements were located close to marsh resources and agricultural soils (Thomas 2008:1035–1037). Oyster beds and fishing grounds were likely short walks away. In addition, locations near the marsh allow easy access to water craft, extending the set of easily-accessible foraging locations (Andrus and Thompson 2012). Maize farming was probably small-scale, as stable isotope analysis suggests it was simply added to the diet and did not replace any marine resources (Larson 2002; Schoeninger et al. 2009). Although no systematic botanical studies were done for these sites, single charred corn cobs were found at Meeting House Field and Back Creek suggesting maize was present, but not common (Ruhl 2008). As part of the Mississippian interaction sphere, Irene folk probably used maize as a currency to symbolize membership in these networks—using it for tribute, ceremonies, and feasts, but not as a dietary staple. As there is little evidence for differential access to animal foods or accumulation of exotic or rare animal parts, within or among the sites, it seems likely these sites were not the chiefly centers supported by maize described by Worth (2002) for sixteenth-century Guale; no single household was more privileged. The following chapter will explore changes between early Mississippian and Irene-phase subsistence in the Meeting House Field locality.

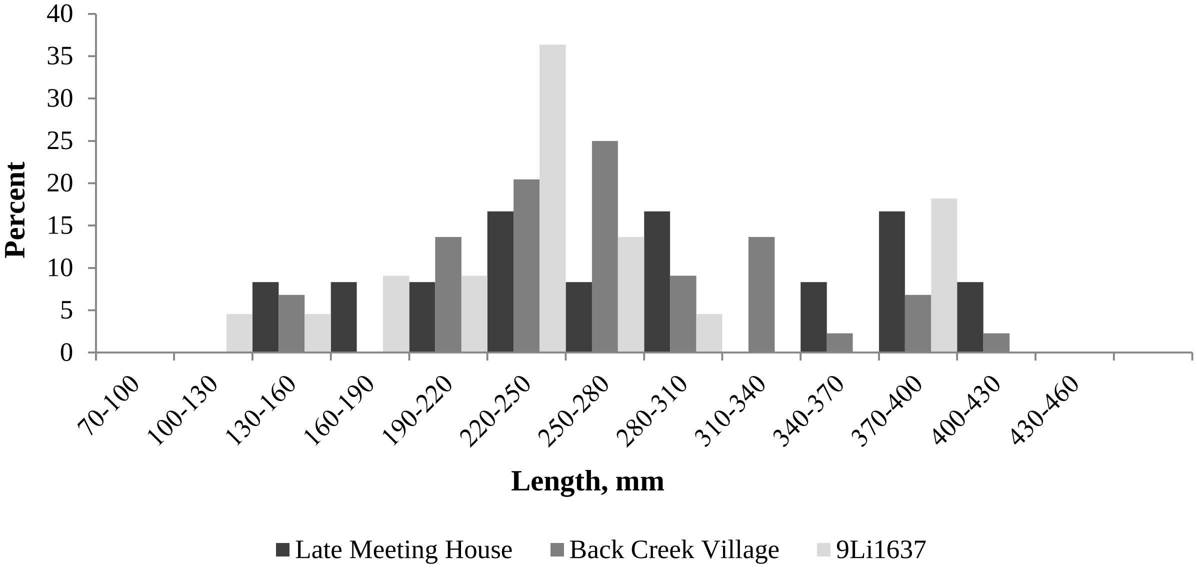


Figure 5.1: Reconstructed size frequency distribution of sea catfishes (Ariidae) from late Meeting House Field, Back Creek Village, and 9LI1637

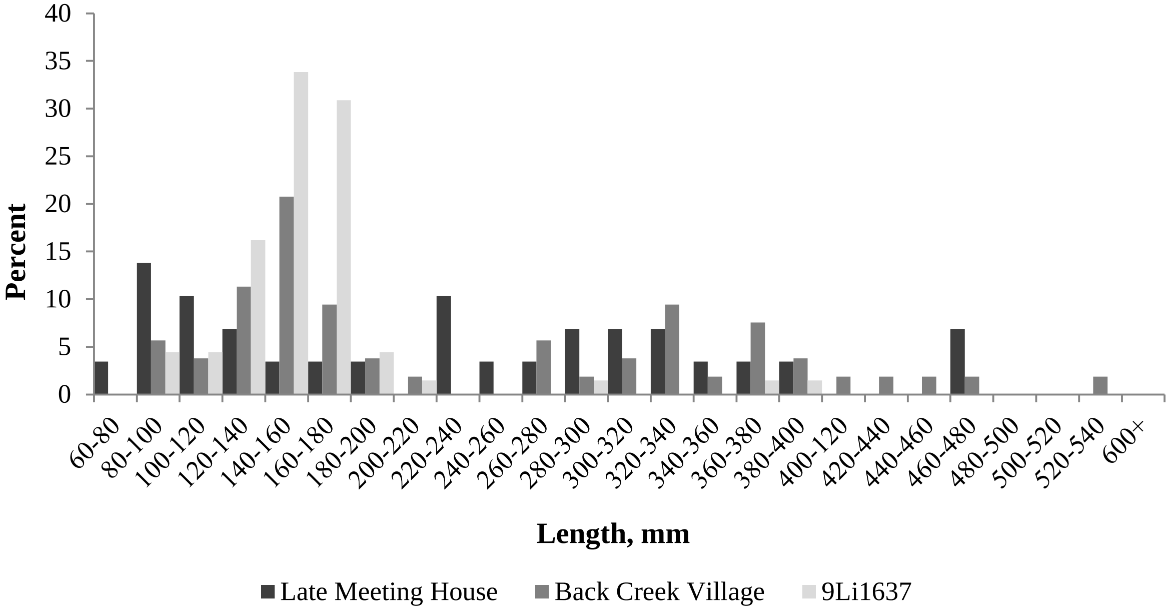


Figure 5.2: Reconstructed size frequency distribution of drums (Sciaenidae) from late Meeting House Field, Back Creek Village, and 9LI1637

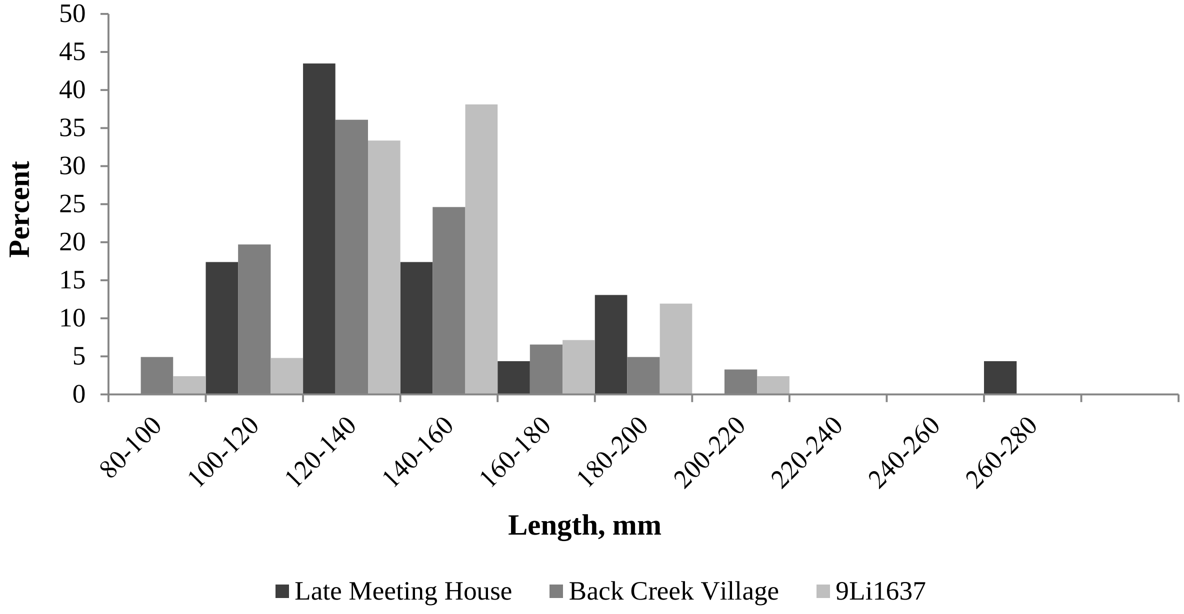


Figure 5.3: Reconstructed size frequency distribution of mullets (*Mugil* sp.) from late Meeting House Field, Back Creek Village, and 9LI1637

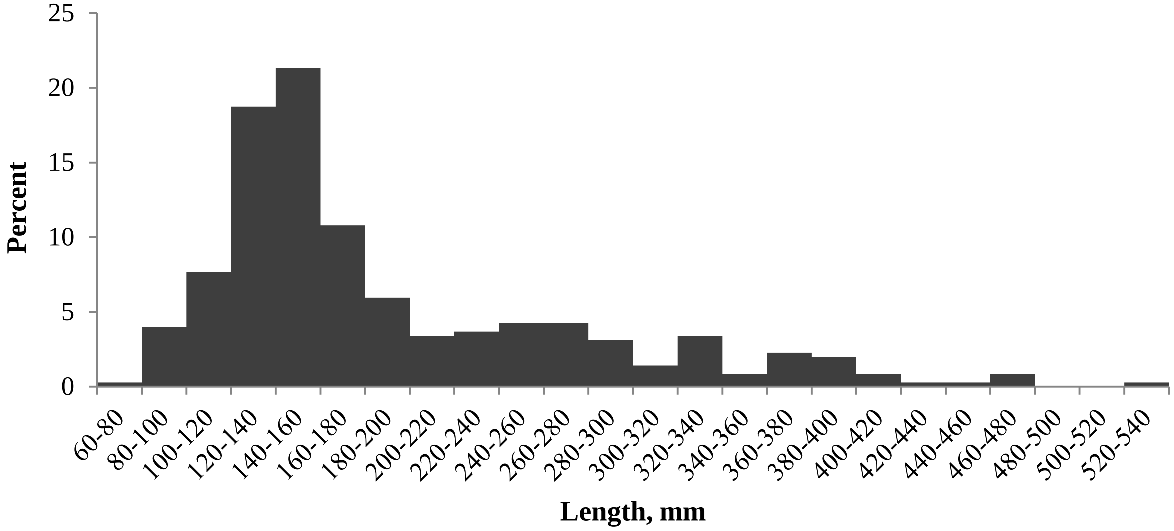


Figure 5.4: Reconstructed size frequency distribution of all fishes from late Meeting House Field, Back Creek Village, and 9LI1637

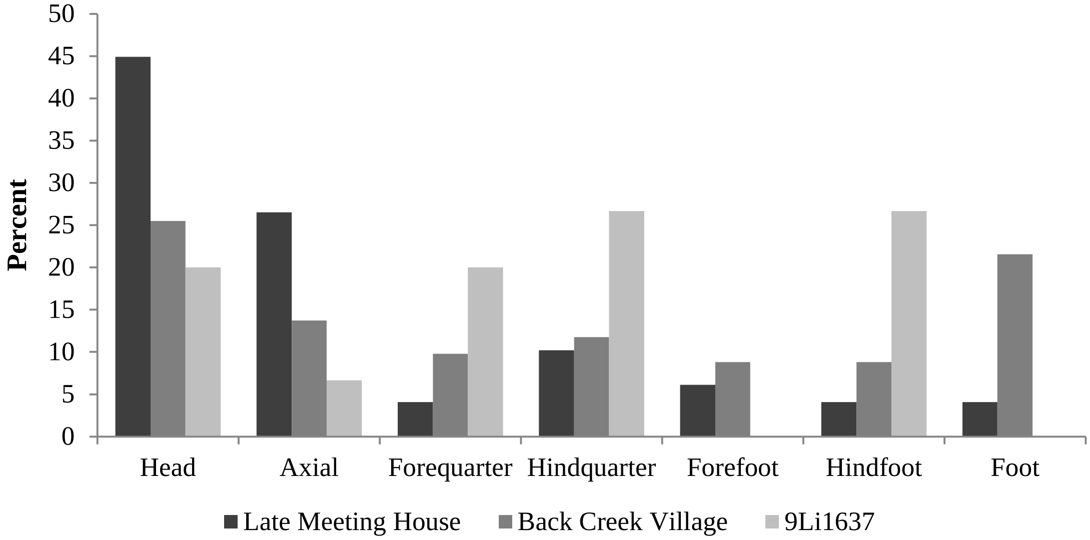


Figure 5.5: Deer element distribution from late Meeting House Field, Back Creek Village, and 9LI1637

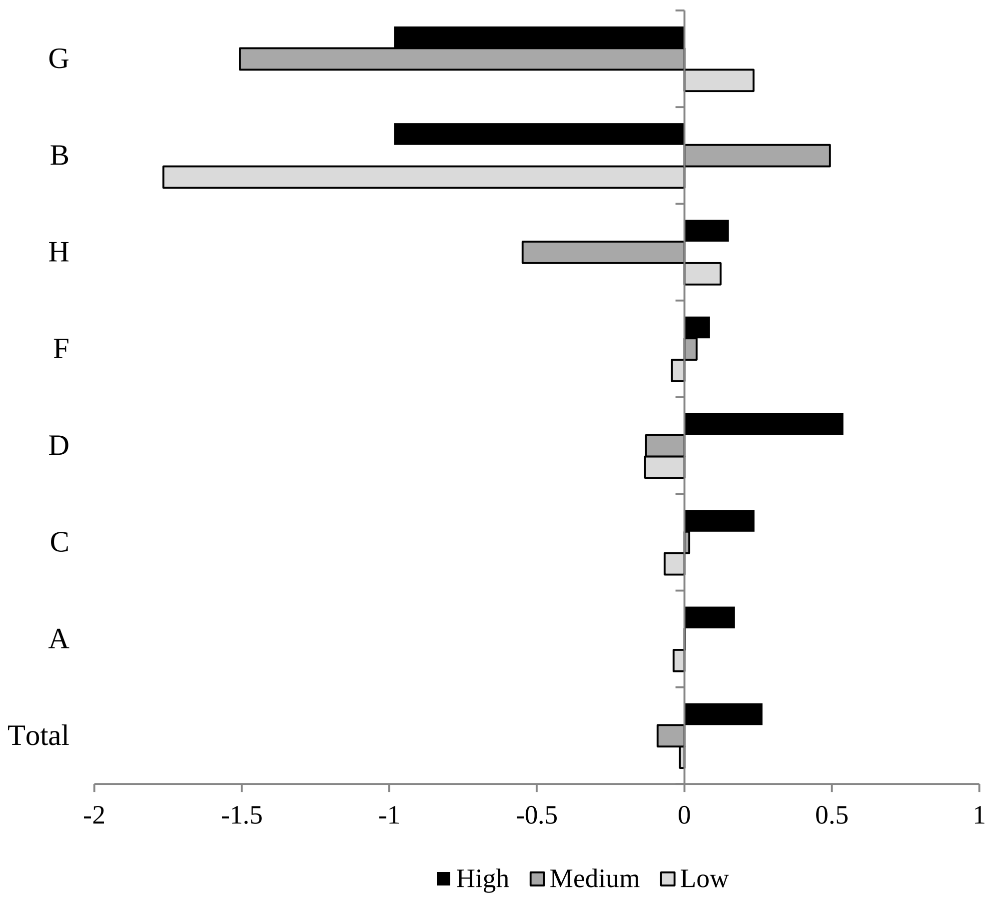


Figure 5.6: Deer food utility indices for individual middens from Back Creek Village and for the site as a whole (following Purdue et al. 1989)

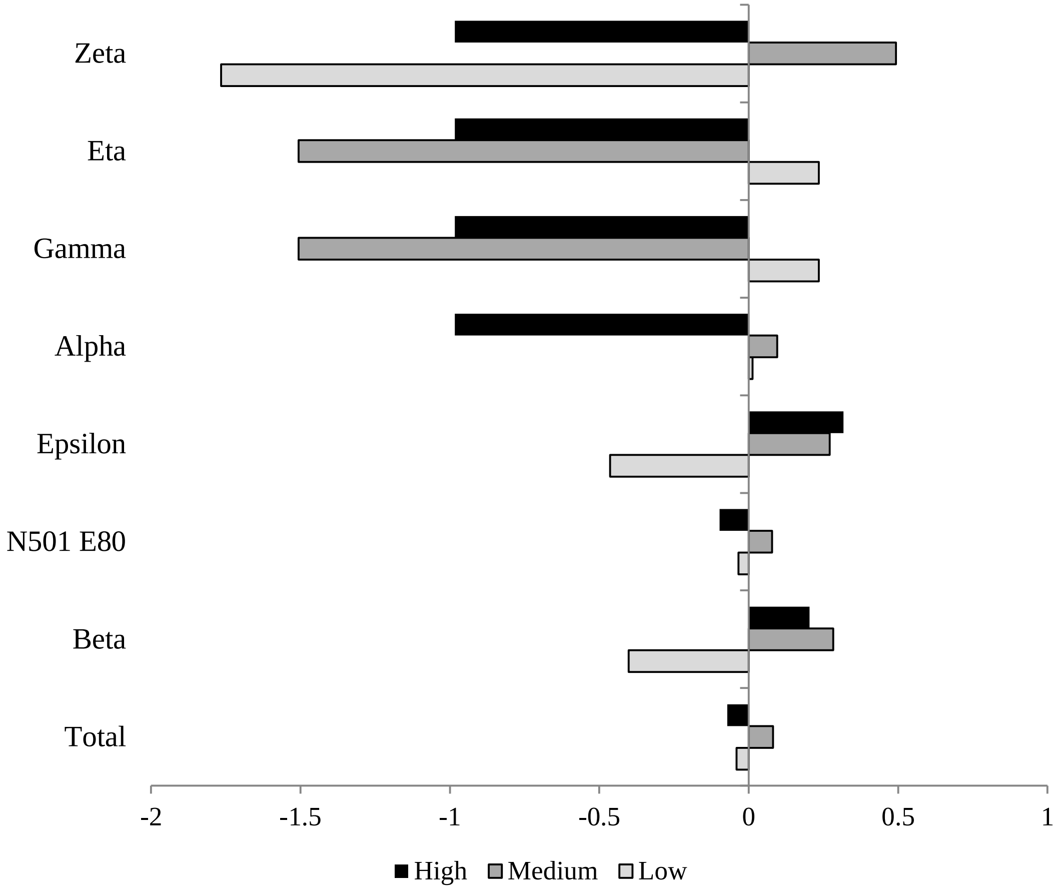


Figure 5.7: Deer food utility indices for individual units from late Meeting House Field and for the site as a whole (following Purdue et al. 1989)

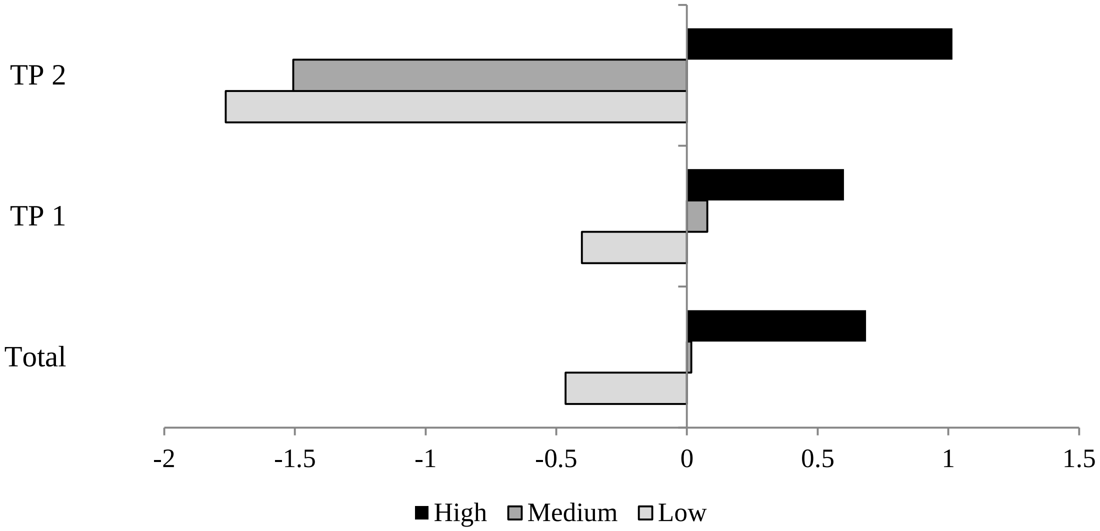


Figure 5.8: Deer food utility indices for individual units from 9LI1637 and for the site as a whole (following Purdue et al. 1989)

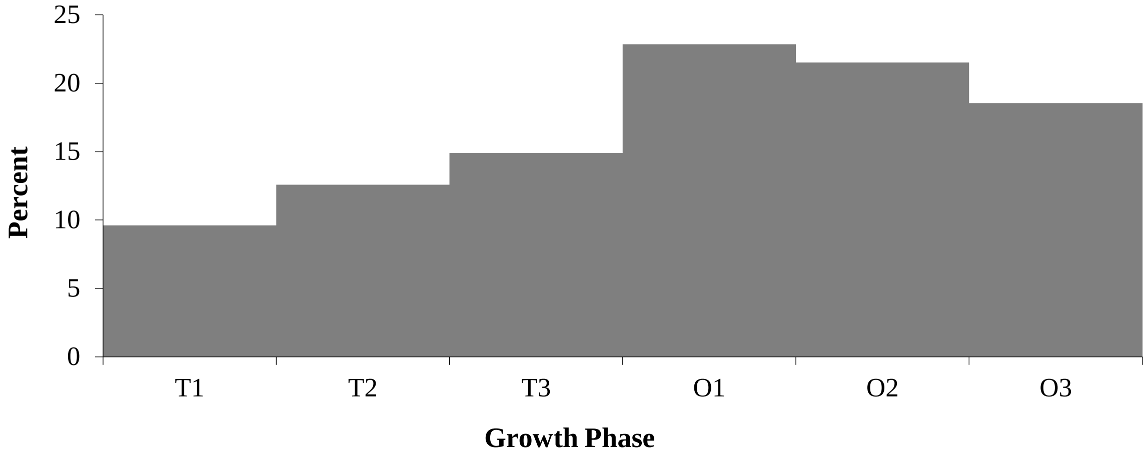


Figure 5.9: Frequency distribution of seasonal growth phases of hard clams (*Mercenaria* sp.) from Back Creek Village

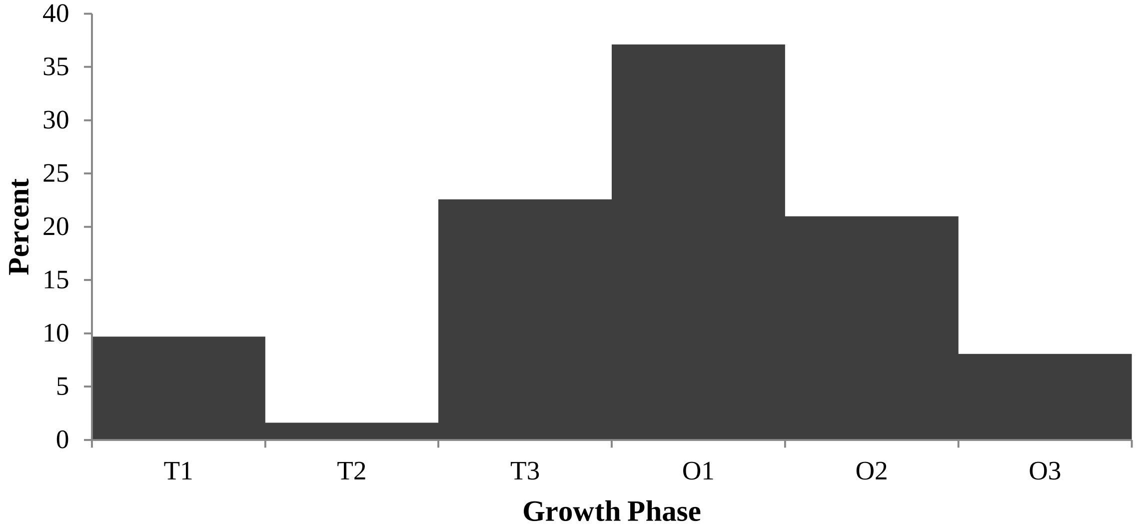


Figure 5.10: Frequency distribution of seasonal growth phases of hard clams (*Mercenaria* sp.) from late Meeting House Field

Table 5.1

Richness, Diversity, Equitability, and Trophic Level Table

Analytical Unit	Richness	Diversity, MNI	Diversity, BIO	Equitability, MNI	Equitability, BIO	Trophic Level
Meeting House Early, Sample	43	0.38	1.19	0.10	0.32	
Meeting House Late, Sample	41	0.29	0.70	0.08	0.19	
Meeting House Early, Vertebrates	33	2.51	2.25	0.72	0.64	3.30
Meeting House Late, Vertebrates	35	1.92	1.33	0.54	0.38	3.20
Back Creek Village, Vertebrates	36	2.56	1.81	0.71	0.50	3.10
9LI1637, Vertebrates	33	2.29	1.80	0.66	0.51	3.10

Table 5.2

Abundance Indices for Late Archaic and Mississippian Period Deer

	Late Archaic			Irene Phase					
	St. Catherines Shell Ring	McQueen Shell Ring	Early Meeting House Field	Late Meeting House Field	Back Creek Village	9LI1637	Average Late Archaic	Early Mississippian	Average Late Mississippian
Deer NISP	478	53	36	49	102	15			
Vertebrate NISP	49587	43240	23641	23958	14881	11145			
NISP AI	**0.010**	**0.001**	**0.002**	**0.002**	**0.007**	**0.001**	**0.005**	**0.002**	**0.003**
Deer MNI	10	3	4	7	9	2			
Vertebrate MNI	1249	1153	453	414	449	240			
MNI AI	**0.008**	**0.003**	**0.009**	**0.017**	**0.020**	**0.008**	**0.005**	**0.003**	**0.015**
Deer Biomass	28.353	6.271	3298.46	1861.86	6093.13	919.53			
Vertebrate Biomass	72.341	26.484	12740.34	9996.53	20828.76	6379			
Biomass AI	**0.392**	**0.237**	**0.259**	**0.186**	**0.293**	**0.144**	**0.314**	**0.237**	**0.208**

CHAPTER 6:

SUBSISTENCE AND SETTLEMENT CHANGE OVER TIME

The second objective of this volume is to examine Mississippian faunal collections for evidence of changes in the subsistence-settlement system. The Meeting House Field collections represent the solutions of multiple groups of people to the problems of resource use, demographic arrangement, and site location. These solutions are aggregated, in this chapter, into a mid-late Irene-phase solution (in this volume referred to as Irene phase or late Mississippian period) and an earlier solution (in this volume referred to as St. Catherines phase or early Mississippian period). Because the socio-political settings within which people made these choices were different, it is possible that the solutions were as well. The zooarchaeological data suggest that people targeted the same set of resources throughout the prehispanic period, and that these resources were mostly mass-collected shellfishes and small fishes. Irene-phase people at Meeting House Field may have exploited different fishing and shellfishing grounds or emphasized different fishing technologies, however. Other differences in the solutions devised by Irene-phase Meeting House Field occupants, suggested by the data, include longer term occupation of settlements and new waste disposal practices.

Resource Use

Subsistence strategies during both the early and late Mississippian periods in the Meeting House Field locality overall were very similar—they emphasized estuarine resources (Tables 4.2, 4.4, 4.6, and 4.11). Oysters were the most common animal by far, and they contributed the vast majority of the biomass. The other dominant shellfish taxa were the same in both time periods:

clams, tagelus, and mussels. Fishes were the dominant vertebrate taxonomic category in both time periods in terms of number of individuals, and contributed over 35 percent of the vertebrate meat. Deer were about as important as fishes in meat contribution, though far fewer in numbers. Turtles and small wild mammals were the next most common vertebrate taxa in both time periods. Birds were present in both periods, but more common in the late contexts. Richness did not change over time (Table 5.1); for the 40-liter samples, richness was just a little lower in the late collection and for the vertebrate collections, richness was just a little higher in the late collection. Diversity and equitability for both periods were greater when estimated from MNI than from biomass (Table 5.1), suggesting that, although many taxa were used, a much smaller subset provided the majority of meat.

There appear to be different emphases in the subsistence strategy between the two periods. Diversity and equitability were much lower for the late period than for the early period (Table 5.1). For the 40-liter samples, this was most obvious when indices were calculated from biomass and may be explained by the greater dominance of oysters in the late period. In the earlier period, tagelus, mussels, clams, and deer contribute a greater proportion of the biomass than in the later period. MNI in the late vertebrate collection is dominated by killifishes, which contribute more than four times as many individuals as any other taxon, and the biomass in the late collection is dominated by deer and diamondback terrapins (Table 4.11). MNI in the early vertebrate collection is more evenly distributed among several fish taxa, and the biomass, though dominated by deer, is more evenly distributed among several mammal, reptile, and fish taxa (Table 4.6). The early period vertebrate strategy used a variety of fish taxa. Though the diet was dominated by deer meat, many other taxa contributed meat as well. The later strategy continued to focus on fishes, but used a smaller variety of taxa, and focused primarily on killifishes. Deer and terrapins were by far the most important meat sources in the later period.

Invertebrates, relative to vertebrates, were more prominent in the late collection than in the early collection. Oysters dominate the MNI and biomass of both periods. In the earlier period, stout tagelus contributed just over 10 percent of the biomass, and deer about 5 percent. Mussels and clams contributed only 3 percent and drums almost 2 percent. In the later period, stout tagelus and hard clams contributed just over 5 percent of the biomass; no other invertebrate taxon or vertebrate family or class contributed over 1 percent of the biomass. This would suggest that although shellfish were the most important resource in the subsistence strategy in both time periods, vertebrates, specifically deer and drums, played a larger role in the diet of the early residents.

Fishing Strategy

The relative abundances of fish families differ between the early and late Meeting House Field contexts (Tables 4.7 and 4.12). Killifishes are the most common fish in the late contexts at Meeting House Field: drums and mullets are both about four times less abundant, and sea catfishes and other fishes about six times less abundant. Sea catfishes, however, contribute most of the biomass; drums contribute about half as much and mullets about a third. In the early contexts at Meeting House Field, on the other hand, drums are the most common family and contribute the most biomass. Killifishes are about half as common as drums, and mullets, other fishes, and sea catfishes are less than five times as common. Sea catfishes contribute about half the biomass as drums, while mullets and other fishes contribute about five times less of the biomass. This represents a change from a fishing strategy that targeted primarily drums to one that primarily captured killifishes, and a fish diet that early focused on drums, and later focused on catfishes.

In both collections the fishes are generally small-bodied or young individuals of potentially large-bodied fishes. Killifishes, the first or second most common fish family in both periods, are small bodied. Mullets can be large bodied, but all the early individuals, and all but four of the late individuals, for which size could be reconstructed, are smaller than 250 mm standard length (Figure 6.1). Sea catfishes are large bodied as adults, but 41 percent of the late and 58 percent of the early individuals, for which size was reconstructed, are less than 250 mm standard length (Figure 6.2). All silver perches, spots, kingfishes, Atlantic croakers, and star drums in both collections are small bodied (Figure 6.3). All seatrouts in the early contexts are small-bodied, while most of the late seatrouts are over 250 mm in length (Figure 6.4). One black drum individual from the early contexts is a very large individual—over 600 mm in standard length. The fishing strategies in both time periods, therefore, focused on small fishes, but caught a range of sizes and taxa, some of which could be very large.

Although the same size range of fishes was captured in both periods, the later fishing strategy caught more large fishes. The peak in the fish size distribution curve occurs at the same size class for both periods—120-140 mm—and both periods have a similar range of sizes (Figure 6.5). The fishes in the early contexts, however, are on average smaller—149 mm versus 209 mm mean standard length. In addition, 89 percent of the early fishes are less than 200 mm in standard length, while only 59 percent of the late fishes are less than 200 mm in standard length. This difference in fish size was not constant across taxa. Sixty-seven percent of the later seatrouts were over 260 mm standard length, while all the early seatrouts were smaller than this (Figure 6.4). The difference is less dramatic for sea catfishes—17 percent more of the late catfishes are large bodied than in the earlier collection (Figure 6.2). However, 41 percent of the early catfishes are under 190 mm, while only 17 percent of the late catfishes are that small. On the other hand, the early mullets and drums other than seatrouts are on average larger during the early period (Figures 6.1 and 6.3). Differences between the two strategies may be explained by use of different capture techniques, changes in seasonal fishing activities, or fishing in different creek locations.

Although the mesh-size of nets remained the same, since the same size range was caught, different capture techniques were likely emphasized. There may have been a greater focus on dip, gill, and seine nets in the earlier period, and perhaps greater use of weirs in the later period. Dip nets catch small fishes, from banks or shallow water, in individually handled nets. Gill nets are more likely to catch small fishes than large fishes (Greenspan 1998). Seine nets target schools of fishes, and are likely to catch large numbers of similar-sized fishes of a single taxon—the large number of Atlantic croakers in a single early unit might represent such an event. Weirs are an ideal communal procurement technique; they require monitoring and maintenance, but they capture large numbers of fishes with little effort and can even be used as live storage (Thomas 2008:123). In the Irene phase such a technique would have been a perfect companion to maize horticulture. Maize horticulture is also a communal activity, and if people spent more time working in gardens and fields and processing plant products in groups, a weir could provide abundant protein to the same working groups. The larger percentage of large fishes in the later contexts may also be the result of an increase in the use of individual capture techniques such as hook-and-line or spearing, which are more likely to catch large catfishes and drums.

Some of the size differences between the early and late collections could also be explained by use of different parts of the estuary for fishing. This might be because different capture techniques target different portions of the water column, later people chose to fish in different creeks or parts of creeks, or geomorphic or environmental changes affected the fish communities in the creeks. Different age cohorts may consume different foods and prefer different habitats. Throughout a year, cohorts will move among habitats that provide the desired food types, water conditions, protection, or access to other members of the population.

The sea catfishes from the early contexts appear to be about equally from two cohorts—possibly the 2-year and the 3-year cohorts (Muncy and Wingo 1983:7; Figure 6.2). Those from the later contexts may be primarily from cohorts over 3 years of age (Muncy and Wingo 1983:7). Adult gafftopsail catfishes are larger than adult hardhead catfishes, so there is a possibility that the relative contributions of the two species are different at the sites. Based on elements attributed to one or another of these two species, however, there are more hardhead catfishes relative to gafftopsails in the later contexts, despite the average size of the individuals being greater. The reverse is found in the early contexts.

The mullets from the early contexts are on average larger than those from the later contexts (Figure 6.1); the early mullets peak at 160-180 mm standard length (average 164 mm), and the late mullets peak at 120-140 mm (average 144 mm). These might represent two different age cohorts or the same age cohort at a different time of year.

The early seatrouts are smaller than the late seatrouts (Figure 6.4); the early average is 202 mm standard length (range 141-246 mm) and the late average is 303 mm (range 175-475 mm). The early individuals might be from the 1- and 2-year cohorts, while the late individuals are from primarily the 3-year cohort, but also from the 1-, 2-, 4-, and maybe 5-year cohorts (Johnson and Seaman 1986:7). The otoliths of the *Cynoscion* genus can be difficult to identify to species. It is, therefore, also possible that more than one species is represented (weakfishes are generally smaller), and the smaller individuals in the early contexts are a different species than most or all of the individuals in the later contexts. In either case, the fishes caught by the fisher folk in the two time periods are different in size, which is suggestive of differences in age cohort, location, and technology.

Evaluation of seasonality using the reconstructed fish size data does not suggest a change in seasonal fishing activities. Sea catfishes in both the early and late collections are within the size range only caught in summer months in modern trawls (Dahlberg 1972). Silver perches of the size found in both time periods were caught during all months of the year in modern trawls (Dahlberg 1972). The seatrouts from both time periods are within the size range, or larger, than the spotted seatrouts caught in trawls during the warmer months (Dahlberg 1972). The spots and kingfishes from the early contexts were within the modern size range caught in all or most months (Dahlberg 1972). Likewise, the croakers from both periods are sizes caught all year (Dahlberg 1972). The early croakers, however, have a size-frequency distribution similar to that in modern summer catches.

If the modern data can be considered analogous to the archaeological data, then there does not appear to have been a drastic change in seasonality of fishing activities between the early and late period. This might suggest that people from the two time periods used different fishing locations. The modern data, however, are not fine-grained enough to discuss size-frequency in different habitats throughout the year, and trawls do not replicate prehispanic fishing techniques. Seasonality of fishing, therefore, cannot be ruled out as a factor in explaining the differences between the early and late Mississippian-period fish collections at Meeting House Field.

Shellfishing Strategy

A slightly different focus in shellfish gathering strategies also is suggested by the collections from the two time periods (Tables 4.2 and 4.4). Oysters dominate both collections; however, they contribute slightly less of the invertebrate biomass in the early contexts. In both the early and late contexts, the only taxa other than oysters to contribute measurably to the MNI or biomass are ribbed mussels, stout tagelus, and hard clams. All three of these secondary molluscs are more abundant in the early collection than the late one. Mussels and tagelus also contribute more meat during the early period. If oyster collection increased in the later period, this may explain the increased abundance of killifishes in the later period as well. Killifishes dominate the later collection and are very common over oyster beds. In the early period, a greater use of clam and tagelus beds for shellfishing, locations that tend to be subtidal or barely intertidal, also may have led to more fishing activity in these locations, and a slightly different set of fish sizes caught and deposited in middens. Changes to the shellfishing strategy, specifically the use of shellfish beds growing on different substrates, are also suggested by the oyster morphology and clam growth rate data, which are discussed in Chapter 7.

Social Factors

The faunal collections show no evidence that social factors governing access to animal resources changed between the early and late Mississippian period at Meeting House Field. Animals that might indicate status are rare in both collections, and their presence can more easily be attributed to chance encounters. Shark and/or ray remains are present in 25 percent of both the early and late period middens. Song birds are present in 50 percent of the early middens and 63 percent of the late middens. No birds of prey are present in any of the early or late contexts. Bird remains, however, are a larger percentage of the individuals and more common by volume excavated in the late contexts, which could suggest 1) that use of birds for food or ritual use increased, or 2) that song birds are a commensal taxon and increased as a result of middens being in use longer. Though dogs are not necessarily indicators of status, they are rare, and are found only in one, early midden.

The pattern of deer element distribution among the middens of the two periods is similar, and does not suggest a change in access (Figures 5.5 and 6.6). Overall, medium-utility portions are overrepresented relative to a standard deer in both periods, while low- and high-utility portions are underrepresented (Figures 5.7 and 6.7). In the early period, high-utility portions are overrepresented in a single midden, though medium-utility portions are overrepresented in this and two other middens. Low-utility portions dominate the other midden. Although this could suggest that there was differential access to deer carcasses in the early period, the midden in which low-utility portions are overrepresented is also the richest in taxa and contained a Weeden Island-esque pottery sherd, something not found in other ceramic collections from the island, and conceivably indicative of high-status. In the later period, the two middens in which low-utility portions are overrepresented contain only deer teeth. This could suggest these households did not have access to deer meat. Other explanations are possible however: these middens could represent village locations where deer were not discarded, these households may have been more diligent in discarding their deer remains in the marsh, or the 1-x-1-m unit just did not encounter deer, a rare taxon, in the midden due to chance.

Demographic Arrangement and Site Location

Archaeological evidence indicates that there were more people living on the island during the late Mississippian (Irene phase) than during the early Mississippian (St. Catherines phase) and that settlements were larger, or at least more heavily occupied. Components per century increased from 4 to 17 (Thomas 2008:1049–1051). Although the percentage of these sites considered large only increased slightly (33 to 38 percent), there were more large sites on the landscape during the Irene, given the shorter time span and larger number of sites (Thomas 2008:877). During the St. Catherines phase, no components had ceramic collections with more than 99 sherds, while 12 sites had more than 99 sherds during the Irene (Thomas 2008:848–850). Although recovery methods were an issue, only 43 percent of the St. Catherines phase components from the transect survey contained identifiable faunal remains, while 71 percent of the Irene components contained identifiable fauna. These measures all suggest that more people occupied the island during the Irene phase and that either more people lived at many of the sites or the sites were occupied for longer periods of time.

Throughout the Mississippian sites were located primarily along the island margins (Thomas 2008:848–850). The most obvious change in settlement distribution was an increase in use of the southern Holocene dune ridges. These locations were used more heavily during the Mississippian period than during preceding periods, probably because of the changing geomorphology. Guale Island and the northern marshes were gone by this time and the southern dunes were likely more stable with better soils than during earlier times (Thomas 2008:846–851). Use of the southern dunes increased from the St. Catherines to Irene phase from 1 component per century to 4 components per century (Thomas 2008:846–851). The ceramic and faunal collections from the southern dune sites were relatively sparse during both phases (Thomas 2008:848–850) suggesting that occupation was relatively light.

Clam Seasonality

The clam incremental analysis may suggest a difference in seasonal use of the Meeting House Field locality during the early and late Mississippian periods. This might account for the differences in fishing and shellfishing strategies. Eight-five percent of the clams from the early context are in opaque growth—in other words they were collected during the winter and spring (Figure 6.8). Sixty-seven percent are in the first phase of opaque growth, suggesting that clams were collected primarily in the early winter. Sixty-six percent of the clams in the late contexts are in opaque growth, and the distribution among growth phases is more equal over all, indicating that clams were collected throughout the year, although primarily during the winter and spring (Figure 5.10). Although the seasons during which clam collection was most common are the same for both time periods, it is possible that the later contexts were occupied for more months of the year. On the other hand, the sample sizes of whole clam valves used in incremental analysis from both periods, and especially the early period, are relatively small (*N*=34 for the early contexts and *N*=62 for the late contexts), and they may not be representative of all clams at the site. The fish seasonality data from the early contexts—namely that those fish sizes that can be associated with a season indicate summer catches—also suggests that these middens were not simply the outcome of fall-winter occupations.

Length of Occupation and Storage

The archaeofaunal collections from Meeting House Field suggest that the locality was occupied for a longer period of time during the Irene phase. Commensals can be indicators of habitation intensity and of the intensity of activities or structures that attract certain taxa. An increase in commensals is often associated with longer-term occupation and/or larger populations (Kelly 1992) and with storage of grains (Cucchi and Vigne 2006). If sites were occupied for longer periods of time by more people during the late Mississippian on St. Catherines Island, then there should be an increase in commensal taxa such as frogs, toads, salamanders, and lizards (herpetiles), and shrews, moles, mice, rats, and terrestrial gastropods.

Mice and rats are notoriously attracted to stored foods and to garbage (Cucchi and Vigne 2006). Shrews are attracted to the animals discarded in middens. Moles, shrews, and toads, among others, eat the arthropods and gastropods attracted to garbage. Many of these animals burrow, which is not conducive to maintaining a clean house floor or dooryard. Herpetiles may also congregate in cool, shady places such as the base of structures shaded by eaves. The longer a site is occupied, the more likely these vertebrate commensal taxa will be encountered at the site and thrown into a midden. Some may have died on the midden itself and other were likely they killed or found by humans and disposed of in the middens. Terrestrial gastropods are a diverse set of taxa with a variety of habitat preferences. All the habitats on St. Catherines Island—forests, dry sandy soils, and swampy areas—are home to terrestrial gastropods. They generally are tolerant of human disturbances and some species are even attracted to calcareous soils, such as those in the vicinity of shell middens. Terrestrial gastropods would be expected at any settlement on St. Catherines, and an increase in their frequency might also be associated with using middens for longer periods of time.

There is little change in commensal vertebrates from the early to late contexts at Meeting House Field. Herpetile and mammal commensals, measured as NISP/volume excavated, are about the same for the early and late contexts—even a little higher in the early contexts (Table 6.1). This would suggest that there was a similar intensity of occupation in the Meeting House Field vicinity throughout the Mississippian period; middens were in use for about the same amount of time and storage of vegetable and grain food stuffs did not greatly increase. Commensal herpetiles and mammals, however, contribute a larger percentage of the vertebrate individuals in the late collection than in the early collection. This is additional support for the hypothesis that more of the vertebrate food remains were discarded somewhere besides shell middens in the later period.

An increase in the frequency of terrestrial gastropods, measured as MNI/volume excavated, from the early to late contexts at Meeting House Field, does suggest that middens were in use longer in the late Mississippian (Table 6.1). Terrestrial gastropods inhabit middens and surrounding calcareous soils and are a good indication that the midden material accreted slowly and over time. If midden material was quickly deposited, abandoned, and covered in soils and vegetation, the number of gastropods throughout the midden would be lower than if midden surfaces were left open to commensal visitors and built up over a long period of time. This does not necessarily contradict the evidence from vertebrate commensals. Terrestrial gastropods end up on middens through their own accord. Herpetiles and mammals were more likely contributed by humans (though, some might have lived in or on middens and died there), and it is possible any increase in commensal herpetiles and mammals on settlements from the early to late period is masked by disposal processes as well. During the late period, more vertebrate commensals might have been disposed of with other vertebrate waste—tossed in the marsh, burned, buried, or scavenged and removed by dogs.

In terms of vertebrate commensal taxa, the Mississippian period as a whole is different from the Late Archaic period in the Meeting House Field locality (Table 6.1). The frequency of commensal herpetiles and mammals (NISP/volume excavated) is far lower in the Late Archaic contexts from the St. Catherines Shell Ring (Colaninno 2010:114–120) than for the Mississippian contexts in the Meeting House Field locality. This suggests an increase in habitation intensity and storage volumes over time in the locality, though the major changes may have occurred before the Mississippian period, not with the advent of Irene chiefdoms.

Waste Management

Longer-term occupation of sites may also lead to more formalized, structured waste management practices (Birch 2010:136; Kelly 1992; Kelly et al. 2005). The Irene-phase populations had to manage greater amounts of garbage. Larger numbers of people create more food and household waste, and the longer a settlement is occupied the more waste accumulates. Health concerns increase when more people live together longer, as viruses, bacteria, and other parasites spread easier. Formal sanitation practices reduce the spread of disease organisms and vectors, which can be common in wet, warm environments such as the marshes and swamps of St. Catherines Island (Reinhard 2008). Placement of middens near residences could have been regulated, but there may also have been an impetus to dispose of some waste in other locations, perhaps further away from living areas. Disposal in non-residential areas could limit the size and rate of midden growth, and cut down on pests. Management of waste may also have been associated with a more hierarchical society. The authority to dictate settlement organization and other behavior might have been part of a chief's status. Or there might be a desire to maintain an aesthetic considered appropriate for a community that was part of a chiefdom. People would have conformed to the new formalized disposal practices, whether imposed by a chief or agreed on by the community, even though they had to walk further to dispose of their food waste.

The archaeofaunal collections from Meeting House Field suggest a change in waste management between the early and late Mississippian. The sheer volume of vertebrate material is greater during the early period. NISP, MNI, and weight per volume in the early contexts are over twice as high as in the late contexts (Table 6.1). The volume of vertebrates is also smaller at the other late Mississippian sites than in the early Meeting House contexts. Commensal vertebrate taxa are a larger percentage of the NISP in the late Meeting House and Back Creek contexts than in the early Meeting House contexts. Although people may have consumed more shellfish relative to vertebrates during the Irene phase, stable isotope evidence does not support that conclusion. Increased consumption of molluscs relative to fishes should lead to a decrease in nitrogen isotope values, something not observed in human skeletal data (Larsen 2002; Schoeninger et al. 2009). Instead, perhaps vertebrate food waste was disposed of in a different location in the late Mississippian than earlier.

One waste management solution might have involved discarding vertebrate materials somewhere besides shell middens. Shells were still deposited in middens, so wherever vertebrates were deposited was likely not conducive for discard of shells. One such location that fits this description is the marsh edge in the vicinity of settlements. Tidal action would remove much of the deposited waste, and aquatic scavengers such as catfishes would also facilitate removal. Discarding heavy, hard, and/or non-organic materials like shell and pottery in the marsh, however, would be less desirable. Such materials get lodged in the mud and grasses and alter the substrate, erosional patterns, and water action along the marsh edge. This might encourage colonization by invertebrates, such as oysters, or lead to other changes in the marsh and tidal creek morphology. Although it might be desirable to encourage formation of new oyster beds in some locations, perhaps it was not desirable so close to a permanent settlement, since settlement sites were chosen because of the existing conditions. As such a disposal strategy would leave little evidence in the marsh, this is speculative. Other possible methods of disposal for vertebrates include burning, use as fertilizer, and burying in pits. Bone is also more easily burned and buried than shell, which is more voluminous and breaks down more slowly. Most excavations at Irene sites have focused on middens, so it is difficult to evaluate off-midden possibilities. Recent block excavations at Meeting House Field have not found evidence for vertebrate materials discarded anywhere besides middens, though the acidic soils of the island are unlikely to preserve vertebrate materials without the addition of shell material.

Another possible explanation for the decrease in vertebrate materials in shell middens is that scavenging animals removed and consumed a large portion of the discarded food remains. In the Kalinga village study, most food remains were removed by dogs and chickens, so the middens contained little food debris (Beck and Hill 2004). The Mississippian people on St. Catherines Island did not have chickens, but other birds may have removed some of the midden material (Wing and Quitmyer 1992). An increase in bird scavenging would likely occur if middens were in use and left open to the elements for longer periods of time, as suggested by the evidence from other commensal taxa. Given the rarity of bird remains in both early and late middens, however, there is no way to evaluate the possibility of increased bird scavenging.

Mississippian people did have dogs, and these animals would also have removed materials from middens. No evidence for large scavenger gnawing was observed on specimens from either the early or late contexts, however. As dog remains are rare—only seven specimens were identified in this study and these were all from early contexts—it is not possible to evaluate the possibility that there were more dogs scavenging during the late Mississippian period.

Evidence from Other Irene Sites

The other Irene-phase collections, from Back Creek Village and 9LI1637, are similar to the collection from the late contexts at Meeting House Field and support the conclusion that there were changes in waste disposal and settlement intensity during the Mississippian period. The amount of vertebrate material—NISP, MNI, and weight per volume excavated—at Back Creek and 9LI1637 is less than the amount per volume from the early Mississippian contexts at Meeting House Field (Table 6.1). This is the same pattern observed between the early and late

Meeting House contexts and supports the conclusion that waste disposal was more formalized in the Irene phase. The amount of vertebrate material is the lowest among Irene sites at Back Creek, perhaps suggesting even more organized waste disposal at that site than at the others. Herpetile and mammal commensal taxa are less frequent per volume at Back Creek and 9LI1637 than in the early or late Meeting House Field collections. Commensal taxa, though less frequent in the Back Creek collection than the late Meeting House Field collection, indicate that both Back Creek and Meeting House were residential sites in the Irene phase. Back Creek Village might have been occupied for a shorter period of time or by a smaller group of people, which would cause less of a disturbance to the plant and animal communities and attract fewer commensal taxa. It is also possible that, if disposal of food waste was better organized at Back Creek, then disposal of commensal animals may have been as well. The frequency of herpetile and mammal commensals is particularly low at 9LI1637, suggesting this site was not occupied as long as Meeting House and Back Creek. The middens at 9LI1637 are larger, but not as numerous, than at the other two Irene sites. The lack of commensal taxa and the sheer dominance of fishes in the 9LI1637 collection suggest that this midden may represent a shorter-term residential site where fishing was the major subsistence activity. Its location along Walburg Creek, as opposed to along the marsh (as at the other sites), may have been intended to facilitate fishing expeditions.

Territoriality

Territory size may have changed during the Irene phase. More people and settlements likely led to greater competition for resources. Although there may have been plenty of resources available on the island, the part of the island used by a specific settlement supported only a subset of these resources and more households were competing for each subset. Territory size may have decreased, as a consequence of more settlements competing for resources. However, foraging territories were probably relatively large, given the use of watercraft to move between barrier island, marsh island, and mainland locations. Some evidence suggests a decrease in the occupation of neighboring barrier islands (DePratter 1978; Pearson 1977; David Hurst Thomas, personal communication 2012). Perhaps people on St. Catherines Island used these other islands for foraging which would have enlarged their foraging territory. Therefore, although Irene-phase settlements had access to fewer resources on St. Catherines Island, their overall access to resources may not have been different from the St. Catherines-phase settlements.

There are few ways to address territoriality using faunal collections, but one method is to examine evidence for processing and transport of large animals. An overrepresentation of low-utility portions is indicative of a butchering site, whereas consumption sites are those where high-utility portions are overrepresented (Binford 1978:72–74; Metcalfe and Jones 1988; Thomas and Mayer 1983). The further a hunter has to transport the deer back to the residential site, the fewer low-utility parts of a carcass he is likely to carry with him. This argument assumes hunters will field-process animals when the costs of transporting a heavy load increases (longer distance), and will only transport the high-utility portions because they contain the most meat. In the case of Meeting House Field, which is considered a consumption site (a village, as opposed to a short-term hunting camp), medium- and high-utility portions of deer are overrepresented in both time periods (Figures 5.7 and 6.7). It might be possible to argue that an underrepresentation of low-utility parts in both time periods is the consequence of field-processing deer. Low-utility portions, such as foot and cranial elements, however, are present in both early and late collections. Teeth account for overrepresentation of low-utility parts in some middens. This may be because teeth are the most identifiable deer elements when fragmented. It could also suggest that heads had some cultural value not associated with meat acquisition. Ultimately, there was little change between the two periods in terms of deer portions in the Meeting House Field locality, so there is no evidence that later people made different decisions about processing and transport. This would suggest that hunting-territory size did not change over time.

Subsistence and Settlement Pattern Change

The people represented by the early and late Meeting House Field faunal collections, living in different social and ecological settings, devised different solutions to the problems of resource use, demographic arrangement, and site placement. The Irene landscape contained more people, living in large, dense, settlements. These people chose to occupy settlements for longer periods of time, and likely adopted a different management strategy for waste, depositing vertebrate waste in locations other than shell middens. Irene people also emphasized different fishing technologies or fishing locations than the St. Catherines-phase people. This may be related to changes in foraging territory size, with greater use of marsh islands and Holocene dunes because access to St. Catherines Island resources was more restricted. People may have preferred using communal fishing techniques, such as weirs and seine nets, during the Irene phase. Larger communities and greater cooperation among households might have made communal methods more attractive. Such methods probably targeted different parts of the water column, different creeks, and different times of day—all factors affecting the relative abundance and size of species in the archaeological record.

Guale society was socially stratified with chiefs or councils making community decisions, and involved household obligations to contribute to tribute payments to the chief. This may have influenced people's daily subsistence activities—producing a surplus on a daily basis. However, Guale appear to have grown maize to meet many communal surplus needs (Worth 1999, 2002, 2004), whereas during the preceding Irene phase, maize does not appear to be a major crop. Stable isotope analysis of human bones suggests maize was added to the existing Irene diet but did not replace estuarine resources (Larson 2002; Schoeninger et al. 2009). This may indicate that the Guale model does not apply to the Irene phase, and was a symptom of European contact and the social and political instability wrought by disease and new power struggles. This is supported by the lack of evidence for differential access to resources in the Irene-phase faunal collections, discussed in this chapter and Chapter 5. Irene-phase societies were chiefdoms, however, which likely required some tribute payments to chiefs and contributions to communal stores. Maize, grown in household gardens or small fields, was likely a tribute currency, but this did not greatly affect daily subsistence activities greatly. Wild resources were likely part of the tribute system (Jackson and Scott 2003; Kelly 2001; VanDerwarker 1999). It is possible that the Irene fishing strategy was designed to capture a greater number of fishes, to be contributed to communal stores or tribute payments. The following chapter will address the impacts the Irene-phase settlement-subsistence solutions had on animal populations.

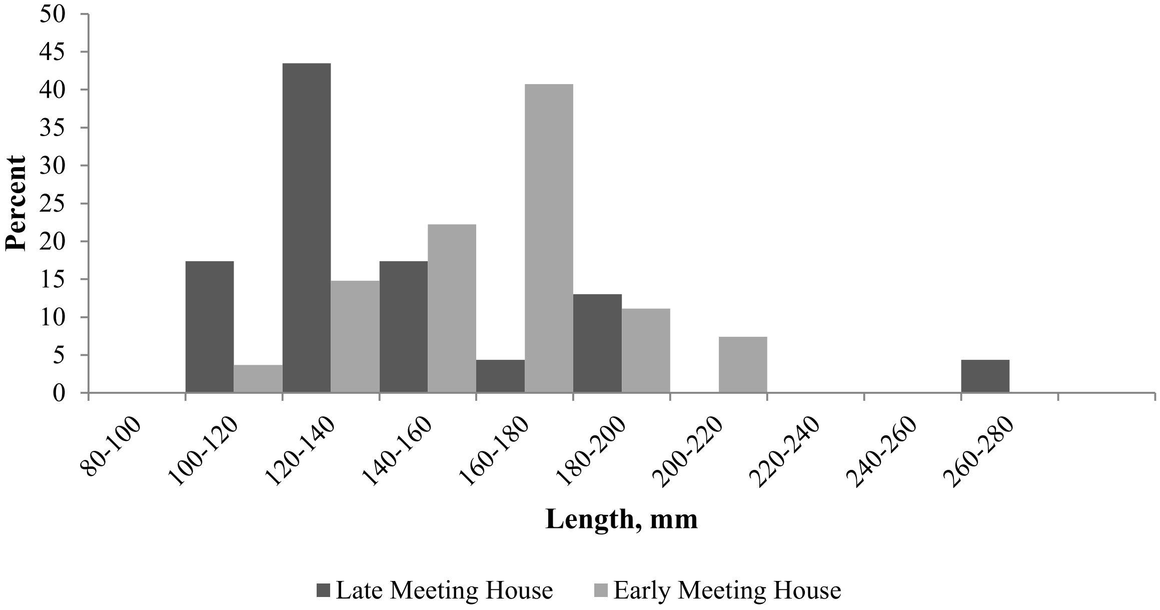


Figure 6.1: Reconstructed size frequency distribution of mullets (*Mugil* sp.) from early Meeting House and late Meeting House Field

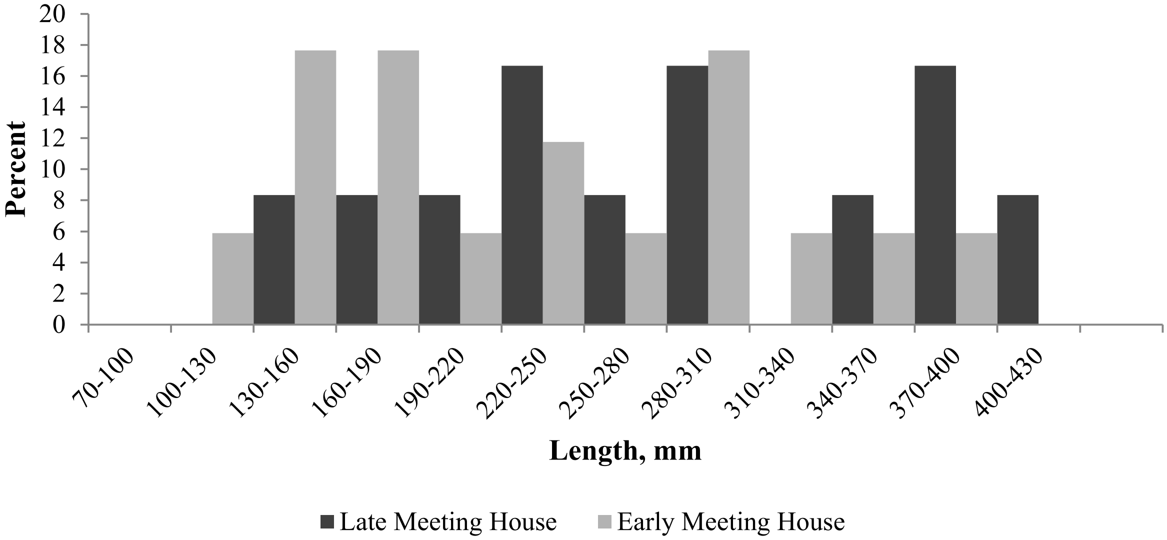


Figure 6.2: Reconstructed size frequency distribution of sea catfishes (Ariidae) from early Meeting House and late Meeting House Field

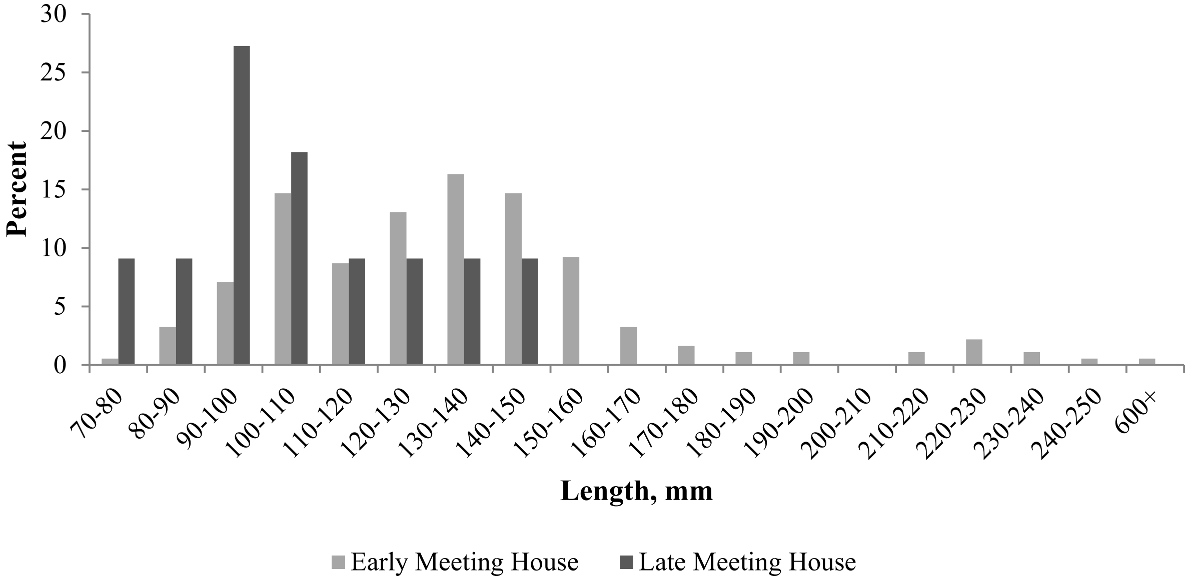


Figure 6.3: Reconstructed size frequency distribution of other drums (Sciaenidae) from early Meeting House and late Meeting House Field

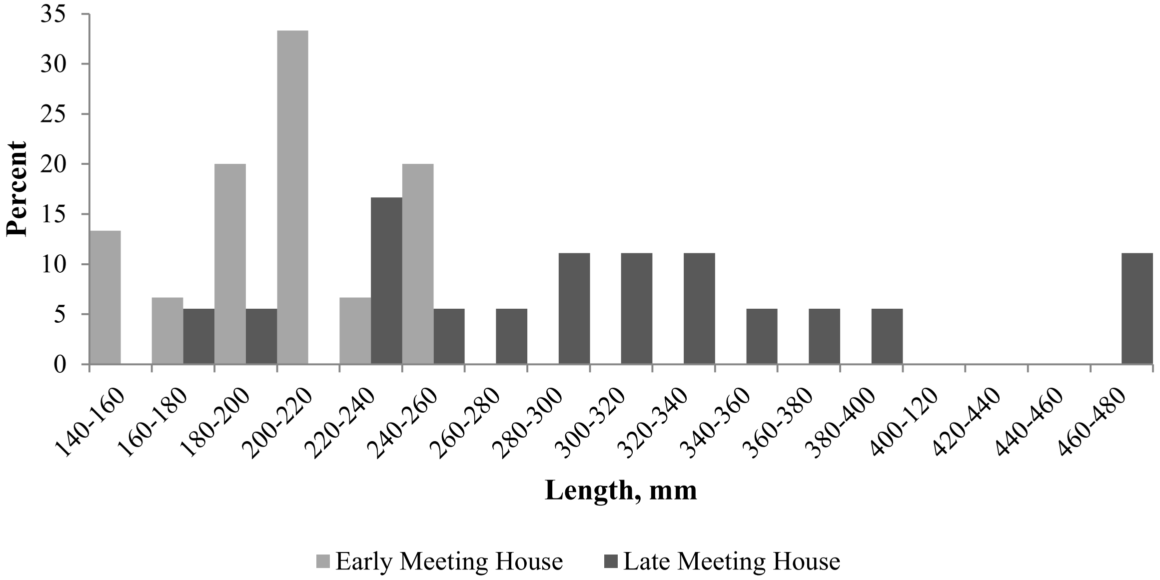


Figure 6.4: Reconstructed size frequency distribution of seatrouts (*Cynoscion* sp.) from early Meeting House and late Meeting House Field

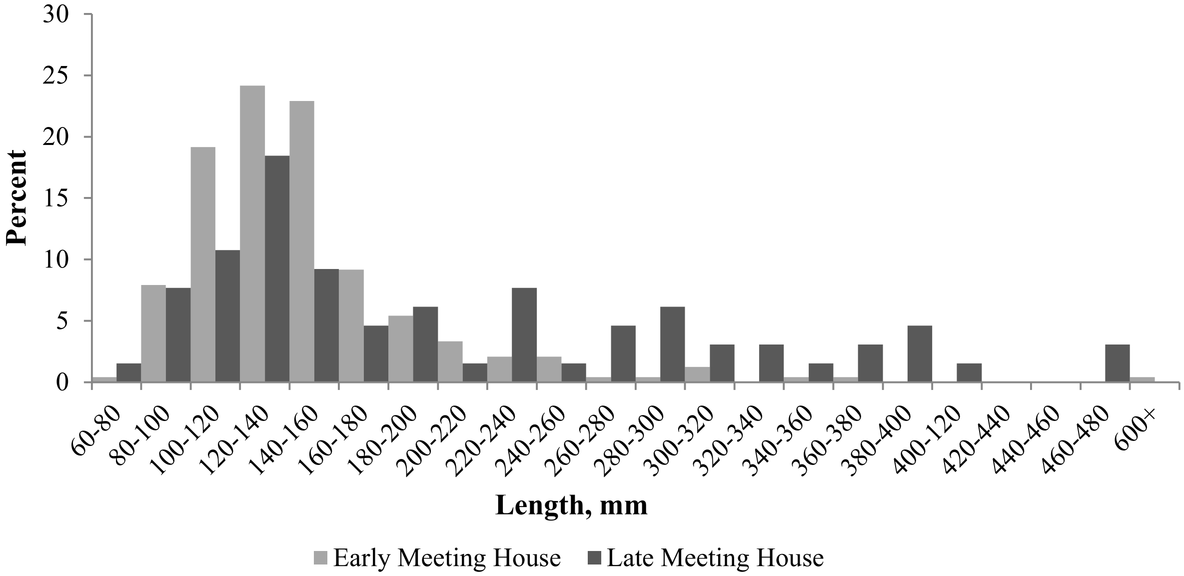


Figure 6.5: Reconstructed size frequency distribution of all fishes from early Meeting House and late Meeting House Field

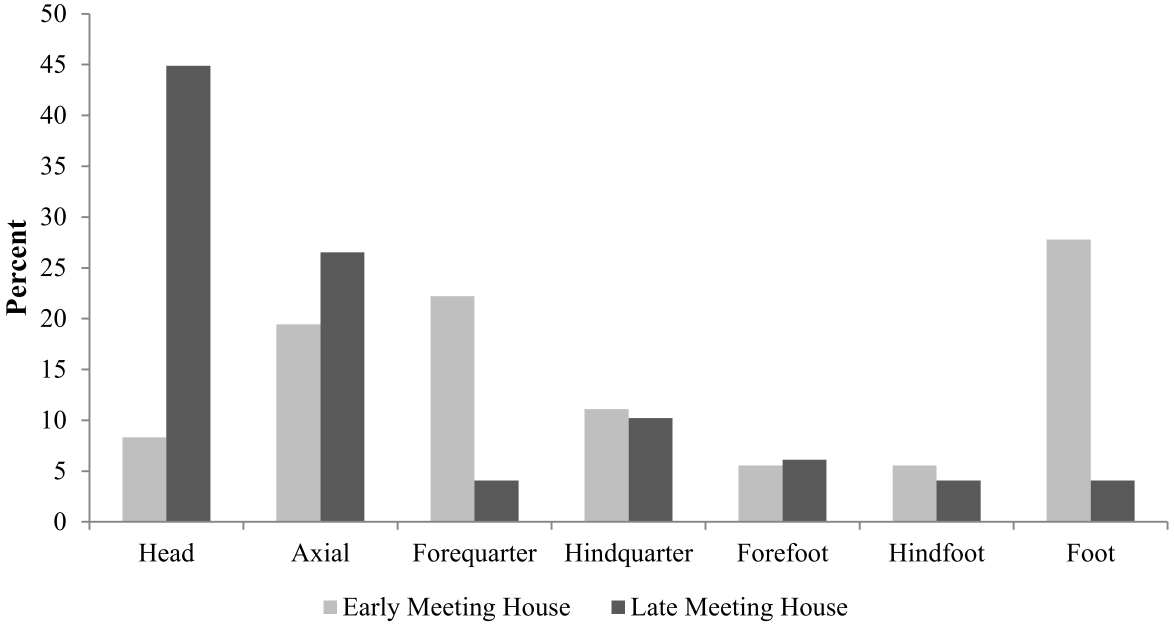


Figure 6.6: Deer element distribution from early Meeting House and late Meeting House Field

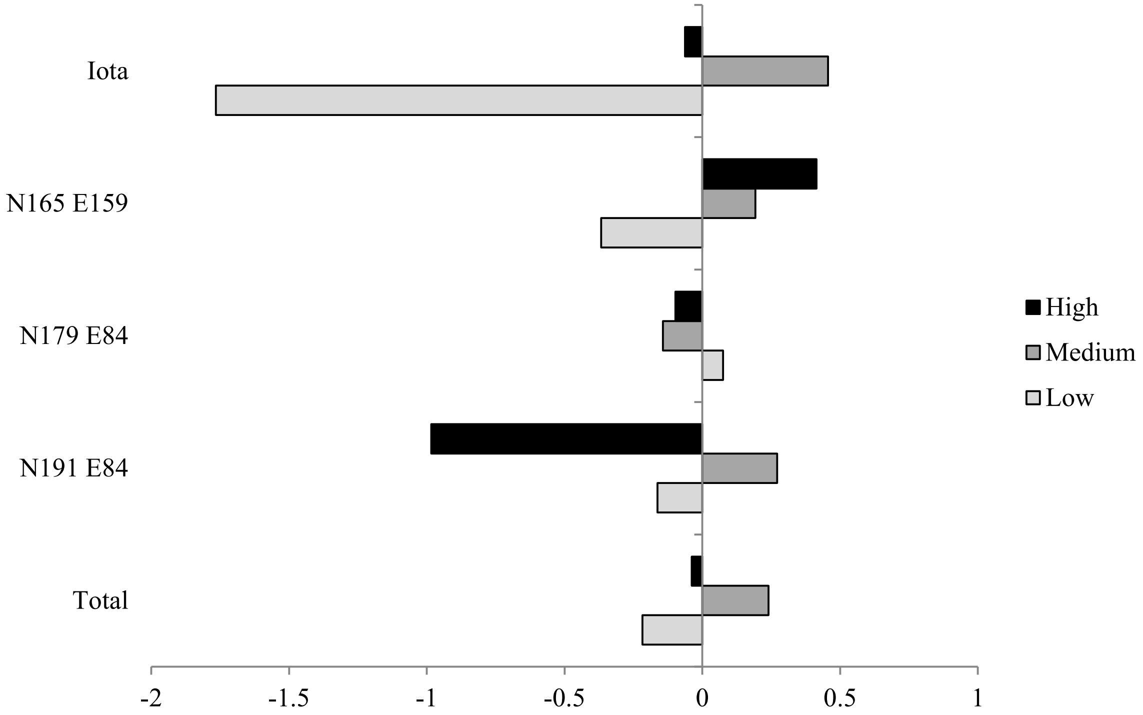


Figure 6.7: Deer food utility indices for individual units from early Meeting House Field and for the early contexts as a whole (following Purdue et al. 1989)

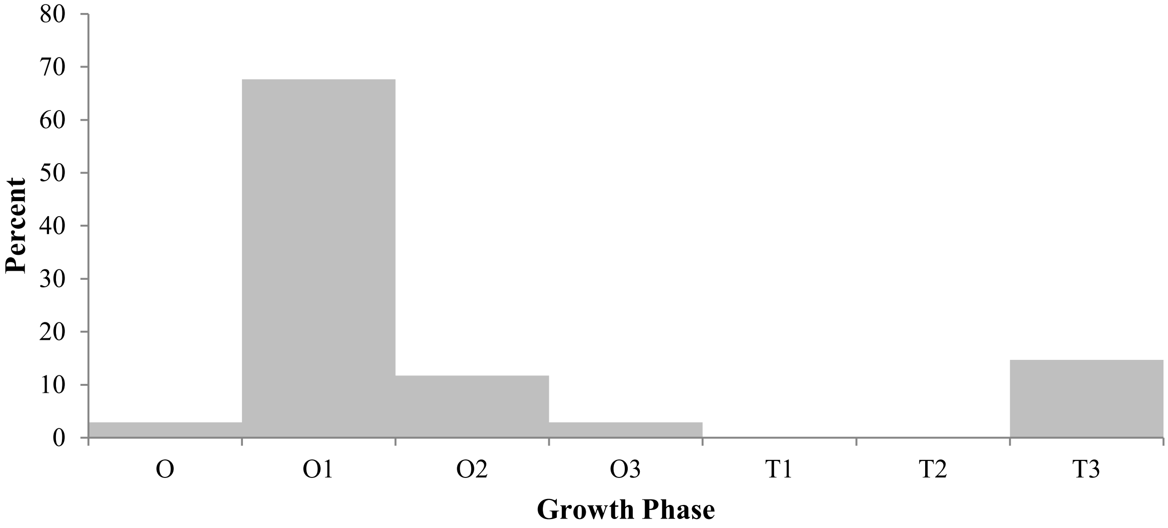


Figure 6.8: Frequency distribution of seasonal growth phases of hard clams from early Meeting House Field

Table 6.1

Volumetric Comparisons

	Early Meeting House Field	Late Meeting House Field	Back Creek Village	9Li1637	St. Catherines Shell Ring (Colaninno 2010)
# Units	4	8	14	2	9
Volume, m3	2.4 total; .96 sample	5.9 total; 2.36 sample	8.4	2	10.1
Vertebrate NISP	23636	23956	14881	11145	—
Vertebrate MNI	452	414	449	240	—
Vertebrate Wt, g	850.481	693.919	2049.296	424.322	—
Terrestrial gastropod NISP	1269	5249	—	—	—
Commensal Herpetile NISP	369	390	374	22	169
Commensal Mammal NISP	61	110	75	2	70
Bird NISP	8	24	—	—	—
Deer NISP	49	36	—	—	—

CHAPTER 7:

RESOURCE DEPRESSION DURING THE MISSISSIPPIAN PERIOD

As discussed in the previous chapter, the Irene subsistence-settlement system was different from that of earlier periods. In Chapter 6, this was discussed in the framework of Jochim's model, which frames subsistence in terms of solutions to problems of resource use, settlement patterns, and demography. This chapter will address subsistence change within an optimal foraging framework. The third objective of the volume—to examine collections for evidence of human impacts on animal populations, will also be addressed. Resource depression covers both these topics. Diet-breadth and patch-choice models, which describe the range of taxa or patches exploited, predict that larger populations of people will lead to more high-ranked animals being killed or more high-ranked patches exploited, a decrease in the abundance of these animals or patches, and subsequent addition of lower-ranked animals or patches to the diet (Kennett 2005:218). The previous chapter suggested Irene people exploited different fishing grounds, and this chapter builds on that evidence by examining the variety of substrates exploited to obtain shellfishes. Environmental factors affect growth patterns of animals in a particular habitat, and changes in growth patterns can indicate human use of different habitats. Animal population dynamics can be sensitive to human predation, and a larger human population likely harvested greater numbers of animals. Morphology and incremental growth patterns of oysters, clams, and sea catfishes provide evidence to address growth conditions and harvesting rates. Although it is difficult to distinguish among the many possible mechanisms responsible for changes in growth patterns, it appears from the evidence presented in this chapter that people did expand the variety of substrates they exploited to obtain shellfish and predation rates did impact the growth of some animal populations during the Irene phase.

Resource Depression

Resource depression refers to decreased foraging efficiency as a result of predation effects on prey (Charnov et al. 1976). Foraging theory predicts that efficiency will decrease over time as people hunt high-ranked prey and eventually affect the abundance of these taxa (Broughton 1997, 2002, 2004; Butler 2000, 2001; Kennett 2005:218; Nagoaka 2002). As high-ranked prey become less abundant, people add lower-ranked resources to the diet. This works for resource patches as well; the resources in high-ranked patches become less abundant, the patches less productive, and people add lower-ranked patches to the repertoire. The depression of high-ranked resources is considered inevitable, as over time these prey are consistently targeted by people. However, changes in demography, technology, or settlement location can increase the effects of human predation (Kennett 2005:218–220; Lupo 2007). Larger human populations and more efficient technologies kill more animals and have a greater impact on prey abundance (Lupo 2007). Increased sedentism may lead to increased harvesting of animals within the catchment area of settlements and settlements are often located near low-ranked, but abundant and stationary resources (Kennett 2005:218–220). Therefore, optimal foraging models would predict that Irene-phase human populations should increase their diet breadth and patch breadth as a result of declining abundance of prey.

Diet Breadth

The zooarchaeological evidence does not suggest that diet breadth increased during the Irene phase. The same taxa dominated both the early and late Mississippian collections, as well as the Late Archaic collections, specifically mussels, oysters, stout tagelus, clams, sea catfishes, mullets, killifishes, drums, diamondback terrapins, and deer (Chapters 4 and 5 this volume; Colaninno 2010). Other, less common, taxa are the same as well—a smattering of marsh gastropods and crustaceans, small birds, and other fishes, small mammals, and turtles. During the Irene phase no new taxa were added to the diet and no taxa became dominant that were not also dominant in the earlier collection. This evidence does not support the predictions of the diet-breadth model that the high-ranked taxa become less abundant and lower-ranked taxa are added to the diet.

One possible reason for this lack of increased diet breadth may be that people were already primarily targeting low-ranked resources. Optimal foraging theory and resource depression both rely on the assumption that large animals provide the most energy for effort. The model developed for St. Catherines Island also makes this assumption, but does account for the fact that mass-capture techniques, such as used in fishing and shellfishing, can make capture of small animals more energy efficient (Thomas 2008:75–197). People on St. Catherines Island did not preferentially target large animals from any patch except the terrestrial patch, where they hunted deer. The rest of the dominant subsistence taxa in both the early and late Meeting House collections were small, mostly mass-captured, estuarine animals. Hence, during the Irene phase there were few low-ranked and abundant taxa not already part of the diet.

It is worth exploring the possibility of resource depression in deer, the one large-bodied animal that was consistently part of the diet. Much has been made of the abundance of deer in St. Catherines Island collections over time (Reitz 2008; Thomas 2008:943–968). The transect survey collections suggest not only a continued abundance of deer on St. Catherines but also a consistent dominance of deer in zooarchaeological collections (Thomas 2008:953). In a regional comparison of the faunal collections from the Georgia barrier islands and adjacent mainland, Thomas (2008:943–968) found that deer were more common over time on the northern barrier islands (e.g., St. Catherines and Ossabaw) than anywhere else on the coast. Given that the diet-breadth model predicts deer were high-ranked resources and should be taken when encountered, these findings suggest that deer populations were not abundant in locations other than the northern barrier islands. This lack of abundance in most places might be due to over-hunting by humans, while deer populations on St. Catherines Island were somehow sustainably managed (Thomas 2008:943–968). Island deer populations are more susceptible to predation pressure than mainland populations because deer from other populations cannot as easily migrate to the islands; perhaps the deer populations on some islands were extirpated as a result of human predation (Thomas 2008:943–968). As for mainland deer populations, given the fact they were not circumscribed, perhaps they preferred more interior habitats, where better-quality browse and mast were more abundant, and avoided the coastal marshes when possible. This would make them an infrequently encountered prey item along the mainland coast.

The fine- and water-screened collections from the Late Archaic (Colaninno 2010) and the Mississippian period presented in this volume, demonstrate that deer were not as dominant in subsistence over time on St. Catherines Island as proposed based on the transect survey collections. Abundance indices (AI) calculated for deer from non-transect collections suggest that deer abundance was low and did not change over time (Figure 7.1; Table 5.2). The AI calculated from biomass, on average, does decrease over time, though there is variability within each time period and this variability is the same for the Archaic as for the Irene phase (Table 5.2). The fact that the AI calculated from NISP and MNI remains constant but decreases when calculated from biomass suggests that the decrease in deer body size, known for St. Catherines deer (Purdue and Reitz 1993), is the reason for this decrease in $\mathrm{AI}_{\mathrm{Biomass}}$ as opposed to a decrease in the overall abundance of deer.

Although resource depression in terms of decrease in prey abundance did not occur in deer populations, behavioral changes associated with human predation may have occurred. Anticipating the results of the stable isotope analysis of St. Catherines deer bones, perhaps the persistence of the deer population, and the decreased body size of deer individuals, is related to a change in animal foraging behavior. It has been suggested by Thomas (2008:960–964) that the poor soils and low-quality browse of the sea islands, may account for the decreased body size. When modern, small island deer are fed a high-nutrition diet they reach greater body weights than deer that feed in the wild on Blackbeard Island (Osborne et al. 1992:36). The stable isotope evidence presented in Chapter 8 suggests that Mississippian and modern deer on St. Catherines forage more frequently on low-quality grasses, such as those in the salt marsh, than Archaic deer. Archaic deer, therefore, had greater access to preferred maritime forest browse because the environment at the time contained more of this habitat-type and because there was less competition with people (during the Mississippian period) or other deer (modern period).

The remainder of this chapter presents evidence for changes in the population ecology of oysters, clams, and sea catfishes in the archaeological record and relates this to resource depression. Morphology and growth patterns of these organisms are dependent on the environmental conditions in which they grow, which is suggestive of human exploitation of certain patch-types. However, humans also can affect growth of organisms through predation. This, in turn, may reduce the productivity of these organisms and result in resource depression.

Population Ecology

Modern fisheries are in decline as a result of fishing practices (Hutchings and Reynolds 2004; Jackson et al. 2001; Worm et al. 2009). The average trophic level of global fisheries has decreased over the past hundred years, suggesting a shift in the marine community towards small piscivorous and herbivorous fishes (Pauly et al. 1998, 2000; Secretariat of the Convention on Biological Diversity 2006). Breeding populations have declined considerably over time (Hutchings and Reynolds 2004; Worm et al. 2009), likely as a result of removing too many breeding adults (Mace 2001). Modern fishery policy has focused on protecting juveniles so they can grow into breeding adults, but this does not account for the fact that many large, productive adults are needed to produce enough offspring to replace the population. Individual growth rates of modern fishes and shellfishes are also sensitive to human predation (Blanchard et al. 2005; Jennings et al. 1999; Peterson 2002; Rijnsdorp and van Leeuwen 1992, 1996; Wootton 1998:238–243). Declines of such global proportions are probably rare before modern times, but there are examples of fishery declines as a result of commercial fishing activities on the Roman Iberian Peninsula (Morales-Muñiz and Roselló-Izquierdo 2008) and in Medieval Europe (Amorosi et al. 1996; Barrett et al. 2004). Smaller-scale changes in the dynamics of marine animals are observed in many archaeological assemblages. Such changes include a decrease in mean and maximum age of exploited shellfish populations (Erlandson et al. 2008; Mannino and Thomas 2001; Milner et al. 2007; Quitmyer and Jones 2000), an increase in growth rates of some fishes (Hales and Reitz 1992; Luff and Bailey 2000), and a decrease in trophic level of exploited fishes (Quitmyer and Reitz 1996; Reitz 2004). It is possible that the socio-political changes during the Mississippian period, by increasing predation, influenced the growth patterns of fishes and shellfishes.

The structure of archaeological estuarine prey populations might have been altered by three main processes during the Mississippian period. One is a change in density-dependent growth. Intraspecific competition can be a major factor in determining the quantity and quality of individuals in a population if there is competition for limited resources (Begon et al. 1996:29–51; Rockwood 2006:34–65; Wootton 1998:126–128). It is difficult to demonstrate that there were limited resources for an archaeological, or even modern, population (Begon et al. 1996:29). In the ecological model of density-dependent growth individuals compete for resources, such as food, space, and mates (Begon et al. 1996:29–51; Rockwood 2006:34–65; Wootton 1998:126–128). Humans are predators, and as such affect the population density of their prey. An increase in predation removes more individuals from a population, which leads to a decrease in intraspecific competition. When individuals have access to more of a previously limited resource each can grow to a larger size and at a faster rate, and mortality rates decrease (Dulvy et al. 2004; Lorenzen and Enberg 2002; Rijnsdorp and van Leeuwen 1992, 1996; Rose et al. 2001). Individuals may also be able to produce more offspring. However, because larger adults produce more offspring, if people remove too many of the larger, adult individuals, population size may not increase and recruitment could even decrease (Dulvy et al. 2004; Rose et al. 2001). By decreasing the population density of one species, humans may affect the entire trophic system (Estes and Duggins 1995; Jackson et al. 2001). Some non-targeted taxa may benefit or be harmed by changes in the abundance of targeted species. For example, hunting of sea otters on the Alaska Coast depleted the otter population, which meant otters' preferred food, the sea urchin, increased in numbers and grazed kelp forests to collapse (Estes and Duggins 1995). Humans, therefore, have the potential to influence the health and relationships of entire estuarine communities (Jennings et al. 1999; Jørgensen et al. 2007; Piet and Jennings 2005).

Removing too many large, reproductive-age individuals also can result in a smaller average body size in a population. Increased mortality can lead to physiological responses in the remaining individuals such as maturing at a smaller size, either because they put more energy into reproduction, or because by avoiding predators they feed less (Jørgensen et al. 2007). This leads to decreasing individual growth rates. Genetic variability may also play a role (Biro and Post 2008; Conover and Munch 2002). There are a variety of genotypes in all populations; one aspect of a genotype is the rate of potential growth expressed in the phenotype (Conover and Munch 2002). Behavior associated with genotypes with faster growth rates, such as greater overall activity and more frequent and aggressive feeding, can expose these individuals to predators more often than those with genotypes for slower growth (Conover and Munch 2002). In a study of lake-fish populations, the faster growing genotypes were 20 percent more likely to be harvested, regardless of body size (Biro and Post 2008). Modern fisheries are highly size-selective, targeting the larger fishes. Recent studies suggest that removing the largest fishes may remove fast-growing genotypes from the population (Conover and Munch 2002; Jørgensen et al. 2007). This leaves a population with smaller overall sizes, slower growth rates, and maturation at smaller sizes—all characteristics of some overfished populations.

Differences in growth between the early and late Meeting House Field contexts also could be due to changes in the habitats humans exploited. Populations of the same species that occupy different habitats can exhibit different growth patterns. This occurs on a large, latitudinal scale where extrinsic factors, such as temperature and precipitation regimes, and intrinsic factors, such as processes of adaptation and genetic drift, affect growth (Conover et al. 2005; Jones and Quitmyer 1996; Singh and Zouros 1978; Wootton 1998:122–126, 128–129). It also occurs in estuaries, where water quality, salinity, food availability, and substrate, among other factors, vary across space and time (Wootton 1998:122–126). Different substrates affect growth patterns in shellfish (Galtsoff 1964:399; Walker 1987:8). Water movement can sort shellfish populations by size and age (Rollins et al. 2008:25–27). When combined with variation in substrates this may result in different growth rates, maximum sizes, and age structures within populations of the same species in the same estuary (Galtsoff 1964:399; Rollins et al. 2008:25–27; Walker 1987:8). Fish cohorts sort themselves by size and age in some cases, feeding in different locations in the estuary based on preferences for food, protection, and environmental conditions (Nelson et al. 1991:41–90; Wootton 1998:87–97). Behavioral traits of individual fishes, such as the frequent and aggressive feeding described above (Biro and Post 2008; Conover and Munch 2002; Jørgensen et al. 2007), or the opposite, deeper burrowing or keeping to parts of the water column where predators and food are less common, also creates variation in growth patterns across space (Lankford et al. 2001). All these processes mean that animals collected in different habitats, or fishing locations, may exhibit different growth patterns.

It is difficult to differentiate among the causes of growth patterns observed in the archaeological record. Individuals recovered at an archaeological site are only partial proxies for the natural populations from which they were drawn. They represent certain sizes and ages selected by humans through use of specific fishing technologies, schedules, or locations. Therefore, it is not possible to know if the size and age ranges represented in the collection are the same as ranges in these characteristics in the natural population. If the same technology and selection processes are assumed, however, differences among collections must derive from differences in the natural populations. These differences may be the result of people collecting animals from different habitats, given that there can be significant variation in age and size structure and growth rates among individuals in different environmental conditions. Exploitation pressure is the other likely explanation for observed differences in collections, as animals can adapt to increased levels of predation, or be depleted and unable to recover to a normal population structure. This chapter presents the results of analyses of shape, size and age structure, and growth rates for archaeological oysters, clams, and sea catfishes from the early and late Mississippian contexts at the Meeting House Field locality, as well as for clams from Back Creek Village. These animals were chosen because of they are common and abundant in archaeological collections and because earlier studies provide methodologies and comparisons for these species.

Oysters

The Eastern oyster is the most common animal component of the shell middens on St. Catherines Island. Oysters utilize most substrates except where the bottom is soft or shifting. Valve morphology varies with specific substrate and environmental conditions (Galtsoff 1964:399; Gunter 1938). Oyster larvae can settle and thrive in a variety of substrates, from rocky bottoms to mud strong enough to support the oyster's weight. Other live or dead bivalves in muddy substrates stabilize bottoms so live larvae can settle; oysters tend to form clusters in such conditions (Galtsoff 1964:399). A cluster can expand into a reef over time as dead oysters are dislodged, providing new substrate, and clusters grow into each other. There must be adequate movement of water to avoid siltation, carry away waste, provide nutrients and oxygen, and to distribute larvae (Galtsoff 1964:400). In the intertidal zone, oysters are exposed to air and sun for part of the day. This does not appear to affect growth, though extended periods of extreme hot or cold will kill individuals (Sellers and Stanley 1984:4). In fact, oysters in the intertidal zone may grow faster than those in subtidal zones, if daily exposure is not too great (Gillmor 1982). Oysters that settle on hard bottoms and have plenty of room to grow tend to have rounded shells that are ornamented with radial ridges and foliated processes (Galtsoff 1964:18). Oysters that settle on soft, muddy bottoms and ones that settle in reefs tend to be long and narrow, with little ornamentation (Galtsoff 1964:18). Oysters living over sticky mud bottoms are wider than they are long (Galtsoff 1964:22).

Height and length were measured for 1,351 oysters from the four early Meeting House Field locality units, and 3,744 oysters from the eight late units (Appendix E). The average height and length were just barely higher in the early period than the late period (Table 7.1). The early oysters tend to be a little longer and wider, though the distribution is quite similar, and the range is about the same (Figures 7.2 and 7.3). This suggests that the oyster populations exploited during the two periods had similar growth patterns, though the later population was a little smaller in size over all. This could indicate that the later population was younger on average than the early population; perhaps increased predation meant fewer individuals were able to reach older age classes. Alternatively, the tendency toward smaller heights and widths could suggest that the late oysters had less room to grow. If the late oysters were from the same locations as the early oysters, this would suggest a decrease in predation. However, it is also possible that late oysters were drawn from different substrates or oyster beds, ones where oysters were more tightly packed.

Additional evidence supports the interpretation that the later oyster populations were drawn from a greater number of substrates and oyster beds. The average height-to-length ratio (HLR) is nearly identical for both periods and falls within the range of oysters from mixed mud and sand bottoms growing in loose clusters (Table 7.1). The frequency distributions of HLR values, however, suggest that the early oyster population tended to have a lower HLR (Figure 7.4). The later oysters were more likely to have an HLR over 2.0, indicative of soft bottom and reef oysters. The average HLRs of the units from both periods are clustered around 1.8; however, the highest (2.18) and lowest (1.63) average HLR are both from late period middens, suggesting greater variation in the late period (Table 7.1). Other evidence supports an increase in use of reef oysters (Table 7.2). A higher percentage of the late oysters have oyster scars, though the vast majority of individuals from both periods have scars. Though uncommon in both populations, a higher percentage of late oysters also display more vivid coloring on the exterior of the shell, indicative of exposure to the sun. Ribbing is moderately common in both populations, but is more common in early populations suggesting those oysters were more loosely packed. Epibionts—sponges and polychaete worms—are more common in the later period, which could suggest that more oysters were collected from higher salinity locations than in the early period (Kent 1992:29–38).

Clams

Clams are consistently present in southeastern shell middens, but rarely in large numbers. Clam beds occur sporadically and infrequently in southeastern estuaries; the clams are often densely packed, but the beds are small (Rollins et al. 2008:24–25). They occur on sandy and muddy substrates, as well as in living or dead oyster beds and within cordgrass clumps. The latter two locations afford more protection from predators. Clams burrow one to two centimeters into mud or sand bottom, small ones generally burrowing deeper, and they can live in subtidal and intertidal locations (Eversole 1987:3–4). Densities vary depending on habitat. Clams are more densely packed within shell substrates and in small feeder creeks than in sandy and muddy substrates within tidal creeks (Walker and Tenore 1980). Hydrodynamics appear to play a role in structuring size and age structure in single locations; as water action sorts clams by size into different locations within a single channel (Rollins et al. 2008:25–27). Clams are long-lived, relatively sessile organisms. They reach maturity after about two years, and are marketable in today's fishery at 44 mm, after two to three years of growth. Growth rates, however, vary based on habitat. Individuals in subtidal populations tend to be larger than those in intertidal populations (Rollins et al. 2008:25). Individuals exposed for a good part of the day or located in densely packed substrates with little space to grow appear to have slower growth rates (Walker 1987:8). Unharvested populations are generally dominated by individuals larger than 78 mm (Walker 1987:9–12). Sustained harvesting can affect populations within a year (Eversole 1987:13). Such populations will be dominated by the 44-67 mm size class as members of the larger classes decrease in abundance (Walker 1987:9–12). Growth rates and distribution of size classes of archaeological clam populations, therefore, are indicators of clam habitats exploited by humans and possibly of changes in exploitation rates.

Incremental analysis of clam samples from the Meeting House Field locality and Back Creek Village was used to evaluate age and size structure, growth rates, and survivorship of the three populations (early Meeting House, late Meeting House, and Back Creek). A total of 97 clams from the Meeting House Field locality were analyzed to determine age at death; 34 of these were from the early units and 63 were from the late units (Table 7.3). A total of 316 clams from Back Creek Village were analyzed for age at death. The distributions of size and age classes, based on percent frequencies are shown in Figures 7.5 and 7.6. Growth rates, graphed as size-at-age at death of individuals, are shown in Figure 7.7. Figure 7.8 illustrates growth rates modeled using the von Bertalanffy method. Figure 7.9 shows the survivorship curves for each analytical unit.

The data suggest that people were selecting for size when they collected clams. All three archaeological clam populations are dominated by what, in today's markets (Walker 1987:3), would be considered littlenecks (44.4-67.0 mm length), the smallest legal size class (Figure 7.5). The second most common size class in these collections is cherrystones (68-77 mm length), which is the second legal size class. Only the Back Creek collection had many chowders (>78 mm): 20 percent. The growth rate curves support the size-selection argument, in that size generally correlates with age in these collections. Individuals from the three clam collections reached the same size-at-age until age two and a half (Figure 7.7). After that, size-at-age is more variable. Some variation is to be expected within a clam population because of individual access to space and other resources (Jones et al. 2012; Quitmyer 1985b:66; Quitmyer and Jones 2000). It appears that until about age two and a half all individuals, no matter the habitat or other conditions, had access to adequate space and resources and grew at the same rate. After this age, growth patterns become more variable in response to habitat or harvesting levels.

There are important differences among the three archaeological populations, likely due to exploitation of different substrates or clam beds. The clam collections from the Meeting House Field locality, on the landward marsh, and the Back Creek Village locality, on the seaward marsh, have different age and size distributions, growth rates, and survivorship curves. The number of age classes represented at Back Creek is larger (Figure 7.6) and the percentage of larger clams is higher (Figure 7.5) than at Meeting House Field. The survivorship curve for Back Creek is close to linear, which indicates that the mortality rate was relatively constant for that population (Figure 7.9). This supports the interpretation that people were selecting for size, since the number of older individuals within the targeted size class decreases with age (and eventually surviving clams will pass beyond the preferred size class). The survivorship curves for the Meeting House Field locality are concave (Figure 7.9), suggesting higher mortality rates at younger ages. The mortality for young individuals (under seven years) is higher than the Back

Creek rate, but for older individuals, it is lower than Back Creek. This suggests that the targeted population at Meeting House Field, especially in the early period, was younger than the population at Back Creek. The modeled growth rates are also different between the localities, with the Meeting House populations reaching larger sizes at earlier ages than the Back Creek population, and the Back Creek clams reaching larger sizes at older ages (Figure 7.8).

The differences described above may be related to substrate and harvesting rates. The Back Creek sample may represent a particularly healthy population growing in ideal conditions. Generally clams are a relatively small component of middens, as in the Meeting House Field locality. At Back Creek they are common in most of the middens—the sample of 316 clams is just a 75 percent sample of the whole left valves recovered the site. Given this overall abundance of clams and the wider range of sizes and ages, it appears the Back Creek clams were collected from a healthy clam bed in a subtidal, muddy or sandy-mud substrate. The rarity of clams at the Meeting House locality, as well as the slower growth rates at older ages, and dominance by small, young clams may indicate that clams were collected from oyster bed substrates and/or intertidal locations. The skewed age distribution could be a sign of sustained harvesting. There is a long record of heavy human occupation in the vicinity of Meeting House Field, but there is far less evidence for long-term human residence in the Back Creek locality before the Irene phase. The clam beds used by the Back Creek occupants may have experienced limited human predation prior to the Mississippian period compared to the clam beds harvested by Meeting House Field residents.

Differences were also observed between the early and late Meeting House Field clam populations. The early population is younger and less likely to survive to older ages than the late one (Figures 7.6 and 7.9). This is often interpreted as a sign of heavy harvesting, in that people are collecting so often that young clams never have the chance to reach older ages (Jones et al. 2012; Quitmyer and Jones 2000, 2012). The modeled growth rates for both time periods are about the same, suggesting that the early clams, though smaller in the first year or two of life, catch up in size to the late clams by three years of age (Figure 7.8). This is confirmed in the size-at-age (at death) curve, except in this curve there is some suggestion that in the early clam population, the older clams reach larger sizes than the late population (Figure 7.7). The data are contradictory when it comes to harvesting pressure—the early clams are younger, but the late clams are smaller. Given the wide range of factors that affect clam growth rates and maximum size attained, it seems likely that the different growth patterns represent different exploited habitats. The late clams could have come from a more densely packed intertidal oyster substrate than the early clams, possibly from a location that was not previously intensively harvested. This would be consistent with the expectations of this volume: that people increase the number and variety of habitats they exploit in order to support larger human populations in smaller territories.

Sea Catfishes

Sea catfishes, though today often considered trash fish, were a staple in the aboriginal diet since at least the Late Archaic period (Colaninno 2010:72–178; Reitz 2008: 625–659; Chapter 5 and 6 this volume). Historically, sea catfishes were both common and widespread in the estuarine waters of the southeast coast (Dahlberg 1972). Gafftopsail catfishes are generally less abundant, but larger, than hardhead catfishes (Muncy and Wingo 1983:6–9). Both species spawn in shallow estuarine waters during the warm months and mature around two years of age. Fecundity is low, but a long gestation period within the males' mouth offsets this (Muncy and Wingo 1983:5). Catfishes prefer warm temperatures and high salinities, and typically migrate offshore in colder months (Muncy and Wingo 1983:6), though some part of the population stays in the estuary year round.

Incremental analysis of otolith samples of both sea catfish species from the Meeting House Field locality, Back Creek Village, and 9LI1637 was used to evaluate size-at-age and growth rates. A total of 21 hardhead catfish otoliths were sectioned in order to estimate size-at-age (Appendix I). Of these, four early Meeting House Field, five late Meeting House Field, and five Back Creek hardhead catfish otolith sections had increment patterns that could be interpreted and measured. A total of 18 gafftopsail catfish otoliths were sectioned. Of these, five early Meeting House, three late Meeting House, five Back Creek, and three 9LI1637 gafftopsail otolith sections could be measured. Average size-at-age curves for each analytical unit are shown in Figures 7.10 and 7.11 for hardhead and gafftopsail catfishes respectively. Figures 7.12 and 7.13 illustrate growth rates modeled using the von Bertalanffy method.

Sample size is obviously a source of bias in these curves. With small sample sizes, individual variation is more likely to skew averages. The small sample probably does not represent the full variation in the natural population, or even in the part of the population that was caught and consumed. A particularly large or small individual in any of the analytical units can make the growth patterns for that analytical unit look very different from the others. The von Bertalanffy model is particularly sensitive to sample size. The parameters for x-intercept and maximum size are derived from the average size-at-age data and one particularly large or small individual or a sample that includes only young ones will result in a growth curve that looks different from others. Another problem is that the von Bertalanffy parameters are more reliable when many age classes are represented. Only five age classes are represented in the early hardhead catfish sample, which is not enough to produce a reliable x-intercept value. Only the three late Mississippian von Bertalanffy hardhead curves are reliable and interpreted here.

The size-at-age curves for the three (early Meeting House, late Meeting House, and Back Creek) archaeological hardhead catfish populations are roughly the same shape, so the growth patterns are consistent, although the absolute sizes are different and growth rates slightly different (Figure 7.10). All individuals in these populations are about the same size after the first year. As individuals get older, they add less length to their otoliths each year. This is consistent with other studies of fish otolith growth (Colaninno 2010:279–295; Wootton 1998:115). The early Meeting House Field hardheads consistently reach larger sizes than the late hardheads, and grow at a slightly faster rate. The standard deviations for the early and late Meeting House curves do not overlap except in one age class. The early Meeting House sample was more variable (higher standard deviations at all ages) and contained younger individuals than the other two samples; people in the early Mississippian period at Meeting House caught younger age classes than did people during the late Mississippian in the same locality. The Back Creek hardhead catfishes also consistently reach larger sizes than the late Meeting House hardheads, at a slightly faster rate. After two years of age, the Back Creek sample does not overlap with the late Meeting House sample, but it does overlap with the early Meeting House sample at all ages. The von Bertalanffy curves show a similar pattern as the size-at-age curves (Figure 7.12); the Back Creek hardhead catfishes are consistently larger than the late Meeting House hardheads. The Back Creek hardhead sample also had a faster growth rate until four years of age.

Growth curves for gafftopsail catfishes also differ across time and space. All four archaeological gafftopsail catfish samples are about the same size until two years of age (Figure 7.11). In the Meeting House Field locality, members of the early sample reach larger sizes at all ages, though the standard deviations overlap until four years of age. Growth is faster in the early gafftopsail catfishes than in the late gafftopsails until five years of age. The Back Creek and 9LI1637 samples also reach larger sizes at all ages than the late Meeting House sample, and they track each other closely until four years of age. The Back Creek sample is highly variable and overlaps with the standard deviations of all the other curves. The 9LI1637 sample overlaps with the standard deviations for the late Meeting House sample at most ages. The von Bertalanffy curves show a different pattern (Figure 7.13). The Back Creek gafftopsail catfishes are, on average, larger than gafftopsails in the other samples. This is probably due, at least in part, to sample size bias. One Back Creek individual is larger than others and this skewed the growth parameters. Individuals in the early Meeting House and 9LI1637 gafftopsail catfish samples track closely. The late Meeting House sample, after two years of age, are smaller at all ages than are members of the other three sample populations.

Several explanations for these different growth patterns are possible. The small sample size of otoliths from each analytical unit may not represent the full range of individual variation within the population that was fished while the site was occupied. If a different subset of the range of variation were represented in each sample population, then the growth patterns for each would be different. It is worth noting, however, that size-at-age is different for the three archaeological Irene sample populations, each of which was recovered from a different location. This suggests spatial variation in both hardhead and gafftopsail catfish populations. This variation in space could be the result of water conditions, food availability, population density, fishing pressure, migratory behavior, or genetic variability. Therefore, it is possible that individual catfishes utilize only a portion of the estuary on a regular basis; although likely interbreeding on some level, relatively separate sub-populations segregate spatially, and this is reflected in the archaeological samples.

Change over time during the Mississippian period can be evaluated only for the Meeting House Field locality, from which there are early and late Mississippian samples for both catfish species. Differences in habitat are less likely to be the reason for different growth patterns, though even here some habitat changes might be expected over time. The late populations of both catfish species are, on average, smaller and grew more slowly than the early populations (Figures 7.10 and 7.11). It is impossible to identify the exact cause of this change—a variety of environmental factors, changes in human fishing techniques, or changes in fishing locations could all account for the change. The fact that the Irene catfishes in samples from Back Creek Village and 9LI1637 are larger individuals, on average, with faster growth rates than those in the late Meeting House Field population, suggests that climatic deterioration is not the reason for the change at Meeting House Field. If climatic deterioration were the explanation, it should have affected all contemporaneous catfish populations at all three sites because rainfall and temperatures are not localized phenomena.

One might speculate that if people were discarding food waste in the marsh, this could have increased the food available to catfishes, especially during winter months. Despite cool, winter water temperatures, more catfishes may have stayed in the estuary because of the available food. This food might have been lower in quality than their natural diet, which could also account for smaller fish size. Alternatively, or in addition, fishing pressure could have caused the change in growth patterns. One common response to increased mortality rates is a decrease in growth rates as more energy is put into reproduction or as individuals reduce feeding activity in favor of safety. The archaeological evidence from the Meeting House Field locality demonstrates the area was occupied by people from the Late Archaic period through the Mississippian. There is less evidence for earlier occupation near 9LI1637 and Back Creek Village, so it is possible that harvesting pressure did not impact those populations as severely. Meeting House also appears to have sustained more people throughout the Irene phase than did the other two sites, so the abundance and reliability of food waste in the marsh could have been more of a factor in catfish behavior near Meeting House Field.

In a similar study hardhead catfish growth, Colaninno (2010:279–295) analyzed the growth rates for Late Archaic hardheads from the St. Catherines Shell Ring and modern hardheads from the St. Catherines estuary and found that, on average, modern catfishes have a faster growth rate, reach larger sizes at all ages, and live longer than the Late Archaic catfishes. Colaninno (2010:279–295) interpreted this change as evidence that modern hardhead catfishes are experiencing greater fishing pressure than those captured by Late Archaic people; modern catfishes experience less intra-specific competition and can grow to larger sizes faster.

Comparing the modern and Late Archaic growth curves to the Mississippian hardhead catfish curves suggests that there may be other explanations for the change over time observed by Colaninno (2010:279–295). The modern catfish growth curve tracks closely with the Back Creek Village hardhead catfish growth curve, likely representing individuals caught on the seaward side of the island (Figure 7.14). Although Colaninno's (2010:279–295) modern otoliths were from a variety of localities, they were primarily from trawls on the seaward side of the island. The late Mississippian Meeting House Field hardhead catfish growth curve tracks closely the Late Archaic growth curve; both these samples are from the landward Meeting House Field locality (Figure 7.15). Therefore, the difference between the modern and Archaic growth rates may be a function of fishing location not fishing pressure.

Fishing pressure, however, may be a factor in the Late Archaic St. Catherines Shell Ring and late Meeting House Field growth patterns. Individuals in the early Mississippian Meeting House Field catfish sample, likely captured in the same western marsh creeks as the Late Archaic and late Mississippian catfishes, had faster growth rates. This suggests that fishing practices, and possibly predation rates, were more similar during the Archaic and late Mississippian than during the early Mississippian period. The early Mississippian settlements were smaller than Archaic and late Mississippian settlements in the Meeting House Field locality. Additionally, hardhead catfishes are rare in the early Mississippian Meeting House vertebrate collection compared to the three Irene collections presented here and to Late Archaic collections (Colaninno 2010:72–178), and the early Mississippian individuals are younger than those found in the Late Archaic or late Mississippian collections. This may suggest early Mississippian people fished in locations where hardhead catfishes were less common and where only young individuals are found. It appears that fishing pressure on hardhead catfishes was greatest during the Late Archaic and late Mississippian periods in the Meeting House locality and the Archaic and late Mississippian hardhead growth curves reflect genetic, physiological, or behavioral responses to this pressure.

Patch Breadth

Although diet breadth did not increase during the Mississippian period, the morphological and incremental data do indicate that patch breadth increased. People living at Meeting House Field during the Irene phase collected oysters and clams from a greater variety of substrates and likely from more beds growing in each substrate than earlier occupants. An increase in patch breadth was also suggested in Chapter 5—people fished in different, or additional, locations in the later time period—and this may be supported by the sea catfish incremental data.

Increased patch breadth was likely related to a number of factors that characterized the Irene phase. There were more people to feed, which required harvesting greater amounts of foodstuffs. It is not surprising people exploited more shellfish beds to meet these needs; productivity of the set of patches (shellfish beds) used to feed the smaller, earlier population would quickly decrease if these were the only locations harvested to feed a large population. The fact that settlements were occupied for longer periods of time would only increase the pressure put on any single shellfish bed, encouraging use of a variety of locations. In Chapter 5, it was suggested that a shift in emphasis in fishing technology towards more communal techniques led to use of different portions of the water column or different portions of tidal creeks and was responsible for the different size distribution and relative abundance of fishes between the two collections.

Use of additional shellfish beds would seem to indicate that resource depression occurred during the Mississippian period. Increased predation rates reduced the productivity of high-ranked patches and led people to add lower-ranked patches to their subsistence strategy—and this is certainly a possibility. However, given the smaller early population, perhaps not all productive patches were already in use. This would mean that use of additional patches during the Irene phase did not result in decreased foraging efficiency. Tidal creeks filled with fishes and shellfish beds are abundant in the marsh system surrounding St. Catherines Island, and people had access to boats which could easily get them to fishing locations not immediately adjacent to the island. Walking or rowing for 10 more minutes may not register in human calculations of costs and benefits.

Social and political relationships likely played a role in determining which fishing and shellfishing locations people used. Lineages probably owned fishing and shellfishing grounds

(Worth 2004)—predictable, abundant, stationary resources are defendable and worth defending (Dyson-Hudson and Smith 1978; Kennett 2005:218–220). The various households living at Meeting House Field probably had different relationships to the local lineage head (chief) and it is possible that households with closer kin relationships had access to better shellfish beds than other households. If access to fishing grounds also was controlled by lineage heads, perhaps communal fishing in the most productive locations was a way for all households to have access to fishing grounds. Alternatively, or additionally, greater household obligations to supply tribute to the local chief or paramount chief during the Irene phase may have encouraged use of additional fishing or shellfishing locations to produce a surplus; these locations could have been used on rare occasions when supplemental foodstuffs were needed.

Human Impacts on Estuarine Animals

There is some evidence that human predation impacted on clam and catfish growth patterns, if not the overall abundance of these taxa. The early and late clams from Meeting House Field were very young—mean age is 3 years in both phases. Therefore, these populations were probably heavily exploited both before and during the Mississippian period. Some evidence from a Late Archaic site on the island suggests that the clam populations during that period were also dominated by young individuals (Quitmyer and Jones 2012). Clams are also relatively uncommon during the Mississippian at Meeting House, suggesting people did not have access to a nearby, healthy clam bed—possibly as a result of heavy human exploitation in the locality beginning in the Late Archaic. Late Mississippian clams reach older ages but attain smaller sizes than the early Mississippian clams. This suggests the late clams grew under less ideal substrate conditions in locations that were previously less heavily fished—perhaps part of a pattern of moving to new, but less healthy clam sources as old ones are exhausted. Hardhead catfishes from the late Meeting House contexts reach smaller sizes at age, on average, than in the early sample. Although environmental conditions might be the cause of the different growth rates, harvesting pressure is suggested by the fact that the late Meeting House hardhead catfish growth curve is similar to that of the Late Archaic catfish found in the same locality. In these two samples, catfishes reach smaller sizes at age than in the early Meeting House, Back Creek Village, and modern samples. Given the presence of particularly large sites in the Meeting House locality during the Late Archaic and late Mississippian, harvesting pressure could be a factor in these seemingly anomalous growth patterns.

Chapter Summary

During the Mississippian period on St. Catherines Island changes occurred in the population dynamics of estuarine animals deposited in the archaeological record. These changes suggest that patch breadth increased between the early and late Mississippian at Meeting House Field; people harvested oysters, clams, and possibly sea catfishes from a greater number of habitat-types. Growth rate changes indicate that catfishes responded to heavy fishing pressure during the Late Archaic and late Mississippian by changing where they foraged, what they foraged for, or the amount of energy they put into growth versus reproduction. Clams throughout the Mississippian period were rare and young, suggestive of overfished populations. Diet breadth, however, did not change during the Mississippian period, so these human impacts on animals did not affect the range of taxa people exploited. The following chapter discusses evidence for anthropogenic environmental changes and the impacts these had on terrestrial animals.

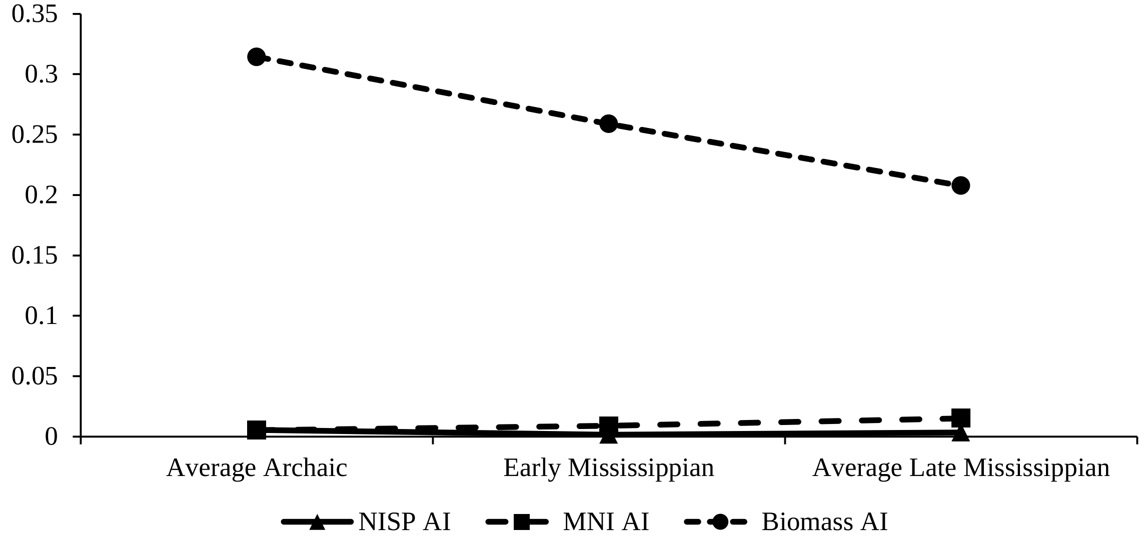


Figure 7.1: Deer abundance indices from Late Archaic (Colaninno 2010) and Mississippian period collections

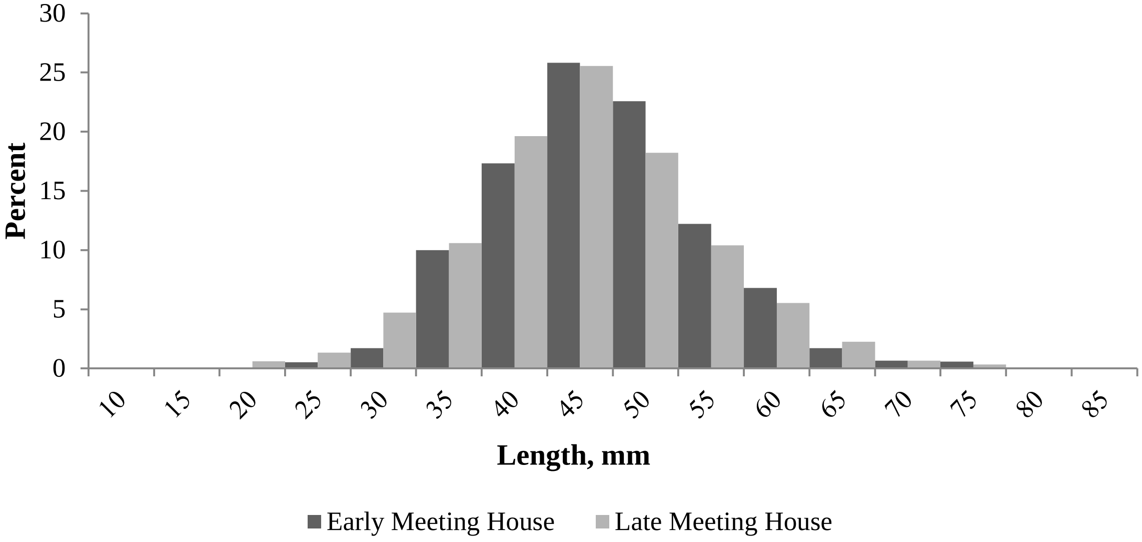


Figure 7.2: Frequency distribution of oyster valve length, in mm, from early Meeting House Field and late Meeting House Field

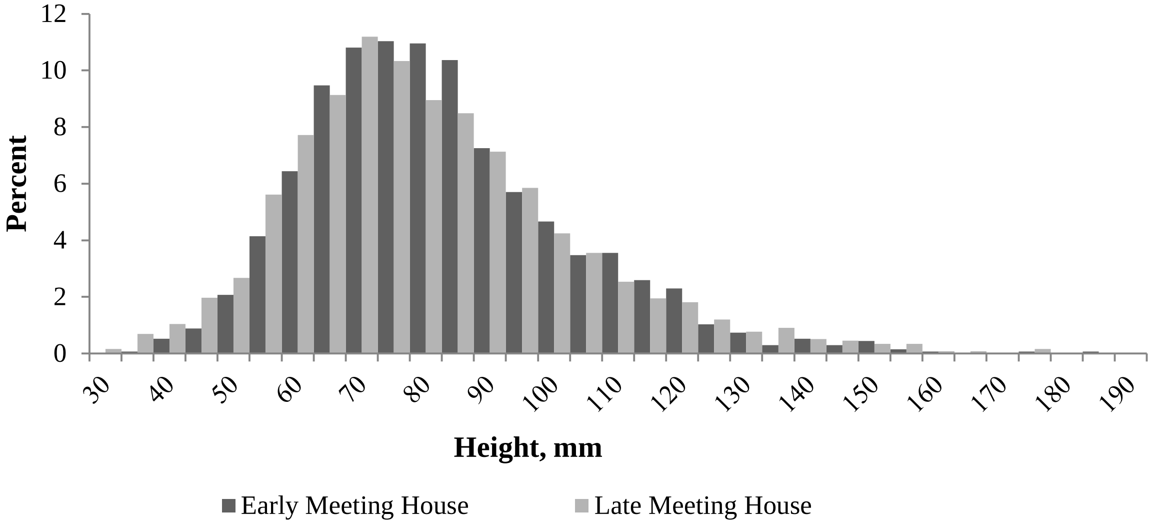


Figure 7.3: Frequency distribution of oyster valve height, in mm, from early Meeting House Field and late Meeting House Field

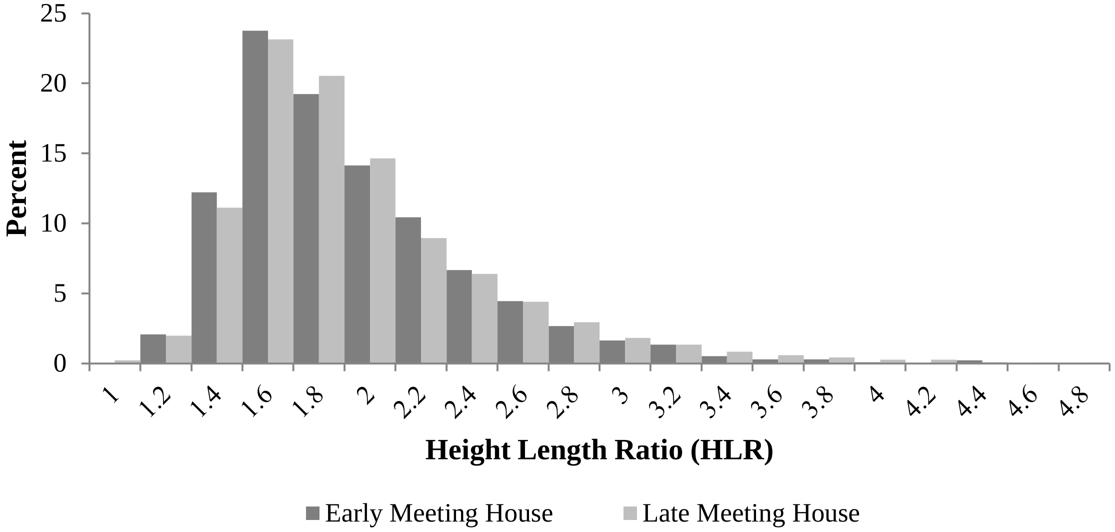


Figure 7.4: Frequency distribution of height-length-ratio (HLR), in mm, from early Meeting House Field and late Meeting House Field

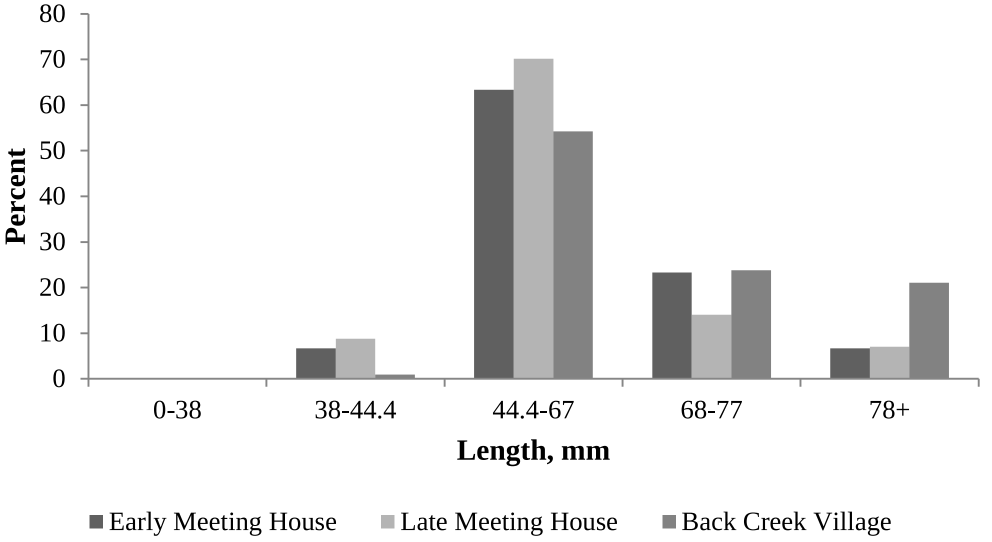
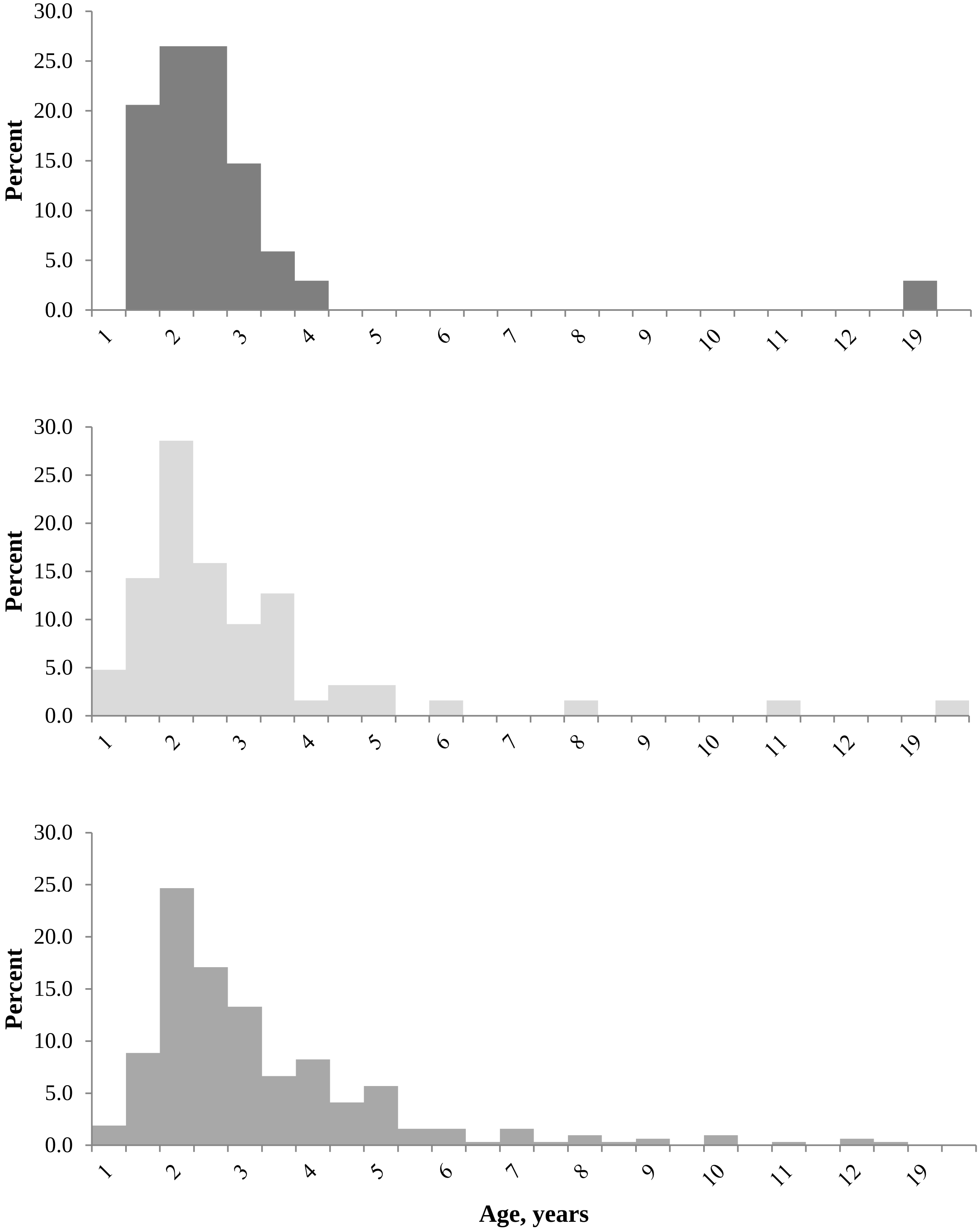


Figure 7.5: Frequency distribution of clam valve length, in mm, from early Meeting House Field, late Meeting House Field, and Back Creek Village



A.

B.

C.

Figure 7.6: Frequency distribution of clam age, in years. A: Early Meeting House Field, B: Late Meeting House Field, C: Back Creek Village

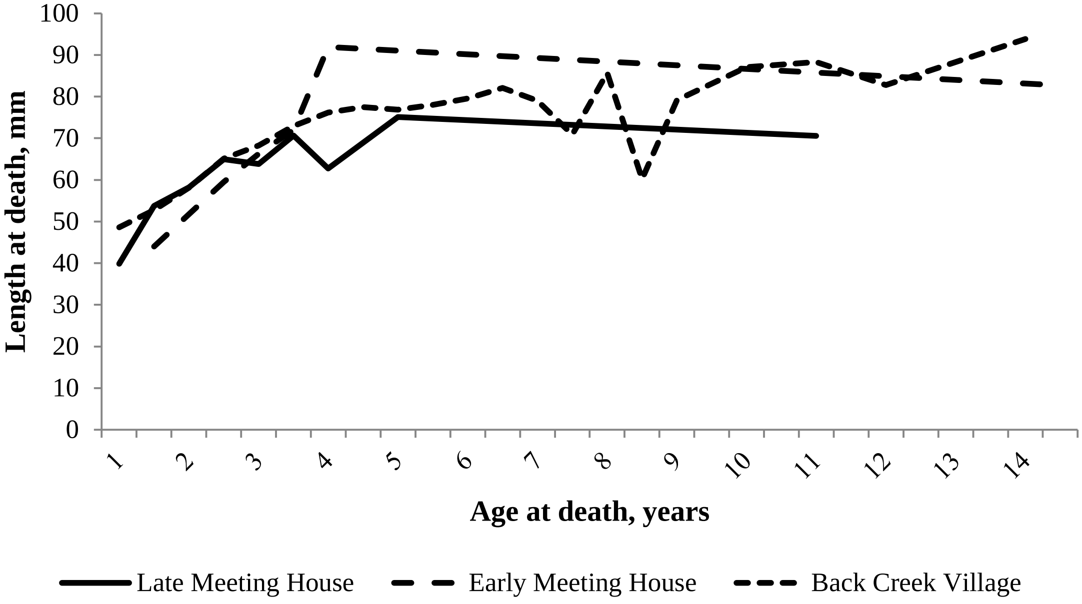


Figure 7.7: Growth rate, length at death (in mm) against age at death (in years) from early Meeting House Field, late Meeting House Field, and Back Creek Village

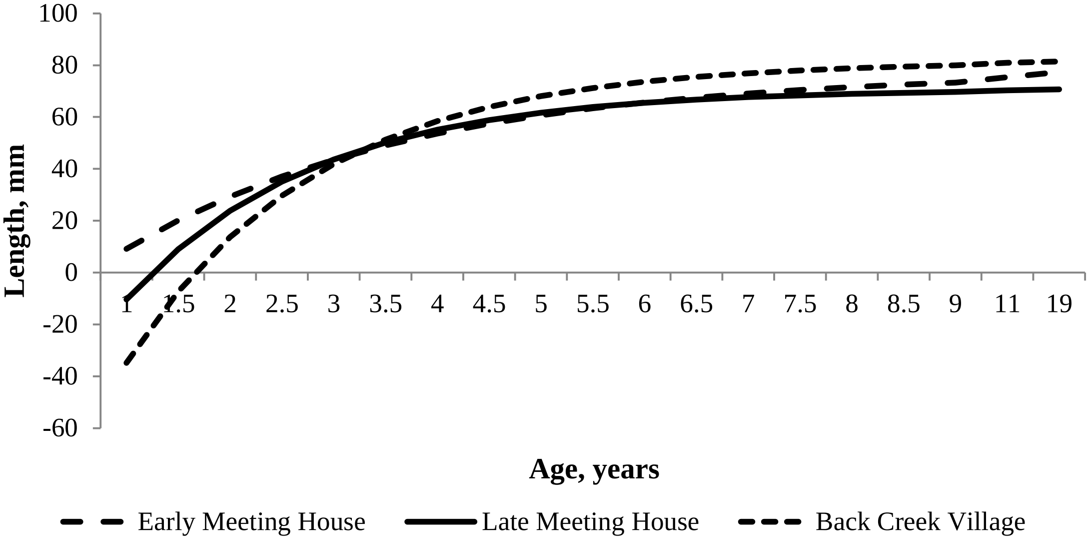


Figure 7.8: Von Bertalanffy growth curves for early Meeting House Field, late Meeting House Field, and Back Creek Village clams.

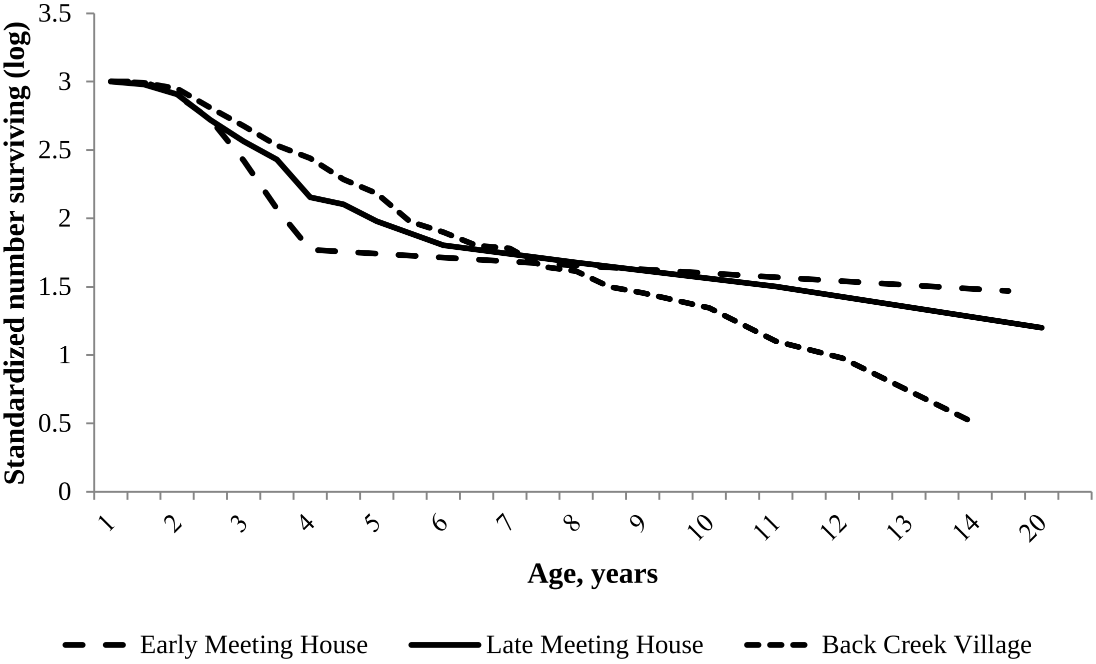


Figure 7.9: Survivorship curves for early Meeting House Field, late Meeting House Field, and Back Creek Village clams.

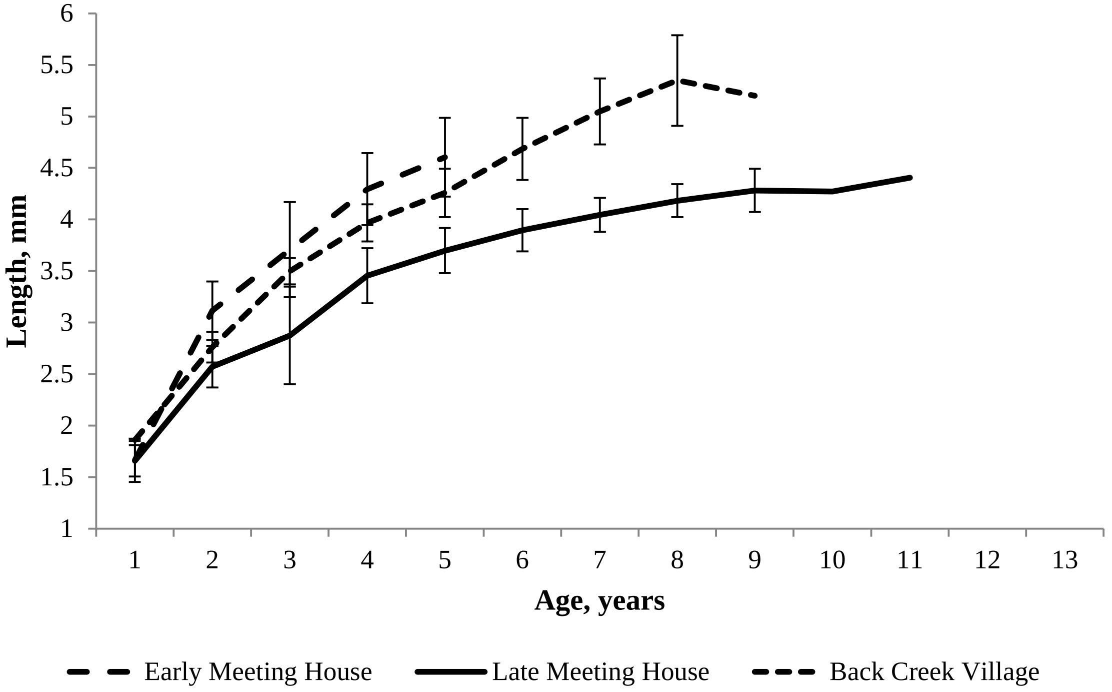


Figure 7.10: Growth rate, otolith length (in mm) against age (in years) for hardhead catfish from early Meeting House Field, late Meeting House Field, and Back Creek Village. Error bars show plus/minus standard deviation

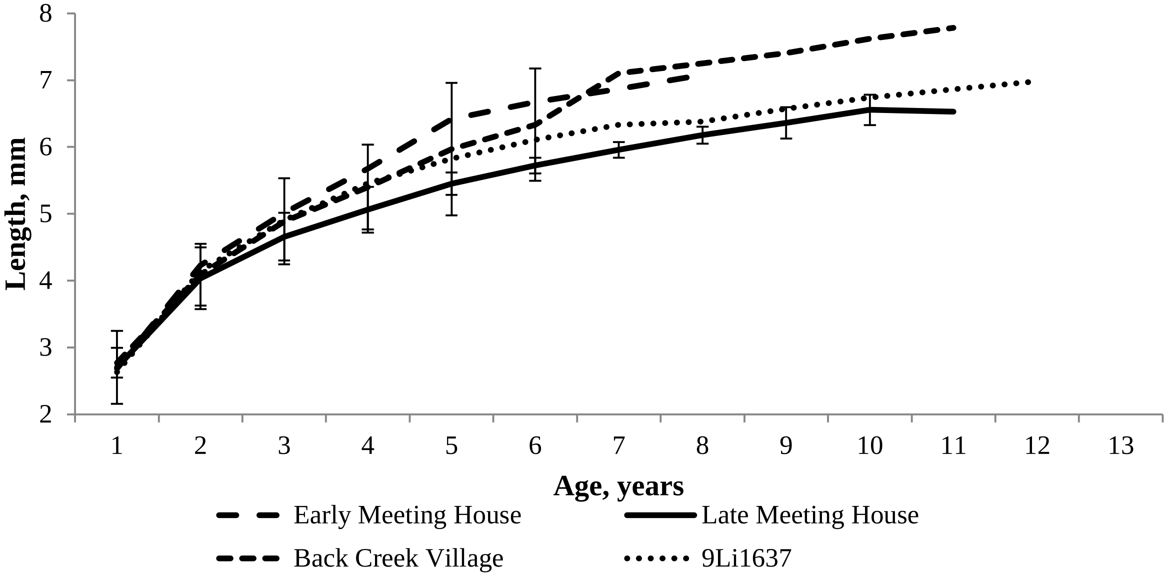


Figure 7.11: Growth rate, otolith length (in mm) against age (in years) for gafftopsail catfish from early Meeting House Field, late Meeting House Field, Back Creek Village, and 9Li1637. Standard deviation error bars shown for late Meeting House Field and Back Creek Village

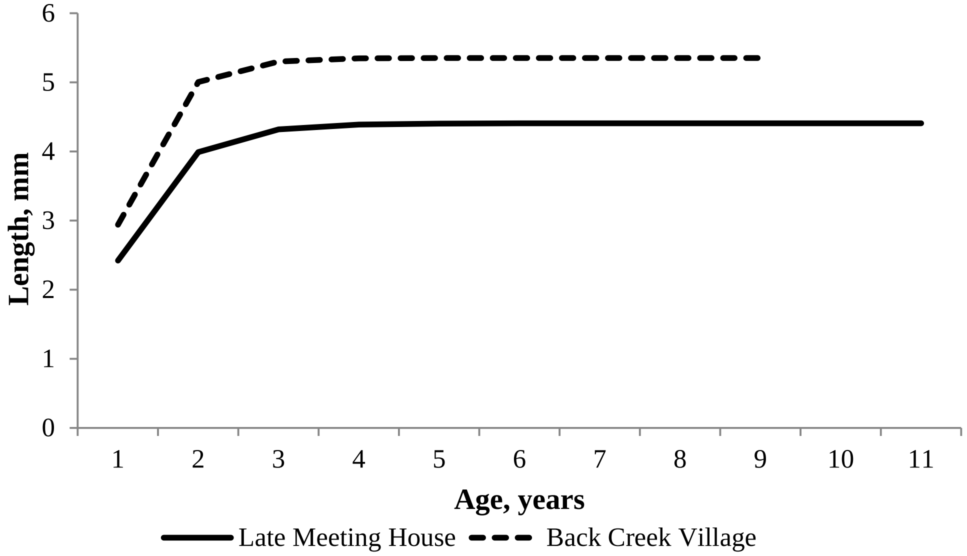


Figure 7.12: Von Bertalanffy growth curves for hardhead catfish from late Meeting House Field and Back Creek Village

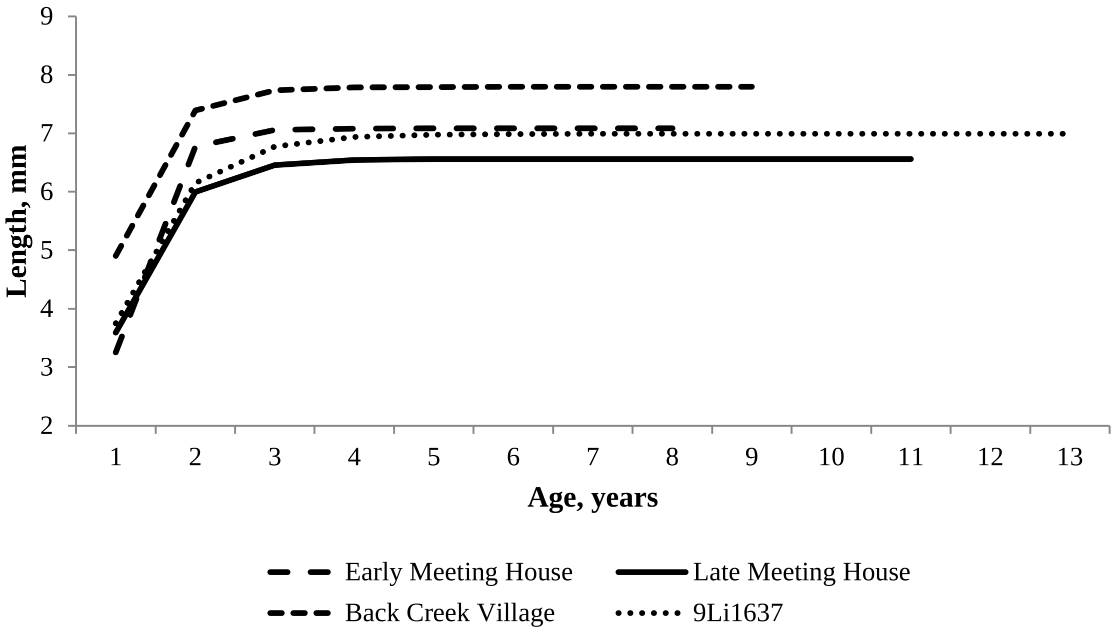


Figure 7.13: Von Bertalanffy growth curves for gafftopsail catfish from early Meeting House Field, late Meeting House Field, Back Creek Village, and 9Li1637

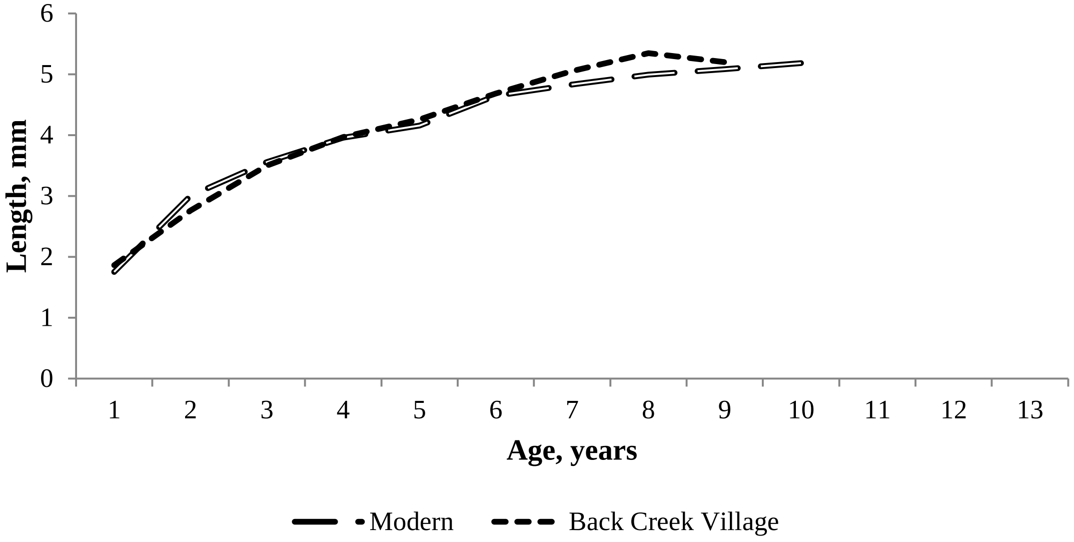


Figure 7.14: Growth rate, otolith length (in mm) against age (in years) for hardhead catfish from Back Creek Village and a modern collection from St. Catherines Island (Colaninno 2010)

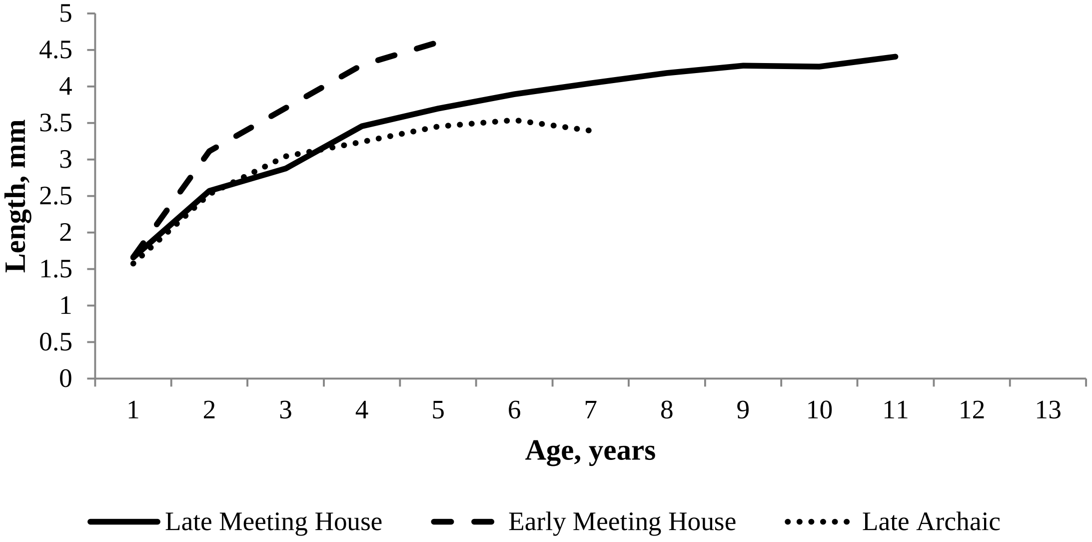


Figure 7.15: Growth rate, otolith length (in mm) against age (in years) for hardhead catfish from early Meeting House Field, late Meeting House Field, and a Late Archaic collection from St. Catherines Island (Colaninno 2010)

Table 7.1

Meeting House Field Locality Oyster Summary Table

Analytical Unit	Unit	N	Mean HLR	sigma	Mean Len, mm	sigma	Mean Hgt, mm	sigma
Early	N179 E84	215	1.73	0.43	40.47	8.87	69.32	19.57
Early	N191 E84	322	1.88	0.49	44.51	7.95	82.41	20.68
Early	N165 E159	500	1.77	0.44	45.68	7.86	79.75	19.16
Early	Iota	314	1.92	0.48	44.83	7.41	84.78	19.82
Early Total		1351	1.83	0.47	44.38	8.14	79.89	20.34
Late	Alpha	522	1.77	0.41	39.71	10.82	68.97	20.68
Late	Gamma	355	1.77	0.48	41.94	10.95	72.95	23.41
Late	N501 E80	586	1.63	0.4	42.77	7.2	68.98	16.69
Late	Epsilon	247	1.81	0.39	46.36	7.95	83.35	20.28
Late	Zeta	719	1.98	0.58	43.61	8.8	84.05	22.07
Late	Beta	541	2.18	0.64	42.07	7.74	89.51	24.97
Late	Eta	369	1.79	0.35	41.14	6.87	73.11	16.86
Late	Theta	405	1.8	0.42	46.48	7.6	82.92	20.04
Late Total		3744	1.85	0.51	42.8	8.86	78.08	22.27

Table 7.2

Meeting House Field Oyster Physical Features

	Early %	Late %
Oyster Scar	86.0	91.9
Mussel Scar	1.0	0.4
Coloring	2.2	6.8
Ribbed	34.5	27.4
Boreholes, rare	5.5	8.7
Boreholes, common	3.2	6.0
Worm Burrows	3.5	4.7
Barnicle Scar	0.6	1.5

Table 7.3

Mississippian Clam Summary Table

	Early Meeting House Field	Late Meeting House Field	Back Creek Village
N	34	63	316
Mean Len, mm	58.66	61.61	66.32
sigma	12.9	10.6	12.1
Mean Hgt, mm	51.37	55.56	60.43
sigma	10.8	9.9	11.1
Mean Wgt, mm	23.95	22.56	33.5
sigma	15.7	13.4	19.7
Mean Age, years	2.8	3	3.3
sigma	2.9	2.7	1.9
Age Range, years	1.5−19	1–20	1–14

CHAPTER 8:

LANDSCAPE CHANGES ON ST. CATHERINES ISLAND

Historical ecologists postulate that societies with different socio-political systems and settlement organizations will have different relationships with their environment, and that the accumulative effects of human occupation transform landscapes (Balée 1998:22, 2006). The late Mississippian society on St. Catherines Island was different from earlier societies. Populations were larger, settlements denser and more numerous, social inequality more marked, and people were growing maize by at least the late fifteenth century. The previous chapters suggested that people lived in the same places for longer periods of time and they exploited a wider range of habitats than in earlier periods. The processes that transformed the landscape began in the Late Archaic when people first occupied the island. Some processes are anthropogenic, such as burning underbrush, clearing or maintaining open areas, cultivating plants, and adding nutrients to soils in the form of garbage and burned material. Others are climatic, such as changes in temperature, precipitation, and storm frequencies. The landscape during the late Mississippian period is the culmination of thousands of years of human activity and climatic fluctuations. It is also the result of resource use by a large, socio-politically complex, maize-farming society.

Stable carbon and nitrogen isotope values from animal bones are proxies for landscape change. Human activities and climatic regimes cause changes in vegetative communities, creating a more heterogeneous landscape. Animals foraging in a greater variety of habitats have a different overall diet than animals foraging in a limited set of habitats, and this is recorded in their bone chemistry. Deer and raccoons, judging by modern behavior, were likely attracted to disturbed habitats and human settlements. They also were consumed by humans and their remains deposited in middens. Deer and raccoon bones from middens therefore offer a way to examine landscape change over time—the fourth research objective of this volume. This chapter provides a summary of carbon and nitrogen stable isotope analysis in archaeology, establishes a modern baseline for deer and raccoon diet on St. Catherines Island using modern bone samples and samples of plants and animals that are part of their diet, and examines change over time in deer and raccoon isotope values from the Late Archaic through Mission periods. The results suggest that over time forests became more open, nitrogen levels in soils increased, and animals, especially deer, foraged in a greater variety of habitats.

Mississippian Societies and Land Use

Human resource-use activities are disturbances in the ecological sense, interrupting the dynamics of plant and animal communities and altering abiotic features of the landscape (Chapin et al. 2002:285–288). Settlements require cleared land for building. Within settlements, waste material is deposited in middens and house floors; floors, plazas, and walkways are trampled; houses are built; gardens are planted; fire pits are built for cooking and firing ceramics; and human waste is concentrated in certain areas. Fire is used to manage and clear brush and palmetto undergrowth for easier planting, hunting, gathering, and travel. Some non-human species are attracted to these settlements and cleared areas. Certain plants colonize forest edges, and many animals are drawn to forest edges for these plants and the benefits of being at the boundary between ecotones. Some animals are attracted to human garbage, to cultivated plants, and to open forests where foraging is enhanced. After a settlement is abandoned, it is transformed by a succession of plant and animal communities, similar to the process of succession after a natural disturbance. The soils on old settlements, however, are altered by anthropogenic packing and the addition of marine and terrestrial waste and burned materials. Some species are attracted to the calcareous soils that form on and around middens, and are more likely to colonize abandoned settlements instead of other clearings. These processes occurred throughout the aboriginal period on St. Catherines Island. The effects accumulated over time, creating a more heterogeneous landscape of patches in varying stages of succession and of varying compositions.

Large-scale non-anthropogenic factors also shaped the landscape over time. Rising and falling sea levels changed shorelines, overtopped Guale Island, and appended Holocene dunes to the south end of the Pleistocene core (Bishop et al. 2011; Linsley et al. 2008). The location of marsh vegetation depends on water depth, salinity, water movement, substrate chemistry and morphology, and many other factors that are affected or controlled by sea levels. Marsh size and location, therefore, is not stable over time. Other vegetative communities also are affected by changes in geomorphology. The central depression running the length of the Pleistocene core held fresh water for swamps and ponds during the prehispanic period (Hayes and Thomas 2008). The amount of water probably varied over time, affecting the composition and location of freshwater plant and animal communities. During the Late Archaic period, there may have been enough fresh water on the island to support freshwater fish populations (Colaninno 2010:208). In addition, the vegetative communities on the southern Holocene dunes matured over time, eventually including oaks and palmettos and not just sand dune vegetation.

Climatic conditions changed over time as well. This, in turn, affected the amount of surface water, the salinity of estuarine waters, the maximum, minimum, and variability of temperatures, and the frequency of storms, among other environmental characteristics. Water availability, light, and temperature affect the composition and health of vegetative communities.

Different plant taxa require and tolerate differing amounts of these variables. In addition, animals may widen their diet breadth in times of dietary stress (such as during extreme weather conditions), putting even more stress on plant communities.

There are few climate reconstructions for the Georgia coast. In general, the Late Archaic occurred just after a warm, wet period in eastern North America (Goman and Leigh 2004; LaMoreaux et al. 2009). Some studies suggest the Late Archaic in the Southeast was wetter and warmer than today, with a greater difference between maximum summer and winter temperatures (Diffenbaugh et al. 2006; Jones et al. 2005). Precipitation patterns since AD 1000 have been reconstructed from tree-ring data from the lower Altamaha River (Blanton and Thomas 2008). This study suggests that wet and dry periods occurred periodically, though there was a major period of drought from AD 1176–1220, during the St. Catherines phase, when conditions were cooler and drier (Blanton and Thomas 2008:801). 9LI230 may have been occupied at this time. Tree-ring data from the lower Savannah River suggest two periods of long-term dry conditions during the Irene phase as well, in the late fourteenth century and then in the early-mid fifteenth century (Anderson et al. 1995). 9LI21, 9LI207, and 9LI1637 were occupied during the Irene phase.

Not only is the Irene phase the culmination of thousands of years of landscape change, but human societies on the island were different from earlier societies. Historical ecology postulates that different societies, with different subsistence, settlement, and mobility patterns, potentially can have different effects on the landscape (Balée 1998:22). The Irene footprint on St. Catherines Island was larger than that of earlier societies, both in sheer numbers of people, and in numbers of settlements. A greater number of, and larger, settlements during the Irene phase means more of the island was subject to anthropogenic use and subsequent succession, and the rates of soil and vegetation change were higher. People also grew maize, in small household gardens, in communal fields, or both. Maize depletes nutrients in the soils in which it is grown, especially in the acidic and poorly drained soils of St. Catherines Island. This may limit the species which can colonize abandoned fields. It seems likely, therefore, that the soils, as well as the plant and animal communities, of the Irene phase had a different composition and distribution than soils in earlier time periods.

Carbon and Nitrogen Stable Isotope Analysis

Isotopes are elements that have the same number of protons and electrons but different numbers of neutrons, and stable isotopes are ones that do not break down after an organism's death. Carbon and nitrogen both have two stable isotopes: ^{13}C and ^{12}C for carbon, and ^{15}N and ^{14}N for nitrogen. Fractionation occurs during the chemical reactions in which carbon and nitrogen are incorporated into the tissue from dietary sources, and results in changes in the relative concentration of each isotope involved. The ^{13}C/^{12}C and ^{15}N/^{14}N ratios (expressed as δ values) measured in bone collagen are products of the ratios in the plants and animals in the living animals' diet and the physiological processes that break dietary sources down and synthesize collagen proteins.

Bone is a body tissue composed of an organic component, the proteinaceous collagen, and an inorganic component, calcium phosphate or hydroxyapatite crystals. Stable isotope values in both these components do not appear to be greatly affected by diagenic processes (Hedges 2002; Hedges et al. 2004). Carbon and nitrogen from different dietary components (proteins, carbohydrates, lipids) are differentially allocated to particular tissues, and hence different tissues have different isotope values (Ambrose and Norr 1993:19–29; DeNiro and Epstein 1978, 1981; Gannes et al. 1997; Jim et al. 2004; Tieszen and Fagre 1993a:131–153). Indispensable amino acids, necessary for building proteins such as collagen, must be obtained from dietary protein. Therefore, bone collagen will more accurately reflect the carbon and nitrogen values of dietary protein than of the whole diet (Ambrose and Norr 1993:19–29; Harrison and Katzenberg 2003; Hedges et al. 2004; Jim et al. 2004; Tieszen and Fagre 1993a:131–153). Herbivores obtain most of their protein from plants, so plant amino acids are used to build proteins such as collagen (Ambrose and Norr 1993:19–29; Tieszen and Fagre 1993a:13–153). It is possible that in foregut-fermenting herbivores (such as deer) more carbon and nitrogen mixing takes place during protein synthesis, and differential routing of isotopes to different tissues is not as marked as in other animals (Gannes et al. 1997; Sponheimer et al. 2003). The collagen isotope values of carnivores and omnivores are more likely to reflect the animal component of the diet, as most dietary protein is derived from animal sources that contain all the essential amino acids.

Carbon and nitrogen isotope values in animal collagen are derived from dietary sources, and, therefore, reflect environmental conditions and foraging behavior of the animal during its life (Cormie and Schwarcz 1994, 1996; DeNiro and Epstein 1978, 1981; Drucker et al. 2008; Emery et al. 2000; Hedges et al. 2004). Isotope values in plants at the base of the food chain vary due to physiological aspects of the plants themselves and environmental conditions such as temperature, precipitation, light availability, soil composition, and soil and air circulation (Heaton 1999; Hedges et al. 2004). When animals consume plants, the isotope values of plants are incorporated into the tissue of the animals. The relationship between plant isotope values and animal collagen isotope values is not linear, however (Ambrose and Norr 1993:19–29; Tieszen and Fagre 1993a:131–153). Plants with higher amounts of carbon or nitrogen in their tissue may dominate the isotope values of consumers, and the same plants do not necessarily have high carbon and nitrogen (Fry 2006: 143–149). Plants containing more essential amino acids are more likely to dominate the isotope values of collagen (Ambrose and Norr 1993:19–29; Tieszen and Fagre 1993a:131–153). The isotope values of plant foods are, however, passed up the food chain, even if the relationship is not straightforward. Fractionation of carbon and nitrogen during incorporation into tissues results in collagen of herbivores being enriched ~5‰ in δ^{13}C and ~3‰ in δ^{15}N relative to their diet. Collagen of carnivores and omnivores is enriched another ~1‰ to 2‰ in δ^{13}C relative to their diet and by ~3‰ in δ^{15}N at each trophic level (Ambrose and Norr 1993:19–29; Bocherens and Drucker 2003; DeNiro and Epstein 1978, 1981; Schoeninger and DeNiro 1984; Tieszen and Fagre 1993a:131–153; van der Merwe 1982).

Physiology of plants at the base of the food chain plays a determining role in carbon and nitrogen isotope values (Pollard and Heron 2008:353–354; Schwarcz and Schoeninger 2011). Terrestrial plants obtain carbon from the atmosphere using one of three photosynthetic pathways. The Calvin-Benthic (C_3) pathway is used by most temperate grasses, trees, flowering plants, shrubs, and tubers. The Hatch-Slack (C_4) pathway is used by many tropical grasses, such as maize, sugar cane, and some sorghums, millets, amaranths, and chenopods. Plants using the Crassulacean Acid Metabolism (CAM) pathway, mostly tropical succulents such as cacti, can use either the C_3 or C_4 pathway depending on environmental conditions. Because each pathway involves a different chemical reaction, the isotopic fractionation in plants using each of these pathways is different. C_4 plants are enriched in the heavier ^{13}C isotope relative to C_3 plants and therefore have a less negative δ^{13}C value (Pollard and Heron 2008:353–354; Schwarcz and Schoeninger 2011). In modern plants, the δ^{13}C values for C_3 plants average about -26‰ (van der Merwe and Medina 1991), while for C_4 plants they average about -12.5‰ (Ehleringer and Monson 1993).

Physiology also affects nitrogen values (Ambrose 1991; Ambrose and DeNiro 1986; Virginia and Delwiche 1982). Plants are generally unable to fix nitrogen directly from the atmosphere and rely on nitrogen-fixing bacteria in soils to break the element down into usable ammonium and nitrates. Some plants, such as legumes, have symbiotic relationships with nitrogen-fixing bacteria and essentially fix nitrogen from the atmosphere. These plants have $\delta^{15}N$ values close to that of atmospheric nitrogen (~0‰).

Other physiological factors also appear to be involved in determining isotope values of plants; conifers tend to have higher carbon values than deciduous vegetation (Stuiver and Braziunas 1987) and woody plants tend to have lower nitrogen values than other plant types (Virginia and Delwiche 1982). It is therefore necessary to establish a modern baseline for the vegetation in a region before interpreting the diet of archaeological animals.

The amount of forest cover under which plants grow also influences isotope values in plants. Soils and plants under dense canopies tend to have lower $\delta^{13}C$ values (Drucker et al. 2008; van der Merwe and Medina 1991). The mechanism for this canopy effect has to do with heavy canopy limiting the amount of ambient air mixing with the forest air, and possibly with low light intensity. CO_2 is recycled in the forest litter; carbon produced by rotting organic matter and incorporated by forest plants is depleted in ^{13}C. Van der Merwe and Medina (1991) also found that the canopy effect extended beyond forest edges. The edges around forest gaps were still subject to the canopy effect, but the effect dissipated towards the center of the gap (Van der Merwe and Medina 1991). Dense forest cover may also promote high rates of nitrogen fixation, which leads to lower $\delta^{15}N$ values.

Soil nitrogen is the determining factor in nitrogen isotope values of non-nitrogen-fixing plants. Except those with symbiotic relationships with nitrogen-fixing bacteria, plants obtain their nitrogen from the soils in which they grow (Ambrose 1991). Nitrogen-fixing bacteria in the soils convert N_2 into ammoniums and nitrates that can be used by plants. Nitrogen cycling in soils is sensitive to environmental conditions (Ambrose 1991; Ambrose and DeNiro 1986) and inputs of nitrogen. Agricultural areas today may have low $\delta^{15}N$ values because of the addition of ^{15}N-depleted fertilizers to the soils. Nitrogen values in soils on long-abandoned Viking farms in Greenland still reflect human activities on these farms (Commisso and Nelson 2008). Former byres and middens have particularly high $\delta^{15}N$ values; byres because of inputs from animal dung and middens because of inputs from discarded marine animal remains (Commisso and Nelson 2008). Inputs of nitrogen from burning forest and grassland also increase $\delta^{15}N$ of soils (Grogan et al. 2000). $\delta^{15}N$ values of soils are, therefore, variable, ranging from -7‰ to +18‰ (Cormie and Schwarcz 1994).

Climatic factors, specifically temperature and precipitation, also influence isotope values in plants and animals (Cormie and Schwarcz 1994, 1996; Drucker et al. 2008; Stevens et al. 2006). Plants in warmer and drier locations tend to have higher carbon and nitrogen isotope values than plants in colder and wetter locations, which may be related to the types of vegetation that dominate these environments (C_3 vs. C_4 plants), the rate of nitrogen fixation by bacteria in soils, and the amount of stomatal conductance and/or the carboxylation rate of plants (Ambrose 1991; Ambrose and DeNiro 1986; Cormie and Schwarcz 1994, 1996; Heaton 1999). In addition, hot and dry environments are often associated with resource stress in animal populations. Under such conditions, deer may consume more grasses (Cormie and Schwarcz 1994), which would lead to higher $\delta^{13}C$ values. Generally deer prefer woody and herbaceous browse because deer are not resistant to parasites often carried on grasses. Deer also seek out higher-protein plants because of the limited animal protein in their diets. When preferred foods are limited, they expand their diet to include grasses (Cormie and Schwarcz 1994). $\delta^{15}N$ values of animals are also affected by dietary stress in hot and dry environments (Ambrose 1991; Ambrose and DeNiro 1986; Cormie and Schwarcz 1994, 1996). Some animals may conserve water by exchanging urea for water in the kidneys, which results in increased excretion of ^{15}N-depleted urea and a higher $\delta^{15}N$ in tissues (Ambrose 1991; Sponheimer et al. 2003). Some animals may also increase the amount of nitrogen available for their own metabolic processes by increasing microbial food processing in rumen, and recycling nitrogen back into the rumen, possibly leading to excretion of a more ^{15}N-depleted urea (Sealy et al. 1987). Animals under dietary stress in hot and dry environments, therefore, are likely to have higher carbon and nitrogen values than animals living under more favorable conditions.

Marine plants have different ranges of carbon and nitrogen isotope values than do terrestrial plants (Schoeninger and DeNiro 1984; Sealy et al. 1987; Schwarcz and Schoeninger 2011). Marine plants use a pathway similar to C_3 terrestrial plants but their carbon source is carbonate in ocean water instead of the atmosphere. $\delta^{13}C$ values of modern marine plants can range from close to C_3 terrestrial plants to close to C_4 terrestrial plants, and marine herbivore $\delta^{13}C$ values average about -15‰ (Schoeninger and DeNiro 1984). This complicates dietary studies of animals, including humans, in coastal settings; it is difficult to distinguish between a diet focused on marine resources from one focused on C_4 plants (Little and Schoeninger 1995). Nitrogen in the marine system is incorporated from sea water by plankton, at the base of the food chain, and animals within the system have higher $\delta^{15}N$ values than animals in a terrestrial system; generally above 11.7‰ (Schoeninger and DeNiro 1984). Analyzing $\delta^{15}N$ values in addition to $\delta^{13}C$ values, therefore, can help distinguish between terrestrial and marine diets. If a diet increasingly includes more marine inputs, both carbon and nitrogen values will increase, but if a diet increasingly includes more terrestrial C_4 plants (such as maize), and the role of marine resources (and the set of exploited animals) stays the same or decreases, then only carbon values will increase.

Applications

Most applications of stable isotope analysis in archaeology concentrate on human paleo-diets. In 1977, Vogel and van der Merwe demonstrated that stable carbon isotope values of human bones from Eastern Woodlands sites reflect the dietary shift to maize. Since then, carbon and nitrogen isotope values have been used to reconstruct human paleo-diets, mobility, and trade all over the world (Barrett et al. 2008; Bocherens et al. 1999; Finucane et al. 2006; Fischer et al. 2007; Honch et al. 2006; Hu et al. 2006; Krigbaum 2003; Richards et al. 2006), and more extensive work has been done on the timing of the farming transition and the importance of maize in eastern North America (Hogue and Melsheimer 2008; Hutchinson et al. 1998; Katzenberg et al. 1995; Larsen 2002; Larsen et al. 1992; Little and Schoeninger 1995; Schoeninger et al. 1990, 2009; Schwarcz et al. 1985).

Paleo-diet Applications. The adoption of maize cultivation in eastern North America was an uneven process, occurring at different rates and times throughout much of the region. In southern Ontario, the transition from foraging to farming occurred between AD 400 and 1300. Carbon values of human bones increased from about -21‰ to -10‰ due to an increase in C_4 plants in the diet, and nitrogen values fell slightly due to a decrease in animal protein in the diet (Katzenberg et al. 1995; Schwarcz et al. 1985). In Georgia and Florida, the timing of maize introduction and its importance varied regionally (Hutchinson et al. 1998). In Mississippian-period Georgia, the $\delta^{13}C$ values in coastal and inland human populations generally increased over time, while $\delta^{15}N$ values remained about the same, indicating increasing consumption of a C_4 plant such as maize (Hutchinson et al. 1998; Larsen et al. 1992; Schoeninger et al. 1990, 2009).

The change was even more marked during the following Mission period. In Florida, there is no increase in $\delta^{13}C$ values until the Mission period, suggesting that maize did not play a significant role in native Floridian diets until contact with Spanish colonists in the sixteenth century (Hutchinson et al. 1998).

There are difficulties in interpreting coastal diets from stable isotope analysis, however. In a study of Late Woodland human remains from Nantucket (Massachusetts), Little and Schoeninger (1995) compared the $\delta^{13}C$ values for terrestrial and marine plants and animals that may have been part of the Indian diet. They concluded that the high carbon and nitrogen isotope values in human bones (mean $\delta^{13}C = -10‰$ and mean $\delta^{15}N= 15.3‰$) were more likely the result of a diet focused on oceanic and nearshore resources that fed in a plankton and salt-marsh food chain than the result of a diet focused on maize.

Paleo-environment Applications. In addition to diet, stable isotope analysis of animal bone collagen can address environmental conditions in landscapes, which speaks to climatic change and human land-use practices. The end of the last ice age was a time of major climatic and environmental changes. Iacumin et al. (1997) used carbon isotope values from herbivores to demonstrate that the landscape in Italy was more open during the last glacial period and the climate was more arid. Isotope values from Western European horses hint that atmospheric CO_2 concentrations increased after the last glacial period, resulting in a decrease in $\delta^{13}C$ values of edible portions of plants (Stevens and Hedges 2004). Decreasing $\delta^{15}N$ values in ice-age herbivores track the degradation of permafrost in northern regions; increases in $\delta^{15}N$ after the ice age are likely associated with soil development in an open system of nitrogen cycling (Stevens et al. 2008).

Animal bones from archaeological contexts also speak to anthropogenic environmental change. Carbon isotope values in deer, an animal that raids maize fields, did not increase during the Classic period in Petexbatun, Guatemala (Emery et al. 2000). Emery et al. (2000) interpret this as evidence that deer did not have more access to maize over time; people did not greatly increase the amount of land used for maize production. Isotope values of domestic cattle are different from those of wild aurochs in Mesolithic Denmark, because domestic cattle fed on grasses at the forest edge, possibly in human-created clearings, and aurochs fed in forested environments (Noe-Nygaard et al. 2005). It is possible that forest clearance using fire combined with grazing exacerbated the decline of elm trees in the region (Noe-Nygaard et al. 2005). Isotope values of Bronze-Age domestic cattle and caprines around the Severn estuary indicate that domestic animals grazed in salt marshes, leading to $\delta^{15}N$ values in humans that are characteristic of marine mammal consumption (Britton et al. 2008).

Modern Deer and Raccoon Foraging Behavior and Diet

In order to understand changes in isotope values of archaeological animals, it is necessary to establish a baseline for the relationship between isotope values of deer and raccoon collagen and their diets. This was done by analyzing isotopes in modern samples of deer and raccoon collagen and in modern plants and marsh animals that are part of their diets. The modern deer and raccoon specimens, collected from St. Catherines Island in the 1970s and curated at the American Museum of Natural History, are listed in Table 8.1, which includes the results of the carbon and nitrogen isotopic analysis reported here. A sample of modern plants and animals identified as common food items in deer (Osborne et al. 1992) and raccoon (Harman and Stains 1979) diets on the Georgia coast today was collected from St. Catherines Island. Additional taxa that were likely part of animal or human diets in the past were included as well. Table 8.2 lists the food items analyzed, the locations from which they were collected, and the results of the carbon and nitrogen isotope analysis.

In addition to aiding the interpretation of archaeological isotope results, analysis of modern plants and animals yields insights into aspects of the modern food web. Stable isotope analysis of animal tissues is used in ecology to establish feeding strategies of populations and trophic structure of communities (Ben-David et al. 1996; Fry 2006:54–62; Hildebrand et al. 1996; McFadden et al. 2006; Roth and Hobson 2000; Urton and Hobson 2005). Stable isotope analysis of animals and their food webs supplements traditional dietary studies that use fecal matter and digestive tract contents (McFadden et al. 2006). Differential digestibility of foodstuffs makes some more likely than others to be found and identified using these traditional methods. Fecal matter and digestive tract contents record the diet on a scale of days, limiting the ability of traditional dietary studies to account for intra- and inter-annual foraging habits. Turn-over rates for carbon and nitrogen in bone collagen occur on the scale of years, allowing for a long-term record of feeding strategies often not possible in field studies. Nitrogen isotope values are enriched at each trophic level, providing a way to examine trophic structure (McFadden et al. 2006).

Due to fractionation, isotope values of animals are enriched over the values of their diet. Correction factors are used to compare the isotope values of animal collagen with the values of their diet. Correction factors have not been established for raccoons, but other studies assume that fractionation in raccoon bones is similar to that in other omnivores, such as minks, black bears, and red foxes (Ben-David et al. 1996; Hildebrand et al. 1996; Roth and Hobson 2000). A correction factor of +2‰ is used for $\delta^{13}C$ and +3.4‰ for $\delta^{15}N$. Correction factors have not been established for white-tailed deer, but other studies assume that fractionation in this species is similar to other herbivores consuming C_3 plants (Ambrose and DeNiro 1986; Bocherens and Drucker 2003; Cormie and Schwarcz 1994; Drucker et al. 2008; van der Merwe 1982). A correction factor of 5‰ is used for $\delta^{13}C$ and 3‰ for $\delta^{15}N$.

A further correction factor is applied to modern samples when modern $\delta^{13}C$ values are compared with archaeological samples. This is because the $\delta^{13}C$ of the atmosphere has decreased since the Industrial Revolution due to the release of increased amounts of CO_2 into the atmosphere (Tieszen and Fagre 1993b). A correction factor of +1.5‰ is applied to modern $\delta^{13}C$ values.

Modern Dietary Items

The isotope values of modern plant and animal food items from St. Catherines Island cluster into groups reflecting trophic level and location in a terrestrial or estuarine setting (Table 8.2; Figure 8.1). The terrestrial plants have $\delta^{13}C$ values ranging from -28.02‰ (yucca) to -33.3‰ (cabbage palm) and $\delta^{15}N$ values ranging from -2.10‰ (wax myrtle) to 2.81‰ (maypop). There is some variation within terrestrial species. For six plant taxa, two samples were analyzed—one from the landward island margin and one from the seaward margin. The muscadine, live oak, saw palmetto, and cabbage palm samples from the two sides of the island were very similar to each other. The two laurel oak and wax myrtle samples, however, were more variable, especially in $\delta^{13}C$.

Estuarine plants and animals generally had higher carbon and nitrogen values than the terrestrial plants. The two C_4 cordgrass species both have high $\delta^{13}C$ values, -14.29‰ for smooth cordgrass and -15.54‰ for marsh cordgrass, but their $\delta^{15}N$ values are very different, 6.24‰ for smooth cordgrass, which grows out in the marsh, and 1.49‰ for marsh cordgrass, which generally (including the collected specimen) grows along the marsh edge. Oysters and mussels, two estuarine molluscs, have $\delta^{13}C$ values and $\delta^{15}N$ values similar to each other. Mollusc $\delta^{13}C$ values are lower than for cordgrasses. As the molluscs and grasses derive their carbon from different sources (ocean water vs. air) this is to be expected. $\delta^{15}N$ values of the molluscs are higher than those of cordgrasses. This is likely a trophic level effect, since molluscs and cordgrasses both obtain nitrogen from estuarine sources, but molluscs are higher on the trophic pyramid than plants. Fiddler crabs, the only other estuarine animal tested, have a $\delta^{13}C$ value similar to that of cordgrasses and a $\delta^{15}N$ value between that of cordgrasses and molluscs. For this study, estuarine animals (oysters, mussels, fiddler crabs) and cordgrasses are graphed as two different rectangles (or ranges of isotope values) in the figures, because deer are unlikely to consume many estuarine animals.

Modern Deer

The isotopic study of modern deer collagen indicates that modern deer derive the $\delta^{13}C$ of their collagen primarily from the terrestrial system and the $\delta^{15}N$ of their collagen from a mix of terrestrial C_3 plants and estuarine C_4 plants (Table 8.1; Figure 8.2). The average $\delta^{13}C$, corrected for trophic level, is -26.42‰ and the average $\delta^{15}N$, corrected for trophic level, is 3.41‰ (Table 8.3). The standard deviations are low for both variables—0.43 for carbon and 0.85 for nitrogen. The range of variation (between the high and low isotope values) for the carbon values is within the range expected for a single population (under 1.8‰; Cormie and Schwarcz 1994), but the range of variation for the nitrogen values is greater than expected for a single population (under 1.2‰; Cormie and Schwarcz 1994). The $\delta^{13}C$ values are less negative than values for all modern C_3 plants analyzed for this study. The $\delta^{15}N$ values are higher than found in most of the C_3 plants, though maypop, saw palmetto, paw paw, mulberry, and yucca have $\delta^{15}N$ values overlapping some of the modern deer values in this study. It appears, therefore, that estuarine grasses do play a role in modern deer diet even if terrestrial sources are more prevalent.

These isotopic results are mostly consistent with the observations of deer diet from scats and digestive tract contents by Osborne et al. (1992:20–28) on Blackbeard Island (Figure 1.1) and Warren et al. (1990:21–30, 63–68) on Cumberland Island (Figure 1.1). Both these studies found that deer consume primarily terrestrial woody and herbaceous plants. Acorns are generally the most common food source in the fall when available, and there is evidence that deer mortality increases in years with poor mast crops (Osborne et al. 1992:28, 67). Saw palmetto fruits, when abundant, are also common in the diet. Other commonly consumed items include leaves, stems, and/or fruits of live oaks, laurel oaks, saw palmetto, cabbage palm, muscadine, mistletoe, red bay, swamp tupelo, wax myrtle, and greenbrier. Cordgrasses were not common in any of the Blackbeard deer scats or digestive contents, though the authors note that deer are commonly seen foraging in marsh habitats in late-winter and spring when more nutritious, new growth is available (Osborne et al. 1992:28–29). Marsh plants were not common in collections of stomach contents from Cumberland Island either (Warren et al. 1990:31).

Modern deer collagen and food item isotope values from St. Catherines Island suggest that cordgrasses, especially smooth cordgrass, are a common food source for deer on the sea islands. None of the modern deer individuals in this study have $\delta^{13}C$ values as low as any of the terrestrial plants. If terrestrial food items constituted the entire deer diet, then the collagen isotope values should fall within the range of the modern terrestrial plants. Some plants have relatively high $\delta^{13}C$ values (-28‰ to -29‰) such as maypop, yucca, mulberry, magnolia, resurrection fern, spurred butterfly pea, and greenbrier. Of these plants, only greenbrier and mulberry could be considered common in deer diets based on the scat and digestive tract studies.

The $\delta^{15}N$ values of deer collagen are also higher than would be expected of a diet focused on terrestrial C_3 plants. Five deer individuals have $\delta^{15}N$ values greater than any of the terrestrial plants included in this study, though five individuals have $\delta^{15}N$ values in the range of maypop, mulberry, yucca, saw palmetto, and yaupon. These latter individuals may have consumed less cordgrass than the former five individuals, however, smooth cordgrass is the only dietary item included in this study that could account for the relatively high carbon and nitrogen isotope values. Nonetheless, isotope analysis of modern deer collagen and food items indicates that although estuarine resources are a consistent part of the modern deer diet on St. Catherines Island, the deer focus foraging efforts on C_3 terrestrial plants.

Modern Raccoon

The results of the isotopic study of modern raccoon collagen suggest that modern raccoons derive the $\delta^{13}C$ and $\delta^{15}N$ of their collagen primarily from the estuarine system (Table 8.1; Figure 8.3). The average $\delta^{13}C$ corrected for trophic level is -16.64‰ and the average $\delta^{15}N$ corrected for trophic level is 5.64‰ (Table 8.4). The standard deviation is low for nitrogen, 0.59; the carbon standard deviation is higher than this, 1.69. The carbon and nitrogen values of raccoons cluster closest to fiddler crabs and smooth cordgrass, though one raccoon's values are closer to those of mussels and oysters. The dominance of estuarine resources in diet is consistent with the observations by Harman and Stains (1979:6–21) that fiddler crabs were the most abundant food item, overall, in raccoon scats, both in terms of numbers and volume. Cordgrasses, also estuarine resources, are commonly consumed in years when acorns are rare (Harman and Stains 1979:6–21). Differences were observed between raccoon scats found near the marsh and those found inland, however. Although fiddler crabs were common in inland scats, as well as marsh scats, dietary items from terrestrial sources, such as insects, beetles, and laurelcherries also were common (Harman and Stains 1979:6–21). This likely explains the one raccoon from this study that has a lower $\delta^{13}C$ value than the others—this individual probably fed more frequently in terrestrial habitats.

From scats and digestive tract contents, Harman and Stains (1979:6–11) concluded that acorns were the most preferred food item in raccoon diets, which is not supported by the isotopic results. Acorns dominated the diet of all raccoons in January 1976, a bumper year for oaks on the island, though fiddler crabs were still abundant in the scats. Harman and Stains (1979:12) speculate that the carbohydrates in acorns sustain animals through the winter, and poor acorn years lead to poor body condition and increased raccoon mortality. They did not test this hypothesis, however. Their study only covered a few months from two different years: January-May 1975, June-August 1975, and January 1979. In 1976, when acorns were abundant, raccoons focused foraging activities on this resource and in 1975, when acorns were not abundant, cordgrass was almost as common as fiddler crabs in the diet (Harman and Stains 1979:6–11). This supports their hypothesis that acorns are an important dietary source for raccoons when they are available.

The isotopic results for modern raccoon collagen and food items suggest that raccoon dietary protein on St. Catherines Island comes primarily from marsh animals and not terrestrial sources such as acorns. This discrepancy between the traditional dietary data of Harman and Staines (1979) and isotope data reported here may be explained by the fact that isotope values in collagen average the dietary protein in an animal’s diet over several years of life. This means that years when acorns are abundant and rare are both represented in isotope values. In addition, the entire annual cycle is represented in the isotope values but not in the scat/stomach contents study. Perhaps, despite acorns being important in seasons and years when they are abundant, acorns are not the most important dietary sources over the long-term. It is also possible that animal protein is differentially incorporated into collagen over other protein sources, so marsh animals contribute more carbon and nitrogen to the collagen values. The isotope study supplements the traditional study by highlighting the importance of estuarine resources in the diet of modern raccoons; terrestrial sources of protein appear to play a secondary role in raccoon diet over the animal's lifetime.

Land Use and Environmental Changes on St. Catherines Island

The results of the modern isotopic analyses provide a baseline for examining change over time in isotope values of archaeological deer and raccoon collagen. Although modern isotope values for plants could be different from isotope values in plants in the past, modern values are useful because they demonstrate: 1) a clear separation between terrestrial C_3 plants and estuarine resources and 2) variation among C_3 plants. The dietary studies of deer and raccoon scat and stomach contents and the isotope values of collagen demonstrate which food items these animals consume today and which they prefer. The modern collagen values also provide a model for the range of variation that can be expected in a population. This provides a baseline for interpreting isotope values from archaeological specimens. Table 8.5 lists the archaeological specimens analyzed for this project and the isotopic results.

Archaeological Deer

The isotopic results from archaeological deer suggest that some changes occurred in deer feeding behavior, from the Late Archaic until today (Table 8.5; Figure 8.4). All the individuals from the archaeological sample clearly had a diet focused primarily on C_3 terrestrial plants, even more so than modern animals. The average $\delta^{13}C$ and $\delta^{15}N$ values for each archaeological time period are lower than the averages of modern deer values (Table 8.3). Variability (highest isotope value minus the lowest value) is greater for the entire archaeological sample than within any of the individual samples for each time period. In the case of carbon, the range for each time period is within that expected for a single population in a given location (Cormie and Schwarcz 1994), but for the entire archaeological sample, the range is greater than expected for a single population. In the case of nitrogen, the range of variation is greater than expected for a single population during all time periods except the Late Archaic. This suggests differences among the time periods.

The Archaic deer diet is distinctive compared to that of deer in all other time periods (Tables 8.3 and Table 8.5; Figure 8.4). Archaic deer isotope values cluster tightly and have lower δ^{13}C values than all but one other archaeological deer individual in this study. All Archaic individuals have δ^{13}C values close to that of yucca, wax myrtle, spurred butterfly pea, resurrection fern, greenbrier, magnolia, maypop, mulberry, and one of the laurel oaks. The Archaic δ^{15}N values are all within the range of those C_3 plants with higher δ^{15}N values, such as maypop, saw palmetto, pawpaw, mulberry, yucca. This suggests some consumption of marsh grasses, pulling delta values away from most woody and herbaceous plants. The Archaic deer, however, more so than deer in other time periods, seem to have consumed mostly woody browse, mast, and fruits.

The variation among deer isotope values is greater in the Mississippian period than during the Late Archaic (Tables 8.3 and 8.5; Figure 8.4). The average δ^{13}C values for both the early and late Mississippian deer are intermediate between the Late Archaic and modern deer, though the range of variation for carbon in the modern and Mississippian deer samples is similar. The average δ^{15}N values for the early and late Mississippian deer are closer to the Late Archaic deer than to the modern deer, but the range of variation is higher than for both the Archaic and modern deer. This suggests that Mississippian deer, both on an individual and a population basis, foraged in a wider range of habitats than Archaic, and, possibly modern, deer. Although terrestrial C_3 plants were the basis of the Mississippian deer diet, marsh grasses probably played a greater role than they had in the Late Archaic. Some Mississippian deer individuals have higher $\delta^{15}N$ values than any of the Archaic deer. Smooth cordgrass would shift $\delta^{13}C$ and $\delta^{15}N$ to higher values, a shift observed for two early Mississippian deer and four late Mississippian deer. Consumption of saltmarsh cordgrass would pull $\delta^{13}C$ higher, but would not alter $\delta^{15}N$, a relationship observed for most of the Mississippian deer. Maize would also pull $\delta^{13}C$, but not $\delta^{15}N$, higher. The fact that $\delta^{15}N$ stays the same for most Mississippian individuals, or even decreases, compared to Archaic individuals could be a result of consuming less smooth cordgrass but more saltmarsh cordgrass. It could also be evidence for consumption of maize.

The late Mississippian deer individuals are drawn from three sites in different locations on the island—Meeting House Field, Back Creek Village, and 9LI1637 (Figure 3.1). The deer for other archaeological time periods are drawn from single localities. The variation in late Mississippian deer, therefore, may be due partly to the fact that a broader segment of the island deer population is sampled—the deer at Meeting House Field have higher $\delta^{13}C$ and $\delta^{15}N$ values on average than those at the other two late Mississippian sites.

The Mission-period deer have a range of isotopic variation similar to that of the Mississippian deer. Most Mission-period $\delta^{13}C$ and $\delta^{15}N$ values are intermediate between the Late Archaic and modern deer values (Table 8.5; Figure 8.4). One Mission deer, with a high $\delta^{15}N$ value similar to three of the modern deer, appears to have consumed more smooth cordgrass than all other archaeological deer. The other Mission deer had a diet similar to that of most Mississippian deer: $\delta^{13}C$ values higher than Late Archaic deer and $\delta^{15}N$ values similar to, or lower than, Late Archaic deer. Maize was definitely grown on St. Catherines Island during the Mission period. It is possible that maize was responsible for the pattern of higher $\delta^{13}C$, combined with unchanged or lower $\delta^{15}N$ values. It also is possible that non-maize dietary items, such as saltmarsh cordgrass, account for this pattern. Some early Mississippian deer had isotope values similar to those of Mission-period deer. As maize was not a dietary staple for early Mississippian humans, it was unlikely to have been common on the island during this period. Therefore, non-maize dietary items that create an isotopic pattern similar to maize were likely consumed throughout the Mississippian and Mission periods.

Meeting House Field Archaeological Deer

This volume's primary focus is on change over time in a single locality: Meeting House Field. Given the long time-span of human occupation at this locality and the large sites located there, it is possible that change would be more apparent in this locality. The general trend in isotope values from the Late Archaic through late Mississippian at Meeting House Field is for $\delta^{13}C$ in deer collagen to become less negative over time (Table 8.5; Figure 8.5). $\delta^{15}N$ values are higher for the late Mississippian deer compared to both Archaic and early Mississippian deer. Both carbon and nitrogen values are more variable in the Mississippian period than in the Archaic.

These data suggest that landscape changes in the Meeting House Field locality, and likely beyond, affected the foraging habits of deer. Late Archaic deer had access to enough preferred woody and herbaceous growth that these plants made up most of the diet. By the Mississippian period, deer not only foraged more frequently in marsh habitats, but there was greater variation among deer individuals and the habitats each frequented. This suggests that Mississippian deer did not have access to as much preferred woody and herbaceous terrestrial browse as they had enjoyed during the Late Archaic period, and so foraged for a wider range of plant material throughout the Mississippian period, possibly including maize during the Irene phase.

Human land-use patterns over the 2,000 years between the Late Archaic and Mississippian periods probably increased the heterogeneity of the landscape, increasing the variety of patches available to deer. These patches include abandoned settlements that may have little forest cover, a great deal of recent undergrowth, and calcareous soils; gardens and fields that are open and include concentrated amounts of plant material; and maintained clearings and open forests for hunting and gathering purposes. Many of these patches were probably larger forest gaps and open forests. Plants growing in such locations had higher $\delta^{13}C$ values due to a decreased canopy effect. $\delta^{15}N$ values of these plants were higher due to inputs of nitrogen from marine and human waste and burned plant material. Over time, as human populations grew and the number of settlements increased, deer probably experienced greater competition, both from people and other deer, for foraging locations and for access to plant materials such as mast and fruits. This may have forced deer to forage more frequently along marsh edges.

It is unclear whether the high carbon values for some Irene-phase deer are evidence that Mississippian deer consumed maize. Maize could be a factor in the increased $\delta^{13}C$ values of deer collagen for this period and in the Mission period, but as noted above, four of five early Mississippian deer have $\delta^{13}C$ values similar to the Mission-period deer (Figure 8.4). Interestingly, two of the late Mississippian deer have $\delta^{13}C$ values higher than deer from any other archaeological period, but not higher $\delta^{15}N$ values. Both are from Meeting House Field. This could be the result of consuming maize; perhaps maize production was concentrated in the vicinity of Meeting House Field. Maize, however, is not likely to show up clearly in bone collagen isotope values unless it was a major constituent of the diet because other plants consumed by deer are higher in protein and likely contribute disproportionately to the δ^{13}C of collagen (Ambrose and Norr 1993:19–29; Harrison and Katzenberg 2003; Hedges et al. 2004; Jim et al. 2004; Tieszen and Fagre 1993a:131–153).

Modern deer have higher δ^{13}C and δ^{15}N values on average than do deer from the archaeological samples, which may be related to environmental changes associated with human land-use practices since AD 1800. Unlike the aboriginal period, when maritime forest dominated the island, much of the island today is pine forest. Pines were among the first trees to colonize antebellum cotton and rice fields when these were abandoned (Thomas 2008:58–60). This decrease in maritime-forest vegetation decreased the amount of preferred woody browse and herbaceous growth available on the island, possibly leading deer to consume more conifers and marsh grass than during aboriginal times. This would result in higher δ^{13}C and δ^{15}N values. Drainage of the extensive interior wetlands of the central depression during the twentieth century decreased the amount of water available and further altered the vegetative communities of the interior. This might increase δ^{15}N values if modern deer are more likely to conserve water or nitrogen and excrete greater amounts of ^{15}N-depleted urea. In addition, the deer population on the island today is large because of the minimal human presence on the island and unmanaged deer population. Increased competition among deer combined with a decrease in preferred terrestrial habitats could force deer to forage more frequently in the marsh today than they did during the aboriginal periods.

Climate

Climate is another source of environmental change that also could have influenced the isotope values of St. Catherines Island. Higher δ^{13}C and δ^{15}N values are often associated with hotter and drier climates (Ambrose 1991; Ambrose and DeNiro 1986; Cormie and Schwarcz

1994, 1996; Heaton 1999). The Late Archaic, when average $\delta^{13}C$ and $\delta^{15}N$ of deer collagen are low and display little variation, may have been warmer and wetter (Diffenbaugh et al. 2006; Jones et al. 2005) than today. If climatic conditions were overall drier after AD 800, this might partially account for higher isotope values during the Mississippian period. The variability observed among individuals in the Mississippian might also be a result of variation in precipitation patterns throughout the Mississippian period. The Mississippian deer are drawn from contexts representing a span of ca. 800 years, during which time several periods of local drought occurred (Anderson et al. 1995; Blanton and Thomas 2008:801).

Modern climatic conditions, like Mississippian conditions, might be cooler and drier than Late Archaic conditions (Diffenbaugh et al. 2006; Jones et al. 2005). This could account for higher isotope values in modern deer than in Late Archaic deer. Climate change, however, does not appear to be the explanation for the increase in isotope values from the Mississippian period to modern times. Evidence suggests that throughout this time frame (AD 800–present), oscillations between wet and dry periods, on a scale of about 30 years, are the norm (Stahle et al. 1988). In addition, the years 1954 to 1984 may have been some of the wettest of that time frame (Stahle et al. 1988). Therefore, the deer specimens collected during the 1970s likely do not represent animals living in a drier climate compared to the archaeological deer. On the other hand, the extent of freshwater wetlands and streams decreased during the historic period due to land-use activities, so the island may be drier than it was in the past.

Archaeological Raccoon

Unlike deer, there is little evidence that the diet of raccoons has changed over time (Tables 8.4 and 8.5; Figure 8.6**)**. The degree of variation in the archaeological sample is similar to the variation in the modern sample, suggesting raccoons in the past derived the majority of the carbon and nitrogen in their collagen from estuarine animals just as modern raccoons do. Average $\delta^{15}N$ values for all time periods, corrected for trophic level, are between 9‰ and 10‰. The range of variation in $\delta^{15}N$ values in each time period is relatively small—about 2‰ or less. Variation is greater for $\delta^{13}C$. The Late Archaic period has the largest amount of variation, with the highest and second lowest $\delta^{13}C$ values.

Raccoons appear to have exploited the same set of habitats over time, with some variation. Some raccoons consumed more C_3 plants, some more mussels and oysters, and some more fiddler crabs (or other organisms, not analyzed in this study, but with similar isotopic signatures as oysters, mussels, and fiddler crabs). This is not surprising since Harman and Stains (1979:6–11) observed differences among scats collected near the marsh and those collected in the interior. Raccoons on St. Catherines have home ranges varying from 20 to 274 hectares, depending on factors such as age, size, sex, and season (Anderson and Hudson 1980:6). Oak forests are preferred as resting and foraging locations. Use of marsh habitats varies; some individuals were rarely observed foraging in the marsh and others were frequently observed in the marsh (Anderson and Hudson 1980:8). Three archaeological individuals, each from a different time period, and one modern individual, have $\delta^{13}C$ values higher than those of any of the food items tested in this study; though all of the (known or likely) raccoon food items were not tested. Sea turtles may have a $\delta^{13}C$ value higher than the fiddler crab in this study (Hutchinson et al. 1998), and the variation among mollusc and crustacean species and habitats is likely not reflected in this study. The animals with especially high $\delta^{13}C$ values may have consumed more sea turtle eggs, common on the beaches in the summer months, or additional estuarine invertebrate species, or species from different habitats, than were included in the modern dietary study. The isotopic data do not indicate that raccoons during the late

Mississippian or Mission periods consumed maize. Maize is unlikely to influence raccoon collagen values unless it was a major staple of the diet, replacing animal proteins. Although one late Mississippian and one Mission raccoon did have particularly high $\delta^{13}C$ values, their $\delta^{15}N$ was as high as other individuals, which would not be the case were they replacing estuarine meat with maize.

Limitations to Isotopic Analysis

The isotopic analysis reported here is limited in many ways:

1) The sample sizes from all archaeological periods are small. The faunal collections did not contain a large number of deer or raccoon bones. However, the modern and archaeological variation is relatively low for both $\delta^{13}C$ and $\delta^{15}N$ in both taxa, suggesting that the archaeological samples, small though they are, capture much of the variation for each time period.

2) The modern sample of food items does not include all food items consumed by modern deer and raccoons. Dietary interpretations, therefore, may not include some important foodstuffs. However, the sampled items do cluster into a terrestrial C_3 category and an estuarine C_4 plant, mollusc, and crustacean category, which is adequate for interpreting the relative importance of these two major sources in raccoon and deer diets.

3) Fractionation factors used in this study are approximations based on the literature. No studies have examined fractionation effects in raccoons, though studies of minks and bears, two other omnivores, suggest a 1‰ fractionation for invertebrate prey and a 2‰ fractionation for plant, mammal, and bird prey (Ben-David et al. 1996; Hildebrand et al. 1996). The general fractionation value for dedicated carnivores is between 4‰ and 5‰ (Ambrose and DeNiro 1986). A fractionation value of +2‰ was chosen for raccoons, for this study, and some error was likely introduced with that choice. The general fractionation value for herbivores over diet is

between 5‰ and 6‰; Drucker et al. (2008) use a 5.4‰ value for red deer in Europe and Cormie and Schwarcz (1994) and Emery et al. (2000) use a value of 5‰ for white-tailed deer in the Americas. Again, some error may have been introduced by using a +5‰ factor for deer in this study. However, since the same factor was used for all individuals of each species, comparisons among individuals are not affected—only comparisons of animal collagen and dietary items are affected.

4) Comparing modern and archaeological samples is problematic since it is not possible to know if modern conditions prevailed in the past. A 1.5‰ decrease in atmospheric $\delta^{13}C$ is thought to have occurred after the Industrial Revolution (Tieszen and Fagre 1993b). This factor, +1.5‰, is applied to the modern collagen and dietary item values to compare them with archaeological $\delta^{13}C$ values. It is possible that this value is not stable across time and space. In fact, if the modern isotope values were not corrected by +1.5‰ in this study, modern deer would have $\delta^{13}C$ values very similar to Mississippian deer.

5) Oceanic $\delta^{13}C$ might not have experienced the same amount of change as atmospheric $\delta^{13}C$ since the Industrial Revolution, which would make the application of the +1.5‰ correction factor to modern estuarine animals and raccoons inappropriate. If salinity levels changed due to changes in precipitation and temperature regimes, $\delta^{13}C$ in marine organisms was likely affected (Eriksson and Lidén 2002; Milner et al. 2004). Given the multitude of environmental factors that affect $\delta^{13}C$ and $\delta^{15}N$ at the base of the food chain, it is possible that modern values for the dietary items analyzed in this study are not directly comparable to archaeological values (Hedges et al. 2004).

Chapter Summary

Human land-use activities over time on St. Catherines Island appear to have created a more heterogeneous landscape. This has not affected raccoon foraging behavior. Raccoons obtain most of their protein from marsh foods, though some individuals forage more frequently further inland than do others. The variability observed in modern raccoons has existed since the Late Archaic. Deer, however, have changed the variety of foraging habitats they frequent. Although terrestrial woody and herbaceous growth are preferred foods and provide most of the protein in both modern and archaeological deer diets, over time the marsh played a larger role in deer foraging. During the Mississippian period there was greater variability among deer in foraging habitats than during the Late Archaic, probably because forest gaps, open forests, nitrogen-enriched soils, and forest patches in varying stages of succession increased, particularly in the late Mississippian. Modern deer forage in the marsh more frequently than did most of the archaeological deer, possibly a result of historic land-use and deer-management practices. Archaeological deer and raccoons did not have access to a reliable source of maize, either in fields or storage features, even during the Mission period. The stable isotope evidence from the Meeting House Field locality alone indicates that some late Mississippian deer consumed more C_4 plants than previous deer in the locality had done. These plants may have been maize, other terrestrial grasses, or cordgrasses. Social, political, and economic changes on St. Catherines Island, both between the Late Archaic and Mississippian and during the Mississippian period, led to environmental changes that affected foraging habits of deer on the island.

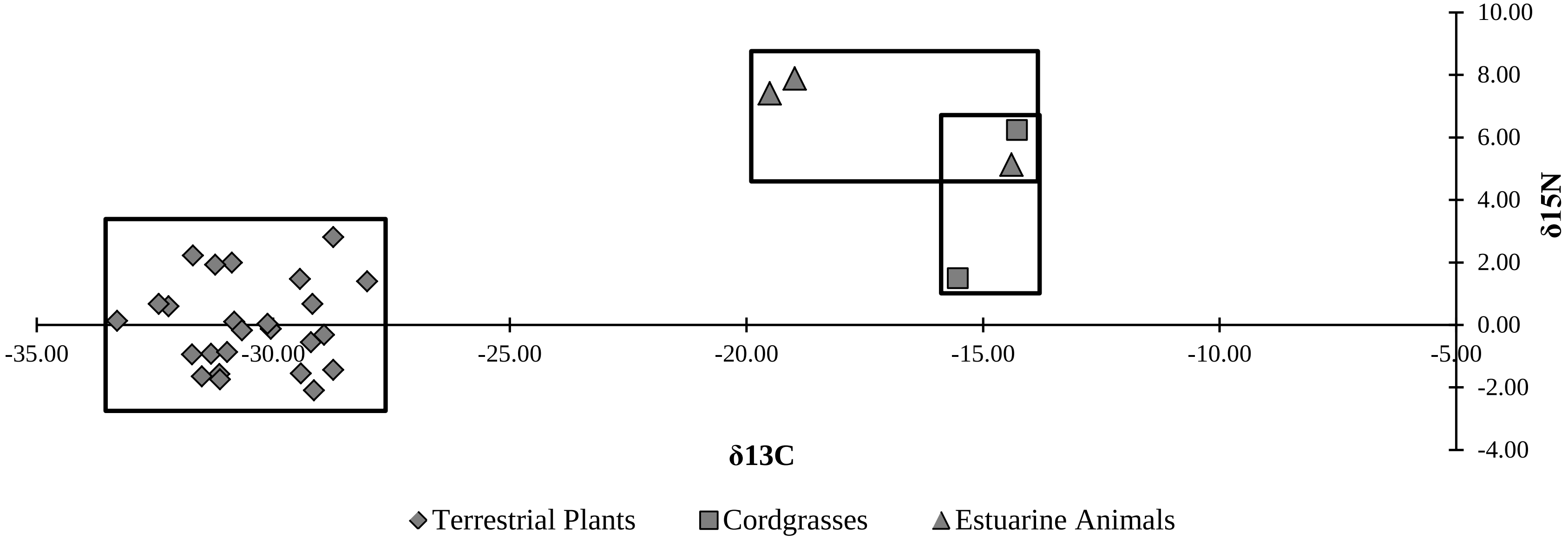


Figure 8.1: Carbon and nitrogen isotopic values of modern dietary items. Boxes show the range of values for each dietary item type: terrestrial plants, cordgrasses, and estuarine animals

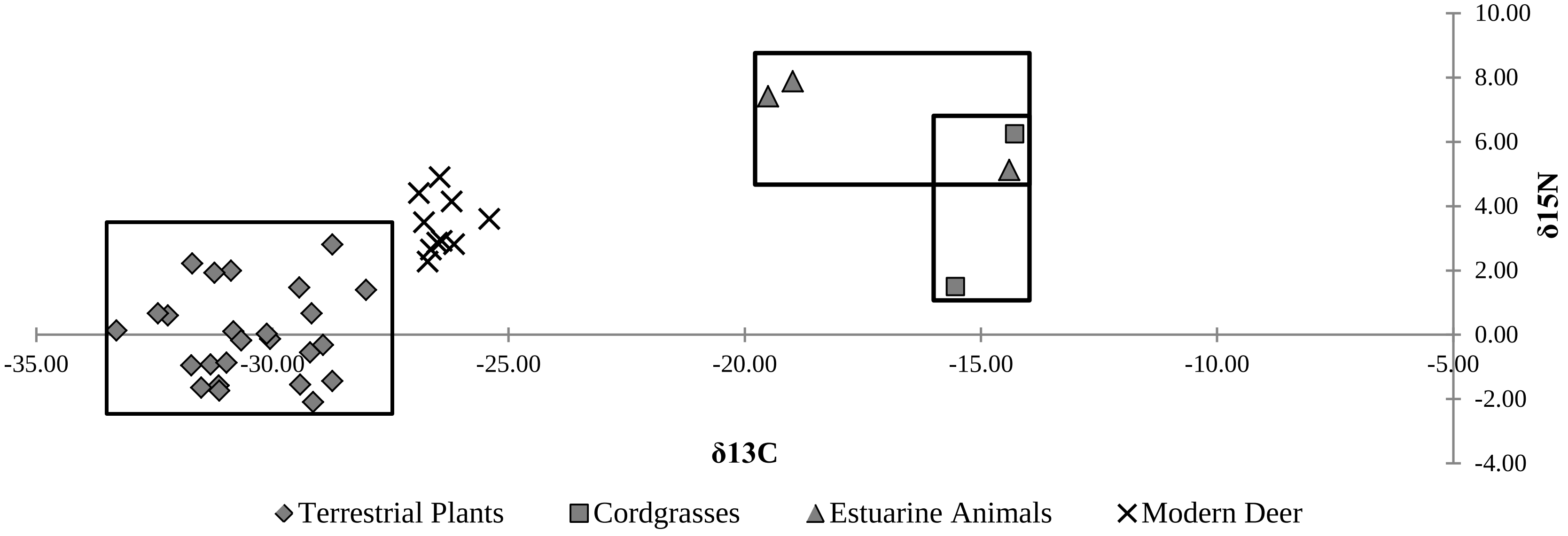


Figure 8.2: Carbon and nitrogen isotope values of modern deer and their dietary items. Boxes show the range of values for each dietary item type: terrestrial plants, cordgrasses, and estuarine animals

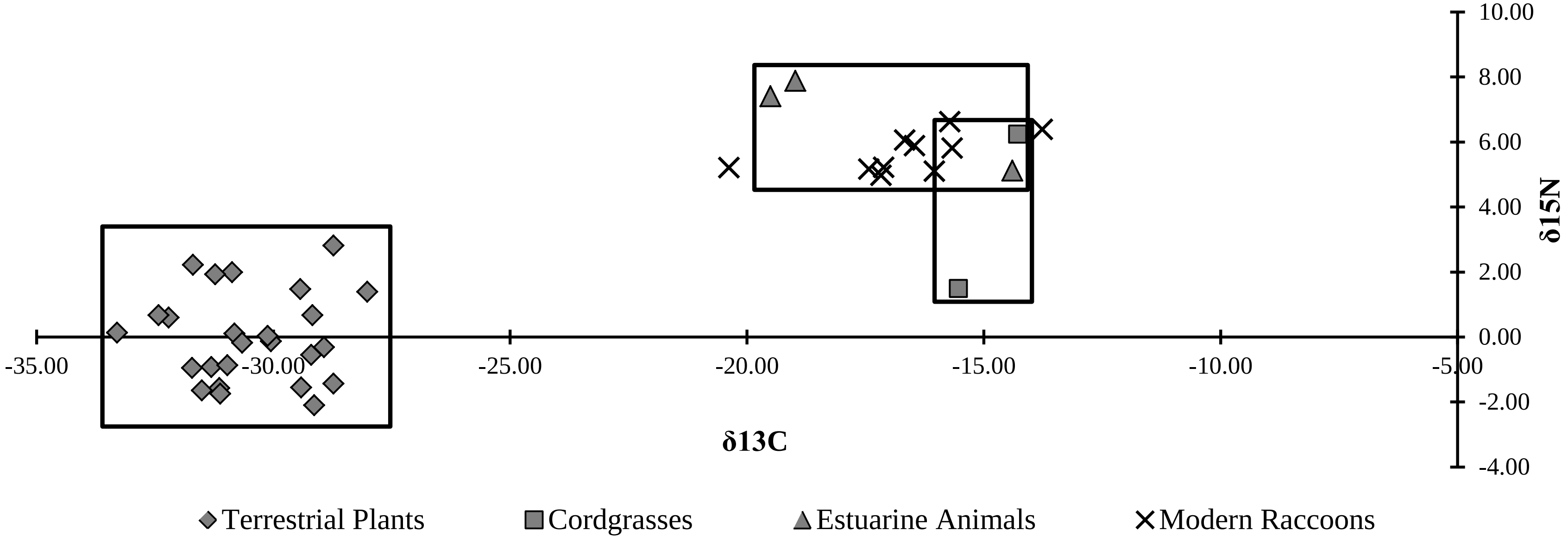


Figure 8.3: Carbon and nitrogen isotope values of modern raccoons and their dietary items. Boxes show the range of values for each dietary item type: terrestrial plants, cordgrasses, and estuarine animals

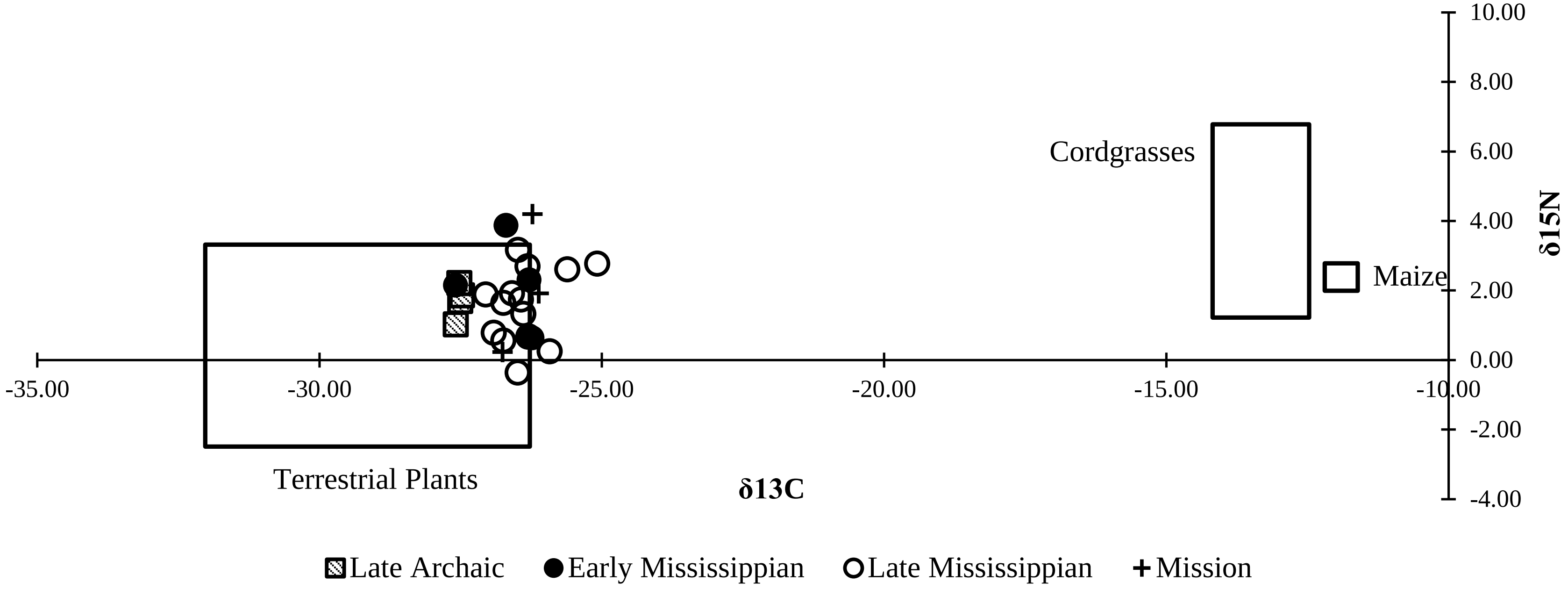


Figure 8.4: Carbon and nitrogen isotope values of archaeological deer. Boxes show the range of values for each dietary item type: terrestrial plants, cordgrasses, and maize (isotope values of maize from Schoeninger et al. 1990:83)

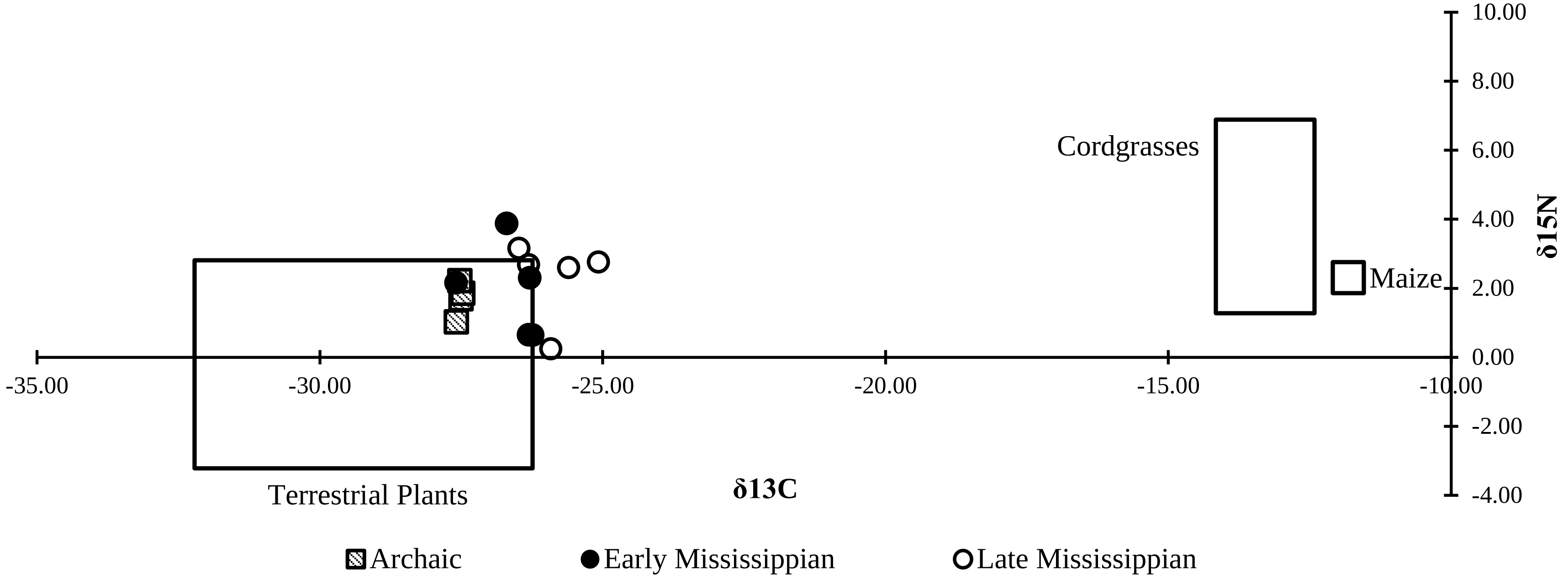


Figure 8.5: Carbon and nitrogen isotope values of archaeological deer from the Meeting House Field locality. Boxes show the range of values for each dietary item type: terrestrial plants, cordgrasses, and maize (isotope values of maize from Schoeninger et al. 1990:83)

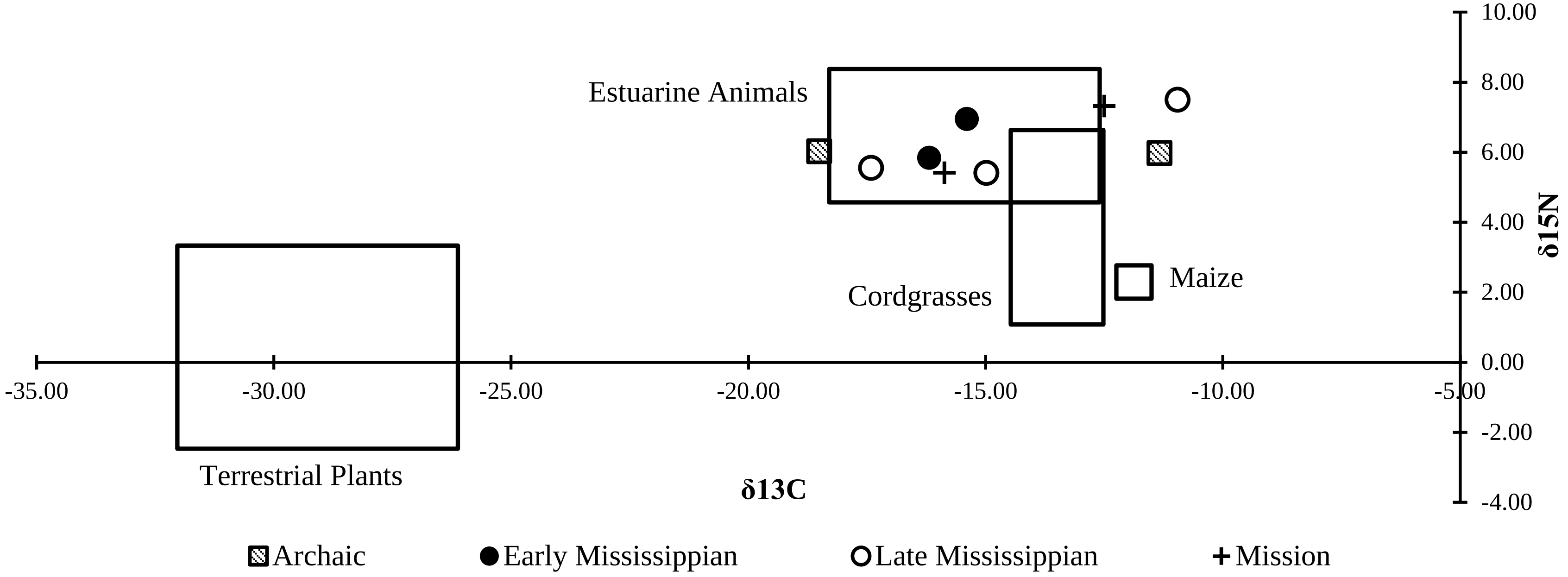


Figure 8.6: Carbon and nitrogen isotope values of archaeological raccoons. Boxes show the range of values for each dietary item type: terrestrial plants, cordgrasses, estuarine animals, and maize (isotope values of maize from Schoeninger et al. 1990:83)

Table 8.1

Modern Deer and Raccoon Specimens and Stable Carbon and Nitrogen Isotopic Results

Sample #	AMNH Catalog #	Taxon	Sex	wt %N	wt %C	C:N	δ13C	δ15N	Trophic level corrected δ13C	Trophic level corrected δ15N	Atmospheric δ13C change corrected δ13C
A_01	234937	*Procyon lotor*	Male	13.27	39.65	3.49	-14.67	9.46	-16.67	6.06	-15.17
A_02	235185	*Procyon lotor*	Female	14.69	43.01	3.42	-13.67	9.21	-15.67	5.81	-14.17
A_03	235189	*Procyon lotor*	Female	13.98	41.82	3.49	-14.46	9.28	-16.46	5.88	-14.96
A_04	236135	*Procyon lotor*	Male	14.59	41.64	3.33	-15.17	8.37	-17.17	4.97	-15.67
A_05	236137	*Procyon lotor*	Male	14.63	43.03	3.43	-11.77	9.79	-13.77	6.39	-12.27
A_06	237439	*Procyon lotor*	Male	14.56	42.78	3.43	-15.11	8.62	-17.11	5.22	-15.61
A_07	238270	*Procyon lotor*	Male	14.8	43.01	3.39	-15.43	8.56	-17.43	5.16	-15.93
A_08	244118	*Procyon lotor*	Male	14.45	43.04	3.47	-13.72	10.02	-15.72	6.62	-14.22
A_09	244119	*Procyon lotor*	Female	13.36	39.3	3.43	-18.38	8.61	-20.38	5.21	-18.88
A_10	245620	*Procyon lotor*	Male	14	40.44	3.37	-14.04	8.50	-16.04	5.10	-14.54
A_11	235194	*Odocoileus virginianus*	Unknown	13.98	40.13	3.35	-21.41	5.92	-26.41	2.92	-24.91
A_12	236155	*Odocoileus virginianus*	Male	15.07	42.63	3.30	-21.51	5.86	-26.51	2.86	-25.01
A_13	236157	*Odocoileus virginianus*	Male	14.41	41.23	3.34	-21.64	5.64	-26.64	2.64	-25.14
A_14	236160	*Odocoileus virginianus*	Female	13.99	40.29	3.36	-21.90	7.40	-26.90	4.40	-25.40
A_15	238170	*Odocoileus virginianus*	Unknown	14.64	42.56	3.39	-21.20	7.14	-26.20	4.14	-24.70
A_16	238171	*Odocoileus virginianus*	Unknown	13.82	39.85	3.36	-20.41	6.60	-25.41	3.60	-23.91
A_17	238469	*Odocoileus virginianus*	Unknown	15.13	43.35	3.34	-21.15	5.81	-26.15	2.81	-24.65
A_18	238640	*Odocoileus virginianus*	Unknown	14.49	42.21	3.40	-21.79	6.50	-26.79	3.50	-25.29
A_19	238644	*Odocoileus virginianus*	Unknown	15.12	43.8	3.38	-21.46	7.90	-26.46	4.90	-24.96

Table 8.1—(*Continued*)

Sample #	AMNH Catalog #	Taxon	Sex	wt %N	wt %C	C:N	δ13C	δ15N	Trophic level corrected δ13C	Trophic level corrected δ15N	Atmospheric δ13C change corrected δ13C
A_20	245629	*Odocoileus virginianus*	Male	15.09	43.36	3.35	-21.71	5.27	-26.71	2.27	-25.21

Precision of standards for δ15N = 0.10 and for δ13C = 0.12

Table 8.2

Modern Plant and Animal Food Item Specimens and Stable Carbon and Nitrogen Isotopic Results

Sample #	Taxon		Collection Location	wt %N	wt %C	δ13C	δ15N	Atmospheric δ13C change corrected δ13C
1	*Quercus laurifolia*	Laurel oak	Meeting House Field	1.51	47.99	-29.17	0.67	-27.67
2	*Nyssa biflora*	Swamp tupelo	Meeting House Road	1.42	46.21	-31.31	-0.93	-29.81
3	*Morus rubra*	Mulberry	Long Field	2.27	44.57	-29.43	1.47	-27.93
4	*Spartina alterniflora*	Smooth cordgrass	Meeting House Field	1.03	41.85	-14.29	6.24	-12.79
5	*Ilex vomitoria*	Yaupon	King New Ground Field	1.81	47.64	-32.21	0.60	-30.71
6	*Magnolia grandiflora*	Southern magnolia	Meeting House Field	2.14	48.69	-28.93	-0.32	-27.43
7	*Smilax* sp.	Greenbrier	East Road	1.39	46.97	-29.20	-0.55	-27.70
8	*Spartina patens*	Saltmarsh cordgrass	Meeting House Field	1.72	43.95	-15.54	1.49	-14.04
9	*Morella cerifera*	Wax myrtle	Meeting House Field	2.01	49.54	-29.14	-2.10	-27.64
10	*Yucca filamentosa*	Adam's Needle	Long Field	0.96	45.01	-28.02	1.39	-26.52
12	*Asmina paviflora*	Paw paw	Meeting House Field Road	2.14	45.46	-30.87	1.99	-29.37
14	*Quercus virginiana*	Live oak	Meeting House Field	1.43	47.83	-30.82	0.10	-29.32
15	*Serenoa repens*	Saw palmetto	Meeting House Road	1.62	43.55	-31.22	1.92	-29.72
16	*Passiflora incarnata*	Maypop	Meeting House Field Road	3.17	43.57	-28.73	2.81	-27.23
17	*Sabal palmetto*	Cabbage palm	Meeting House Field	1.37	45.20	-33.30	0.13	-31.80
19	*Vitis rotundifolia*	Muscadine	Meeting House Field	1.11	44.04	-31.14	-1.58	-29.64
20	*Prunus caroliniana*	Carolina laurelcherries	King New Ground Field	1.31	44.79	-30.97	-0.87	-29.47
21	*Centrosema virginiana*	Spurred butterfly pea	North Pasture	2.27	42.71	-29.41	-1.56	-27.91
22	*Hydrocotyle umbellata*	Pennywort	Sandhill Road beach	1.54	38.52	-30.66	-0.18	-29.16

Table 8.2—*(Continued)*

Sample #	Taxon		Collection Location	wt %N	wt %C	δ13C	δ15N	Atmospheric δ13C change corrected δ13C
23	*Polypodium polypodioides*	Resurrection fern	Compound	1.00	42.38	-28.73	-1.44	-27.23
25	*Vitis rotundifolia*	Muscadine	Back Creek Village	1.47	42.45	-31.12	-1.74	-29.62
26	*Quercus laurifolia*	Laurel oak	Back Creek Village	1.29	45.56	-31.71	-0.95	-30.21
27	*Carya glabra*	Pignut hickory	Back Creek Village	0.85	44.38	-30.05	-0.13	-28.55
29	*Sabal palmetto*	Cabbage palm	Back Creek Village	1.25	45.76	-32.42	0.67	-30.92
30	*Quercus virginiana*	Live oak	Back Creek Road	1.33	46.69	-30.12	0.03	-28.62
31	*Myrica cerifera*	Wax myrtle	Back Creek Village	1.35	46.54	-31.51	-1.65	-30.01
32	*Serenoa repens*	Saw palmetto	Back Creek Village	0.93	45.95	-31.70	2.22	-30.20
33	*Crassostrea virginica*	Eastern oyster	South End Dock	9.24	38.64	-18.98	7.88	-17.48
34	*Geukensia demissa*	Ribbed mussel	South End Dock	9.62	39.85	-19.50	7.41	-18.00
35	*Uca* sp.	Fiddler crab	South End Dock	4.38	23.91	-14.40	5.12	-12.90

Table 8.3

Deer Stable Isotope Results Summary Table

		Entire Archaeological Sample	Archaic	Early Mississippian	Late Mississippian	Mission	Modern	Atmospheric δ13C corrected Modern
	Sample Size	26	4	5	14	3	10	
δ13C	Raw Average	-21.59	-22.52	-21.62	-21.36	-21.36	-21.42	
	Trophic level corrected average	-26.59	-27.52	-26.62	-26.36	-26.36	-24.92	-26.42
	Trophic level corrected high	-25.08	-27.47	-26.23	-25.08	-26.11	-23.91	-25.41
	Trophic level corrected low	-27.59	-27.58	-27.59	-26.91	-26.76	-25.40	-26.90
	Range	2.51	0.11	1.36	1.83	0.65	1.49	
	Sigma	0.62	0.05	0.57	0.52	0.34	0.43	
δ15N	Raw Average	4.70	4.69	4.92	4.54	5.11	6.41	
	Trophic level corrected average	1.70	1.69	1.92	1.54	2.11	3.41	
	Trophic level corrected high	4.19	2.21	3.87	3.16	4.19	4.90	
	Trophic level corrected low	-0.36	1.02	0.63	-0.36	0.23	2.27	
	Range	4.55	1.19	3.24	3.52	3.96	2.63	
	Sigma	1.12	0.50	1.35	1.06	1.99	0.85	

Range=Lowest isotope value subtracted from highest isotope value for each time period; Sigma=$\sqrt{\Sigma(x\text{-mean})^2/N}$

Table 8.4

Raccoon Stable Isotope Results Summary Table

		Entire Archaeological Sample	Archaic	Early Mississippian	Late Mississippian	Mission	Modern	Atmospheric δ13C corrected Modern
	Sample size	9	2	2	3	2	10	
δ13C	Raw Average	-12.79	-12.92	-13.79	-12.44	-12.18	-14.64	
	Trophic level corrected average	-17.79	-14.92	-15.79	-14.44	-14.18	-16.64	-15.14
	Trophic level corrected high	-10.95	-11.33	-15.39	-10.95	-12.50	-13.77	-12.27
	Trophic level corrected low	-18.50	-18.50	-16.18	-17.41	-15.86	-20.38	-18.88
	Range	7.55	7.17	0.79	6.46	3.36	6.61	
	Sigma	2.95	5.07	0.56	3.26	2.38	1.69	
δ15N	Raw Average	9.61	9.40	9.79	9.55	9.76	9.04	
	Trophic level corrected average	6.61	6.00	6.39	6.15	6.36	5.64	
	Trophic level corrected high	7.49	6.02	6.94	7.49	7.31	6.62	
	Trophic level corrected low	5.40	5.97	5.83	5.40	5.41	4.97	
	Range	2.09	0.05	1.11	2.09	1.90	1.65	
	Sigma	0.82	0.03	0.78	1.17	1.35	0.59	

Range=Lowest isotope value subtracted from highest isotope value for each time period; Sigma=$\sqrt{\Sigma(x\text{-mean})^2/N}$

Table 8.5

Archaeological Deer and Raccoon Specimens and Carbon and Nitrogen Isotopic Results

Sample #	Site #	Unit	Level	Taxon	wt %N	wt %C	C:N	δ13C	δ15N	Trophic level corrected δ13C	Trophic level corrected δ15N	Time Period
O_01	9Li21	Alpha	20-30	*Odocoileus virginianus*	12.39	36.74	3.46	-20.92	3.24	-25.92	0.24	Late Miss.
O_02	9Li21	Beta	55-65	*Odocoileus virginianus*	13.58	40.46	3.48	-20.60	5.60	-25.60	2.60	Late Miss.
O_03	9Li21	Epsilon	20-30	*Odocoileus virginianus*	13.23	39.62	3.49	-21.48	6.16	-26.48	3.16	Late Miss.
O_04	9Li230	Iota	10-20	*Odocoileus virginianus*	11.73	34.17	3.40	-21.28	5.30	-26.28	2.30	Early Miss.
O_05	9Li21	N501 E80	70-80	*Odocoileus virginianus*	10.64	29.95	3.28	-20.08	5.76	-25.08	2.76	Late Miss.
O_06	9Li21	Zeta	10-20	*Odocoileus virginianus*	11.21	33.70	3.51	-21.31	5.69	-26.31	2.69	Late Miss.
O_07	9Li229	N165E159	40-50	*Odocoileus virginianus*	10.27	30.71	3.49	-21.23	3.63	-26.23	0.63	Early Miss.
O_08	9Li229	N191E84	40-50	*Odocoileus virginianus*	13.11	38.46	3.42	-22.59	5.15	-27.59	2.15	Early Miss.
O_09	9Li1637	TP 1	70-80	*Odocoileus virginianus*	14.14	40.10	3.31	-21.42	4.73	-26.42	1.73	Late Miss.
O_10	9Li229	N179 E84	F.2 30-40	*Odocoileus virginianus*	13.65	38.73	3.31	-21.31	3.65	-26.31	0.65	Early Miss.
O_11	9Li1637	TP 2	20-30	*Odocoileus virginianus*	11.31	35.40	3.65	-22.05	4.88	-27.05	1.88	Late Miss.
O_13	9Li207	N488 E495	49.66-49.56	*Odocoileus virginianus*	11.15	31.66	3.31	-21.29	3.68	-26.29	0.68	Late Miss.
O_14	9Li207	N493 E499	49.75-49.65	*Odocoileus virginianus*	13.85	39.59	3.33	-21.74	3.56	-26.74	0.56	Late Miss.
O_15	9Li207	N557 E482	48.34-48.24	*Odocoileus virginianus*	13.14	38.27	3.40	-21.39	4.32	-26.39	1.32	Late Miss.
O_16	9Li207	N586 E441	48.79-48.69	*Odocoileus virginianus*	12.12	34.82	3.35	-21.58	4.91	-26.58	1.91	Late Miss.
O_17	9Li207	N587 E437	48.83-48.73	*Odocoileus virginianus*	13.76	39.27	3.33	-21.74	4.64	-26.74	1.64	Late Miss.
O_18	9Li207	TP VI	48.68-48.58	*Odocoileus virginianus*	14.10	39.85	3.30	-21.49	2.64	-26.49	-0.36	Late Miss.
O_19	9Li207	TP VII	48.85-48.75	*Odocoileus virginianus*	11.74	34.33	3.41	-21.91	3.78	-26.91	0.78	Late Miss.
O_21	441	A	48-60	*Odocoileus virginianus*	8.45	25.82	3.56	-21.76	3.23	-26.76	0.23	Mission

Table 8.5—*(Continued)*

Sample #	AMNH Site #	Unit	Level	Taxon	wt %N	wt %C	C:N	δ13C	δ15N	Trophic level corrected δ13C	Trophic level corrected δ15N	Time Period
O_22	680	V	20-30	*Odocoileus virginianus*	12.78	36.61	3.34	-21.11	4.92	-26.11	1.92	Mission
O_23	680	VII	10-20	*Odocoileus virginianus*	13.49	39.01	3.37	-21.22	7.19	-26.22	4.19	Mission
O_24	9Li231	Feature 23	2.1-2.0	*Odocoileus virginianus*	13.21	37.27	3.29	-22.52	5.21	-27.52	2.21	Archaic
O_25	9Li231	Feature 23	2.1-2.0	*Odocoileus virginianus*	13.15	38.07	3.38	-22.50	4.69	-27.50	1.69	Archaic
O_26	9Li231	W84 S2	2.6-2.5	*Odocoileus virginianus*	9.81	29.22	3.48	-22.47	4.85	-27.47	1.85	Archaic
O_27	9Li231	N771 E819	2.6-2.5	*Odocoileus virginianus*	13.86	39.85	3.35	-22.58	4.02	-27.58	1.02	Archaic
O_28	9Li230	Iota	10-20	*Odocoileus virginianus*	12.38	35.64	3.36	-21.69	6.87	-26.69	3.87	Early Miss.
P_01	9Li230	Iota	10-20	*Procyon lotor*	13.37	40.26	3.51	-13.39	10.34	-18.39	7.34	Early Miss.
P_02	9Li230	Iota	10-20	*Procyon lotor*	12.44	36.50	3.42	-14.18	9.23	-19.18	6.23	Early Miss.
P_03	9Li207	N587 E437	48.83-48.73	*Procyon lotor*	13.28	38.07	3.34	-12.98	8.80	-17.98	5.80	Late Miss.
P_04	9Li207	TP IX	50.02-49.92	*Procyon lotor*	12.80	37.68	3.43	-8.95	10.89	-13.95	7.89	Late Miss.
P_05	441	A	30-40	*Procyon lotor*	13.96	40.06	3.35	-10.50	10.71	-15.50	7.71	Mission
P_06	680	III	10-20	*Procyon lotor*	13.58	39.79	3.42	-13.86	8.81	-18.86	5.81	Mission
P_07	9Li21	Epsilon	20-30	*Procyon lotor*	14.10	40.83	3.38	-15.41	8.94	-20.41	5.94	Late Miss.
P_08	9Li231	N771 E819	2.6-2.5	*Procyon lotor*	12.90	37.67	3.41	-9.33	9.37	-14.33	6.37	Archaic
P_09	9Li231	Feature 23	2.0-1.9	*Procyon lotor*	13.72	41.09	3.49	-16.50	9.42	-21.50	6.42	Archaic

Precision of standards for δ15N = 0.10 and for δ13C = 0.12

CHAPTER 9:

SUMMARY AND CONCLUSIONS

Human-environment interactions are dynamic; human behavior associated with different subsistence-settlement systems, demographics, and socio-political relationships results in different interactions (Balée 1998, 2006; Crumley 1994). Recent archaeological research on these interactions in coastal environments—environments today threatened by development, pollution, climate change, and over-fishing—suggests that coastal resources have been affected by fishing activities for thousands of years (Amorosi et al. 1996; Barrett et al. 2004; Braje et al. 2007; Broughton 1997, 2002, 2004; Butler 2000, 2001; Erlandson et al. 2005, 2008; Fitzpatrick and Keegan 2007; Hales and Reitz 1992; Kennett 2005: 217–238; Milner et al. 2007; Morales-Muñiz and Roselló-Izquierdo 2008; Morrison and Hunt 2007; Nagoaka 2002; Quitmyer and Jones 2000; Quitmyer and Reitz 2006; Reitz 2004; Rick et al. 2001; Wing 2001). Resource depression views depletion of resources as inevitable based on the premise of foraging theory that people will always capture high-ranked prey when encountered, and these resources are generally the larger-bodied individuals with life histories selecting for quality over quantity in off-spring (Broughton 1997, 2002, 2004; Butler 2000, 2001; Kennett 2005: 217–238; Nagoaka 2002; Thomas 2008:936–987). Other studies, based in the framework of historical ecology, emphasize transformation of landscapes as a result of long-term human occupation, while not assuming human impacts are either inherently good or bad for the abiotic and biotic environment (Balée 2006; Butzer 1996; Dugmore et al. 2005; Fairhead and Leach 1995; Graham 1998; Kidder 2008; Kirch 1997; Neves et al. 2003; Posey 1985, 1998; Pyne 1998; Stahl 1996:114–

115). Additional case studies, therefore, are necessary to record past human-environment interactions: especially the role of the social and political contexts of these interactions and the effects on coastal environments.

This dissertation provides such a case study, using multiple analytical techniques applied to fine-screened faunal samples from the Mississippian period on St. Catherines Island. Although zooarchaeological analysis was included in previous subsistence studies on the island, recovery methods were coarse-grained, possibly masking change over time (Reitz 2008; Reitz and Dukes 2008). The materials used for this dissertation, both vertebrates and invertebrates, were not only recovered with fine-grained methods, but also subjected to morphological, incremental, and stable isotope analyses to gather environmental information beyond relative abundance measures. Four research objectives were addressed with these data: 1) characterizing the late Mississippian diet, 2) evaluating data for subsistence change over time during the Mississippian period, 3) evaluating data for resource depression and human impacts on estuarine animals, and 4) assessing stable isotope data for environmental change and impacts on terrestrial animals.

Investigating these objectives produced additional information regarding human-environmental interactions along coasts. This information can be compared with other fine-grained studies from the region and other parts of the globe, while providing an understanding of the implications of socio-political, demographic, and economic changes during the Mississippian period for the landscape of St. Catherines Island. This final chapter summarizes the findings of this volume, discusses implications for anthropology and modern ecological research and management, defines areas for future research, and provides conclusions about human-environment interactions on St. Catherines Island.

Summary of the Mississippian-Period Zooarchaeological Analyses and Anthropological Implications

Mississippian Subsistence

The fine- and water-screened collections of vertebrates and invertebrates demonstrate that estuarine resources were the dominant components of human subsistence during the Mississippian period. The collections reported here are larger than other Mississippian collections from St. Catherines Island or the Georgia coast in general, and include invertebrates, which have not previously been studied from Mississippian middens on St. Catherines. It is clear that Mississippian people focused their subsistence strategy on small, mass-capture fishes and mass-collected molluscs. Sea catfishes, mullets, killifishes, drums, oysters, mussels, stout tagelus, and hard clams were the most common vertebrate and invertebrate food taxa. Deer contributed a similar amount of meat to the diet as fishes, but hunting was an uncommon activity.

These findings are consistent with Thomas' (2008:192–194) optimal foraging models, which posit that the salt-marsh was the most productive patch and salt-marsh fishing the most productive hunt-type. However, alligators, bears, sea turtles, red drums, and sharks, all large animals ranked high in the model, are rare or absent in these collections. Instead, Irene-phase people relied on resources ranked low in the model. A similar pattern was found in coastal California, where high-ranked resources such as sea mammals, abundant on the coast today, are rare in archaeological collections through time (Kennett 2005:222–223). The advantages of abundant and reliable resources, such as shellfishes, have been discussed in foraging models (Dyson-Hudson and Smith 1978; Kennett 5005:218–220; Thomas 2008:192–194)—they can be collected by people of all ages, they are available throughout the day and year, they are defendable—but perhaps the value people placed on them has been underestimated. Clearly, on the Georgia coast, shellfish beds and small fishes in tidal creeks can support large human populations. An efficient subsistence strategy adapted to exploiting these resources was likely of high value to people and led to expectations about food stuffs that emphasized these taxa. This may mean people viewed capturing other animals only as chance events or a special occasion.

Subsistence Change over Time

The early and late zooarchaeological collections from Meeting House Field suggest that the people living at the site during these two periods devised different subsistence solutions. Overall, the zooarchaeological collections from early and late contexts are very similar. Both early and late subsistence strategies focused on estuarine resources and the same dominant taxa were present in both periods. There is no evidence that diet-breadth changed; no new common taxa were added to the diet during the Irene phase. There is evidence, however, that Irene-phase people exploited a broader range of patches than did earlier residents; in the later phase they exploited the same taxa, but obtained these taxa from a greater number of locations: oysters and clams from different substrates and fishes from different parts of the water column or different portions of the tidal creek system. Irene-phase people, living in denser concentrations in more island locations, also occupied their settlements for longer periods of time and devised different waste management practices.

These different solutions to problems of resource use, demographic arrangement, and site location were likely related to the socio-political developments of the Mississippian period. Little evidence for such developments was found in the zooarchaeological record, however. All households during both the early and late periods had access to the same set of resources and the same portions of deer carcasses. Markers of status, such as dangerous, carnivorous, or decorative animals, are largely absent from middens and are certainly not concentrated in any particular middens. Therefore, the middens at these sites contain no evidence for differential status as measured by animal remains. However, longer-term occupation of settlements and more structured waste disposal were probably consequences of a newly formed, regionally integrated polity with a large population dispersed on the landscape in many communities. Use of a greater number of, or different, fishing and shell-fishing locations might be a consequence of changes in territory size to which individual communities had access. Territory size may have been reduced because of competition among settlements, causing people to make greater use of the limited fishing grounds available to them. Alternatively, territory size may have increased because of cooperation among settlements or access to unoccupied nearby islands, and people may have gone further afield to fish. Another explanation for the change in fish size is a greater emphasis on communal use of weirs. With a larger labor pool, made possible by higher population numbers and density, weirs might be more cost-effective than earlier. Geomorphological or climatic changes could also result in different patterns of fish and shellfish distribution in the estuary; Irene-phase people could do exactly what they did earlier but encounter different fish cohorts or shellfish substrates. Unfortunately, the data do not point to any single explanation, though future research may elaborate on this.

Resource Depression and Human Impacts on Estuarine Animals

There is little evidence for resource depression on St. Catherines Island during the Mississippian period, despite the fact that foraging models predict long-term exploitation will lead to decreased abundance of preferred resources. This is likely due to the fact that people never emphasized large-bodied animals that produce small numbers of offspring (often referred to as K-strategists). Such animals are most likely to be affected by long-term predation (e.g., Broughton 1997; Butler 2001; Morrison and Hunt 2007; Nagoaka 2002; Wing 2001). Instead, throughout the prehispanic period people emphasized small-bodied animals that occur in aggregates in predictable locations, and produce many offspring (referred to as r-strategists). People began the aboriginal period by emphasizing low-ranked resources (according to foraging models), and their successors did not increase their diet breadth. In other words, the Late Archaic solutions to problems of resource use, demographic arrangement, and site location laid the groundwork for a system that relied on resilient animal taxa. This incongruity suggests that foraging models fail to account for some benefits offered by low-ranked resources. There may be values associated with these resources that outweigh the benefits of targeting other prey types that have not been quantified. Campbell and Butler (2010) suggest that long-term exploitation of aquatic resources and a lack of resource depression on the Northwest Coast were related to human use of a range of resources as well as social institutions and beliefs that regulated use of resources. These same mechanisms also probably contributed to the resilience of the subsistence system on the Georgia coast. The development of chiefdoms during the Mississippian, with a clear social hierarchy and ownership rights, likely alleviated the pressure of larger populations using the same resources. Therefore, calculations of energy per unit effort based on modern experiments and ethnographic data likely are not directly applicable to these earlier subsistence activities given the fact that they do not reflect the social and political contexts of the aboriginal period on St. Catherines Island.

Although there is little evidence for a decrease in abundance of any preferred taxa, the zooarchaeological analyses did suggest that some taxa were affected by human predation. Clam populations, during both the Late Archaic (Quitmyer and Jones 2012) and throughout the Mississippian (this volume) were probably over-harvested; the age distributions are skewed towards young animals, unlike unharvested populations. It is possible that people selected for what today are called littlenecks and cherrystones (also generally younger animals). Because the relationship between size and age in southeastern clams varies on an individual basis, one would expect to get a range of ages when selecting for size (Jones et al. 2012; Quitmyer 1985b; Quitmyer and Jones 2012). In an unharvested population, however, there would likely be more older clams than found in these archaeological samples (Jones et al. 2012; Quitmyer 1985b; Quitmyer and Jones 2012).

Sea catfishes may also have been impacted by human predation. During the Late Archaic (Colaninno 2010) and Irene phase (this volume), hardhead catfishes grew at slower rates than during the early Mississippian when human predation rates were lower. This might be due to environmental conditions in the estuary around Meeting House Field, but the behavior of heavily exploited catfishes also might have changed; individuals might have avoided heavily fished parts of creeks, fed on lower-quality foods, or put more energy into reproduction than growth.

Deer may have responded behaviorally to human presence. Behavioral depression is a form of resource depression (Broughton 2002; Kie and Bowyer 1999; Wolverton et al. 2012). Predator avoidance and changes in foraging choices based on deer density by all or portions of deer populations have been suggested in modern studies (Kie and Bowyer 1999), though others argue that such behavioral changes would be unlikely in white-tailed deer (Wolverton et al. 2012). The evidence presented here suggests that deer supplemented maritime forest foraging with less-preferred grasses during aboriginal times. This might have been a result of predator avoidance or competition with humans. Deer do not decrease in abundance over time, suggesting they maintained breeding populations on the island; they may have accomplished this through predator avoidance or they may not have been primary targets of human predators.

Anthropogenic Environmental Change and Impacts on Terrestrial Animals

Stable carbon and nitrogen isotope evidence suggests that during the aboriginal period land-use practices transformed the landscape and affected the foraging habits of, at least, deer. Some environmental change may have been due to changes in climate regimes, but it seems likely that anthropogenic effects were key factors, given that terrestrial habitats were more altered than were estuarine ones and climate regimes should affect both types of habitats. Maize cultivation does not appear to have affected deer or raccoon diet, as neither consumed maize to any great extent during the Mississippian or Mission periods. Humans may have diligently protected their gardens and storage facilities to keep pests away, or maize may not have been as important in human diets during the fifteenth through seventeenth centuries as previously thought. If deer and raccoons avoided human settlements during the aboriginal period, then they would not have had access to maize. Access to mast and other preferred forest resources was likely limited due to competition with humans and other animals. In response, deer foraged on cordgrasses and raccoons foraged on molluscs and crustaceans in marsh locations away from human settlements, instead of raiding occupied settlements. Therefore, the Mississippian land-use practices that had the greatest impact on deer and raccoons were the increased number and size of sites and the creation of a more open terrestrial landscape with greater inputs of nitrogen.

Ecological Implications

The data presented in this volume have implications for modern ecological research and resource management planning. First, the estuarine and terrestrial animals on the Georgia coast were exploited by humans for almost 5,000 years, with no long-term, wide-spread effects on populations. At times, this exploitation was necessarily intense to feed human populations that were larger than found on the less-developed sea islands today. This suggests that populations of oysters, clams, mussels, tagelus, sea catfishes, mullets, drums, diamondback terrapins, and deer can be managed to produce food for large numbers of people and remain viable. The trick may be to maintain some patches relatively unexploited to provide recruits to other locations given that human populations, though large at times, likely never exploited all the locations in which these animals lived.

The fact that hardhead catfishes, abundant in archaeological collections, have become rare off the Georgia coast in recent years (Lambert 2007) is a sign that the species is in serious trouble. Hardhead catfishes were able to withstand thousands of years as a major human food source on the Georgia coast. This species is not harvested for food in today's commercial or sport fisheries, but it was caught in huge numbers in the twentieth century as by-catches of other commercial fisheries (Muncy and Wingo 1983:2–4). This probably plays a role in its decline, but other factors associated with anthropogenic environmental change (Groom and Vynne 2006:181–197) may be at work. As it is not part of an important fishery, there is little attention paid to its decline by managers and scientists, however, it likely played an important role in the estuarine ecosystem, given its abundance and resilience in the face of predation for thousands of years. Its decline could have serious consequences for other species that are of fishery interest or for the estuarine ecosystem in general. Its decline also may be a signal that there are other problems in the ecosystem, if such a hardy species has been affected; there may be problems with pollutants or sedimentation that are not as yet recognized.

This research also suggests that there is a great deal of variability within populations, even in relatively small areas. In the waters surrounding a single island, variation in individual growth rates generated different growth curves for hardhead and gafftopsail catfishes in three different locations. These samples likely do not represent the entire range of variation in each species, and possibly the three samples combined do not represent the full range. The fact that different, averaged, patterns emerge on a spatial scale, however, may suggest that populations of these species actually have relatively small geographical ranges—spending most of their time in a single cluster of tidal creeks, or at least on one side of a single island. Alternatively, the different growth rates observed may represent different behavior; animals leaving the estuary each winter contrasted with those that stayed within the estuary throughout the year. In order to design plans for protecting or managing sea catfishes this spatial behavior and sensitivity to local environmental factors must be better understood.

The stable isotope results for deer and raccoon diets have implications for wildlife ecology. Studies of these animals' modern diets on the Georgia coast are based on scats and digestive tract contents (Harman and Stains 1979; Osborne et al. 1992; Warren et al. 1990). The results of the isotopic study suggest that raccoons and deer both forage more frequently in estuarine habitats than scat and digestive tract studies find. In the traditional studies, mast was considered the most important food source for both these animals. The stable isotope values suggest that, although mast could certainly be a staple food item, deer derive a good deal of protein from cordgrasses and raccoons derive most of their protein from molluscs and crustaceans. The traditional studies did not examine evidence from all months of multiple years, so the full dietary habits reflected in isotopes likely were missed. In addition, raccoons may not have consumed the hard-bodies of some molluscs and crustaceans, or these hard-body fragments might have been hard to identify—the study identified mussel shell, which is highly distinctive, but oyster shell is less distinctive, and less likely to be identified in scat.

It is also clear that deer foraging patterns have changed over time on St. Catherines Island. Despite being undeveloped today, the island has been subject to anthropogenic influences for the past 5,000 years. The most dramatic effects are probably those associated with antebellum rice and cotton farming, historic dredging to reduce wetland area, and use of the Floridan Aquifer for industrial purposes (Durham and Thomas 1978; Hayes and Thomas 2008; Thomas 2008:58–61), however, human activities also shaped the island landscape during the aboriginal period. Modern deer foraging habits, therefore, are not necessarily representative of deer foraging habits in the past, and may not represent "preferred" or "natural" deer behavior. It is important for modern ecologists to keep in mind that observed behavior are contextual, and management plans based on that behavior might not be successful.

Data Limitations and Areas of Future Research

Sample size is a common problem in archaeology, from which this research is not exempt. The vertebrate and invertebrate samples used to discuss subsistence strategies in this study are relatively large—they are larger than many other Mississippian samples from the region, due to the sampling and recovery methods used. Given the consistency within and among the collections from each analytical unit, it appears that these samples are adequate for evaluating the major features of the Mississippian subsistence strategy and their social implications.

The samples used to examine growth rates and for stable isotope analysis, however, are small. Although the overall size of the vertebrate and invertebrate collections is large, the actual number of specimens for any single taxon is relatively small, and the chance that these specimens represent the same portion of the same side of the same element is very small. The Back Creek Village clam sample used to study growth rates is large, and is likely representative of the clams in the archaeological record, and possibly of the natural population. Many fewer clam valves were available from the Meeting House Field locality, however. This probably reflects the habitats exploited, as discussed earlier, but interpretations of growth rates and age distributions are more tenuous than for Back Creek. The otolith samples from each site are even smaller. Given the high degree of variation among these samples, it is unlikely any single sample is representative of the population from which it was drawn. As some interesting spatial and temporal patterns emerged, the samples do allow speculation about the causes of variability. The samples of deer and raccoon bones used for stable isotope analysis are also small. Although they likely do not represent all animals from a given time period, they may reflect much of the variability since the modern isotope samples are relatively large, and exhibit a similar degree of variation as the archaeological samples.

Archaeologists cannot control what they find when they excavate, and most zooarchaeological collections are similar to this one, with small samples of any single element even within a large collection. Financial restraints are also a problem when it comes to biochemical analyses—these are expensive and studies must be tailored to answer questions despite small samples. The interpretations of this volume are certainly subject to sample bias, but the strength of this study is that it draws upon multiple proxies from multiple contexts, many of which corroborate the results and interpretations.

Another problem faced in this research is the lack of modern ethnographic and ecological data to help interpret patterns observed in the past. Ethnoarchaeological studies illuminate the myriad ways people feed their families, organize labor, and dispose of waste. This does not begin to capture modern variability, however, let alone variability on the Georgia coast before AD 1580. Modern ecological studies can shed light on the temporal and spatial frequency and distribution of animals in terrestrial and aquatic environments, but ecological researchers do not answer the questions archaeologists ask. It would be useful to know which species are found together in which locations and environmental conditions on a seasonal basis in the waters around St. Catherines Island. This is a tall order, for one thing, and requires more fine-grained field methods than modern studies have used. Dahlberg's data (1972, 1975) was gathered monthly, from a variety of locations that were lumped together in reporting. Further, Dahlberg only examined a handful of species for size-frequency distribution. Given the variability observed in the growth and age distributions on spatial and temporal scales reported in this volume, it is likely that modern studies do not subsume the full variability in fish populations, making modern data hard to compare with archaeological data. In addition, the modern environmental conditions in the estuary are the result of a specific climate regime and of a couple hundred years of intensive human disturbance, both to coastal environments directly and indirectly through land-use practices in the piedmont and coastal plain. Environmental conditions were likely different during the prehispanic period. The archaeological record is an accumulation of organisms over time and space, filtered through cultural behavior. This makes any modern study that represents a specific human or animal behavior difficult to apply to the archaeological data.

Understanding of the St. Catherines Island Mississippian period subsistence-settlement patterns and their socio-political contexts would benefit from a number of additional studies. Larger portions of middens (not just single 1-x-1-m units) would be excavated in an ideal research design. These assemblages would capture intra- and inter-midden variability, allowing interpretations about social organization, labor management, meat transport and sharing practices, and seasonality across each site. Botanical studies would also enhance our understanding of subsistence and settlement patterns; plant exploitation may be more closely linked to climatic shifts or the adoption of maize horticulture than was animal exploitation.

Block excavations off-midden might clarify the organization of Mississippian settlements, including the relationship among middens and houses, the location of public structures, and other waste disposal methods used, such as hearths or pits. Such fine-grained understanding of Mississippian sites would allow us to better evaluate the aggregated data from 1-x-1-m units, excavated in a small percentage of middens, described in this volume.

Additionally, other periods in the aboriginal history of St. Catherines Island need to be better understood in order to put the Mississippian subsistence-settlement patterns within a long-term context. The Woodland period is relatively unstudied on the island and the coast in general. Excavation of the large Wilmington-phase site in Meeting House Field could fill in some of the gap between the Late Archaic and the Mississippian patterns described in this volume and in Colaninno (2010). Likewise, fine- and water-screen recovery methods should be applied to the Mission-period settlements on the island. This is the time period in which subsistence and settlement changes most likely occurred, with the reorganization of Guale and other native polities as a result of contact with Europeans. We do not know if small fishes remained the target of Mission-period subsistence strategies. If groups from places other than the Georgia coast were re-settled on St. Catherines, fishing strategies may differ among people living in the Mission pueblo. Additionally, multiple lines of evidence indicate people grew maize and lived in sedentary villages during the Mission period, so the invertebrate and vertebrate collections might provide a model for the subsistence strategy of a village of sedentary farmers that can be compared with the evidence from earlier time periods.

Finally, the research in this volume demonstrates that use of fine- and water-screen recovery methods for faunal materials yields valuable information about subsistence, settlement, and land-use patterns. These methods should be applied to other localities on St. Catherines

Island, other islands, and the mainland coast where occupation spans several time periods. The changes observed at Meeting House Field may not be representative of how coastal Georgia people altered their subsistence and settlement patterns in response to increased human populations, denser settlements, and greater socio-political inequality. Case studies from other localities would also help clarify whether the immediate marsh environment played a role in structuring subsistence and animal populations or whether all communities had access to a similar variety of fishing, hunting, and gathering habitats. Using the methods described in this volume, applied to a variety of coastal localities, it is possible to understand both the overall trajectory of change in subsistence-settlement systems as well as local variations of these patterns as a result of environmental and socio-political factors.

Conclusion

The goal of this research was to examine changes in the human-environment relationship during the Mississippian period using collections recovered with fine-grained techniques. No other study of Mississippian subsistence on the Georgia coast has relied on .32 cm water-screened collections that included vertebrates and invertebrates and came from multiple middens from multiple time periods in the same locality. Relative abundance, morphological, incremental, and stable isotope analyses of these collections provide evidence for changes in where and how people collected resources, how long they occupied settlements, how they disposed of waste, and impacts they had on the environment and animal populations. Most interesting, perhaps, is how subtle these changes were; the overall picture of subsistence on the Georgia coast is one of continuity. People exploited a specific set of estuarine molluscs and small fishes throughout the aboriginal period, occasionally supplementing this suite with deer. Many studies of modern and archaeological coastal regions indicate that these environments and the animals that inhabit them are sensitive to anthropogenic influences, historical ecologists postulate changes in human-environment relationships as a result of societal changes, and foraging theory views depression of resources as inevitable. Hence, the lack of dramatic change over time on St. Catherines Island seems incongruous with the rest of the archaeological evidence. The research presented in this volume, however, suggests that people on the Georgia coast targeted resources that are resilient in the face of sustained exploitation for subsistence purposes and are available year round. Selection of resources for inclusion in subsistence strategies likely took into account aspects of animals' life histories that affect long-term productivity in addition to potential caloric and social gains of the resources. Human occupation of St. Catherines Island over the long term did transform the landscape, but it did not affect the viability of the animal populations upon which people relied.

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APPENDIX A

COLLECTIONS AND PROVENIENCES STUDIED

Site AMNH #	Bag #	Unit	Depth	Recovery
203	8767	Alpha	0-10	40-liter sample
203	8821	Alpha	0-10	Field
203	8770	Alpha	10-20	40-liter sample
203	8838	Alpha	10-20	Field
203	8773	Alpha	20-30	40-liter sample
203	9218	Alpha	20-30	Field
203	8776	Alpha	30-31	40-liter sample
203	8796	Alpha	30-31	Field
203	8813	Alpha	31-41	40-liter sample
203	9220	Alpha	31-41	Field
203	8861	Alpha	41-51	40-liter sample
203	9221	Alpha	41-51	Field
203	8819	Alpha	51-61	40-liter sample
203	9225	Alpha Baulk	0-9	Field
203	8933	Alpha Baulk	25-44	Field
203	8932	Alpha Baulk	9-25	Field
203	8928	Beta	0-5	Field
203	8906	Beta	15-25	40-liter sample
203	9001	Beta	15-25	Field
203	9002	Beta	15-25	Field
203	8904	Beta	25-35	40-liter sample
203	8909	Beta	25-35	Field
203	8920	Beta	35-45	40-liter sample
203	9004	Beta	35-45	Field
203	8921	Beta	45-55	40-liter sample
203	9003	Beta	45-55	Field
203	8900	Beta	5-15	40-liter sample
203	8929	Beta	5-15	Field
203	8922	Beta	55-65	40-liter sample
203	9095	Beta	55-65	Field
203	8923	Beta	65-75	40-liter sample
203	8965	Beta	75-85	40-liter sample
203	9103	Beta Baulk	15-25	Field
203	9000	Beta Baulk	25-35	Field
203	9104	Beta Baulk	35-45	Field
203	8945	Beta Baulk	45-55	Field
203	9102	Beta Baulk	5-15	Field
203	9105	Beta Baulk	55-65	Field
203	9106	Beta Baulk	65-75	Field
203	9107	Beta Baulk	75-85	Field
203	8949	Epsilon	0-10	40-liter sample
203	9006	Epsilon	0-10	Field
203	8953	Epsilon	10-20	40-liter sample
203	9008	Epsilon	10-20	Field
203	8951	Epsilon	20-30	40-liter sample
203	8960	Epsilon	20-30	Field
203	8994	Epsilon	30-40	40-liter sample
203	9011	Epsilon	30-40	Field
203	8995	Epsilon	40-50	40-liter sample

APPENDIX A—(*Continued*)

Site AMNH #	Bag #	Unit	Depth	Recovery
203	8998	Eta	0-10	40-liter sample
203	8997	Eta	10-20	40-liter sample
203	9024	Eta	10-20	Field
203	9062	Eta	20-30	40-liter sample
203	9176	Eta	20-30	Field
203	9067	Eta	30-40	40-liter sample
203	9093	Eta	30-40	Field
203	9069	Eta	40-50	40-liter sample
203	9068	Eta	50-60	40-liter sample
203	8831	Gamma	0-10	40-liter sample
203	9222	Gamma	0-10	Field
203	8834	Gamma	10-20	40-liter sample
203	9223	Gamma	10-20	Field
203	8837	Gamma	20-30	40-liter sample
203	8938	Gamma	20-35	Field
203	8855	Gamma	23-35	40-liter sample
203	8858	Gamma	35-40	40-liter sample
203	8858	Gamma	35-45	40-liter sample
203	8936	Gamma	35-45	Field
203	8869	Gamma	40-50	40-liter sample
203	8874	Gamma	50-60	40-liter sample
203	8937	Gamma	50-60	Field
203	5911	Gamma	60-70	40-liter sample
203	8934	Gamma	60-70	Field
203	8939	Gamma Baulk	0-10	Field
203	8940	Gamma Baulk	10-20	Field
203	8941	Gamma Baulk	20-30	Field
203	8942	Gamma Baulk	30-40	Field
203	9132	Iota	0-10	40-liter sample
203	9137	Iota	0-10	Field
203	9188	Iota	10-20	40-liter sample
203	9177	Iota	10-20	Field
203	9147	Iota	20-30	40-liter sample
203	9174	Iota	20-30	Field
203	9146	Iota	30-40	40-liter sample
203	9179	Iota	30-40	Field
203	9144	Iota	40-50	40-liter sample
203	9145	Iota	50-60	40-liter sample
203		N501 E80	0-10	40-liter sample
203	5861	N501 E80	0-10	Field
203		N501 E80	10-20	40-liter sample
203	5854	N501 E80	10-20	Field
203		N501 E80	20-30	40-liter sample
203	5843	N501 E80	20-30	Field
203	5908	N501 E80	30-40	40-liter sample
203	5845	N501 E80	30-40	Field
203	5909	N501 E80	40-50	40-liter sample
203	5844	N501 E80	40-50	Field
203	5910	N501 E80	50-60	40-liter sample
203	5883	N501 E80	50-60	Field

APPENDIX A—(*Continued*)

Site AMNH #	Bag #	Unit	Depth	Recovery
203	5911	N501 E80	60-70	40-liter sample
203	5882	N501 E80	60-70	Field
203	5912	N501 E80	70-80	40-liter sample
203	5881	N501 E80	70-80	Field
203	5913	N501 E80	80-90	40-liter sample
203	5884	N501 E80	80-90	Field
203	5914	N501 E80	90-100	40-liter sample
203	5869	N501 E80	90-100	Field
203	9073	Theta	0-17	40-liter sample
203	9181	Theta	0-17	Field
203	9076	Theta	17-27	40-liter sample
203	9173	Theta	17-27	Field
203	9186	Theta	27-37	40-liter sample
203	9124	Theta	27-37	Field
203	9114	Theta	37-47	40-liter sample
203	9119	Theta	37-47	Field
203	9116	Theta	47-57	40-liter sample
203	9182	Theta	47-57	Field
203	9184	Theta	57-67	40-liter sample
203	9180	Theta	57-67	Field
203	9143	Theta	67-77	40-liter sample
203	8990	Zeta	0-10	40-liter sample
203	9028	Zeta	0-10	Field
203	8986	Zeta	10-20	40-liter sample
203	9030	Zeta	10-20	Field
203	8996	Zeta	20-30	40-liter sample
203	9031	Zeta	20-30	Field
203	8981	Zeta	30-40	40-liter sample
203	9039	Zeta	30-40	Field
203	8978	Zeta	40-50	40-liter sample
203	9044	Zeta	40-50	Field
203	9066	Zeta	50-60	40-liter sample
203	9178	Zeta	50-60	Field
203	9064	Zeta	60-66	40-liter sample
203	9097	Zeta	60-66	Field
203	9085	Zeta	66-76	40-liter sample
203	9098	Zeta	66-76	Field
203	9061	Zeta	78-88	40-liter sample
203	9063	Zeta	88-98	40-liter sample
203	9080	Zeta	F. 3	40-liter sample
502	9994	N165 E159	0-10	40-liter sample
502	10142	N165 E159	0-10	Field
502	10163	N165 E159	10-20	40-liter sample
502	9997	N165 E159	10-20	Field
502	10155	N165 E159	20-30	40-liter sample
502	10360	N165 E159	20-30	Field
502	10160	N165 E159	30-40	40-liter sample
502	10366	N165 E159	30-40	Field
502	10224	N165 E159	40-50	40-liter sample
502	10362	N165 E159	40-50	Field

APPENDIX A—(*Continued*)

Site AMNH #	Bag #	Unit	Depth	Recovery
502	10254	N165 E159	50-60 no shell	40-liter sample
502	10364	N165 E159	50-60 no shell	Field
502	10225	N165 E159	50-60 shell	40-liter sample
502	10358	N165 E159	50-60 shell	Field
502	10255	N165 E159	60-70	40-liter sample
502	10253	N165 E159	70-80	40-liter sample
502	10148	N165 E159	F. 3 30-40	40-liter sample
502	10227	N165 E159	F. 3 40-50	40-liter sample
502	10361	N165 E159	F. 3 40-50	Field
502	9993	N179 E84	0-10	40-liter sample
502	10141	N179 E84	0-10	Field
502	10144	N179 E84	10-20	40-liter sample
502	10201	N179 E84	10-20	Field
502	10140	N179 E84	20-30	40-liter sample
502	10200	N179 E84	20-30	Field
502	10138	N179 E84	30-40	40-liter sample
502	10269	N179 E84	35-40	Field
502	10242	N179 E84	50-60	40-liter sample
502	10376	N179 E84	50-60	Field
502	10377	N179 E84	60-70	Field
502	10238/10246	N179 E84	F. 2 30-40	40-liter sample
502	10374	N179 E84	F. 2 40-45	Field
502	10248/10243	N179 E84	F. 2 40-50	40-liter sample
502	10334	N191 E84	0-10	40-liter sample
502	10370	N191 E84	0-10	Field
502	10336	N191 E84	10-20	40-liter sample
502	10157	N191 E84	10-20	Field
502	10337	N191 E84	20-30	40-liter sample
502	10368	N191 E84	20-30	Field
502	10335	N191 E84	30-40	40-liter sample
502	10367	N191 E84	30-40	Field
502	10338	N191 E84	40-50	40-liter sample
502	10369	N191 E84	40-50	Field
502	10340	N191 E84	50-60	40-liter sample
502	10371	N191 E84	50-60	Field
502	10339	N191 E84	60-70	40-liter sample
502	10373	N191 E84	60-70	Field
467	4630	N488 E495	49.36-49.26	Field
467	4625	N488 E495	49.56-49.46	Field
467	4624	N488 E495	49.66-49.56	Field
467	4632	N488 E495	49.66-49.56	Field
467	4573	N488 E495	49.76-49.66	Field
467	4623	N488 E495	49.86-49.76	Field
467	4568	N488 E495	49.96-49.86	Field
467	4545	N488 E495	50.06-49.96	Field
467	4531	N493 E499	49.35-49.25	Field
467	4622	N493 E499	49.45-49.35	Field
467	4620	N493 E499	49.55-49.45	Field
467	4619	N493 E499	49.65-49.55	Field
467	4607	N493 E499	49.75-49.65	Field

APPENDIX A—(*Continued*)

Site AMNH #	Bag #	Unit	Depth	Recovery
467	4606	N493 E499	49.85-49.75	Field
467	4578	N493 E499	49.95-49.85	Field
467	4550	N493 E499	50.05-49.95	Field
467	4480	N513 E507	49.85-49.75	Field
467	4481	N513 E507	49.95-49.85	Field
467	4544	N513 E507	50.05-49.95	Field
467	4476	N513 E507	50.15-50.05	Field
467	4477	N513 E507	50.25-50.15	Field
467	4485	N513 E507	50.35-50.25	Field
467	4455	N557 E482	48.04-47.94	Field
467	4366	N557 E482	48.14-48.04	Field
467	4397	N557 E482	48.24-48.14	Field
467	4337	N557 E482	48.34-48.24	Field
467	4341	N557 E482	48.44-48.34	Field
467	4332	N557 E482	48.54-48.44	Field
467	4283	N569 E458	48.47-48.37	Field
467	4281	N569 E458	48.57-48.47	Field
467	4282	N569 E458	48.67-48.57	Field
467	4280	N569 E458	48.77-48.67	Field
467	4161	N569 E458	48.77-48.67	Field
467	4234	N569 E458	48.87-48.77	Field
467	4430	N575 E453	48.79-48.69	Field
467	4431	N575 E453	48.89-48.79	Field
467	4434	N575 E453	48.99-48.89	Field
467	4429	N575 E453	49.09-48.99	Field
467	4433	N576 E453	48.73-48.63	Field
467	4427	N576 E453	48.83-48.73	Field
467	4432	N576 E453	48.83-48.73	Field
467	4436	N576 E453	48.93-48.83	Field
467	4435	N576 E453	49.03-48.93	Field
467	4391	N576 E453	49.13-49.03	Field
467	4274	N584 E466	48.48-48.38	Field
467	4273	N584 E466	48.58-48.48	Field
467	4272	N584 E466	48.68-48.58	Field
467	4271	N584 E466	48.78-48.68	Field
467	4270	N584 E466	48.88-48.78	Field
467	4233	N584 E466	48.98-48.88	Field
467	4195	N586 E441	48.69-48.59	Field
467	4172	N586 E441	48.79-48.69	Field
467	4055	N586 E441	48.89-48.79	Field
467	4140	N586 E441	48.89-48.79	Field
467	4117	N586 E441	48.89-48.79	Field
467	4298	N586 E441	48.89-48.79	Field
467	4299	N586 E441	48.89-48.79	Field
467	4056	N586 E441	48.99-48.89	Field
467	4000	N586 E441	49.09-48.99	Field
467	4292	N587 E437	48.53-48.43	Field
467	4291	N587 E437	48.63-48.53	Field
467	4290	N587 E437	48.73-48.63	Field
467	4289	N587 E437	48.83-48.73	Field

APPENDIX A—(*Continued*)

Site AMNH #	Bag #	Unit	Depth	Recovery
467	4237	N587 E437	48.93-48.83	Field
467	4167	N587 E437	49.03-48.93	Field
467	4586	TP IX	49.42-49.32	Field
467	4585	TP IX	49.42-49.32	Field
467	4583	TP IX	49.52-49.42	Field
467	4582	TP IX	49.62-49.52	Field
467	4535	TP IX	49.82-49.72	Field
467	4534	TP IX	49.92-49.82	Field
467	4533	TP IX	50.02-49.92	Field
467	4532	TP IX	50.12-50.02	Field
467	4458	TP IX	50.22-50.12	Field
467	4137	TP VI	48.48-48.38	Field
467	4136	TP VI	48.58-48.48	Field
467	4058	TP VI	48.68-48.58	Field
467	4139	TP VI	48.78-48.68	Field
467	4135	TP VI	48.78-48.68	Field
467	4059	TP VI	48.88-48.78	Field
467	4022	TP VI	48.98-48.88	Field
467	4131	TP VII	48.65-48.55	Field
467	4130	TP VII	48.75-48.65	Field
467	4057	TP VII	48.85-48.75	Field
467	4011	TP VII	48.95-48.85	Field
467	4370	TP VIII	48.10-48.00	Field
467	4369	TP VIII	48.20-48.10	Field
467	4368	TP VIII	48.30-48.20	Field
467	4342	TP VIII	48.40-48.30	Field
467	4338	TP VIII	48.50-48.40	Field
701	4646	TP I	0-20	Field
701	4647	TP I	20-30	Field
701	4648	TP I	30-40	Field
701	4650	TP I	50-60	Field
701	4739	TP I	60-70	Field
701	4678	TP I	70-80	Field
701	4748	TP I	80-90	Field
701	4742	TP I	90-100	Field
701	4782	TP I	100-110	Field
701	4787	TP I	110-120	Field
701	4788	TP I	120-130	Field
701	4789	TP I	130-140	Field
701	4651	TP II	0-10	Field
701	4652	TP II	10-20	Field
701	4653	TP II	20-30	Field
701	4654	TP II	30-40	Field
701	4655	TP II	40-50	Field
701	4746	TP II	50-60	Field
701	4692	TP II	60-70	Field
701	4745	TP II	60-70	Field
701	4757	TP II	70-80	Field
701	4762	TP II	80-90	Field
701	4768	TP II	90-100	Field

APPENDIX A—(*Continued*)

Site AMNH #	Bag #	Unit	Depth	Recovery
701	4774	TP II	100-110	Field

APPENDIX B

TAXONOMIC LIST OF ANIMAL SPECIES

Scientific Name	Common Name
Mollusca	Indeterminate molluscs
Lampsilis dolabraeformis	Altamaha pocketbook
Arcidae	Arks
Anadara ovalis	Blood ark
Geukensia demissa	Ribbed mussel
Crassostrea virginica	Eastern oyster
Veneroida	Tellins and surf clams
Cardiidae	Cockles
Dinocardium robustum	Atlantic giant cockle
Tagelus plebeius	Stout tagelus
Mercenaria sp.	Hard clam
Gastropoda	Indeterminate gastropods
Melampus bidentatus	Eastern melampus
Crepidula sp.	Slipper snail
Littorina irrorata	Marsh periwinkle
Polygyridae	Terrestrial snails
Polygyra sp.	Terrestrial snail
Succineidae	Amber snails
Euglandina sp.	Wolf snail
Zonitidae	Glass snails
Acteocina candei	Candé's barrel bubble
Prunum apicinum	Common Atlantic marginella
Melongenidae	Whelks
Busycon carica	Knobbed whelk
Busycoptycus canaliculatus	Channeled whelk
Eupleura caudata	Thick-lipped drill
Urosalpinx sp.	Oyster drill
Nassarius obsoletus	Eastern mudsnail
Olivella sp.	Olive
Decapoda	Crabs, crayfish, shrimp, lobster
Brachyura	Crabs
Callinectes sapidus	Eastern blue crab
Menippe sp.	Stone crab
Balanus sp.	Barnacle
Carcharhinidae	Sharks, rays, and skates
Dasyatidae	Stingrays
Actinopterygii	Indeterminate bony fishes
Lepisosteus sp.	Gar
Elops saurus	Ladyfish
Anguilla rostrata	American eel
Clupeidae	Herrings and shads
Brevoortia sp.	Menhaden
Cyprinidae	Carps and minnows
Siluriformes	Catfishes
Ameiurus natalis	Yellow bullhead
Ichtalurus punctatus	Channel catfish
Ariidae	Sea catfishes
Ariopsis felis	Hardhead catfish
Bagre marinus	Gafftopsail catfish

APPENDIX B—(*Continued*)

Scientific Name	Common Name
Opsanus sp.	Toadfish
Mugil sp.	Mullet
Belonidae	Needlefishes
Cyprinodontidae	Killifishes
Centropristis sp.	Sea bass
Centrarchidae	Sunfishes
Lepomis sp.	Sunfish
Pomatomus saltatrix	Bluefish
Carangidae	Jacks
Orthopristis chrysoptera	Pigfish
Archosargus probatocephalus	Sheepshead
Lagodon rhomboides	Pinfish
Sciaenidae	Drums
Bairdiella chrysoura	Silver perch
Cynoscion sp.	Seatrout
Leiostomus xanthurus	Spot
Menticirrhus sp.	Kingfish
Micropogonias undulatus	Atlantic croaker
Pogonias cromis	Black drum
Sciaenops ocellatus	Red drum
Stellifer lanceolatus	Star drum
Peprilus sp.	Harvest and butter fishes
Paralichthyidae	Flounders
Anura	Frogs and toads
Anaxyrus sp.	North American toads
Anaxyrus americanus	American toad
Anaxyrus terrestris	Southern toad
Scaphiopus holbrookii	Eastern spadefoot toad
Hyla sp.	Tree frog
Rana sp.	Bullfrog
Caudata	Newts and salamanders
Siren sp.	Siren
Testudines	Indeterminate turtles
Chelydra serpentina	Snapping turtle
Kinosternidae	Mud and musk turtles
Kinosternon sp.	Mud turtle
Emydidae	Pond turtles
Malaclemys terrapin	Diamondback terrapin
Terrapene carolina	Box turtle
Lacertilia	Indeterminate lizards
Serpentes	Indeterminate snakes
Colubridae	Non-venomous snakes
Nerodia sp.	Water snake
Viperidae	Venomous snakes
Aves	Indeterminate birds
Anas sp.	Duck
Corvus ossifragus	Fish crow
Rallidae	Coots and rails
Zenaida macroura	Mourning dove
Passeriformes	Perching birds

APPENDIX B—(*Continued*)

Scientific Name	**Common Name**
Ammodramus maritimus	Seaside sparrow
Turdis migratorius	American robin
Mammalia	Indeterminate mammals
Didelphis virginiana	Opossum
Soricidae	Shrews
Scalopus aquaticus	Eastern mole
Vespertilionidae	Bats
Sylvilagus sp.	Cottontail rabbit
Sciurus sp.	Squirrel
Sigmondontinae	New World mice and rats
Neotoma floridana	Eastern woodrat
Ochrotomys nuttalli	Golden mouse
Oryzomys palustris	Marsh rice rat
Peromyscus sp.	Deer mouse
Sigmodon hispidus	Hispid cotton rat
Canis familiaris	Dog
Procyon lotor	Raccoon
Lontra canadensis	River otter
Neovison vison	Mink
Odocoileus virginianus	White-tailed deer

APPENDIX C

FISH MEASUREMENTS

Taxon	Site #	Unit	Level	Feature	Element	Side	Len, mm	Brt, mm	Wdh, mm	Th, mm	Wght, g
Ariidae	9Li207	N493 E499	49.65-49.55		Otolith	Left	11.17	10.08	9.47	4.9	0.537
Ariidae	9Li207	N493 E499	49.85-49.75		Otolith	Right	10.2	8.99	8.58	4.17	0.375
Ariidae	9Li207	N493 E499	49.85-49.75		Otolith	Right	9.69	8.96	8.13	3.91	0.336
Ariidae	9Li207	N493 E499	50.05-49.95		Otolith	Right	9.17	8.11	7.48	3.9	0.273
Ariidae	9Li207	N513 E507	50.02-49.95		Otolith	Right	9.7	8.75	8.22	3.81	0.326
Ariidae	9Li207	N513 E507	50.05-49.95		Otolith	Left	10.96	9.88	9.29	4.48	0.477
Ariidae	9Li207	N513 E507	50.05-49.95		Otolith	Left	11.92	10.49	10.09	4.94	0.578
Ariidae	9Li207	N513 E507	50.05-49.95		Otolith	Left	15.42	14.14	12.15	6.21	1.212
Ariidae	9Li207	N513 E507	50.05-49.95		Otolith	Right	10.59	9.25	9.09	4.5	0.405
Ariidae	9Li207	N513 E507	50.25-50.15		Otolith	Left	11.79	10.69	10.2	4.59	0.568
Ariidae	9Li207	N513 E507	50.25-50.15		Otolith	Right	10.43	9.8	9.35	5.06	0.464
Ariidae	9Li207	N557 E482	48.34-48.24		Otolith	Right	9.82	8.89	8.87	4.01	0.371
Ariidae	9Li207	N557 E482	48.44-48.34		Otolith	Right	9.92	9.1	9.01	4.4	0.339
Ariidae	9Li207	N569 E458	48.77-48.67		Otolith	Left	14.68	13.88	12.26	6	1.17
Ariidae	9Li207	N569 E458	48.77-48.67		Otolith	Left	14.63	12.97	11.47	6.5	1.121
Ariidae	9Li207	N569 E458	48.77-48.67		Otolith	Right		8.82	8.58	4.08	0.357
Ariidae	9Li207	N569 E458	48.77-48.67		Otolith	Right		13.8	12.29	6.53	1.285
Ariidae	9Li207	N575 E453	48.89-48.79		Otolith	Left	6.3		5.7	2.62	0.075
Ariidae	9Li207	N575 E453	48.99-48.89		Otolith	Right	17.34	16.28	14.31	8.67	2.389
Ariidae	9Li207	N575 E453	49.09-48.99		Otolith	Right	14.4	13.57	12.41	5.87	1.187
Ariidae	9Li207	N576 E453	49.03-48.93		Otolith	Left	11.54	10.81	8.72	4.99	0.559
Ariidae	9Li207	N576 E453	49.03-48.93		Otolith	Left	13.33	12.88	11.1	6.01	0.998
Ariidae	9Li207	N576 E453	49.03-48.93		Otolith	Left	15.02	13.83	12.32	6.61	1.307
Ariidae	9Li207	N576 E453	49.03-48.93		Otolith	Left	13.21	12.17	10.7	5.65	0.871
Ariidae	9Li207	N576 E453	49.03-48.93		Otolith	Left	11.61	10.76	9.1	4.47	0.494
Ariidae	9Li207	N576 E453	49.03-48.93		Otolith	Left	7.02	6.36	5.52	2.69	0.105
Ariidae	9Li207	N576 E453	49.03-48.93		Otolith	Left	11.8	11.38	9.67	5.21	0.642
Ariidae	9Li207	N576 E453	49.03-48.93		Otolith	Right	7.14	6.52	6.1	3.22	0.145
Ariidae	9Li207	N576 E453	49.03-49.93		Otolith	Right	14	14.39	12.44	6.24	1.342
Ariidae	9Li207	N576 E453	49.03-49.93		Otolith	Right	14.32	14.41	12.53	5.9	1.306
Ariidae	9Li207	N576 E453	49.03-49.93		Otolith	Right	11.96	11.71	10.15	5.19	0.702
Ariidae	9Li207	N584 E466	48.78-48.68		Otolith	Left	7.31	6.81	6.1	2.93	0.126
Ariidae	9Li207	N584 E466	48.78-48.68		Otolith	Right	7.52	6.99	6.25	3.03	0.138
Ariidae	9Li207	N584 E466	48.78-48.68		Otolith	Right	7.66	6.89	6.03	3.18	0.156
Ariidae	9Li207	N584 E466	48.78-48.68		Otolith	Right	9.71	8.96	8.33	3.87	0.34

APPENDIX C—(*Continued*)

Taxon	Site #	Unit	Level	Feature	Element	Side	Len, mm	Brt, mm	Wdh, mm	Th, mm	Wght, g
Ariidae	9Li207	N584 E466	48.78-48.68		Otolith	Right	11.1	9.9	9.49	4.68	0.515
Ariidae	9Li207	N584 E466	48.88-48.78		Otolith	Left	11.9	10.5	9.85	5.23	0.602
Ariidae	9Li207	N584 E466	48.88-48.78		Otolith	Left	10.35	9.61	9.31	4.77	0.483
Ariidae	9Li207	N584 E466	48.88-48.78		Otolith	Left	10.33	9.61	9.31	4.74	0.483
Ariidae	9Li207	N584 E466	48.88-48.78		Otolith	Left	11.82	10.56	9.84	5.22	0.603
Ariidae	9Li207	N584 E466	48.88-48.78		Otolith	Right	10.62	9.67	9.23	4.97	0.513
Ariidae	9Li207	N584 E466	48.88-48.78		Otolith	Right	12.55	11.14	11.1	5.46	0.776
Ariidae	9Li207	N584 E466	48.98-48.88		Otolith	Left	11.35	10.4	9.44	5.05	0.558
Ariidae	9Li207	N584 E466	48.98-48.88		Otolith	Left	11.14	10.04	9.22	4.99	0.528
Ariidae	9Li207	N584 E466	48.98-48.88		Otolith	Left	9.04	8.02	7.35	3.59	0.253
Ariidae	9Li207	N584 E466	48.98-48.88		Otolith	Left	12.61	11.23	10.91	5.49	0.775
Ariidae	9Li207	N584 E466	48.98-48.88		Otolith	Right	11.48	10.75	10.37	4.68	0.556
Ariidae	9Li207	N586 E441	48.79-48.69		Otolith	Right	12.07	11.65	10.43	5.63	0.8
Ariidae	9Li207	N586 E441	48.89-48.79	3	Otolith	Right	9.69	8.93	8.21	4.21	0.359
Ariidae	9Li207	N587 E437	48.63-48.53		Otolith	Right	14.89	14.01	12.57	6.16	1.146
Ariidae	9Li207	N587 E437	48.73-48.63		Otolith	Left	14.06	12.79	10.93	5.36	0.864
Ariidae	9Li207	N587 E437	48.93-48.83		Otolith	Right	13.81	13.08	11.43	6.41	1.135
Ariidae	9Li207	TP IX	49.92-49.82		Otolith	Right	9.28	8.21	7.93	3.82	0.286
Ariidae	9Li207	TP IX	50.02-49.92		Otolith	Right	7.4	6.7	6.03	2.94	0.139
Ariidae	9Li207	TP IX	50.12-50.02		Otolith	Left	11.49	10.03	9.75	5.03	0.568
Ariidae	9Li207	TP IX	50.12-50.02		Otolith	Left	8.95	8.15	7.68	3.86	0.263
Ariidae	9Li207	TP IX	50.12-50.02		Otolith	Right	11.34	10.38	9.75	5.74	0.673
Ariidae	9Li207	TP IX	50.22-50.12		Otolith	Right	11.03	9.84	9.65	4.83	0.513
Ariidae	9Li207	TP VI	48.68-48.58		Otolith	Left	11.33	10.1	9.41	4.72	0.516
Ariidae	9Li207	TP VI	48.78-48.68		Otolith	Right	10.1	9.6	8.74	4.3	0.41
Ariidae	9Li207	TP VII	48.75-48.65		Otolith	Left	10.04	8.68	8.39	4.45	0.377
Ariidae	9Li207	TP VII	48.75-48.65		Otolith	Right	11.55	10.61	9.78	4.71	0.574
Ariidae	9Li207	TP VIII	48.30-48.20		Otolith	Right	10.78	10.14	9.12	5.24	0.548
Ariidae	9Li207	TP VIII	48.40-48.30		Otolith	Left	11.23	10.13	9.6	4.43	0.502
Ariidae	9Li207	TP VIII	48.50-48.40		Otolith	Left	14.12	12.81	11.78	5.94	1.034
Ariidae	9Li21	Alpha	0-10		Otolith	Right	16.01	14.56	12.77	6.95	1.531
Ariidae	9Li21	Alpha	10-20		Otolith	Right	17.45	15.93	13.79	7.47	1.987
Ariidae	9Li21	Epsilon	0-10		Otolith	Left	11.84	10.83	9.97	5.43	0.699
Ariidae	9Li21	Epsilon	20-30		Otolith	Right	9.66	8.5	8.04	3.94	0.308
Ariidae	9Li21	Gamma	10-20		Otolith	Right	8.84	8.5	7.67	4.38	0.327
Ariidae	9Li21	Gamma	20-35		Otolith	Left	17.33	15.84	13.7	7.03	1.813

APPENDIX C—(*Continued*)

Taxon	Site #	Unit	Level	Feature	Element	Side	Len, mm	Brt, mm	Wdh, mm	Th, mm	Wght, g
Ariidae	9Li21	N501 E80	0-10		Otolith	Right		7.09	6.36	3.3	0.146
Ariidae	9Li21	N501 E80	20-30		Otolith	Right	7.15	7.02	5.72	2.7	0.122
Ariidae	9Li21	N501 E80	30-40		Otolith	Right	11	10.61	9.72	4.38	0.499
Ariidae	9Li21	N501 E80	40-50		Otolith	Right	12.02	10.49	10.18	4.58	0.568
Ariidae	9Li21	N501 E80	60-70		Otolith	Left	10.45	9.56	9.39	4.02	0.406
Ariidae	9Li21	N501 E80	90-100		Otolith	Right	15.85	15.11	13.15	6.96	1.657
Ariidae	9Li21	Zeta	0-10		Otolith	Left	10.49	9.47	8.63	3.99	0.395
Ariidae	9Li229	N179 E84	0-10		Otolith	Left	11.69	10.48	8.91	5.27	0.568
Ariidae	9Li229	N179 E84	0-10		Otolith	Right	15.38	15.05	13.05	6.62	1.516
Ariidae	9Li229	N179 E84	10-20		Otolith	Left	13.99	13.18	10.77	5.94	0.972
Ariidae	9Li229	N179 E84	10-20		Otolith	Left	12.85	11.8	10.13	5.29	0.75
Ariidae	9Li229	N179 E84	10-20		Otolith	Right	15.23	13.89	12.34	6.72	1.307
Ariidae	9Li229	N179 E84	10-20		Otolith	Right	15.92	14.84	13.05	7.38	1.768
Ariidae	9Li229	N179 E84	10-20		Otolith	Right	14.06	12.54	11.02	5.62	0.926
Ariidae	9Li229	N179 E84	10-20		Otolith	Right	12.82	12.08	10.81	5.58	0.862
Ariidae	9Li229	N179 E84	10-20		Otolith	Right	10.68	9.67	8.9	5.07	0.524
Ariidae	9Li229	N179 E84	10-20		Otolith	Right	9.31	8.63	8.17	3.84	0.307
Ariidae	9Li229	N179 E84	20-30		Otolith	Left	12.66	11.42	10.13	5.09	0.702
Ariidae	9Li229	N179 E84	20-30		Otolith	Left	12.89	11.9	10.07	5.17	0.748
Ariidae	9Li229	N179 E84	20-30		Otolith	Left	12.87	11.8	10.48	5.02	0.695
Ariidae	9Li229	N179 E84	20-30		Otolith	Right	7.9	7.39	6.79	3.67	0.209
Ariidae	9Li229	N179 E84	30-40	2	Otolith	Left	6.72	6.69	5.67	2.5	0.103
Ariidae	9Li229	N179 E84	30-40	2	Otolith	Left	5.76	5.66	5.07	2.04	0.064
Ariidae	9Li229	N179 E84	30-40		Otolith	Right	12.85	12.69	10.79	5.69	0.958
Ariidae	9Li229	N179 E84	30-40	2	Otolith	Right	7.32	6.82	5.75	2.5	0.102
Ariidae	9Li229	N179 E84	50-60		Otolith	Right	6.87	6.38	5.3	2.31	0.09
Ariidae	9Li229	N179 E84	60-70		Otolith	Right	12.59	11.65	10.35	5.41	0.751
Ariidae	9Li229	N191 E84	0-10		Otolith	Right	9.19	8.53	7.17	3.7	0.265
Ariidae	9Li229	N191 E84	20-30		Otolith	Left	6.54	6.15	5.05	2.38	0.086
Ariidae	9Li229	N191 E84	30-40		Otolith	Right	11.34	10.74	9.52	5.1	0.53
Ariidae	9Li229	N191 E84	30-40		Otolith	Right	8.59	8.07	6.87	3.37	0.229
Ariidae	9Li229	N191 E84	40-50		Otolith	Right	6.71	6.19	5.05	2.27	0.087
Ariidae	9Li230	Iota	30-40		Otolith	Left	10.52	9.16	8.95	5.19	0.413
Ariidae	9Li230	Iota	30-40		Otolith	Left	5.22	5.08	4.06	1.61	0.032
Ariidae	9Li230	Iota	30-40		Otolith	Right	8.05	7.42	6.75	3.57	0.18
Ariidae	9Li230	Iota	30-40		Otolith	Right	5.39	5.02	4.2	1.64	0.034

APPENDIX C—(*Continued*)

Taxon	Site #	Unit	Level	Feature	Element	Side	Len, mm	Brt, mm	Wdh, mm	Th, mm	Wght, g
Ariidae	9Li1637	TP 1	0-20		Otolith	Right	12.6	11.54	10.49	5.39	0.743
Ariidae	9Li1637	TP 1	100-110		Otolith	Right		10.74	9.77	4.88	0.574
Ariidae	9Li1637	TP 1	100-110		Otolith	Right		6.52	5.92	2.71	0.114
Ariidae	9Li1637	TP 1	60-70		Otolith	Left	8.14	7.33	6.84	3.77	0.226
Ariidae	9Li1637	TP 1	60-70		Otolith	Left	9.91	8.92	8.53	4.5	0.397
Ariidae	9Li1637	TP 1	60-70		Otolith	Right	10.13	9.08	8.69	4.57	0.424
Ariidae	9Li1637	TP 1	60-70		Otolith	Right	10.8	10.08	9.54	4.56	0.504
Ariidae	9Li1637	TP 1	60-70		Otolith	Right	10.62	9.6	8.96	4.19	0.435
Ariidae	9Li1637	TP 1	60-70		Otolith	Right	8.73	8.17	4.5	3.75	0.262
Ariidae	9Li1637	TP 1	60-70		Otolith	Right	7.58	7.13	6.63	3.33	0.188
Ariidae	9Li1637	TP 1	70-80		Otolith	Left	9.99	9.23	8.57	4.65	0.417
Ariidae	9Li1637	TP 1	70-80		Otolith	Left		7.24		3.2	
Ariidae	9Li1637	TP 1	70-80		Otolith	Right	8.89	7.98	7.78	3.7	0.266
Ariidae	9Li1637	TP 1	70-80		Otolith	Right	10.71	9.63	8.9	4.51	0.46
Ariidae	9Li1637	TP 1	70-80		Otolith	Right	8.54	7.74	7.38	3.63	0.243
Ariidae	9Li1637	TP 1	80-90		Otolith	Left	11.19	10.6	10	5.13	0.62
Ariidae	9Li1637	TP 1	80-90		Otolith	Left	9.39	8.83	8.51	4.35	0.37
Ariidae	9Li1637	TP 1	80-90		Otolith	Left	10.32	9.47	9.02	4.72	0.468
Ariidae	9Li1637	TP 1	80-90		Otolith	Left	11.79	11.09	10.13	4.96	0.639
Ariidae	9Li1637	TP 1	80-90		Otolith	Left	9.56	9.15	8.49	5.05	0.441
Ariidae	9Li1637	TP 1	80-90		Otolith	Left	9.3	8.46	7.77	4.13	0.315
Ariidae	9Li1637	TP 1	80-90		Otolith	Left	10.07	9.18	8.55	4.85	0.44
Ariidae	9Li1637	TP 1	80-90		Otolith	Right	15.18	14.79	13.15	7.01	1.592
Ariidae	9Li1637	TP 1	80-90		Otolith	Right	14.01	13.34	13.06	6.79	1.393
Ariidae	9Li1637	TP 1	80-90		Otolith	Right	9.31	8.49	8.17	4	0.316
Ariidae	9Li1637	TP 1	80-90		Otolith	Right	9.69	8.93	8.5	4.45	0.374
Ariidae	9Li1637	TP 1	80-90		Otolith	Right	9.86	8.74	8.75	4.59	0.398
Ariidae	9Li1637	TP 1	80-90		Otolith	Right	7.31	7.38	6.3	3.26	0.188
Ariidae	9Li1637	TP 1	90-100		Otolith	Left		9.66	9.16	4.23	0.401
Ariidae	9Li1637	TP 1	90-100		Otolith	Left	14.08	14.7	12.84	6.93	1.494
Ariidae	9Li1637	TP 1	90-100		Otolith	Right	9.87	9.06	8.55	4.14	0.374
Ariidae	9Li1637	TP 1	90-100		Otolith	Right	10.17	9.21	8.5	4.28	0.381
Ariidae	9Li1637	TP 1	90-100		Otolith	Right	10.88	9.82	9.46	4.12	0.439
Ariidae	9Li1637	TP II	0-10		Otolith	Left	14.9	14.16	12.39	6.33	1.345
Ariidae	9Li1637	TP II	20-30		Otolith	Left	7.68	7.31	6.45	3.23	0.179
Ariidae	9Li1637	TP II	20-30		Otolith	Right	16.11	14.94	13.42	7.07	1.729

APPENDIX C—(*Continued*)

Taxon	Site #	Unit	Level	Feature	Element	Side	Len, mm	Brt, mm	Wdh, mm	Th, mm	Wght, g
Ariidae	9Li1637	TP II	70-80		Otolith	Right	15.78	15.03	13.14	7.38	1.873
Bairdiella chrysoura	9Li207	N488 E495	49.86-49.76		Sagitta otolith	Left	5.63		4.74	2.21	0.043
Bairdiella chrysoura	9Li207	N488 E495	49.96-49.86		Sagitta otolith	Right	4.75		3.81	2.18	0.032
Bairdiella chrysoura	9Li207	N569 E458	48.77-48.67		Sagitta otolith	Left	9.86		7.4	3.51	0.197
Bairdiella chrysoura	9Li207	N569 E458	48.77-48.67		Sagitta otolith	Right	6.89		5.33	2.82	0.088
Bairdiella chrysoura	9Li207	N575 E453	48.89-48.79		Sagitta otolith	Left	6.96		5.53	2.43	0.071
Bairdiella chrysoura	9Li207	N575 E453	48.89-48.79		Sagitta otolith	Right	8.19		6.25	3.11	0.133
Bairdiella chrysoura	9Li207	N575 E453	48.89-48.79		Sagitta otolith	Right	8.01		6.33	3.26	0.132
Bairdiella chrysoura	9Li207	N575 E453	48.99-48.89		Sagitta otolith	Right	7.36		5.5	2.92	0.1
Bairdiella chrysoura	9Li207	N575 E453	49.09-48.99		Sagitta otolith	Right	7.05		6.06	3.02	0.092
Bairdiella chrysoura	9Li207	N576 E453	48.83-48.73		Sagitta otolith	Right	10.07		7.61	4.53	0.27
Bairdiella chrysoura	9Li207	N576 E453	48.93-48.83		Sagitta otolith	Left	6.8		5.22	2.47	0.071
Bairdiella chrysoura	9Li207	N576 E453	48.93-48.83		Sagitta otolith	Right	6.59		5.92	2.75	0.079
Bairdiella chrysoura	9Li207	N576 E453	48.93-48.83		Sagitta otolith	Right	6.36		5.32	2.48	0.073
Bairdiella chrysoura	9Li207	N576 E453	49.03-48.93		Sagitta otolith	Left	5.94		4.79	2.32	0.058
Bairdiella chrysoura	9Li207	N576 E453	49.03-48.93		Sagitta otolith	Right	7.11		5.25	2.57	0.076
Bairdiella chrysoura	9Li207	N584 E466	48.78-48.68		Sagitta otolith	Right	5.31		4.02	2.12	0.041
Bairdiella chrysoura	9Li207	N584 E466	48.78-48.68		Sagitta otolith	Right	6.54		4.93	2.66	0.075
Bairdiella chrysoura	9Li207	N584 E466	48.78-48.68		Sagitta otolith	Right	6.78		5.54	2.76	0.09
Bairdiella chrysoura	9Li207	TP VI	48.68-48.58		Sagitta otolith	Left	8.97		6.89	3.47	0.153
Bairdiella chrysoura	9Li21	Eta	20-30		Sagitta otolith	Left	4.55		4.08	1.87	0.028
Bairdiella chrysoura	9Li21	Gamma	0-10		Sagitta otolith	Left	6.69		5.65	2.89	0.103
Bairdiella chrysoura	9Li21	Gamma	10-20		Sagitta otolith	Left	5.56		4.65	2.38	0.054
Bairdiella chrysoura	9Li21	Gamma	10-20		Lapillis otolith	Right	4.81		3.07	1.39	0.022
Bairdiella chrysoura	9Li21	N501 E80	10-20		Sagitta otolith	Left	4.58		4.55	1.92	0.037
Bairdiella chrysoura	9Li21	Theta	47-57		Sagitta otolith	Left	4.45		4.14	2.04	0.034
Bairdiella chrysoura	9Li21	Theta	47-57		Sagitta otolith	Right	4.31		3.83	1.92	0.026
Bairdiella chrysoura	9Li21	Zeta	20-30		Sagitta otolith	Left	4.18		4.08	2.04	0.034
Bairdiella chrysoura	9Li21	Zeta	50-60		Atlas				2.99		0.021
Bairdiella chrysoura	9Li229	N165 E159	40-50		Sagitta otolith	Left	5.33		4.94	2.36	0.049
Bairdiella chrysoura	9Li229	N165 E159	40-50		Sagitta otolith	Right	5.42		4.83	2.29	0.049
Bairdiella chrysoura	9Li229	N165 E159	50-60 shell		Sagitta otolith	Left	4.92		4.36	2.16	0.042
Bairdiella chrysoura	9Li229	N165 E159	50-60 shell		Sagitta otolith	Right	4.65		4.33	2.17	0.04
Bairdiella chrysoura	9Li229	N179 E84	0-10		Lapillis otolith	Left	6.27		3.82	1.96	0.049
Bairdiella chrysoura	9Li229	N179 E84	0-10		Sagitta otolith	Right	5.66		5.76	2.66	0.082
Bairdiella chrysoura	9Li229	N179 E84	0-10		Sagitta otolith	Right	4.63		4.32	2.05	0.036

APPENDIX C—(*Continued*)

Taxon	Site #	Unit	Level	Feature	Element	Side	Len, mm	Brt, mm	Wdh, mm	Th, mm	Wght, g
Bairdiella chrysoura	9Li229	N179 E84	10-20		Sagitta otolith	Left	5.51		4.96	2.38	0.057
Bairdiella chrysoura	9Li229	N179 E84	10-20		Sagitta otolith	Left	5.2		4.62	2.33	0.047
Bairdiella chrysoura	9Li229	N179 E84	10-20		Sagitta otolith	Left	5.3		5.06	2.28	0.053
Bairdiella chrysoura	9Li229	N179 E84	10-20		Sagitta otolith	Left	5.82		5.33	2.56	0.07
Bairdiella chrysoura	9Li229	N179 E84	10-20		Sagitta otolith	Left	5.81		5.36	2.49	0.059
Bairdiella chrysoura	9Li229	N179 E84	10-20		Lapillis otolith	Left	5.33		3.43	1.67	0.029
Bairdiella chrysoura	9Li229	N179 E84	10-20		Lapillis otolith	Left	5.48		3.38	1.8	0.036
Bairdiella chrysoura	9Li229	N179 E84	10-20		Sagitta otolith	Left	6.04		5.33	2.53	0.072
Bairdiella chrysoura	9Li229	N179 E84	10-20		Sagitta otolith	Left	5.05		4.8	2.21	0.043
Bairdiella chrysoura	9Li229	N179 E84	10-20		Sagitta otolith	Left	6.04		5.19	2.66	0.077
Bairdiella chrysoura	9Li229	N179 E84	10-20		Sagitta otolith	Left	5.77		4.99	2.39	0.064
Bairdiella chrysoura	9Li229	N179 E84	10-20		Sagitta otolith	Left	6.31		5.4	2.91	0.097
Bairdiella chrysoura	9Li229	N179 E84	10-20		Sagitta otolith	Left	5.35		4.34	2.08	0.043
Bairdiella chrysoura	9Li229	N179 E84	10-20		Sagitta otolith	Left	4.76		4.29	2.09	0.04
Bairdiella chrysoura	9Li229	N179 E84	10-20		Sagitta otolith	Right	5.28		4.36	2.3	0.047
Bairdiella chrysoura	9Li229	N179 E84	10-20		Sagitta otolith	Right	6.59		5.71	2.83	0.098
Bairdiella chrysoura	9Li229	N179 E84	10-20		Sagitta otolith	Right	4.69		4.59	2.08	0.037
Bairdiella chrysoura	9Li229	N179 E84	10-20		Sagitta otolith	Right	4.34		4.15	1.94	0.03
Bairdiella chrysoura	9Li229	N179 E84	10-20		Lapillis otolith	Right	5.13		3.23	1.68	0.028
Bairdiella chrysoura	9Li229	N179 E84	10-20		Sagitta otolith	Right	5.56		4.66	2.31	0.051
Bairdiella chrysoura	9Li229	N179 E84	10-20		Sagitta otolith	Right	5.9		5.06	2.53	0.07
Bairdiella chrysoura	9Li229	N179 E84	10-20		Sagitta otolith	Right	5.63		5.16	2.46	0.067
Bairdiella chrysoura	9Li229	N179 E84	10-20		Sagitta otolith	Right	6.65		5.63	2.79	0.107
Bairdiella chrysoura	9Li229	N179 E84	10-20		Lapillis otolith	Right	5.27		3.47	1.71	0.033
Bairdiella chrysoura	9Li229	N179 E84	10-20		Lapillis otolith	Right	5.39		3.43	1.91	0.041
Bairdiella chrysoura	9Li229	N179 E84	10-20		Atlas		2.56				
Bairdiella chrysoura	9Li229	N179 E84	10-20		Atlas				2.67		
Bairdiella chrysoura	9Li229	N179 E84	20-30		Sagitta otolith	Left	5.99		5.16	2.79	0.078
Bairdiella chrysoura	9Li229	N179 E84	20-30		Sagitta otolith	Left	6.18		5.12	2.73	0.08
Bairdiella chrysoura	9Li229	N179 E84	20-30		Sagitta otolith	Left	5.58		4.68	2.39	0.055
Bairdiella chrysoura	9Li229	N179 E84	20-30		Sagitta otolith	Left	4.71		4.48	2.08	0.041
Bairdiella chrysoura	9Li229	N179 E84	20-30		Sagitta otolith	Left	4.87		4.46	2.2	0.044
Bairdiella chrysoura	9Li229	N179 E84	20-30		Sagitta otolith	Left	5.12		4.4	2.26	0.043
Bairdiella chrysoura	9Li229	N179 E84	20-30		Lapillis otolith	Left	4.99		3	1.65	0.027
Bairdiella chrysoura	9Li229	N179 E84	20-30		Lapillis otolith	Left	5.54		3.34	1.77	0.038
Bairdiella chrysoura	9Li229	N179 E84	20-30		Sagitta otolith	Left	4.82		4.43	2.34	0.043

APPENDIX C—(*Continued*)

Taxon	Site #	Unit	Level	Feature	Element	Side	Len, mm	Brt, mm	Wdh, mm	Th, mm	Wght, g
Bairdiella chrysoura	9Li229	N179 E84	20-30		Sagitta otolith	Left	5.09		4.41	2.2	0.045
Bairdiella chrysoura	9Li229	N179 E84	20-30		Sagitta otolith	Left	5.22		4.57	2.17	0.046
Bairdiella chrysoura	9Li229	N179 E84	20-30		Sagitta otolith	Left	4.96		4.42	2.25	0.049
Bairdiella chrysoura	9Li229	N179 E84	20-30		Sagitta otolith	Left	4.97		4.51	2.23	0.04
Bairdiella chrysoura	9Li229	N179 E84	20-30		Sagitta otolith	Left	5.24		4.63	2.34	0.052
Bairdiella chrysoura	9Li229	N179 E84	20-30		Sagitta otolith	Left	5.42		4.79	2.18	0.05
Bairdiella chrysoura	9Li229	N179 E84	20-30		Sagitta otolith	Left	5.88		5.04	2.47	0.067
Bairdiella chrysoura	9Li229	N179 E84	20-30		Sagitta otolith	Left	5.73		4.63	2.42	0.063
Bairdiella chrysoura	9Li229	N179 E84	20-30		Sagitta otolith	Right	5.01		4.38	2.2	0.042
Bairdiella chrysoura	9Li229	N179 E84	20-30		Sagitta otolith	Right	5.41		4.5	2.29	0.052
Bairdiella chrysoura	9Li229	N179 E84	20-30		Sagitta otolith	Right	4.81		4.45	2.09	0.04
Bairdiella chrysoura	9Li229	N179 E84	20-30		Sagitta otolith	Right	5.12		4.3	2.12	0.042
Bairdiella chrysoura	9Li229	N179 E84	20-30		Sagitta otolith	Right	4.3		4	1.93	0.03
Bairdiella chrysoura	9Li229	N179 E84	20-30		Lapillis otolith	Right	5.12		3.33	1.67	0.032
Bairdiella chrysoura	9Li229	N179 E84	20-30		Sagitta otolith	Right	5.05		4.7	2.26	0.049
Bairdiella chrysoura	9Li229	N179 E84	20-30		Sagitta otolith	Right	4.76		4.26	2.18	0.037
Bairdiella chrysoura	9Li229	N179 E84	20-30		Sagitta otolith	Right	5.56		4.74	2.32	0.056
Bairdiella chrysoura	9Li229	N179 E84	20-30		Sagitta otolith	Right	6.42		5.21	2.67	0.078
Bairdiella chrysoura	9Li229	N179 E84	20-30		Sagitta otolith	Right	4.84		4.33	2.1	0.039
Bairdiella chrysoura	9Li229	N179 E84	20-30		Sagitta otolith	Right	4.18		3.5	1.72	0.022
Bairdiella chrysoura	9Li229	N179 E84	20-30		Sagitta otolith	Right	5.23		4.74	2.31	0.051
Bairdiella chrysoura	9Li229	N179 E84	20-30		Sagitta otolith	Right	5.3		4.71	2.22	0.048
Bairdiella chrysoura	9Li229	N179 E84	20-30		Sagitta otolith	Right	4.86		4.11	2.04	0.041
Bairdiella chrysoura	9Li229	N179 E84	20-30		Sagitta otolith	Right	3.94		4.15	1.88	0.025
Bairdiella chrysoura	9Li229	N179 E84	20-30		Sagitta otolith	Right	4.58		4.33	2.03	0.035
Bairdiella chrysoura	9Li229	N179 E84	20-30		Atlas				2.81		0.011
Bairdiella chrysoura	9Li229	N179 E84	20-30		Atlas				2.28		0.009
Bairdiella chrysoura	9Li229	N179 E84	20-30		Atlas				2.3		0.009
Bairdiella chrysoura	9Li229	N179 E84	20-30		Atlas				2.41		0.01
Bairdiella chrysoura	9Li229	N179 E84	20-30		Atlas				2.28		0.008
Bairdiella chrysoura	9Li229	N179 E84	20-30		Atlas				1.82		0.006
Bairdiella chrysoura	9Li229	N179 E84	20-30		Atlas				2.27		
Bairdiella chrysoura	9Li229	N179 E84	20-30		Atlas				2.62		
Bairdiella chrysoura	9Li229	N179 E84	20-30		Atlas				2.35		
Bairdiella chrysoura	9Li229	N179 E84	30-40		Lapillis otolith	Left	5.23		3.31	1.82	0.035
Bairdiella chrysoura	9Li229	N179 E84	30-40		Lapillis otolith	Left	4.64		3.13	1.62	0.024

APPENDIX C—(*Continued*)

Taxon	Site #	Unit	Level	Feature	Element	Side	Len, mm	Brt, mm	Wdh, mm	Th, mm	Wght, g
Bairdiella chrysoura	9Li229	N179 E84	30-40	2	Sagitta otolith	Left	4.1		3.82	1.82	0.023
Bairdiella chrysoura	9Li229	N179 E84	30-40	2	Sagitta otolith	Left	4.57		4.25	2.05	0.033
Bairdiella chrysoura	9Li229	N179 E84	30-40		Sagitta otolith	Right	4.68		4.28	2.08	0.036
Bairdiella chrysoura	9Li229	N179 E84	30-40		Sagitta otolith	Right	3.99		3.68	1.88	0.021
Bairdiella chrysoura	9Li229	N179 E84	30-40		Sagitta otolith	Right	3.71		3.4	1.71	0.017
Bairdiella chrysoura	9Li229	N179 E84	30-40	2	Sagitta otolith	Right	6.01		5.21	2.71	0.071
Bairdiella chrysoura	9Li229	N179 E84	30-40	2	Sagitta otolith	Right	6.27		5.04	2.63	0.073
Bairdiella chrysoura	9Li229	N179 E84	30-40	2	Sagitta otolith	Right	4.65		4.36	2.18	0.038
Bairdiella chrysoura	9Li229	N179 E84	30-40	2	Sagitta otolith	Right	3.99		3.67	1.85	0.025
Bairdiella chrysoura	9Li229	N179 E84	40-45	2	Sagitta otolith	Left	6.15		5.27	2.85	0.077
Bairdiella chrysoura	9Li229	N179 E84	40-45	2	Sagitta otolith	Left	4.75		3.91	2	0.03
Bairdiella chrysoura	9Li229	N179 E84	40-50	2	Sagitta otolith	Left	4.19		3.76	1.85	0.024
Bairdiella chrysoura	9Li229	N179 E84	40-50	2	Sagitta otolith	Left	4.3		3.99	1.91	0.023
Bairdiella chrysoura	9Li229	N179 E84	40-50	2	Sagitta otolith	Right	6.64		5.56	2.95	0.093
Bairdiella chrysoura	9Li229	N179 E84	40-50	2	Sagitta otolith	Right	5.96		4.89	2.68	0.066
Bairdiella chrysoura	9Li229	N179 E84	40-50	2	Sagitta otolith	Right	5.33		4.53	2.36	0.041
Bairdiella chrysoura	9Li229	N179 E84	40-50	2	Sagitta otolith	Right	4.45		4.1	2.16	0.032
Bairdiella chrysoura	9Li229	N179 E84	40-50	2	Atlas				2.66		0.011
Bairdiella chrysoura	9Li229	N179 E84	40-50	2	Atlas				2.33		0.009
Bairdiella chrysoura	9Li229	N191 E84	0-10		Lapillis otolith	Left	6.38		4.19	2.17	0.054
Bairdiella chrysoura	9Li229	N191 E84	0-10		Sagitta otolith	Left	6.13		5.27	2.66	0.081
Bairdiella chrysoura	9Li229	N191 E84	0-10		Sagitta otolith	Left	7.26		5.85	3.07	0.129
Bairdiella chrysoura	9Li229	N191 E84	0-10		Sagitta otolith	Left	5.07		4.25	2.16	0.04
Bairdiella chrysoura	9Li229	N191 E84	0-10		Sagitta otolith	Right	7.37		5.66	3.01	0.119
Bairdiella chrysoura	9Li229	N191 E84	0-10		Atlas				2.63		
Bairdiella chrysoura	9Li229	N191 E84	10-20		Sagitta otolith	Left	4.18		3.62	1.77	0.022
Bairdiella chrysoura	9Li229	N191 E84	20-30		Sagitta otolith	Left	5.81		4.8	2.37	0.059
Bairdiella chrysoura	9Li229	N191 E84	20-30		Sagitta otolith	Right	5.42		4.48	2.29	0.054
Bairdiella chrysoura	9Li229	N191 E84	20-30		Lapillis otolith	Right	5.51		3.26	1.81	0.033
Bairdiella chrysoura	9Li229	N191 E84	20-30		Lapillis otolith	Right	4.96		3.01	1.47	0.025
Bairdiella chrysoura	9Li229	N191 E84	30-40		Sagitta otolith	Left	5.48		4.98	2.51	0.068
Bairdiella chrysoura	9Li229	N191 E84	30-40		Sagitta otolith	Left	3.92		3.62	1.71	0.018
Bairdiella chrysoura	9Li229	N191 E84	30-40		Sagitta otolith	Left	4.88		4.42	2.24	0.049
Bairdiella chrysoura	9Li229	N191 E84	30-40		Sagitta otolith	Left	4.92		4.29	2.02	0.038
Bairdiella chrysoura	9Li229	N191 E84	30-40		Sagitta otolith	Left	5.88		4.93	2.64	0.063
Bairdiella chrysoura	9Li229	N191 E84	30-40		Sagitta otolith	Left	4.78		4.3	2.15	0.037

APPENDIX C—(*Continued*)

Taxon	Site #	Unit	Level	Feature	Element	Side	Len, mm	Brt, mm	Wdh, mm	Th, mm	Wght, g
Bairdiella chrysoura	9Li229	N191 E84	30-40		Sagitta otolith	Left	5.19		4.48	2.2	0.043
Bairdiella chrysoura	9Li229	N191 E84	30-40		Sagitta otolith	Left	5.43		4.56	2.27	0.051
Bairdiella chrysoura	9Li229	N191 E84	30-40		Sagitta otolith	Left	4.55		3.77	2.01	0.032
Bairdiella chrysoura	9Li229	N191 E84	30-40		Sagitta otolith	Left	5.34		4.56	2.32	0.047
Bairdiella chrysoura	9Li229	N191 E84	30-40		Sagitta otolith	Left	5.63		4.76	2.49	0.059
Bairdiella chrysoura	9Li229	N191 E84	30-40		Sagitta otolith	Left	4.17		3.75	1.95	0.024
Bairdiella chrysoura	9Li229	N191 E84	30-40		Sagitta otolith	Left	4.76		4.31	1.96	0.033
Bairdiella chrysoura	9Li229	N191 E84	30-40		Sagitta otolith	Left	4.25		3.8	1.87	0.026
Bairdiella chrysoura	9Li229	N191 E84	30-40		Sagitta otolith	Left	3.55		3.16	1.54	0.014
Bairdiella chrysoura	9Li229	N191 E84	30-40		Lapillis otolith	Left	4.69		2.93	1.51	0.023
Bairdiella chrysoura	9Li229	N191 E84	30-40		Sagitta otolith	Right	5.32		4.53	2.27	0.05
Bairdiella chrysoura	9Li229	N191 E84	30-40		Sagitta otolith	Right	4.71		4.22	2	0.036
Bairdiella chrysoura	9Li229	N191 E84	30-40		Sagitta otolith	Right	6.1		4.92	2.58	0.067
Bairdiella chrysoura	9Li229	N191 E84	30-40		Sagitta otolith	Right	5.73		4.56	2.45	0.056
Bairdiella chrysoura	9Li229	N191 E84	30-40		Sagitta otolith	Right	4.76		4.29	2.01	0.038
Bairdiella chrysoura	9Li229	N191 E84	30-40		Sagitta otolith	Right	4.94		4.48	2.01	0.042
Bairdiella chrysoura	9Li229	N191 E84	30-40		Sagitta otolith	Right	4.75		4	2.1	0.035
Bairdiella chrysoura	9Li229	N191 E84	30-40		Sagitta otolith	Right	5.88		5.56	2.47	0.068
Bairdiella chrysoura	9Li229	N191 E84	30-40		Sagitta otolith	Right	6.51		5.34	2.77	0.089
Bairdiella chrysoura	9Li229	N191 E84	30-40		Sagitta otolith	Right	3.99		3.69	1.84	0.024
Bairdiella chrysoura	9Li229	N191 E84	30-40		Sagitta otolith	Right	3.79		3.57	1.63	0.018
Bairdiella chrysoura	9Li229	N191 E84	30-40		Atlas				2.65		0.009
Bairdiella chrysoura	9Li229	N191 E84	30-40		Atlas				2.74		
Bairdiella chrysoura	9Li229	N191 E84	40-50		Sagitta otolith	Left	6.11		5.36	2.7	0.081
Bairdiella chrysoura	9Li229	N191 E84	40-50		Sagitta otolith	Left	5.37		4.69	2.38	0.052
Bairdiella chrysoura	9Li229	N191 E84	40-50		Lapillis otolith	Left	5.52		3.37	1.83	0.037
Bairdiella chrysoura	9Li229	N191 E84	40-50		Sagitta otolith	Right	5.07		4.25	2.18	0.041
Bairdiella chrysoura	9Li229	N191 E84	40-50		Sagitta otolith	Right	4.41		3.85	1.96	0.03
Bairdiella chrysoura	9Li229	N191 E84	40-50		Atlas				2.27		0.008
Bairdiella chrysoura	9Li229	N191 E84	40-50		Atlas				2.53		0.017
Bairdiella chrysoura	9Li229	N191 E84	40-50		Atlas				2.05		0.007
Bairdiella chrysoura	9Li229	N191 E84	40-50 shell		Sagitta otolith	Left	4.83		4.54	2.14	0.041
Bairdiella chrysoura	9Li229	N191 E84	40-50 shell		Sagitta otolith	Left	5.35		4.55	2.16	0.046
Bairdiella chrysoura	9Li229	N191 E84	40-50 shell		Lapillis otolith	Left	5.6		3.45	1.85	0.038
Bairdiella chrysoura	9Li229	N191 E84	40-50 shell		Sagitta otolith	Right	4.63		4.02	2.03	0.032
Bairdiella chrysoura	9Li229	N191 E84	40-50 shell		Sagitta otolith	Right	5.46		4.52	2.4	0.056

APPENDIX C—(*Continued*)

Taxon	Site #	Unit	Level	Feature	Element	Side	Len, mm	Brt, mm	Wdh, mm	Th, mm	Wght, g
Bairdiella chrysoura	9Li229	N191 E84	40-50 shell		Sagitta otolith	Right	5.95		4.8	2.61	0.063
Bairdiella chrysoura	9Li229	N191 E84	40-50 shell		Sagitta otolith	Right	6.09		5.29	2.68	0.083
Bairdiella chrysoura	9Li229	N191 E84	40-50 shell		Sagitta otolith	Right	5.22		4.57	2.43	0.047
Bairdiella chrysoura	9Li229	N191 E84	40-50 shell		Sagitta otolith	Right	6.56		5.49	2.9	0.092
Bairdiella chrysoura	9Li229	N191 E84	40-50 shell		Sagitta otolith	Right	6		5.15	2.56	0.068
Bairdiella chrysoura	9Li229	N191 E84	40-50 shell		Atlas				2.9		
Bairdiella chrysoura	9Li230	Iota	20-30		Sagitta otolith	Left	6.2		5.68	2.75	0.088
Bairdiella chrysoura	9Li230	Iota	20-30		Sagitta otolith	Left	5.87		5.22	2.41	0.067
Bairdiella chrysoura	9Li230	Iota	20-30		Sagitta otolith	Left	6.16		5.34	2.58	0.057
Bairdiella chrysoura	9Li230	Iota	20-30		Lapillis otolith	Left	4.99		3.25	1.57	0.019
Bairdiella chrysoura	9Li230	Iota	20-30		Atlas				2.22		0.007
Bairdiella chrysoura	9Li230	Iota	30-40		Lapillis otolith	Right	5.3		3.32	1.85	0.021
Bairdiella chrysoura	9Li230	Iota	30-40		Sagitta otolith	Right	6.3		5.2	2.58	0.057
Bairdiella chrysoura	9Li230	Iota	30-40		Sagitta otolith	Right	5.98		5.09	2.7	0.061
Bairdiella chrysoura	9Li230	Iota	30-40		Sagitta otolith	Right	4.58		4.15	2.08	0.026
Bairdiella chrysoura	9Li1637	TP 1	0-20		Sagitta otolith	Left	7.54		6.01	3.16	0.128
Bairdiella chrysoura	9Li1637	TP 1	0-20		Sagitta otolith	Right	7.78		6.23	3.39	0.153
Bairdiella chrysoura	9Li1637	TP 1	0-20		Sagitta otolith	Right	7.43		5.78	3.1	0.128
Bairdiella chrysoura	9Li1637	TP 1	0-20		Atlas				3.32		
Bairdiella chrysoura	9Li1637	TP 1	0-20		Atlas				2.76		
Bairdiella chrysoura	9Li1637	TP 1	0-20		Atlas				3.11		
Bairdiella chrysoura	9Li1637	TP 1	0-20		Atlas				2.68		
Bairdiella chrysoura	9Li1637	TP 1	20-30		Atlas				3.36		
Bairdiella chrysoura	9Li1637	TP 1	20-30		Atlas				3.09		
Bairdiella chrysoura	9Li1637	TP 1	20-30		Atlas				2.82		
Bairdiella chrysoura	9Li1637	TP 1	30-40		Sagitta otolith	Left	4.66		4.16	2.12	0.038
Bairdiella chrysoura	9Li1637	TP 1	30-40		Sagitta otolith	Right	4.89		4.22	2.13	0.042
Bairdiella chrysoura	9Li1637	TP 1	30-40		Sagitta otolith	Right	5.39		4.66	2.33	0.053
Bairdiella chrysoura	9Li1637	TP 1	30-40		Sagitta otolith	Right	6.93		5.93	2.96	0.105
Bairdiella chrysoura	9Li1637	TP 1	30-40		Atlas				2.64		
Bairdiella chrysoura	9Li1637	TP 1	30-40		Atlas				3.42		
Bairdiella chrysoura	9Li1637	TP 1	30-40		Atlas				2.62		
Bairdiella chrysoura	9Li1637	TP 1	30-40		Atlas				3.05		
Bairdiella chrysoura	9Li1637	TP 1	30-40		Atlas				2.88		
Bairdiella chrysoura	9Li1637	TP 1	30-40		Atlas				3.43		
Bairdiella chrysoura	9Li1637	TP 1	30-40		Atlas				3.03		

APPENDIX C—(*Continued*)

Taxon	Site #	Unit	Level	Feature	Element	Side	Len, mm	Brt, mm	Wdh, mm	Th, mm	Wght, g
Bairdiella chrysoura	9Li1637	TP 1	30-40		Atlas				2.32		
Bairdiella chrysoura	9Li1637	TP 1	50-60		Sagitta otolith	Left	7.24		6.39	3.28	0.141
Bairdiella chrysoura	9Li1637	TP 1	50-60		Sagitta otolith	Left	6.44		5.8	2.76	0.09
Bairdiella chrysoura	9Li1637	TP 1	50-60		Sagitta otolith	Left	6.78		5.63	2.9	0.105
Bairdiella chrysoura	9Li1637	TP 1	50-60		Sagitta otolith	Left	4.72		3.93	2.06	0.034
Bairdiella chrysoura	9Li1637	TP 1	50-60		Lapillis otolith	Left	5.26		3.48	1.73	0.033
Bairdiella chrysoura	9Li1637	TP 1	50-60		Lapillis otolith	Left	5.47		3.64	1.86	0.04
Bairdiella chrysoura	9Li1637	TP 1	50-60		Sagitta otolith	Right	6.67		5.3	2.91	0.091
Bairdiella chrysoura	9Li1637	TP 1	50-60		Sagitta otolith	Right	6.64		5.46	2.8	0.093
Bairdiella chrysoura	9Li1637	TP 1	50-60		Sagitta otolith	Right	6.74		5.52	2.87	0.103
Bairdiella chrysoura	9Li1637	TP 1	50-60		Sagitta otolith	Right	6.63		5.55	2.85	0.092
Bairdiella chrysoura	9Li1637	TP 1	50-60		Atlas				3.35		
Bairdiella chrysoura	9Li1637	TP 1	50-60		Atlas				2.57		
Bairdiella chrysoura	9Li1637	TP 1	60-70		Sagitta otolith	Left	4.93		3.97	2.11	0.04
Bairdiella chrysoura	9Li1637	TP 1	60-70		Sagitta otolith	Right	6.61		5.47	3.1	0.097
Bairdiella chrysoura	9Li1637	TP 1	60-70		Sagitta otolith	Right	5.96		4.7	2.48	0.059
Bairdiella chrysoura	9Li1637	TP 1	60-70		Lapillis otolith	Right	5.51		3.43	1.82	0.035
Bairdiella chrysoura	9Li1637	TP 1	60-70		Atlas				3.18		
Bairdiella chrysoura	9Li1637	TP 1	70-80		Sagitta otolith	Left	6.19		5.43	2.77	0.085
Bairdiella chrysoura	9Li1637	TP 1	70-80		Sagitta otolith	Left	6.66		5.91	2.91	0.083
Bairdiella chrysoura	9Li1637	TP 1	70-80		Sagitta otolith	Right	6.74		5.95	2.96	0.107
Bairdiella chrysoura	9Li1637	TP 1	70-80		Sagitta otolith	Right	6.57		5.05	2.68	0.09
Bairdiella chrysoura	9Li1637	TP 1	70-80		Sagitta otolith	Right	6.81		5.65	2.96	0.098
Bairdiella chrysoura	9Li1637	TP 1	70-80		Sagitta otolith	Right	6.51		5.1	2.7	0.086
Bairdiella chrysoura	9Li1637	TP 1	70-80		Sagitta otolith	Right			4.44	2.13	0.044
Bairdiella chrysoura	9Li1637	TP 1	70-80		Atlas				3.05		
Bairdiella chrysoura	9Li1637	TP 1	70-80		Atlas				2.41		
Bairdiella chrysoura	9Li1637	TP 1	70-80		Atlas				3.26		
Bairdiella chrysoura	9Li1637	TP 1	70-80		Atlas				2.93		
Bairdiella chrysoura	9Li1637	TP 1	70-80		Atlas				2.94		
Bairdiella chrysoura	9Li1637	TP 1	80-90		Sagitta otolith	Left	7.24		5.91	3.14	0.123
Bairdiella chrysoura	9Li1637	TP 1	80-90		Sagitta otolith	Left	6.78		5.59	2.93	0.101
Bairdiella chrysoura	9Li1637	TP 1	80-90		Sagitta otolith	Left	6.42		4.97	2.76	0.088
Bairdiella chrysoura	9Li1637	TP 1	80-90		Lapillis otolith	Left	5.52		3.31	1.79	0.036
Bairdiella chrysoura	9Li1637	TP 1	80-90		Sagitta otolith	Right	6.96		5.6	2.96	0.103
Bairdiella chrysoura	9Li1637	TP 1	80-90		Sagitta otolith	Right	6.23		4.96	2.75	0.074

APPENDIX C—(*Continued*)

Taxon	Site #	Unit	Level	Feature	Element	Side	Len, mm	Brt, mm	Wdh, mm	Th, mm	Wght, g
Bairdiella chrysoura	9Li1637	TP 1	80-90		Sagitta otolith	Right	6.85		5.54	2.98	0.104
Bairdiella chrysoura	9Li1637	TP 1	80-90		Sagitta otolith	Right	6.05		5.16	2.7	0.083
Bairdiella chrysoura	9Li1637	TP 1	80-90		Lapillis otolith	Right	6.14		3.8	2.16	0.055
Bairdiella chrysoura	9Li1637	TP II	10-20		Sagitta otolith	Right	6.67		5.56	2.78	0.097
Bairdiella chrysoura	9Li1637	TP II	30-40		Sagitta otolith	Left	6.39		5.6	2.97	0.1
Bairdiella chrysoura	9Li1637	TP II	70-80		Sagitta otolith	Right	7.39		6.15	3.11	0.129
Cynoscion sp.	9Li207	N488 E495	49.86-49.76		Sagitta otolith	Right	16.25		7.34	3.37	0.347
Cynoscion sp.	9Li207	N488 E495	49.96-49.86		Sagitta otolith	Right	16.55		6.74	3.99	0.386
Cynoscion sp.	9Li207	N493 E499	49.75-49.65		Sagitta otolith	Left	12.3		4.47	2.86	0.136
Cynoscion sp.	9Li207	N513 E507	50.05-49.95		Sagitta otolith	Left	19.21		7.6	4.47	0.564
Cynoscion sp.	9Li207	N569 E458	48.87-48.77		Sagitta otolith	Right	21.11		7.96	4.5	0.684
Cynoscion sp.	9Li207	N586 E441	48.69-48.59		Sagitta otolith	Right	15.29		5.97	3.15	0.278
Cynoscion sp.	9Li207	N586 E441	48.79-48.69		Sagitta otolith	Left	19.54		7.81	4.2	0.583
Cynoscion sp.	9Li207	N586 E441	48.79-48.69		Sagitta otolith	Left	19.88		7.9	4.9	0.675
Cynoscion sp.	9Li207	N586 E441	48.79-48.69		Sagitta otolith	Left	25.07		9.1	5.45	1.079
Cynoscion sp.	9Li207	N586 E441	48.79-48.69		Sagitta otolith	Left	17.71		6.74	4.35	0.498
Cynoscion sp.	9Li207	N586 E441	48.79-48.69		Sagitta otolith	Left	17.64		7.15	4.12	0.416
Cynoscion sp.	9Li207	N586 E441	48.79-48.69		Sagitta otolith	Left	21.65		7.85	5.09	0.773
Cynoscion sp.	9Li207	N586 E441	48.79-48.69		Sagitta otolith	Left	17.22		6.85	3.98	0.423
Cynoscion sp.	9Li207	N586 E441	48.79-48.69		Sagitta otolith	Left	15.27		6.24	3.15	0.283
Cynoscion sp.	9Li207	N586 E441	48.79-48.69		Sagitta otolith	Left	14.57		6.24	3.28	0.277
Cynoscion sp.	9Li207	N586 E441	48.79-48.69		Sagitta otolith	Left	22.15		8.34	4.91	0.738
Cynoscion sp.	9Li207	N586 E441	48.79-48.69		Sagitta otolith	Left	23.02		8.63	5.2	0.859
Cynoscion sp.	9Li207	N586 E441	48.79-48.69		Sagitta otolith	Right	21.59		8.31	4.42	0.675
Cynoscion sp.	9Li207	N586 E441	48.79-48.69		Sagitta otolith	Right			6.9	3.42	0.348
Cynoscion sp.	9Li207	N586 E441	48.79-48.69		Sagitta otolith	Right	16.52		6.62	4	0.387
Cynoscion sp.	9Li207	N586 E441	48.79-48.69		Sagitta otolith	Right	21.6		8.33	4.91	0.722
Cynoscion sp.	9Li207	N586 E441	48.79-48.69		Sagitta otolith	Right	16.09		6.28	3.38	0.31
Cynoscion sp.	9Li207	N586 E441	48.79-48.69		Sagitta otolith	Right			7.13	3.98	0.443
Cynoscion sp.	9Li207	N586 E441	48.79-48.69		Sagitta otolith	Right			7.61	4.41	0.549
Cynoscion sp.	9Li207	N586 E441	48.79-48.69		Sagitta otolith	Right	18.1		6.89	4.01	0.453
Cynoscion sp.	9Li207	N586 E441	48.79-48.69		Sagitta otolith	Right			7.42	4.28	0.602
Cynoscion sp.	9Li207	N586 E441	48.79-48.69		Sagitta otolith	Right	18.65		7.04	4.09	0.499
Cynoscion sp.	9Li207	N586 E441	48.79-48.69		Sagitta otolith	Right			6.76	3.68	0.373
Cynoscion sp.	9Li207	N587 E437	48.73-48.63		Sagitta otolith	Left	19.57		7.53	4.42	0.562
Cynoscion sp.	9Li207	N587 E437	48.73-48.63		Sagitta otolith	Right	16.92		6.69	3.61	0.384

APPENDIX C—(*Continued*)

Taxon	Site #	Unit	Level	Feature	Element	Side	Len, mm	Brt, mm	Wdh, mm	Th, mm	Wght, g
Cynoscion sp.	9Li207	N587 E437	49.03-48.93		Sagitta otolith	Left	17.66		7.06	4.13	0.478
Cynoscion sp.	9Li207	TP IX	49.92-49.82		Sagitta otolith	Left	18.35		7.39	4.13	0.566
Cynoscion sp.	9Li207	TP VII	48.75-48.65		Sagitta otolith	Left	19.51		7.84	4.06	0.569
Cynoscion sp.	9Li21	Alpha	0-10		Sagitta otolith	Left			5.91	2.89	
Cynoscion sp.	9Li21	Alpha Baulk	9-25		Sagitta otolith	Right			4.91	2.51	
Cynoscion sp.	9Li21	Beta Baulk	55-65		Sagitta otolith	Right			5.07	2.47	0.165
Cynoscion sp.	9Li21	Eta	10-20		Sagitta otolith	Right			6.52	4.02	
Cynoscion sp.	9Li21	Gamma	0-10		Sagitta otolith	Right	17.85		6.56	3.99	0.417
Cynoscion sp.	9Li21	N501 E80	20-30		Sagitta otolith	Left	15.78		6.63	3.53	0.334
Cynoscion sp.	9Li21	N501 E80	30-40		Sagitta otolith	Left	17.41		6.67	3.56	0.377
Cynoscion sp.	9Li21	N501 E80	30-40		Sagitta otolith	Left			6.13	3.26	0.302
Cynoscion sp.	9Li21	Theta	0-17		Sagitta otolith	Left	15.53		7	3.58	0.357
Cynoscion sp.	9Li21	Theta	17-27		Sagitta otolith	Left	21.68		8.46	5.32	0.785
Cynoscion sp.	9Li21	Theta	17-27		Sagitta otolith	Left	17.66		7.05	4.11	0.462
Cynoscion sp.	9Li21	Theta	37-47		Sagitta otolith	Left	20.26		8.37	4.95	0.687
Cynoscion sp.	9Li21	Zeta	50-60		Sagitta otolith	Right	14.56		5.62	2.96	0.236
Cynoscion sp.	9Li21	Zeta	60-66		Sagitta otolith	Left	13.61		5.53	2.58	0.193
Cynoscion sp.	9Li21	Zeta	60-66		Sagitta otolith	Left	14.8		5.63	3.01	0.234
Cynoscion sp.	9Li21	Zeta	60-66		Sagitta otolith	Left			7.55	3.44	
Cynoscion sp.	9Li21	Zeta	60-66		Sagitta otolith	Right	17.68		6.93	3.96	0.438
Cynoscion sp.	9Li21	Zeta	60-66		Sagitta otolith	Right	13.61		5.57	2.52	0.195
Cynoscion sp.	9Li21	Zeta	60-66		Atlas				4.87		0.079
Cynoscion sp.	9Li21	Zeta		3	Sagitta otolith	Left	18.14		7.36	4.32	0.489
Cynoscion sp.	9Li21	Zeta		3	Sagitta otolith	Right			5.65	3.05	
Cynoscion sp.	9Li229	N165 E159	10-20		Sagitta otolith	Right	13.43		5.34	2.53	0.162
Cynoscion sp.	9Li229	N179 E84	0-10		Sagitta otolith	Left			5.48	2.5	
Cynoscion sp.	9Li229	N179 E84	0-10		Atlas				3.55		
Cynoscion sp.	9Li229	N179 E84	10-20		Sagitta otolith	Left	13.53		5.17	2.54	0.179
Cynoscion sp.	9Li229	N179 E84	10-20		Sagitta otolith	Left			5.21	2.86	
Cynoscion sp.	9Li229	N179 E84	10-20		Sagitta otolith	Left	13.35		5.4	2.64	0.195
Cynoscion sp.	9Li229	N179 E84	10-20		Sagitta otolith	Left			5.59	2.65	0.202
Cynoscion sp.	9Li229	N179 E84	10-20		Sagitta otolith	Right	13.22		4.98	2.45	0.169
Cynoscion sp.	9Li229	N179 E84	10-20		Sagitta otolith	Right	12.69		5.34	2.49	0.155
Cynoscion sp.	9Li229	N179 E84	20-30		Sagitta otolith	Left	13.96		5.65	2.81	0.21
Cynoscion sp.	9Li229	N179 E84	20-30		Sagitta otolith	Left	13.57		5.76	2.62	0.197
Cynoscion sp.	9Li229	N179 E84	20-30		Sagitta otolith	Right	13.14		5.36	2.6	0.188

APPENDIX C—(*Continued*)

Taxon	Site #	Unit	Level	Feature	Element	Side	Len, mm	Brt, mm	Wdh, mm	Th, mm	Wght, g
Cynoscion sp.	9Li229	N179 E84	20-30		Sagitta otolith	Right	13.69		5.17	2.61	0.198
Cynoscion sp.	9Li229	N179 E84	20-30		Sagitta otolith	Right	12.44		5.43	2.76	0.159
Cynoscion sp.	9Li229	N179 E84	20-30		Sagitta otolith	Right	13.16		5.49	2.65	0.194
Cynoscion sp.	9Li229	N179 E84	20-30		Sagitta otolith	Right	10.39		5.19	2.29	0.113
Cynoscion sp.	9Li229	N179 E84	40-45	2	Atlas				2.55		
Cynoscion sp.	9Li229	N179 E84	40-50	2	Sagitta otolith	Left	9.94		4.7	1.96	0.08
Cynoscion sp.	9Li229	N191 E84	0-10		Sagitta otolith	Right			5.87	3.12	0.233
Cynoscion sp.	9Li229	N191 E84	30-40		Sagitta otolith	Left	13.44		5.45	2.79	0.179
Cynoscion sp.	9Li229	N191 E84	30-40		Sagitta otolith	Left			5.73	2.66	0.149
Cynoscion sp.	9Li229	N191 E84	30-40		Sagitta otolith	Right	9.84		4.55	1.92	0.076
Cynoscion sp.	9Li229	N191 E84	40-50		Sagitta otolith	Left	12.84		5.45	2.34	0.146
Cynoscion sp.	9Li229	N191 E84	40-50 shell		Sagitta otolith	Right	12.45		5.31	2.4	0.161
Cynoscion sp.	9Li229	N191 E84	40-50 shell		Sagitta otolith	Right			5.9	2.56	0.15
Cynoscion sp.	9Li229	N191 E84	50-60		Sagitta otolith	Left	14.11		5.82	2.76	0.217
Cynoscion sp.	9Li229	N191 E84	50-60		Sagitta otolith	Right	14.21		5.86	2.81	0.217
Cynoscion sp.	9Li230	Iota	10-20		Sagitta otolith	Right	13.44		5.8	2.94	0.209
Cynoscion sp.	9Li230	Iota	30-40		Sagitta otolith	Left	9.64		4.36	1.88	0.055
Cynoscion sp.	9Li1637	TP 1	0-20		Sagitta otolith	Right	9.43		7.5	4.21	0.578
Cynoscion sp.	9Li1637	TP 1	100-110		Sagitta otolith	Right	16.75		7.29	3.97	0.413
Cynoscion sp.	9Li1637	TP 1	110-120		Sagitta otolith	Right	15.64		6.39	3.61	0.33
Cynoscion sp.	9Li1637	TP 1	80-90		Sagitta otolith	Left	13.23		5.11	2.63	0.183
Cynoscion sp.	9Li1637	TP 1	80-90		Sagitta otolith	Right	13.47		5.24	2.65	0.181
Cyprinodontidae	9Li229	N179 E84	10-20		Atlas			1.67			
Cyprinodontidae	9Li229	N179 E84	10-20		Atlas			1.48			
Cyprinodontidae	9Li1637	TP 1	20-30		Atlas				1.67		
Leiostomus xanthurus	9Li207	N513 E507	50.05-49.95		Sagitta otolith	Left	6.54		3.77	1.46	0.032
Leiostomus xanthurus	9Li21	N501 E80	70-80		Atlas				2.47		
Leiostomus xanthurus	9Li229	N165 E159	40-50		Atlas				2.44		0.006
Leiostomus xanthurus	9Li229	N179 E84	10-20		Sagitta otolith	Left	5.98		3.64	1.12	0.025
Leiostomus xanthurus	9Li229	N179 E84	10-20		Sagitta otolith	Right	5.57		3.33	1.15	0.026
Leiostomus xanthurus	9Li229	N179 E84	10-20		Sagitta otolith	Right	5.19		3.37	1.19	0.02
Leiostomus xanthurus	9Li229	N179 E84	10-20		Atlas				2.51		
Leiostomus xanthurus	9Li229	N179 E84	10-20		Atlas				2.59		
Leiostomus xanthurus	9Li229	N179 E84	10-20		Atlas				2.53		
Leiostomus xanthurus	9Li229	N179 E84	20-30		Sagitta otolith	Left	5.63		3.54	1.12	0.025
Leiostomus xanthurus	9Li229	N179 E84	20-30		Sagitta otolith	Right	7.7		3.87	1.57	0.05

APPENDIX C—(*Continued*)

Taxon	Site #	Unit	Level	Feature	Element	Side	Len, mm	Brt, mm	Wdh, mm	Th, mm	Wght, g
Leiostomus xanthurus	9Li229	N179 E84	20-30		Sagitta otolith	Right	6.51		3.44	1.34	0.029
Leiostomus xanthurus	9Li229	N179 E84	20-30		Sagitta otolith	Right	4.16		2.91	0.95	0.013
Leiostomus xanthurus	9Li229	N179 E84	20-30		Atlas				2.59		0.01
Leiostomus xanthurus	9Li229	N179 E84	20-30		Atlas				2.43		0.008
Leiostomus xanthurus	9Li229	N179 E84	20-30		Atlas				2.69		0.008
Leiostomus xanthurus	9Li229	N179 E84	20-30		Atlas				2.62		0.009
Leiostomus xanthurus	9Li229	N179 E84	20-30		Atlas				1.92		0.006
Leiostomus xanthurus	9Li229	N179 E84	20-30		Atlas				1.87		
Leiostomus xanthurus	9Li229	N179 E84	20-30		Atlas				2.16		
Leiostomus xanthurus	9Li229	N179 E84	20-30		Atlas				2.56		
Leiostomus xanthurus	9Li229	N179 E84	20-30		Atlas				1.83		
Leiostomus xanthurus	9Li229	N179 E84	20-30		Atlas				2.3		
Leiostomus xanthurus	9Li229	N179 E84	20-30		Atlas				2.59		
Leiostomus xanthurus	9Li229	N179 E84	20-30		Atlas				2.88		
Leiostomus xanthurus	9Li229	N179 E84	20-30		Atlas				2.37		
Leiostomus xanthurus	9Li229	N179 E84	20-30		Atlas				2.24		
Leiostomus xanthurus	9Li229	N179 E84	30-40	2	Sagitta otolith	Left			3.69	1.63	0.034
Leiostomus xanthurus	9Li229	N179 E84	30-40		Atlas				2.44		0.008
Leiostomus xanthurus	9Li229	N179 E84	40-50	2	Sagitta otolith	Left	5.55		3.42	1.18	0.02
Leiostomus xanthurus	9Li229	N191 E84	20-30		Sagitta otolith	Left	5.59		3.29	1.17	0.022
Leiostomus xanthurus	9Li229	N191 E84	20-30		Atlas				2.69		
Leiostomus xanthurus	9Li229	N191 E84	30-40		Sagitta otolith	Left			3.48	1.28	0.027
Leiostomus xanthurus	9Li229	N191 E84	30-40		Sagitta otolith	Left	5.68			1.14	0.018
Leiostomus xanthurus	9Li229	N191 E84	30-40		Sagitta otolith	Right	6.18		3.56	1.28	0.024
Leiostomus xanthurus	9Li229	N191 E84	30-40		Sagitta otolith	Right	6.04		3.35	1.32	0.028
Leiostomus xanthurus	9Li229	N191 E84	30-40		Sagitta otolith	Right	6.64		3.7	1.28	0.031
Leiostomus xanthurus	9Li229	N191 E84	30-40		Atlas				2.48		0.009
Leiostomus xanthurus	9Li229	N191 E84	30-40		Atlas				2.5		0.01
Leiostomus xanthurus	9Li229	N191 E84	30-40		Atlas				2.99		0.013
Leiostomus xanthurus	9Li229	N191 E84	30-40		Atlas				3.18		0.016
Leiostomus xanthurus	9Li229	N191 E84	30-40		Atlas				2.72		0.012
Leiostomus xanthurus	9Li229	N191 E84	30-40		Atlas				2.57		0.011
Leiostomus xanthurus	9Li229	N191 E84	30-40		Atlas				2.33		0.009
Leiostomus xanthurus	9Li229	N191 E84	30-40		Atlas				2.36		
Leiostomus xanthurus	9Li229	N191 E84	30-40		Atlas				2.88		
Leiostomus xanthurus	9Li229	N191 E84	40-50		Atlas				2.48		0.008

APPENDIX C—(*Continued*)

Taxon	Site #	Unit	Level	Feature	Element	Side	Len, mm	Brt, mm	Wdh, mm	Th, mm	Wght, g
Leiostomus xanthurus	9Li229	N191 E84	40-50 shell		Atlas				2.23		
Leiostomus xanthurus	9Li229	N191 E84	40-50 shell		Atlas				2.38		
Leiostomus xanthurus	9Li230	Iota	0-10		Sagitta otolith	Right	7.07		3.78	1.44	0.039
Leiostomus xanthurus	9Li230	Iota	10-20		Sagitta otolith	Left	4.84		3.22	0.96	0.015
Leiostomus xanthurus	9Li1637	TP 1	0-20		Atlas				3.26		
Leiostomus xanthurus	9Li1637	TP 1	0-20		Atlas				3.18		
Leiostomus xanthurus	9Li1637	TP 1	0-20		Atlas				1.99		
Leiostomus xanthurus	9Li1637	TP 1	0-20		Atlas				2.85		
Leiostomus xanthurus	9Li1637	TP 1	0-20		Atlas				2.67		
Leiostomus xanthurus	9Li1637	TP 1	0-20		Atlas				2.56		
Leiostomus xanthurus	9Li1637	TP 1	0-20		Atlas				2.27		
Leiostomus xanthurus	9Li1637	TP 1	30-40		Atlas				2.24		
Leiostomus xanthurus	9Li1637	TP 1	30-40		Atlas				2.33		
Leiostomus xanthurus	9Li1637	TP 1	30-40		Atlas				2.45		
Leiostomus xanthurus	9Li1637	TP 1	30-40		Atlas				2.82		
Leiostomus xanthurus	9Li1637	TP 1	30-40		Atlas				2.78		
Leiostomus xanthurus	9Li1637	TP 1	50-60		Sagitta otolith	Left	6.26		3.5	1.36	0.03
Leiostomus xanthurus	9Li1637	TP 1	50-60		Sagitta otolith	Right	6.08		3.36	1.31	0.03
Leiostomus xanthurus	9Li1637	TP 1	50-60		Atlas				2.6		
Leiostomus xanthurus	9Li1637	TP 1	50-60		Atlas				2.93		
Leiostomus xanthurus	9Li1637	TP 1	50-60		Atlas				2.75		
Leiostomus xanthurus	9Li1637	TP 1	50-60		Atlas				2.33		
Leiostomus xanthurus	9Li1637	TP 1	60-70		Atlas				1.94		
Leiostomus xanthurus	9Li1637	TP 1	70-80		Atlas				2.81		
Leiostomus xanthurus	9Li1637	TP 1	70-80		Atlas				1.99		
Leiostomus xanthurus	9Li1637	TP 1	70-80		Atlas				3.05		
Leiostomus xanthurus	9Li1637	TP 1	70-80		Atlas				2.64		
Leiostomus xanthurus	9Li1637	TP 1	70-80		Atlas				2.23		
Leiostomus xanthurus	9Li1637	TP 1	70-80		Atlas				2.43		
Leiostomus xanthurus	9Li1637	TP 1	70-80		Atlas				2.37		
Leiostomus xanthurus	9Li1637	TP 1	70-80		Atlas				2.6		
Leiostomus xanthurus	9Li1637	TP 1	70-80		Atlas				3.19		
Leiostomus xanthurus	9Li1637	TP 1	70-80		Atlas				2.8		
Leiostomus xanthurus	9Li1637	TP 1	80-90		Sagitta otolith	Left	5.18		3.24	1.1	0.017
Menticirrhus sp.	9Li229	N179 E84	10-20		Sagitta otolith	Left	9.93		3.46	2.42	0.076
Menticirrhus sp.	9Li229	N179 E84	10-20		Sagitta otolith	Left	9.15		3.24	2.04	0.059

APPENDIX C—(*Continued*)

Taxon	Site #	Unit	Level	Feature	Element	Side	Len, mm	Brt, mm	Wdh, mm	Th, mm	Wght, g
Menticirrhus sp.	9Li229	N179 E84	10-20		Sagitta otolith	Left	9.25		3.51	2.3	0.068
Menticirrhus sp.	9Li229	N179 E84	20-30		Sagitta otolith	Left	8.93		3.56	2.12	0.064
Menticirrhus sp.	9Li229	N179 E84	20-30		Sagitta otolith	Right	7.92		2.87	1.8	0.037
Menticirrhus sp.	9Li229	N191 E84	30-40		Sagitta otolith	Left	8.05		3.02	2.05	0.043
Menticirrhus sp.	9Li229	N191 E84	40-50		Sagitta otolith	Right	9.36		3.32	2.03	0.06
Menticirrhus sp.	9Li1637	TP 1	70-80		Sagitta otolith	Left	10.06		3.7	2.46	0.087
Menticirrhus sp.	9Li1637	TP 1	70-80		Atlas				4.25		
Menticirrhus sp.	9Li1637	TP 1	80-90		Sagitta otolith	Left	9.13		3.26	1.99	0.053
Menticirrhus sp.	9Li1637	TP 1	80-90		Atlas				3.5		
Menticirrhus sp.	9Li207	N488 E495	49.96-49.86		Sagitta otolith	Right	10.23		3.71	2.57	0.081
Menticirrhus sp.	9Li207	N493 E499	49.95-49.85		Sagitta otolith	Left			3.14	2.21	0.056
Menticirrhus sp.	9Li207	N586 E441	48.89-48.79		Sagitta otolith	Left	16.82		9.28	4.37	0.673
Micropogonias undulatus	9Li207	N576 E453	48.83-48.73		Sagitta otolith	Left	9.88		7.25	4.58	0.225
Micropogonias undulatus	9Li207	N576 E453	48.83-48.73		Sagitta otolith	Right	10.03		7.75	4.36	0.265
Micropogonias undulatus	9Li207	N576 E453	49.03-48.93		Sagitta otolith	Right	10.9		8.2	5.18	0.379
Micropogonias undulatus	9Li207	N584 E466	48.78-48.68		Sagitta otolith	Right	18.42		6.85	4.15	0.468
Micropogonias undulatus	9Li207	N587 E437	48.93-48.83		Sagitta otolith	Right	11.16		8.2	5.06	0.365
Micropogonias undulatus	9Li207	TP VI	48.78-48.68		Sagitta otolith	Left	8.33		6.35	3.41	0.149
Micropogonias undulatus	9Li21	Theta	17-27		Sagitta otolith	Left	4.58		3.31	2.03	0.024
Micropogonias undulatus	9Li21	Theta	17-27		Sagitta otolith	Right	7.4		5.29	3.41	0.104
Micropogonias undulatus	9Li21	Zeta	0-10		Sagitta otolith	Left	6.97		5	2.82	0.089
Micropogonias undulatus	9Li229	N179 E84	0-10		Sagitta otolith	Left	9.28		6.69	3.93	0.202
Micropogonias undulatus	9Li229	N179 E84	0-10		Sagitta otolith	Left	8.55		6.51	3.61	0.16
Micropogonias undulatus	9Li229	N179 E84	0-10		Sagitta otolith	Right	8.71		6.52	3.81	0.162
Micropogonias undulatus	9Li229	N179 E84	0-10		Sagitta otolith	Right	8.14		6.37	3.4	0.143
Micropogonias undulatus	9Li229	N179 E84	0-10		Sagitta otolith	Right	6.65		5.03	3.01	0.08
Micropogonias undulatus	9Li229	N179 E84	10-20		Sagitta otolith	Left	8.38		6.07	3.5	0.147
Micropogonias undulatus	9Li229	N179 E84	10-20		Sagitta otolith	Left	8.29		6.07	3.63	0.145
Micropogonias undulatus	9Li229	N179 E84	10-20		Sagitta otolith	Left	8.42		6.23	3.8	0.15
Micropogonias undulatus	9Li229	N179 E84	10-20		Sagitta otolith	Left	8.31		6.21	3.36	0.149
Micropogonias undulatus	9Li229	N179 E84	10-20		Sagitta otolith	Left	6.6		4.81	2.55	0.07
Micropogonias undulatus	9Li229	N179 E84	10-20		Sagitta otolith	Left	8.77		6.14	3.63	0.151
Micropogonias undulatus	9Li229	N179 E84	10-20		Sagitta otolith	Left	7.75		5.67	3.05	0.12
Micropogonias undulatus	9Li229	N179 E84	10-20		Sagitta otolith	Left	7.62		5.81	3.29	0.129
Micropogonias undulatus	9Li229	N179 E84	10-20		Sagitta otolith	Left	8.79		6.25	3.38	0.179
Micropogonias undulatus	9Li229	N179 E84	10-20		Sagitta otolith	Left	8.8		6.27	3.87	0.179

APPENDIX C—(*Continued*)

Taxon	Site #	Unit	Level	Feature	Element	Side	Len, mm	Brt, mm	Wdh, mm	Th, mm	Wght, g
Micropogonias undulatus	9Li229	N179 E84	10-20		Sagitta otolith	Left	8.21		6.2	3.67	0.138
Micropogonias undulatus	9Li229	N179 E84	10-20		Sagitta otolith	Left	5.44		3.97	2.14	0.039
Micropogonias undulatus	9Li229	N179 E84	10-20		Sagitta otolith	Right	8.44		5.85	3.78	0.153
Micropogonias undulatus	9Li229	N179 E84	10-20		Sagitta otolith	Right	8.68		6.26	3.85	0.173
Micropogonias undulatus	9Li229	N179 E84	10-20		Sagitta otolith	Right	9.03		6.5	3.82	0.191
Micropogonias undulatus	9Li229	N179 E84	10-20		Sagitta otolith	Right	9.9		7.24	4	0.228
Micropogonias undulatus	9Li229	N179 E84	10-20		Sagitta otolith	Right	8.58		6.48	3.65	0.159
Micropogonias undulatus	9Li229	N179 E84	10-20		Sagitta otolith	Right	8.32		6.04	3.49	0.142
Micropogonias undulatus	9Li229	N179 E84	10-20		Sagitta otolith	Right	7.86		5.78	3.32	0.127
Micropogonias undulatus	9Li229	N179 E84	10-20		Sagitta otolith	Right	9.16		6.53	3.79	0.196
Micropogonias undulatus	9Li229	N179 E84	10-20		Sagitta otolith	Right	8.13		5.93	3.18	0.141
Micropogonias undulatus	9Li229	N179 E84	10-20		Sagitta otolith	Right	7.58		5.79	2.91	0.115
Micropogonias undulatus	9Li229	N179 E84	10-20		Sagitta otolith	Right	7.84		5.85	3.32	0.131
Micropogonias undulatus	9Li229	N179 E84	10-20		Sagitta otolith	Right	7.82		5.81	3.14	0.127
Micropogonias undulatus	9Li229	N179 E84	10-20		Sagitta otolith	Right	8.1		6.12	3.15	0.129
Micropogonias undulatus	9Li229	N179 E84	10-20		Sagitta otolith	Right	8.49		6.16	3.49	0.155
Micropogonias undulatus	9Li229	N179 E84	10-20		Sagitta otolith	Right	6.48		4.72	2.85	0.071
Micropogonias undulatus	9Li229	N179 E84	10-20		Sagitta otolith	Right	4.34		3.31	1.55	0.022
Micropogonias undulatus	9Li229	N179 E84	10-20		Atlas				2.78		
Micropogonias undulatus	9Li229	N179 E84	10-20		Atlas				3.21		
Micropogonias undulatus	9Li229	N179 E84	10-20		Atlas				2.75		
Micropogonias undulatus	9Li229	N179 E84	10-20		Atlas				3.44		
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Left	10.51		7.61	4.2	0.301
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Left	8		5.71	3.34	0.132
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Left	8.43		6.16	3.55	0.145
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Left	8.03		6.06	3.47	0.144
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Left	7.02		5.41	2.99	0.099
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Left	8.33		5.94	3.57	0.159
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Left	8.36		5.89	3.52	0.134
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Left	9.68		6.01	3.85	0.179
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Left	8.7		6.02	3.68	0.172
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Left	7.77		5.45	2.93	0.112
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Left	8.31		6.01	3.05	0.148
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Left	7.46		5.55	3.01	0.108
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Left	6.73		4.83	3.09	0.077
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Left	7.87		5.85	3.39	0.134

APPENDIX C—(*Continued*)

Taxon	Site #	Unit	Level	Feature	Element	Side	Len, mm	Brt, mm	Wdh, mm	Th, mm	Wght, g
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Left	8.03		5.86	2.97	0.124
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Left	7.79		5.84	2.61	0.128
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Left	7.75		5.81	3.28	0.119
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Left	7.42		5.44	3.16	0.115
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Left	8.25		6.17	3.4	0.163
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Left	7.83		5.96	3.49	0.137
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Left	7.81		5.71	3.45	0.142
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Left	8.35		6.23	3.58	0.153
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Left	9.07		6.5	3.72	0.19
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Left	8.32		5.88	3.7	0.15
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Right	8.56		6.17	3.35	0.16
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Right	9.6		6.98	3.99	0.238
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Right	7.98		5.78	3.37	0.13
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Right	7.78		5.85	3.25	0.123
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Right	8.17		5.76	3.54	0.141
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Right	8.29		6.06	3.69	0.171
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Right	9.09		6.47	3.64	0.186
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Right	7.72		5.88	3.42	0.131
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Right	7.6		5.76	3.02	0.105
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Right	8.79		6.4	3.62	0.159
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Right	7.76		5.86	3.07	0.128
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Right	7.68		5.59	3.37	0.123
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Right	7.46		5.45	3.1	0.111
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Right	7.92		5.68	3.6	0.125
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Right	9.23		7.02	4.47	0.242
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Right	8.15		6.07	3.37	0.136
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Right	8.44		6.26	3.3	0.142
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Right	7.13		5.43	3.2	0.112
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Right	8.95		6.45	3.63	0.17
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Right	7.76		5.74	3.01	0.114
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Right	9.96		7.44	4.63	0.276
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Right	7.23		5.88	3.37	0.118
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Right	6.68		4.55	2.9	0.07
Micropogonias undulatus	9Li229	N179 E84	20-30		Sagitta otolith	Right	6.89		5.22	3.12	0.084
Micropogonias undulatus	9Li229	N179 E84	20-30		Atlas				3.23		0.019
Micropogonias undulatus	9Li229	N179 E84	20-30		Atlas				3		

APPENDIX C—(*Continued*)

Taxon	Site #	Unit	Level	Feature	Element	Side	Len, mm	Brt, mm	Wdh, mm	Th, mm	Wght, g
Micropogonias undulatus	9Li229	N179 E84	20-30		Atlas				3.45		
Micropogonias undulatus	9Li229	N179 E84	20-30		Atlas				2.78		
Micropogonias undulatus	9Li229	N179 E84	30-40		Sagitta otolith	Left	6.91		5.41	3.16	0.098
Micropogonias undulatus	9Li229	N179 E84	30-40		Sagitta otolith	Left	6.38		6.01	3.42	0.154
Micropogonias undulatus	9Li229	N179 E84	30-40		Sagitta otolith	Left	7.81		5.89	3.28	0.13
Micropogonias undulatus	9Li229	N179 E84	30-40		Sagitta otolith	Left	7.36		5.38	3.32	0.112
Micropogonias undulatus	9Li229	N179 E84	30-40	2	Sagitta otolith	Left	6.29		4.76	3	0.062
Micropogonias undulatus	9Li229	N179 E84	30-40		Sagitta otolith	Right	7.91		6.06	3.3	0.133
Micropogonias undulatus	9Li229	N179 E84	30-40		Sagitta otolith	Right	7.74		5.65	3.15	0.121
Micropogonias undulatus	9Li229	N179 E84	30-40		Sagitta otolith	Right	6.64		5.07	2.88	0.073
Micropogonias undulatus	9Li229	N179 E84	30-40		Sagitta otolith	Right	7.01		5.51	3.22	0.095
Micropogonias undulatus	9Li229	N179 E84	30-40		Sagitta otolith	Right	7.34		5.47	3.25	0.104
Micropogonias undulatus	9Li229	N179 E84	30-40		Sagitta otolith	Right	5.64		4.24	2.12	0.044
Micropogonias undulatus	9Li229	N179 E84	30-40	2		Right	6.53		4.65	2.45	0.059
Micropogonias undulatus	9Li229	N179 E84	30-40		Atlas				2.28		0.007
Micropogonias undulatus	9Li229	N179 E84	30-40	2	Atlas				2.56		0.006
Micropogonias undulatus	9Li229	N179 E84	40-50	2	Sagitta otolith	Left			5.04	2.57	0.064
Micropogonias undulatus	9Li229	N179 E84	60-70		Sagitta otolith	Right	6.98		4.9	3.06	0.074
Micropogonias undulatus	9Li229	N191 E84	0-10		Sagitta otolith	Left	7.75		5.49	3.52	0.117
Micropogonias undulatus	9Li229	N191 E84	0-10		Sagitta otolith	Left			7.13	4.12	0.242
Micropogonias undulatus	9Li229	N191 E84	0-10		Sagitta otolith	Left			5.68	3.29	0.115
Micropogonias undulatus	9Li229	N191 E84	0-10		Sagitta otolith	Right	8.25		6	3.56	0.137
Micropogonias undulatus	9Li229	N191 E84	0-10		Sagitta otolith	Right	8.21		5.9	3.38	0.139
Micropogonias undulatus	9Li229	N191 E84	10-20		Sagitta otolith	Right	8.79		6.62	3.57	0.177
Micropogonias undulatus	9Li229	N191 E84	20-30		Sagitta otolith	Left	5.76		4.4	2.37	0.048
Micropogonias undulatus	9Li229	N191 E84	20-30		Sagitta otolith	Left	7.48		5.51	3.44	0.119
Micropogonias undulatus	9Li229	N191 E84	20-30		Sagitta otolith	Right	5.81		4.29	2.48	0.05
Micropogonias undulatus	9Li229	N191 E84	30-40		Sagitta otolith	Left	6.74		4.99	3.04	0.081
Micropogonias undulatus	9Li229	N191 E84	30-40		Sagitta otolith	Right	6.32		4.55	2.64	0.063
Micropogonias undulatus	9Li229	N191 E84	30-40		Atlas				2.54		0.01
Micropogonias undulatus	9Li229	N191 E84	40-50 shell		Sagitta otolith	Left	6.42		4.79	3.03	0.072
Micropogonias undulatus	9Li229	N191 E84	40-50 shell		Sagitta otolith	Right	6.98		4.75	2.88	0.077
Micropogonias undulatus	9Li230	Iota	0-10		Sagitta otolith	Right	8.66		5.97	3.35	0.158
Micropogonias undulatus	9Li230	Iota	10-20		Sagitta otolith	Left	5.91		4.41	2.32	0.049
Micropogonias undulatus	9Li230	Iota	30-40		Sagitta otolith	Right	7.05		5.09	3.05	0.095
Micropogonias undulatus	9Li1637	TP 1	30-40		Sagitta otolith	Left	8.66		6.26	3.53	0.166

APPENDIX C—(*Continued*)

Taxon	Site #	Unit	Level	Feature	Element	Side	Len, mm	Brt, mm	Wdh, mm	Th, mm	Wght, g
Micropogonias undulatus	9Li1637	TP 1	60-70		Sagitta otolith	Left	7.83		5.67	2.94	0.12
Micropogonias undulatus	9Li1637	TP 1	60-70		Sagitta otolith	Right	8.89		6.55	3.65	0.181
Micropogonias undulatus	9Li1637	TP 1	70-80		Sagitta otolith	Left	7.85		5.71	3.3	0.123
Micropogonias undulatus	9Li1637	TP 1	70-80		Sagitta otolith	Right	9.06		6.56	3.81	0.195
Micropogonias undulatus	9Li1637	TP 1	70-80		Sagitta otolith	Right	7.65		5.49	3.45	0.126
Micropogonias undulatus	9Li1637	TP 1	70-80		Sagitta otolith	Right	7.81		5.73	2.95	0.114
Micropogonias undulatus	9Li1637	TP 1	80-90		Sagitta otolith	Left	7.76		5.69	3.29	0.131
Micropogonias undulatus	9Li1637	TP 1	80-90		Sagitta otolith	Right	7.68		5.77	3.23	0.117
Micropogonias undulatus	9Li1637	TP II	20-30		Sagitta otolith	Left	8.24		6.01	3.51	0.149
Mugil sp.	9Li21	Alpha	20-30		Atlas				3.48		
Mugil sp.	9Li21	Alpha	30-31		Atlas				2.85		0.028
Mugil sp.	9Li21	Alpha	30-31		Atlas				2.05		0.01
Mugil sp.	9Li21	Alpha	41-51		Atlas				2.37		
Mugil sp.	9Li21	Alpha Baulk	9-25		Atlas				1.88		
Mugil sp.	9Li21	Alpha Baulk	9-25		Atlas				2.31		
Mugil sp.	9Li21	Beta	15-25		Atlas				2.32		
Mugil sp.	9Li21	Beta	45-55		Atlas				2.97		
Mugil sp.	9Li21	Beta	45-55		Atlas				2.5		
Mugil sp.	9Li21	Beta Baulk	25-35		Atlas				2.25		
Mugil sp.	9Li21	Gamma	20-35		Atlas				1.83		
Mugil sp.	9Li21	N501 E80	10-20		Atlas				2		
Mugil sp.	9Li21	N501 E80	20-30		Atlas				2.17		
Mugil sp.	9Li21	N501 E80	60-70		Atlas				2.13		
Mugil sp.	9Li21	N501 E80	70-80		Atlas				2.4		
Mugil sp.	9Li21	N501 E80	70-80		Atlas				3.53		
Mugil sp.	9Li21	Theta	0-17		Atlas				2.59		
Mugil sp.	9Li21	Theta	17-27		Atlas				2.19		
Mugil sp.	9Li21	Theta	17-27		Atlas				2.65		
Mugil sp.	9Li21	Theta	27-37		Atlas				3.64		
Mugil sp.	9Li21	Theta	27-37		Atlas				2.56		
Mugil sp.	9Li21	Zeta	30-40		Atlas				2.37		0.017
Mugil sp.	9Li21	Zeta	50-60		Atlas				5.25		
Mugil sp.	9Li229	N165 E159	0-10		Atlas				2.2		
Mugil sp.	9Li229	N165 E159	50-60 shell		Atlas				3.27		
Mugil sp.	9Li229	N165 E159	50-60 shell		Atlas				2.55		
Mugil sp.	9Li229	N191 E84	0-10		Atlas				3.09		

APPENDIX C—(*Continued*)

Taxon	Site #	Unit	Level	Feature	Element	Side	Len, mm	Brt, mm	Wdh, mm	Th, mm	Wght, g
Mugil sp.	9Li229	N191 E84	10-20		Atlas				2.76		
Mugil sp.	9Li229	N191 E84	10-20		Atlas				3.64		
Mugil sp.	9Li229	N191 E84	20-30		Atlas				3.17		
Mugil sp.	9Li229	N191 E84	20-30		Atlas				3.58		
Mugil sp.	9Li229	N191 E84	20-30		Atlas				2.78		
Mugil sp.	9Li229	N191 E84	20-30		Atlas				3.85		
Mugil sp.	9Li229	N191 E84	20-30		Atlas				3.38		
Mugil sp.	9Li229	N191 E84	20-30		Atlas				2.98		
Mugil sp.	9Li229	N191 E84	30-40		Atlas				4.2		
Mugil sp.	9Li229	N191 E84	30-40		Atlas				3.14		
Mugil sp.	9Li229	N191 E84	30-40		Atlas				3.38		
Mugil sp.	9Li229	N191 E84	30-40		Atlas				3.66		
Mugil sp.	9Li229	N191 E84	30-40		Atlas				2.92		
Mugil sp.	9Li229	N191 E84	30-40		Atlas				2.95		
Mugil sp.	9Li229	N191 E84	30-40		Atlas				3.15		
Mugil sp.	9Li229	N191 E84	30-40		Atlas				2.31		
Mugil sp.	9Li229	N191 E84	30-40		Atlas				3.07		
Mugil sp.	9Li229	N191 E84	30-40		Atlas				3.33		
Mugil sp.	9Li229	N191 E84	30-40		Atlas				2.52		
Mugil sp.	9Li229	N191 E84	40-50 shell		Atlas				2.9		
Mugil sp.	9Li229	N191 E84	40-50 shell		Atlas				3.03		
Mugil sp.	9Li230	Iota	0-10		Atlas				1.93		
Mugil sp.	9Li230	Iota	20-30		Atlas				2.43		
Mugil sp.	9Li1637	TP 1	0-20		Atlas				2.88		
Mugil sp.	9Li1637	TP 1	0-20		Atlas				3.62		
Mugil sp.	9Li1637	TP 1	0-20		Atlas				3.26		
Mugil sp.	9Li1637	TP 1	0-20		Atlas				2.81		
Mugil sp.	9Li1637	TP 1	0-20		Atlas				2.45		
Mugil sp.	9Li1637	TP 1	20-30		Atlas				3.5		
Mugil sp.	9Li1637	TP 1	20-30		Atlas				2.03		
Mugil sp.	9Li1637	TP 1	20-30		Atlas				2.55		
Mugil sp.	9Li1637	TP 1	20-30		Atlas				2.16		
Mugil sp.	9Li1637	TP 1	30-40		Atlas				2.52		
Mugil sp.	9Li1637	TP 1	30-40		Atlas				2.47		
Mugil sp.	9Li1637	TP 1	30-40		Atlas				3.75		
Mugil sp.	9Li1637	TP 1	30-40		Atlas				2.75		

APPENDIX C—(*Continued*)

Taxon	Site #	Unit	Level	Feature	Element	Side	Len, mm	Brt, mm	Wdh, mm	Th, mm	Wght, g
Mugil sp.	9Li1637	TP 1	30-40		Atlas				3.41		
Mugil sp.	9Li1637	TP 1	50-60		Atlas				2.87		
Mugil sp.	9Li1637	TP 1	50-60		Atlas				2.3		
Mugil sp.	9Li1637	TP 1	50-60		Atlas				3.94		
Mugil sp.	9Li1637	TP 1	50-60		Atlas				2.27		
Mugil sp.	9Li1637	TP 1	60-70		Atlas				2.61		
Mugil sp.	9Li1637	TP 1	60-70		Atlas				2.43		
Mugil sp.	9Li1637	TP 1	60-70		Atlas				1.64		
Mugil sp.	9Li1637	TP 1	60-70		Atlas				2.12		
Mugil sp.	9Li1637	TP 1	60-70		Atlas				3.02		
Mugil sp.	9Li1637	TP 1	70-80		Atlas				2.78		
Mugil sp.	9Li1637	TP 1	70-80		Atlas				2.37		
Mugil sp.	9Li1637	TP 1	70-80		Atlas				2.76		
Mugil sp.	9Li1637	TP 1	70-80		Atlas				2.89		
Mugil sp.	9Li1637	TP 1	70-80		Atlas				2.89		
Mugil sp.	9Li1637	TP 1	70-80		Atlas				2.49		
Mugil sp.	9Li1637	TP 1	70-80		Atlas				3.48		
Mugil sp.	9Li1637	TP 1	70-80		Atlas				2.69		
Mugil sp.	9Li1637	TP 1	70-80		Atlas				2.05		
Mugil sp.	9Li1637	TP 1	70-80		Atlas				2.51		
Mugil sp.	9Li1637	TP 1	80-90		Atlas				2.73		
Mugil sp.	9Li1637	TP 1	80-90		Atlas				2.39		
Mugil sp.	9Li1637	TP 1	80-90		Atlas				2.39		
Mugil sp.	9Li1637	TP 1	80-90		Atlas				2.62		
Mugil sp.	9Li1637	TP 1	80-90		Atlas				2.55		
Mugil sp.	9Li1637	TP 1	80-90		Atlas				2.66		
Mugil sp.	9Li1637	TP 1	80-90		Atlas				3.36		
Mugil sp.	9Li1637	TP 1	80-90		Atlas				2.7		
Mugil sp.	9Li1637	TP 1	80-90		Atlas				2.11		
Pogonias cromis	9Li207	N584 E466	48.78-48.68		Sagitta otolith	Left	5.55		4.19	1.29	0.032
Pogonias cromis	9Li207	N584 E466	48.78-48.68		Sagitta otolith	Right	5.22		4.7	1.25	0.024
Pogonias cromis	9Li229	N179 E84	10-20		Sagitta otolith	Left	25.98		18.36	9.99	5.787
Pogonias cromis	9Li229	N191 E84	30-40		Sagitta otolith	Right	7.72		6.59	1.91	0.093
Pogonias cromis	9Li229	N191 E84	30-40		Sagitta otolith	Right	5.69		4.89	1.36	0.033
Sciaenops ocellatus	9Li207	N576 E453	49.13-49.03		Sagitta otolith	Left	17.17		9.19	4.34	0.673
Sciaenops ocellatus	9Li207	N584 E466	48.98-48.88		Sagitta otolith	Right	17.82		9.4	4.72	0.738

APPENDIX C—(*Continued*)

Taxon	Site #	Unit	Level	Feature	Element	Side	Len, mm	Brt, mm	Wdh, mm	Th, mm	Wght, g
Stellifer lanceolatus	9Li21	Zeta	50-60		Atlas				2.01		0.003
Stellifer lanceolatus	9Li21	Zeta		3	Sagitta otolith	Right	4.51		3.04	1.89	0.027
Stellifer lanceolatus	9Li229	N179 E84	10-20		Sagitta otolith	Left	5.23		3.48	2.12	0.04
Stellifer lanceolatus	9Li229	N179 E84	10-20		Sagitta otolith	Left	5.29		3.36	2.14	0.039
Stellifer lanceolatus	9Li229	N179 E84	10-20		Sagitta otolith	Right	4.47		3.11	1.98	0.028
Stellifer lanceolatus	9Li229	N179 E84	10-20		Lapillis otolith	Right	5.26		4.39	1.86	0.042
Stellifer lanceolatus	9Li229	N179 E84	20-30		Sagitta otolith	Left	5.69		3.65	2.4	0.048
Stellifer lanceolatus	9Li229	N179 E84	20-30		Sagitta otolith	Right	5.16		3.72	2.29	0.044
Stellifer lanceolatus	9Li229	N179 E84	20-30		Sagitta otolith	Right	5.81		3.88	2.41	0.055
Stellifer lanceolatus	9Li229	N179 E84	20-30		Lapillis otolith	Right			4.55	1.9	0.143
Stellifer lanceolatus	9Li230	Iota	20-30		Atlas				2.7		
Stellifer lanceolatus	9Li1637	TP 1	50-60		Sagitta otolith	Left	5.53		3.7	2.4	0.049
Stellifer lanceolatus	9Li1637	TP 1	60-70		Sagitta otolith	Right	4.31		2.75	1.75	0.028
Stellifer lanceolatus	9Li1637	TP 1	60-70		Lapillis otolith	Right	4.72		3.93	1.64	0.035
Stellifer lanceolatus	9Li1637	TP 1	60-70		Lapillis otolith	Right	5.84		4.45	1.97	0.057
Stellifer lanceolatus	9Li1637	TP 1	70-80		Lapillis otolith	Left	5.27		4.32	1.8	0.043
Stellifer lanceolatus	9Li1637	TP 1	70-80		Lapillis otolith	Left	5.41		4.45	1.82	0.038
Stellifer lanceolatus	9Li1637	TP 1	70-80		Sagitta otolith	Right	5.59		3.79	2.39	0.052
Stellifer lanceolatus	9Li1637	TP 1	70-80		Atlas				2.69		
Stellifer lanceolatus	9Li1637	TP 1	70-80		Atlas				2.63		
Stellifer lanceolatus	9Li1637	TP 1	70-80		Atlas				2.77		
Stellifer lanceolatus	9Li1637	TP 1	80-90		Sagitta otolith	Left	5.3		3.59	2.29	0.043
Stellifer lanceolatus	9Li1637	TP 1	80-90		Sagitta otolith	Left	4.43		3.19	2.06	0.034
Stellifer lanceolatus	9Li1637	TP 1	80-90		Sagitta otolith	Left	5.09		3.85	2.61	0.048
Stellifer lanceolatus	9Li1637	TP 1	80-90		Sagitta otolith	Left	5.22		3.5	2.1	0.038
Stellifer lanceolatus	9Li1637	TP 1	80-90		Sagitta otolith	Left	4.64		3.17	1.97	0.028
Stellifer lanceolatus	9Li1637	TP 1	80-90		Sagitta otolith	Left	5.09		3.22	2	0.033
Stellifer lanceolatus	9Li1637	TP 1	80-90		Lapillis otolith	Left	5.41		4.57	1.95	0.047
Stellifer lanceolatus	9Li1637	TP 1	80-90		Lapillis otolith	Left	5.18		4.31	1.87	0.042
Stellifer lanceolatus	9Li1637	TP 1	80-90		Lapillis otolith	Left	5.04		4	1.66	0.034
Stellifer lanceolatus	9Li1637	TP 1	80-90		Lapillis otolith	Left					
Stellifer lanceolatus	9Li1637	TP 1	80-90		Sagitta otolith	Right	5.9		3.94	2.54	0.058
Stellifer lanceolatus	9Li1637	TP 1	80-90		Sagitta otolith	Right	5.37		3.63	2.23	0.043
Stellifer lanceolatus	9Li1637	TP 1	80-90		Sagitta otolith	Right	5.15		3.48	2.27	0.039
Stellifer lanceolatus	9Li1637	TP 1	80-90		Sagitta otolith	Right	4.76		3.11	2.17	0.032
Stellifer lanceolatus	9Li1637	TP 1	80-90		Sagitta otolith	Right	5.62		3.54	2.44	0.045

APPENDIX C—(*Continued*)

Taxon	Site #	Unit	Level	Feature	Element	Side	Len, mm	Brt, mm	Wdh, mm	Th, mm	Wght, g
Stellifer lanceolatus	9Li1637	TP 1	80-90		Lapillis otolith	Right	5.15		4.11	1.73	0.037
Stellifer lanceolatus	9Li1637	TP 1	80-90		Lapillis otolith	Right	5.6		4.76	2.02	0.054
Stellifer lanceolatus	9Li1637	TP 1	80-90		Lapillis otolith	Right	5.15		4.28	1.77	0.037
Stellifer lanceolatus	9Li1637	TP 1	80-90		Lapillis otolith	Right	4.55		3.78	1.59	0.028
Stellifer lanceolatus	9Li1637	TP 1	80-90		Atlas				2.78		
Stellifer lanceolatus	9Li1637	TP 1	80-90		Atlas				2.48		
Stellifer lanceolatus	9Li1637	TP 1	80-90		Atlas				2.57		
Stellifer lanceolatus	9Li1637	TP II	10-20		Sagitta otolith	Left	5.13		3.41	2.21	0.039
Stellifer lanceolatus	9Li1637	TP II	10-20		Atlas				2.59		

APPENDIX D

MAMMAL MEASUREMENTS

Taxon	Site	Unit	Level	Feature	Element	Side	Dimension	Measurement, mm
Odocoileus virginianus	9Li21	N179 E84	30-40	2	Ulnar carpal	Right	GB	19.4
Procyon lotor	9Li230	Iota	10-20		Mandible	Right	TL	70.06
Odocoileus virginianus	9Li230	Iota	10-20		Calcaneus	Left	GL	82.51
							GB	28.09
Odocoileus virginianus	9Li230	Iota	10-20		Radius, distal	Right	Bd	28.23
Odocoileus virginianus	9Li230	Iota	10-20		Radius, proximal	Right	Bp	31.82
Odocoileus virginianus	9Li230	Iota	10-20		Radius, proximal	Left	Bp	31.58
Odocoileus virginianus	9Li230	Iota	10-20		Sacrum		BFcr	34.02
							HFcr	16.09
Odocoileus virginianus	9Li229	N191E84	40-50		Radius, distal	Left	Bfd	27.7
Canis familiaris	9Li229	N191E84	20-30		Lower P3	Right	B	4.93
							L	9.56
Odocoileus virginianus	9Li21	N501 E80	50-60		2nd and 3rd carpal	Left	GB	19.68
Odocoileus virginianus	9Li21	N501 E80	70-80		Radius, proximal	Left	Bp	34.46
Odocoileus virginianus	9Li21	Epsilon	0-10		Radius, distal	Right	Bd	33.03
Odocoileus virginianus	9Li21	Epsilon	20-30		2nd and 3rd carpal	Right	GB	19.89

APPENDIX E

OYSTER MEASUREMENTS

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8767	Alpha	0-10		85.13	48.39
9Li21	8767	Alpha	0-10		96.44	59.88
9Li21	8767	Alpha	0-10		70.82	52.95
9Li21	8767	Alpha	0-10		83.66	43.96
9Li21	8767	Alpha	0-10		83.58	40.76
9Li21	8767	Alpha	0-10		106.5	39.85
9Li21	8767	Alpha	0-10		46.28	18.65
9Li21	8767	Alpha	0-10		71.15	50.47
9Li21	8767	Alpha	0-10		63.49	31.36
9Li21	8767	Alpha	0-10		53.32	34.47
9Li21	8767	Alpha	0-10		40.21	32.06
9Li21	8767	Alpha	0-10		34.84	25.08
9Li21	8767	Alpha	0-10		69.93	46.16
9Li21	8767	Alpha	0-10		60.1	44.86
9Li21	8767	Alpha	0-10		70.94	50.08
9Li21	8767	Alpha	0-10		52.92	43.2
9Li21	8767	Alpha	0-10		36.33	18.07
9Li21	8767	Alpha	0-10		43.53	23.16
9Li21	8767	Alpha	0-10		64.82	41.49
9Li21	8767	Alpha	0-10		99.91	36.57
9Li21	8767	Alpha	0-10		35.7	24.27
9Li21	8767	Alpha	0-10		53.54	43.52
9Li21	8767	Alpha	0-10		95.69	55.49
9Li21	8767	Alpha	0-10		35.07	21.07
9Li21	8767	Alpha	0-10		84.5	53.17
9Li21	8767	Alpha	0-10		85.86	57.81
9Li21	8767	Alpha	0-10		37.29	9.79
9Li21	8767	Alpha	0-10		69.49	37.3
9Li21	8767	Alpha	0-10		43.43	40.74
9Li21	8767	Alpha	0-10		72.26	38.1
9Li21	8767	Alpha	0-10		34.08	23.61
9Li21	8767	Alpha	0-10		58.54	41.04
9Li21	8767	Alpha	0-10		35.19	19.59
9Li21	8767	Alpha	0-10		80.56	48.42
9Li21	8767	Alpha	0-10		37.48	26.97
9Li21	8767	Alpha	0-10		29.59	19.33
9Li21	8767	Alpha	0-10		40.77	27.73
9Li21	8770	Alpha	10-20		95.71	32.2
9Li21	8770	Alpha	10-20		79.69	50.37
9Li21	8770	Alpha	10-20		71.45	43.67
9Li21	8770	Alpha	10-20		80.86	37.8
9Li21	8770	Alpha	10-20		101.05	39.73
9Li21	8770	Alpha	10-20		95.75	56.65
9Li21	8770	Alpha	10-20		34.99	43.76
9Li21	8770	Alpha	10-20		72.09	40.66
9Li21	8770	Alpha	10-20		115.9	74.78
9Li21	8770	Alpha	10-20		54.66	33.55
9Li21	8770	Alpha	10-20		133.51	63.5
9Li21	8770	Alpha	10-20		53.62	31.71

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8770	Alpha	10-20		73.65	52.8
9Li21	8770	Alpha	10-20		87.6	40.62
9Li21	8770	Alpha	10-20		85.07	58.3
9Li21	8770	Alpha	10-20		55.57	29.64
9Li21	8770	Alpha	10-20		74.25	34.23
9Li21	8770	Alpha	10-20		67.25	41.47
9Li21	8770	Alpha	10-20		84.8	36.13
9Li21	8770	Alpha	10-20		90.16	49.62
9Li21	8770	Alpha	10-20		95.84	52.33
9Li21	8770	Alpha	10-20		54.34	35.53
9Li21	8770	Alpha	10-20		102.03	43.79
9Li21	8770	Alpha	10-20		80.68	46.5
9Li21	8770	Alpha	10-20		41.59	33.49
9Li21	8770	Alpha	10-20		42.64	34.94
9Li21	8770	Alpha	10-20		65.32	33.72
9Li21	8770	Alpha	10-20		38.61	29.52
9Li21	8770	Alpha	10-20		36.47	18.63
9Li21	8770	Alpha	10-20		94.02	36.06
9Li21	8770	Alpha	10-20		38.45	26.52
9Li21	8770	Alpha	10-20		87.79	49.96
9Li21	8770	Alpha	10-20		104.46	61.85
9Li21	8770	Alpha	10-20		61.81	18.84
9Li21	8770	Alpha	10-20		59.15	30.1
9Li21	8770	Alpha	10-20		76.66	41.43
9Li21	8770	Alpha	10-20		86.19	39.29
9Li21	8770	Alpha	10-20		70.75	25.28
9Li21	8770	Alpha	10-20		52.36	38.77
9Li21	8770	Alpha	10-20		54.53	37.52
9Li21	8770	Alpha	10-20		59.3	31.63
9Li21	8770	Alpha	10-20		68.28	31.45
9Li21	8770	Alpha	10-20		66.61	38.49
9Li21	8770	Alpha	10-20		117.6	50.99
9Li21	8770	Alpha	10-20		51.13	20.03
9Li21	8770	Alpha	10-20		109.63	57
9Li21	8770	Alpha	10-20		79.6	42.05
9Li21	8770	Alpha	10-20		58.27	26.38
9Li21	8770	Alpha	10-20		57.74	42.61
9Li21	8770	Alpha	10-20		61.29	38.04
9Li21	8770	Alpha	10-20		103.35	51.82
9Li21	8770	Alpha	10-20		98.66	59.46
9Li21	8770	Alpha	10-20		50.44	47.03
9Li21	8770	Alpha	10-20		90.21	43.85
9Li21	8770	Alpha	10-20		37.17	25.86
9Li21	8770	Alpha	10-20		46.85	35.68
9Li21	8770	Alpha	10-20		83.62	48.65
9Li21	8770	Alpha	10-20		51.32	35.36
9Li21	8770	Alpha	10-20		43.32	19.97
9Li21	8770	Alpha	10-20		41.59	21.79
9Li21	8770	Alpha	10-20		95.45	49.72
9Li21	8770	Alpha	10-20		40.53	25.7

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8770	Alpha	10-20		53.31	37.87
9Li21	8770	Alpha	10-20		97.94	56.37
9Li21	8770	Alpha	10-20		44.37	37.03
9Li21	8770	Alpha	10-20		48.89	24.49
9Li21	8770	Alpha	10-20		99.34	41.8
9Li21	8770	Alpha	10-20		51.63	32.92
9Li21	8770	Alpha	10-20		46.19	38.84
9Li21	8770	Alpha	10-20		30.68	18.03
9Li21	8770	Alpha	10-20		59.23	32.97
9Li21	8770	Alpha	10-20		59	36.27
9Li21	8770	Alpha	10-20		27.56	16.62
9Li21	8770	Alpha	10-20		63.73	35.59
9Li21	8770	Alpha	10-20		55.41	47.73
9Li21	8770	Alpha	10-20		28.68	23.31
9Li21	8770	Alpha	10-20		98.96	73
9Li21	8770	Alpha	10-20		56.55	28.05
9Li21	8770	Alpha	10-20		56.06	38.47
9Li21	8770	Alpha	10-20		73.6	34.92
9Li21	8770	Alpha	10-20		69.56	55.52
9Li21	8770	Alpha	10-20		75.45	46.31
9Li21	8770	Alpha	10-20		33.36	26.45
9Li21	8770	Alpha	10-20		33.57	23.29
9Li21	8770	Alpha	10-20		46.53	26.05
9Li21	8770	Alpha	10-20		64.22	32.22
9Li21	8770	Alpha	10-20		70.66	37.94
9Li21	8770	Alpha	10-20		87.12	59.22
9Li21	8770	Alpha	10-20		59.28	33.02
9Li21	8770	Alpha	10-20		31.12	20.92
9Li21	8770	Alpha	10-20		84.67	43.16
9Li21	8773	Alpha	20-30		88.75	37.51
9Li21	8773	Alpha	20-30		57.53	28.26
9Li21	8773	Alpha	20-30		50.84	28.14
9Li21	8773	Alpha	20-30		90.89	35.86
9Li21	8773	Alpha	20-30		126.65	51.4
9Li21	8773	Alpha	20-30		83.27	41.99
9Li21	8773	Alpha	20-30		80.05	36.06
9Li21	8773	Alpha	20-30		75.7	38.45
9Li21	8773	Alpha	20-30		115.28	47.87
9Li21	8773	Alpha	20-30		113.24	58.43
9Li21	8773	Alpha	20-30		70.84	29.23
9Li21	8773	Alpha	20-30		48.2	31.96
9Li21	8773	Alpha	20-30		65.96	39.63
9Li21	8773	Alpha	20-30		66.24	44.3
9Li21	8773	Alpha	20-30		54.25	32.84
9Li21	8773	Alpha	20-30		92.35	38.32
9Li21	8773	Alpha	20-30		117.59	60.79
9Li21	8773	Alpha	20-30		50.42	28.95
9Li21	8773	Alpha	20-30		125.5	56.72
9Li21	8773	Alpha	20-30		59.95	34.68
9Li21	8773	Alpha	20-30		80.28	46.32

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8773	Alpha	20-30		62.6	50.32
9Li21	8773	Alpha	20-30		88.19	47.52
9Li21	8773	Alpha	20-30		48.14	36.02
9Li21	8773	Alpha	20-30		89.65	38.3
9Li21	8773	Alpha	20-30		101.55	48.76
9Li21	8773	Alpha	20-30		87.72	50.42
9Li21	8773	Alpha	20-30		86.07	50.43
9Li21	8773	Alpha	20-30		83.72	54.94
9Li21	8773	Alpha	20-30		91.2	72.79
9Li21	8773	Alpha	20-30		76.38	36.44
9Li21	8773	Alpha	20-30		98.7	54.99
9Li21	8773	Alpha	20-30		103.49	41.92
9Li21	8773	Alpha	20-30		86.6	60.65
9Li21	8773	Alpha	20-30		69.44	47.19
9Li21	8773	Alpha	20-30		68.59	40.54
9Li21	8773	Alpha	20-30		58.56	43.35
9Li21	8773	Alpha	20-30		69.79	47.89
9Li21	8773	Alpha	20-30		63.52	41.85
9Li21	8773	Alpha	20-30		79.2	30.81
9Li21	8773	Alpha	20-30		106.03	67.63
9Li21	8773	Alpha	20-30		34.02	41.67
9Li21	8773	Alpha	20-30		63.43	42.92
9Li21	8773	Alpha	20-30		81.68	36.81
9Li21	8773	Alpha	20-30		58.83	35.42
9Li21	8773	Alpha	20-30		79.56	38.12
9Li21	8773	Alpha	20-30		84.95	52.73
9Li21	8773	Alpha	20-30		79.44	25.91
9Li21	8773	Alpha	20-30		65.25	45.96
9Li21	8773	Alpha	20-30		72.72	51.55
9Li21	8773	Alpha	20-30		64.13	41.86
9Li21	8773	Alpha	20-30		105.04	39.96
9Li21	8773	Alpha	20-30		70.26	31.04
9Li21	8773	Alpha	20-30		57.37	31.1
9Li21	8773	Alpha	20-30		77.95	57.51
9Li21	8773	Alpha	20-30		75.22	35.44
9Li21	8773	Alpha	20-30		59.07	49.71
9Li21	8773	Alpha	20-30		66.94	35.58
9Li21	8773	Alpha	20-30		62.42	27.78
9Li21	8773	Alpha	20-30		70.91	35.42
9Li21	8773	Alpha	20-30		67.48	34.66
9Li21	8773	Alpha	20-30		69.1	45.39
9Li21	8773	Alpha	20-30		49.41	36.59
9Li21	8773	Alpha	20-30		57.47	38.18
9Li21	8773	Alpha	20-30		106.35	46.09
9Li21	8773	Alpha	20-30		58.71	34.52
9Li21	8773	Alpha	20-30		58.32	34.16
9Li21	8773	Alpha	20-30		62.24	31.63
9Li21	8773	Alpha	20-30		74.04	41.84
9Li21	8773	Alpha	20-30		100.23	45.62
9Li21	8773	Alpha	20-30		97.64	33.23

APPENDIX E—(*Continued*)

Site #	**Bag No.**	**Unit**	**Level**	**Feature**	**Height, mm**	**Length, mm**
9Li21	8773	Alpha	20-30		80.12	44.57
9Li21	8773	Alpha	20-30		67.34	36.37
9Li21	8773	Alpha	20-30		71.51	28.32
9Li21	8773	Alpha	20-30		64.62	42.56
9Li21	8773	Alpha	20-30		81.3	39.96
9Li21	8773	Alpha	20-30		87.24	31.87
9Li21	8773	Alpha	20-30		72.36	35.32
9Li21	8773	Alpha	20-30		90.35	51.4
9Li21	8773	Alpha	20-30		65.12	32.89
9Li21	8773	Alpha	20-30		52.34	35.94
9Li21	8773	Alpha	20-30		97.19	32.79
9Li21	8773	Alpha	20-30		49.09	25.32
9Li21	8773	Alpha	20-30		56.64	35.93
9Li21	8773	Alpha	20-30		73.73	41.2
9Li21	8773	Alpha	20-30		56.53	27.44
9Li21	8773	Alpha	20-30		49.25	31.03
9Li21	8773	Alpha	20-30		76.4	33.25
9Li21	8773	Alpha	20-30		79.3	44.06
9Li21	8773	Alpha	20-30		55.97	31.26
9Li21	8773	Alpha	20-30		51.71	41.22
9Li21	8773	Alpha	20-30		56.45	24.39
9Li21	8773	Alpha	20-30		73	40.66
9Li21	8773	Alpha	20-30		70.05	29.35
9Li21	8773	Alpha	20-30		74.53	45.5
9Li21	8773	Alpha	20-30		82.69	32.01
9Li21	8773	Alpha	20-30		51.5	34.47
9Li21	8773	Alpha	20-30		53.36	32.48
9Li21	8773	Alpha	20-30		45.51	37.7
9Li21	8773	Alpha	20-30		46.04	28.71
9Li21	8773	Alpha	20-30		74.86	41.94
9Li21	8776	Alpha	30-31		91.35	37.72
9Li21	8776	Alpha	30-31		74.81	46.48
9Li21	8776	Alpha	30-31		75.69	40.06
9Li21	8776	Alpha	30-31		71.32	33.12
9Li21	8776	Alpha	30-31		72.93	36.18
9Li21	8776	Alpha	30-31		57.76	30
9Li21	8776	Alpha	30-31		116.04	58.91
9Li21	8776	Alpha	30-31		119.91	45.7
9Li21	8776	Alpha	30-31		115.14	46.68
9Li21	8776	Alpha	30-31		83.53	38.89
9Li21	8776	Alpha	30-31		82.6	35.95
9Li21	8776	Alpha	30-31		83.92	34.01
9Li21	8776	Alpha	30-31		94.36	48.46
9Li21	8776	Alpha	30-31		66.64	39.35
9Li21	8776	Alpha	30-31		113.3	51.44
9Li21	8776	Alpha	30-31		89.44	37.61
9Li21	8776	Alpha	30-31		100.03	40.08
9Li21	8776	Alpha	30-31		68.66	39.16
9Li21	8776	Alpha	30-31		98.51	47.49
9Li21	8776	Alpha	30-31		58.15	26.29

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8776	Alpha	30-31		63.43	27.2
9Li21	8776	Alpha	30-31		73.64	29.13
9Li21	8776	Alpha	30-31		38.4	29.25
9Li21	8776	Alpha	30-31		77.78	34.88
9Li21	8776	Alpha	30-31		58.43	33.12
9Li21	8776	Alpha	30-31		76.46	35.18
9Li21	8776	Alpha	30-31		77.74	42.66
9Li21	8776	Alpha	30-31		97.53	60.39
9Li21	8776	Alpha	30-31		96.03	49.34
9Li21	8776	Alpha	30-31		94.14	66.73
9Li21	8776	Alpha	30-31		70.26	32.78
9Li21	8776	Alpha	30-31		48.33	35.05
9Li21	8776	Alpha	30-31		34.3	28.48
9Li21	8776	Alpha	30-31		76.67	34.72
9Li21	8776	Alpha	30-31		129.06	48.55
9Li21	8776	Alpha	30-31		43.04	30.5
9Li21	8776	Alpha	30-31		89.82	43.08
9Li21	8776	Alpha	30-31		71.44	48.42
9Li21	8776	Alpha	30-31		38.1	23.29
9Li21	8776	Alpha	30-31		81.14	52.35
9Li21	8776	Alpha	30-31		100.81	61.71
9Li21	8776	Alpha	30-31		64.77	40.39
9Li21	8776	Alpha	30-31		77.1	42.28
9Li21	8776	Alpha	30-31		83	38.13
9Li21	8776	Alpha	30-31		75.78	34.29
9Li21	8776	Alpha	30-31		72.36	42.28
9Li21	8776	Alpha	30-31		86.34	42.79
9Li21	8776	Alpha	30-31		60.84	34.45
9Li21	8776	Alpha	30-31		41.66	17.66
9Li21	8776	Alpha	30-31		72.4	41.15
9Li21	8776	Alpha	30-31		75.12	47.4
9Li21	8776	Alpha	30-31		79.2	42.09
9Li21	8776	Alpha	30-31		83.39	47.65
9Li21	8776	Alpha	30-31		47.07	21.29
9Li21	8776	Alpha	30-31		95.18	29.03
9Li21	8776	Alpha	30-31		50.81	26.1
9Li21	8776	Alpha	30-31		37.88	24.61
9Li21	8776	Alpha	30-31		50.37	33.6
9Li21	8776	Alpha	30-31		51.11	26.49
9Li21	8776	Alpha	30-31		71.71	44.62
9Li21	8776	Alpha	30-31		32.74	20.75
9Li21	8776	Alpha	30-31		57.63	28.71
9Li21	8776	Alpha	30-31		61.19	26.95
9Li21	8776	Alpha	30-31		44.65	32.59
9Li21	8776	Alpha	30-31		62.44	39.42
9Li21	8776	Alpha	30-31		65.3	37.69
9Li21	8776	Alpha	30-31		67.83	46.15
9Li21	8776	Alpha	30-31		57.61	28.74
9Li21	8776	Alpha	30-31		78.02	40.46
9Li21	8776	Alpha	30-31		51.57	31.89

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8776	Alpha	30-31		91.27	44.97
9Li21	8776	Alpha	30-31		66.76	42.6
9Li21	8776	Alpha	30-31		49.27	25.48
9Li21	8776	Alpha	30-31		40.55	33.24
9Li21	8776	Alpha	30-31		56.26	30.26
9Li21	8776	Alpha	30-31		56.31	26.56
9Li21	8776	Alpha	30-31		57.17	34.48
9Li21	8776	Alpha	30-31		75.8	29.42
9Li21	8776	Alpha	30-31		42.92	25.18
9Li21	8776	Alpha	30-31		44.2	26.26
9Li21	8776	Alpha	30-31		44.15	34.87
9Li21	8776	Alpha	30-31		37.38	25.47
9Li21	8776	Alpha	30-31		33.94	26.07
9Li21	8776	Alpha	30-31		46.36	25.38
9Li21	8776	Alpha	30-31		31.94	25.62
9Li21	8776	Alpha	30-31		32.58	19.68
9Li21	8776	Alpha	30-31		38.62	29.24
9Li21	8776	Alpha	30-31		53.44	27.45
9Li21	8776	Alpha	30-31		32.33	25.6
9Li21	8776	Alpha	30-31		40.61	25.39
9Li21	8776	Alpha	30-31		43.64	18.07
9Li21	8776	Alpha	30-31		35.07	13.37
9Li21	8813	Alpha	31-41		81.69	50.15
9Li21	8813	Alpha	31-41		52.27	32.06
9Li21	8813	Alpha	31-41		77.57	42.87
9Li21	8813	Alpha	31-41		83.57	49.32
9Li21	8813	Alpha	31-41		44.91	33.04
9Li21	8813	Alpha	31-41		86.28	51.78
9Li21	8813	Alpha	31-41		75.42	38.05
9Li21	8813	Alpha	31-41		59.09	39.52
9Li21	8813	Alpha	31-41		80.37	56.15
9Li21	8813	Alpha	31-41		97.64	37.56
9Li21	8813	Alpha	31-41		53.71	36.23
9Li21	8813	Alpha	31-41		77.68	57.95
9Li21	8813	Alpha	31-41		59.18	36.84
9Li21	8813	Alpha	31-41		86.27	49.63
9Li21	8813	Alpha	31-41		95.38	55.77
9Li21	8813	Alpha	31-41		85.2	46.06
9Li21	8813	Alpha	31-41		35.91	27.01
9Li21	8813	Alpha	31-41		75.68	51
9Li21	8813	Alpha	31-41		76.32	42.91
9Li21	8813	Alpha	31-41		68.57	46.38
9Li21	8813	Alpha	31-41		65.91	40.35
9Li21	8813	Alpha	31-41		93.87	62.74
9Li21	8813	Alpha	31-41		124.82	44.78
9Li21	8813	Alpha	31-41		64.82	45.99
9Li21	8813	Alpha	31-41		65.08	44.31
9Li21	8813	Alpha	31-41		77.72	37.66
9Li21	8813	Alpha	31-41		82.51	44.12
9Li21	8813	Alpha	31-41		64.3	48.52

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8813	Alpha	31-41		103.73	67.44
9Li21	8813	Alpha	31-41		81.73	56.47
9Li21	8813	Alpha	31-41		68.16	28.22
9Li21	8813	Alpha	31-41		66.02	43.26
9Li21	8813	Alpha	31-41		48.12	34.31
9Li21	8813	Alpha	31-41		60.16	39.93
9Li21	8813	Alpha	31-41		49.86	35.01
9Li21	8813	Alpha	31-41		51.08	38.09
9Li21	8813	Alpha	31-41		43.53	25.82
9Li21	8813	Alpha	31-41		70.45	36.4
9Li21	8813	Alpha	31-41		41.01	30.38
9Li21	8813	Alpha	31-41		42.8	30.83
9Li21	8813	Alpha	31-41		50.37	34.08
9Li21	8813	Alpha	31-41		64.41	39.61
9Li21	8813	Alpha	31-41		76.03	52.29
9Li21	8813	Alpha	31-41		66.71	45.58
9Li21	8813	Alpha	31-41		79.53	43.19
9Li21	8813	Alpha	31-41		70.85	45.09
9Li21	8813	Alpha	31-41		67.28	37.49
9Li21	8813	Alpha	31-41		64.51	36.72
9Li21	8813	Alpha	31-41		56.03	51.51
9Li21	8813	Alpha	31-41		59.03	36.28
9Li21	8813	Alpha	31-41		123.26	62.45
9Li21	8813	Alpha	31-41		64.65	38.23
9Li21	8813	Alpha	31-41		69.32	34.64
9Li21	8813	Alpha	31-41		70.82	41.26
9Li21	8813	Alpha	31-41		85.98	54.35
9Li21	8813	Alpha	31-41		64.16	37.58
9Li21	8813	Alpha	31-41		82.01	58.14
9Li21	8813	Alpha	31-41		68.05	43.65
9Li21	8813	Alpha	31-41		59.52	42.22
9Li21	8813	Alpha	31-41		85.05	54.89
9Li21	8813	Alpha	31-41		64.83	49.85
9Li21	8813	Alpha	31-41		65.04	54.57
9Li21	8813	Alpha	31-41		83.42	48.58
9Li21	8813	Alpha	31-41		48.65	35.51
9Li21	8813	Alpha	31-41		55.49	33.5
9Li21	8813	Alpha	31-41		39.31	20.36
9Li21	8813	Alpha	31-41		36.62	25.34
9Li21	8813	Alpha	31-41		46.5	25.37
9Li21	8813	Alpha	31-41		44.92	30.22
9Li21	8813	Alpha	31-41		86.2	46.53
9Li21	8813	Alpha	31-41		89.1	37.9
9Li21	8813	Alpha	31-41		82.14	58.25
9Li21	8813	Alpha	31-41		81.98	37.64
9Li21	8813	Alpha	31-41		73.69	50.35
9Li21	8813	Alpha	31-41		87.41	44.24
9Li21	8813	Alpha	31-41		70.9	52.35
9Li21	8813	Alpha	31-41		50.94	32.73
9Li21	8813	Alpha	31-41		69.41	60.4

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8813	Alpha	31-41		70.48	46.55
9Li21	8813	Alpha	31-41		88.84	52.93
9Li21	8813	Alpha	31-41		101.63	37.32
9Li21	8813	Alpha	31-41		80.43	45.47
9Li21	8813	Alpha	31-41		73.94	41.01
9Li21	8813	Alpha	31-41		77.12	45.86
9Li21	8813	Alpha	31-41		86.05	31.31
9Li21	8813	Alpha	31-41		105.67	65.63
9Li21	8813	Alpha	31-41		103.45	56.75
9Li21	8813	Alpha	31-41		71.77	49.46
9Li21	8813	Alpha	31-41		83.75	68.73
9Li21	8813	Alpha	31-41		67.58	45.94
9Li21	8813	Alpha	31-41		58.35	43.8
9Li21	8813	Alpha	31-41		64.96	42.38
9Li21	8813	Alpha	31-41		58.35	35.19
9Li21	8813	Alpha	31-41		50.04	32.3
9Li21	8813	Alpha	31-41		41.89	18.89
9Li21	8813	Alpha	31-41		50.87	39.34
9Li21	8813	Alpha	31-41		54.01	32.24
9Li21	8813	Alpha	31-41		43.97	30.69
9Li21	8813	Alpha	31-41		40.37	25.03
9Li21	8816	Alpha	41-51		88.42	44.79
9Li21	8816	Alpha	41-51		77.5	40.05
9Li21	8816	Alpha	41-51		52.04	36.67
9Li21	8816	Alpha	41-51		80.17	44.78
9Li21	8816	Alpha	41-51		92.07	33.08
9Li21	8816	Alpha	41-51		93.58	46.15
9Li21	8816	Alpha	41-51		66.5	39.99
9Li21	8816	Alpha	41-51		67.1	51.26
9Li21	8816	Alpha	41-51		85.7	32.71
9Li21	8816	Alpha	41-51		55.28	44.44
9Li21	8816	Alpha	41-51		81.91	39.56
9Li21	8816	Alpha	41-51		51.36	33.87
9Li21	8816	Alpha	41-51		100.66	57.83
9Li21	8816	Alpha	41-51		103.12	67.24
9Li21	8816	Alpha	41-51		78.38	41.65
9Li21	8816	Alpha	41-51		97	66.55
9Li21	8816	Alpha	41-51		66.38	34.96
9Li21	8816	Alpha	41-51		101.51	41.61
9Li21	8816	Alpha	41-51		90.08	47.58
9Li21	8816	Alpha	41-51		67.65	30.67
9Li21	8816	Alpha	41-51		104.86	55.93
9Li21	8816	Alpha	41-51		107.04	41.06
9Li21	8816	Alpha	41-51		74.23	46.52
9Li21	8816	Alpha	41-51		105.1	53.34
9Li21	8816	Alpha	41-51		71.34	47.63
9Li21	8816	Alpha	41-51		89.93	48.54
9Li21	8816	Alpha	41-51		85.58	49.31
9Li21	8816	Alpha	41-51		78.75	35.83
9Li21	8816	Alpha	41-51		75.43	50.49

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8816	Alpha	41-51		72.76	53.96
9Li21	8816	Alpha	41-51		64.56	36.37
9Li21	8816	Alpha	41-51		77	31.19
9Li21	8816	Alpha	41-51		58.43	44.83
9Li21	8816	Alpha	41-51		53.06	35.37
9Li21	8816	Alpha	41-51		77.89	46.14
9Li21	8816	Alpha	41-51		73.22	35
9Li21	8816	Alpha	41-51		49.41	27.04
9Li21	8816	Alpha	41-51		73.48	46.38
9Li21	8816	Alpha	41-51		40.72	24.2
9Li21	8816	Alpha	41-51		59.05	38.97
9Li21	8816	Alpha	41-51		54.97	38.43
9Li21	8816	Alpha	41-51		70.57	44.41
9Li21	8816	Alpha	41-51		67.28	32.62
9Li21	8816	Alpha	41-51		64.17	41.41
9Li21	8816	Alpha	41-51		73.87	42.75
9Li21	8816	Alpha	41-51		75.45	41.54
9Li21	8816	Alpha	41-51		62.47	53.57
9Li21	8816	Alpha	41-51		102.07	53.85
9Li21	8816	Alpha	41-51		82.52	35.33
9Li21	8816	Alpha	41-51		58.63	40.13
9Li21	8816	Alpha	41-51		115.38	50.75
9Li21	8816	Alpha	41-51		65.63	39.95
9Li21	8816	Alpha	41-51		53.8	43.41
9Li21	8816	Alpha	41-51		65.57	49.14
9Li21	8816	Alpha	41-51		66.26	42.15
9Li21	8816	Alpha	41-51		54.08	53.05
9Li21	8816	Alpha	41-51		59.79	37.36
9Li21	8816	Alpha	41-51		69.32	51.98
9Li21	8816	Alpha	41-51		98.14	45.64
9Li21	8816	Alpha	41-51		70.11	44.88
9Li21	8816	Alpha	41-51		65.96	37.25
9Li21	8816	Alpha	41-51		59.44	44.02
9Li21	8816	Alpha	41-51		107.19	64.35
9Li21	8816	Alpha	41-51		68.15	44.16
9Li21	8816	Alpha	41-51		58.01	37
9Li21	8816	Alpha	41-51		110.87	54.57
9Li21	8816	Alpha	41-51		53.89	34.38
9Li21	8816	Alpha	41-51		61.13	35.53
9Li21	8816	Alpha	41-51		42.51	41.36
9Li21	8816	Alpha	41-51		50.31	39.74
9Li21	8816	Alpha	41-51		38.54	28.49
9Li21	8816	Alpha	41-51		96.33	59.56
9Li21	8816	Alpha	41-51		87.32	50.03
9Li21	8816	Alpha	41-51		72.5	47.62
9Li21	8816	Alpha	41-51		77.08	67.86
9Li21	8816	Alpha	41-51		51.89	34.51
9Li21	8816	Alpha	41-51		62.78	38.02
9Li21	8816	Alpha	41-51		58.25	37.7
9Li21	8816	Alpha	41-51		40.44	28.68

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8816	Alpha	41-51		60.82	44.38
9Li21	8816	Alpha	41-51		57.67	40.51
9Li21	8816	Alpha	41-51		45.49	41.23
9Li21	8816	Alpha	41-51		57.48	44.4
9Li21	8816	Alpha	41-51		71.22	42.45
9Li21	8816	Alpha	41-51		57.01	40.55
9Li21	8816	Alpha	41-51		70.03	38.06
9Li21	8816	Alpha	41-51		58.25	40.3
9Li21	8816	Alpha	41-51		61.81	34.9
9Li21	8816	Alpha	41-51		53.4	44.48
9Li21	8816	Alpha	41-51		63.74	38.42
9Li21	8816	Alpha	41-51		51.68	29.09
9Li21	8816	Alpha	41-51		51.94	23.82
9Li21	8816	Alpha	41-51		54.91	53.96
9Li21	8816	Alpha	41-51		42.19	26.75
9Li21	8816	Alpha	41-51		40.87	39.73
9Li21	8816	Alpha	41-51		54.6	27.48
9Li21	8816	Alpha	41-51		41.15	26.22
9Li21	8816	Alpha	41-51		66.4	27.27
9Li21	8816	Alpha	41-51		44.34	34.17
9Li21	8816	Alpha	41-51		52.78	30.12
9Li21	8816	Alpha	41-51		43.79	30.67
9Li21	8816	Alpha	41-51		44.99	28.21
9Li21	8831	Gamma	0-10		100.27	52.69
9Li21	8831	Gamma	0-10		85.41	48.83
9Li21	8831	Gamma	0-10		61.69	41.39
9Li21	8831	Gamma	0-10		81.88	53.99
9Li21	8831	Gamma	0-10		78.31	45.74
9Li21	8831	Gamma	0-10		47.93	44.48
9Li21	8831	Gamma	0-10		66.87	42.25
9Li21	8831	Gamma	0-10		82.57	57.5
9Li21	8831	Gamma	0-10		59.81	44.61
9Li21	8831	Gamma	0-10		74.46	55.46
9Li21	8831	Gamma	0-10		62.59	51.39
9Li21	8831	Gamma	0-10		46.83	35.52
9Li21	8831	Gamma	0-10		62.07	46.71
9Li21	8831	Gamma	0-10		88.09	53.84
9Li21	8831	Gamma	0-10		92.34	61.33
9Li21	8831	Gamma	0-10		58.88	42.4
9Li21	8831	Gamma	0-10		74.44	47.64
9Li21	8831	Gamma	0-10		63.59	41.82
9Li21	8831	Gamma	0-10		63.74	36.76
9Li21	8831	Gamma	0-10		42.47	22.25
9Li21	8831	Gamma	0-10		56.19	35.99
9Li21	8831	Gamma	0-10		40.67	26.51
9Li21	8834	Gamma	10-20		76.7	48.62
9Li21	8834	Gamma	10-20		54.95	34.66
9Li21	8834	Gamma	10-20		53.85	49.73
9Li21	8834	Gamma	10-20		50.3	28.73
9Li21	8834	Gamma	10-20		113.63	58.95

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8834	Gamma	10-20		59.18	23.63
9Li21	8834	Gamma	10-20		61.47	48.18
9Li21	8834	Gamma	10-20		87.71	55.75
9Li21	8834	Gamma	10-20		74.28	42.22
9Li21	8834	Gamma	10-20		72.05	44.95
9Li21	8834	Gamma	10-20		61.34	37.51
9Li21	8834	Gamma	10-20		91.88	71.05
9Li21	8834	Gamma	10-20		50.75	40.3
9Li21	8834	Gamma	10-20		77.01	43.77
9Li21	8834	Gamma	10-20		83.22	46
9Li21	8834	Gamma	10-20		75.52	53.12
9Li21	8834	Gamma	10-20		29.26	21.68
9Li21	8834	Gamma	10-20		60.96	34.58
9Li21	8834	Gamma	10-20		77.84	41.28
9Li21	8834	Gamma	10-20		78.64	30.49
9Li21	8834	Gamma	10-20		76.32	57.27
9Li21	8834	Gamma	10-20		89.2	45.87
9Li21	8834	Gamma	10-20		77.89	54.23
9Li21	8834	Gamma	10-20		87.22	48.09
9Li21	8834	Gamma	10-20		44.53	37.02
9Li21	8834	Gamma	10-20		60.03	31.6
9Li21	8834	Gamma	10-20		28.25	17.27
9Li21	8834	Gamma	10-20		68.8	42.72
9Li21	8834	Gamma	10-20		65.71	48.48
9Li21	8834	Gamma	10-20		65.14	47.82
9Li21	8834	Gamma	10-20		86.1	42.38
9Li21	8834	Gamma	10-20		45.61	28.04
9Li21	8834	Gamma	10-20		49.95	43.9
9Li21	8834	Gamma	10-20		109.33	61.38
9Li21	8834	Gamma	10-20		65.65	42.31
9Li21	8834	Gamma	10-20		65.83	38.75
9Li21	8834	Gamma	10-20		71.88	44.32
9Li21	8834	Gamma	10-20		86.45	50.17
9Li21	8834	Gamma	10-20		54.25	36.42
9Li21	8834	Gamma	10-20		99.72	46.29
9Li21	8834	Gamma	10-20		80.61	49.2
9Li21	8834	Gamma	10-20		60.04	40.38
9Li21	8834	Gamma	10-20		62.59	47.19
9Li21	8834	Gamma	10-20		84.6	57.27
9Li21	8834	Gamma	10-20		78.16	50.08
9Li21	8834	Gamma	10-20		102.96	35.42
9Li21	8834	Gamma	10-20		48.17	29.18
9Li21	8834	Gamma	10-20		75.95	54.54
9Li21	8834	Gamma	10-20		48.95	22.68
9Li21	8834	Gamma	10-20		29.09	19.44
9Li21	8834	Gamma	10-20		55.25	32.61
9Li21	8834	Gamma	10-20		74.93	44.5
9Li21	8834	Gamma	10-20		32.14	25.89
9Li21	8834	Gamma	10-20		47.77	36.26
9Li21	8834	Gamma	10-20		69.03	36.67

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8834	Gamma	10-20		41.03	38.51
9Li21	8834	Gamma	10-20		66.09	38.83
9Li21	8834	Gamma	10-20		69.06	57.29
9Li21	8834	Gamma	10-20		72.2	42.3
9Li21	8834	Gamma	10-20		53.8	24.54
9Li21	8834	Gamma	10-20		32.54	33.58
9Li21	8834	Gamma	10-20		92.17	45.3
9Li21	8837	Gamma	20-30		88.25	61.72
9Li21	8837	Gamma	20-30		80.87	39.44
9Li21	8837	Gamma	20-30		63.23	47.36
9Li21	8837	Gamma	20-30		84.09	58.06
9Li21	8837	Gamma	20-30		56.24	32.9
9Li21	8837	Gamma	20-30		50.21	33.47
9Li21	8837	Gamma	20-30		78.78	53.28
9Li21	8837	Gamma	20-30		102.5	58.22
9Li21	8837	Gamma	20-30		115.64	47.96
9Li21	8837	Gamma	20-30		130.97	56.3
9Li21	8837	Gamma	20-30		75.71	47.78
9Li21	8837	Gamma	20-30		94.68	54.71
9Li21	8837	Gamma	20-30		90.03	42.32
9Li21	8837	Gamma	20-30		62.81	33.13
9Li21	8837	Gamma	20-30		40.83	37.62
9Li21	8837	Gamma	20-30		84.01	52.04
9Li21	8837	Gamma	20-30		65.02	40.77
9Li21	8837	Gamma	20-30		93.06	54.37
9Li21	8837	Gamma	20-30		52.64	22.15
9Li21	8837	Gamma	20-30		70.17	43.64
9Li21	8837	Gamma	20-30		94.84	61.18
9Li21	8837	Gamma	20-30		85.22	50.21
9Li21	8837	Gamma	20-30		84.26	47.05
9Li21	8837	Gamma	20-30		44.93	29.6
9Li21	8837	Gamma	20-30		52.72	36.2
9Li21	8837	Gamma	20-30		43.86	33.69
9Li21	8837	Gamma	20-30		54.81	35.42
9Li21	8837	Gamma	20-30		37.13	26.42
9Li21	8837	Gamma	20-30		40.42	28.6
9Li21	8837	Gamma	20-30		59.45	36.46
9Li21	8837	Gamma	20-30		39.09	30.26
9Li21	8837	Gamma	20-30		52.75	36.15
9Li21	8837	Gamma	20-30		67.18	53.03
9Li21	8837	Gamma	20-30		123.3	51.76
9Li21	8837	Gamma	20-30		113.76	55.82
9Li21	8837	Gamma	20-30		70.31	40.33
9Li21	8837	Gamma	20-30		65.4	41.51
9Li21	8837	Gamma	20-30		90.18	46.54
9Li21	8837	Gamma	20-30		77.76	44.49
9Li21	8837	Gamma	20-30		103.45	52.72
9Li21	8837	Gamma	20-30		79.28	38.64
9Li21	8837	Gamma	20-30		57.9	40.95
9Li21	8837	Gamma	20-30		72.14	53.02

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8837	Gamma	20-30		65.66	40.64
9Li21	8837	Gamma	20-30		74.62	52.63
9Li21	8837	Gamma	20-30		83.34	55.77
9Li21	8837	Gamma	20-30		79.34	65.67
9Li21	8837	Gamma	20-30		107.2	60.38
9Li21	8837	Gamma	20-30		142.13	42.36
9Li21	8837	Gamma	20-30		115.34	47.23
9Li21	8837	Gamma	20-30		84.6	42.34
9Li21	8837	Gamma	20-30		111.15	46.85
9Li21	8837	Gamma	20-30		55.5	45.45
9Li21	8837	Gamma	20-30		88	31.63
9Li21	8837	Gamma	20-30		85.34	49.29
9Li21	8837	Gamma	20-30		109.65	61.91
9Li21	8837	Gamma	20-30		75.17	54.21
9Li21	8837	Gamma	20-30		60.48	48.6
9Li21	8837	Gamma	20-30		67.23	51.9
9Li21	8837	Gamma	20-30		95.1	55.73
9Li21	8837	Gamma	20-30		76.89	50.66
9Li21	8837	Gamma	20-30		70.34	53.43
9Li21	8837	Gamma	20-30		72.54	58.68
9Li21	8837	Gamma	20-30		38.95	20.5
9Li21	8837	Gamma	20-30		91.06	53.98
9Li21	8837	Gamma	20-30		137.45	51.61
9Li21	8837	Gamma	20-30		93.73	40.1
9Li21	8837	Gamma	20-30		66.87	51.97
9Li21	8837	Gamma	20-30		50.5	35.04
9Li21	8837	Gamma	20-30		55.48	37.76
9Li21	8837	Gamma	20-30		48.84	30.72
9Li21	8837	Gamma	20-30		73.01	42.35
9Li21	8837	Gamma	20-30		70.41	52.38
9Li21	8837	Gamma	20-30		64.69	41.28
9Li21	8837	Gamma	20-30		74.63	53.72
9Li21	8837	Gamma	20-30		72.09	37.9
9Li21	8837	Gamma	20-30		103.4	69.7
9Li21	8837	Gamma	20-30		86.96	59.76
9Li21	8837	Gamma	20-30		68.34	48.99
9Li21	8837	Gamma	20-30		141.3	47.56
9Li21	8837	Gamma	20-30		96.25	51.46
9Li21	8837	Gamma	20-30		90.94	55.25
9Li21	8837	Gamma	20-30		99.27	39.2
9Li21	8837	Gamma	20-30		57.98	38.68
9Li21	8837	Gamma	20-30		59.06	45.94
9Li21	8837	Gamma	20-30		68.94	43.49
9Li21	8837	Gamma	20-30		80.66	53.4
9Li21	8837	Gamma	20-30		53.81	41.27
9Li21	8837	Gamma	20-30		99.71	70.08
9Li21	8837	Gamma	20-30		175	43.02
9Li21	8837	Gamma	20-30		115.64	37.84
9Li21	8837	Gamma	20-30		120.15	41.67
9Li21	8837	Gamma	20-30		81.6	36.55

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8837	Gamma	20-30		75.55	43.17
9Li21	8837	Gamma	20-30		81.06	59.63
9Li21	8837	Gamma	20-30		91.85	67.8
9Li21	8837	Gamma	20-30		53.33	36.6
9Li21	8837	Gamma	20-30		69.42	29.07
9Li21	8837	Gamma	20-30		85.15	49.59
9Li21	8837	Gamma	20-30		88.2	58.37
9Li21	8837	Gamma	20-30		120.45	69.5
9Li21	8858	Gamma	35-40		60.24	34.18
9Li21	8858	Gamma	35-40		65.54	43.75
9Li21	8858	Gamma	35-40		58.22	51.56
9Li21	8858	Gamma	35-40		84.54	52.91
9Li21	8858	Gamma	35-40		58.67	22.16
9Li21	8858	Gamma	35-40		47.11	26.44
9Li21	8858	Gamma	35-40		60.73	36.19
9Li21	8858	Gamma	35-40		90.34	55.75
9Li21	8858	Gamma	35-40		64.84	41.19
9Li21	8858	Gamma	35-40		52.56	35.4
9Li21	8858	Gamma	35-40		68.65	41.38
9Li21	8858	Gamma	35-40		93.26	42.4
9Li21	8858	Gamma	35-40		77.56	54.31
9Li21	8858	Gamma	35-40		89.01	60.52
9Li21	8858	Gamma	35-40		62.23	38.8
9Li21	8858	Gamma	35-40		76.93	54.94
9Li21	8858	Gamma	35-40		135.38	36.1
9Li21	8858	Gamma	35-40		115.44	37.85
9Li21	8858	Gamma	35-40		90.39	54.46
9Li21	8858	Gamma	35-40		72.76	51.77
9Li21	8858	Gamma	35-40		111.28	59.82
9Li21	8858	Gamma	35-40		81.63	64.57
9Li21	8858	Gamma	35-40		82.13	44.73
9Li21	8858	Gamma	35-40		44.31	35.03
9Li21	8858	Gamma	35-40		76.16	36.5
9Li21	8858	Gamma	35-40		94.62	51.12
9Li21	8858	Gamma	35-40		42.37	22.64
9Li21	8858	Gamma	35-40		35.63	17.12
9Li21	8858	Gamma	35-40		67.37	32.48
9Li21	8858	Gamma	35-40		80.9	52.08
9Li21	8858	Gamma	35-40		90.26	36.83
9Li21	8858	Gamma	35-40		62.81	42.69
9Li21	8858	Gamma	35-40		74.5	47.01
9Li21	8858	Gamma	35-40		138.97	43.62
9Li21	8858	Gamma	35-40		65.73	29.05
9Li21	8858	Gamma	35-40		64.84	27.59
9Li21	8858	Gamma	35-40		55.37	24.81
9Li21	8858	Gamma	35-40		88.77	34.48
9Li21	8858	Gamma	35-40		97.21	27.88
9Li21	8858	Gamma	35-40		47.62	35.11
9Li21	8858	Gamma	35-40		58.49	33.33
9Li21	8858	Gamma	35-40		87.44	42.93

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8858	Gamma	35-40		75.93	44.04
9Li21	8858	Gamma	35-40		100.55	36.92
9Li21	8858	Gamma	35-40		90.21	43.95
9Li21	8858	Gamma	35-40		49.75	29.56
9Li21	8858	Gamma	35-40		55.37	32.13
9Li21	8858	Gamma	35-40		85.25	33.57
9Li21	8858	Gamma	35-40		73.94	40.13
9Li21	8858	Gamma	35-40		100.03	61.3
9Li21	8858	Gamma	35-40		64.08	47.89
9Li21	8858	Gamma	35-40		62.21	33.7
9Li21	8858	Gamma	35-40		69.69	48.58
9Li21	8858	Gamma	35-40		65.65	30.91
9Li21	8858	Gamma	35-40		86.51	51.25
9Li21	8858	Gamma	35-40		83.97	43.49
9Li21	8858	Gamma	35-40		112.47	42.8
9Li21	8858	Gamma	35-40		49.34	30.83
9Li21	8858	Gamma	35-40		145.9	60.09
9Li21	8858	Gamma	35-40		55.5	38.88
9Li21	8858	Gamma	35-40		66.2	41.32
9Li21	8858	Gamma	35-40		64.92	22.67
9Li21	8858	Gamma	35-40		90.27	63.83
9Li21	8858	Gamma	35-40		73.88	28.47
9Li21	8858	Gamma	35-40		49.85	56.78
9Li21	8858	Gamma	35-40		84.1	51.19
9Li21	8858	Gamma	35-40		41.87	17.86
9Li21	8858	Gamma	35-40		76.67	30.18
9Li21	8858	Gamma	35-40		52.14	27.03
9Li21	8858	Gamma	35-40		33.34	22.62
9Li21	8858	Gamma	35-40		31.71	25
9Li21	8858	Gamma	35-40		32.56	23.24
9Li21	8858	Gamma	35-40		59.14	22.65
9Li21	8858	Gamma	35-40		38.64	18.93
9Li21	8858	Gamma	35-40		39.14	22.3
9Li21	8858	Gamma	35-40		34.53	26.8
9Li21	8869	Gamma	40-50		85.24	48.13
9Li21	8869	Gamma	40-50		89.94	44
9Li21	8869	Gamma	40-50		100.1	39.59
9Li21	8869	Gamma	40-50		105.85	50.7
9Li21	8869	Gamma	40-50		83.4	55.7
9Li21	8869	Gamma	40-50		118.08	45.71
9Li21	8869	Gamma	40-50		66.75	42.3
9Li21	8869	Gamma	40-50		65.01	44.5
9Li21	8869	Gamma	40-50		90.61	28.58
9Li21	8869	Gamma	40-50		160	49.32
9Li21	8869	Gamma	40-50		47.66	32.22
9Li21	8869	Gamma	40-50		49.3	30.03
9Li21	8869	Gamma	40-50		155	50.13
9Li21	8869	Gamma	40-50		86.78	47.01
9Li21	8869	Gamma	40-50		68.25	31.11
9Li21	8869	Gamma	40-50		46.2	25.66

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8869	Gamma	40-50		52.57	38.69
9Li21	8869	Gamma	40-50		52.93	36.77
9Li21	8869	Gamma	40-50		46.31	28.66
9Li21	8869	Gamma	40-50		37.8	27.45
9Li21	8869	Gamma	40-50		56.59	32.77
9Li21	8869	Gamma	40-50		39.36	22.62
9Li21	8869	Gamma	40-50		50.49	28.96
9Li21	8869	Gamma	40-50		69.59	39.58
9Li21	8869	Gamma	40-50		37.84	29.44
9Li21	8869	Gamma	40-50		49.26	31.24
9Li21	8869	Gamma	40-50		52.35	22.43
9Li21	8869	Gamma	40-50		70.96	29.63
9Li21	8869	Gamma	40-50		63.99	35.56
9Li21	8869	Gamma	40-50		50.42	21.67
9Li21	8869	Gamma	40-50		67.12	43.69
9Li21	8869	Gamma	40-50		85.49	43.41
9Li21	8869	Gamma	40-50		76.73	48.59
9Li21	8869	Gamma	40-50		91.49	36.24
9Li21	8874	Gamma	50-60		61.54	43.3
9Li21	8874	Gamma	50-60		47.2	38.5
9Li21	8874	Gamma	50-60		66.24	41.98
9Li21	8874	Gamma	50-60		54.8	37.71
9Li21	8874	Gamma	50-60		52.92	30.83
9Li21	8874	Gamma	50-60		86.53	29.5
9Li21	8874	Gamma	50-60		48.31	25.37
9Li21	8874	Gamma	50-60		71.33	45.07
9Li21	8874	Gamma	50-60		51.18	32.82
9Li21	8874	Gamma	50-60		56	32.35
9Li21	8874	Gamma	50-60		100.8	39.48
9Li21	8874	Gamma	50-60		54.9	39.06
9Li21	8874	Gamma	50-60		48.72	33.65
9Li21	8874	Gamma	50-60		57.24	31.33
9Li21	8874	Gamma	50-60		45.97	27.22
9Li21	8874	Gamma	50-60		102.82	54.31
9Li21	8874	Gamma	50-60		97.57	46.78
9Li21	8874	Gamma	50-60		100.01	34.96
9Li21	8874	Gamma	50-60		51.58	29.56
9Li21	8874	Gamma	50-60		49.19	25.42
9Li21	8855	Gamma	23-35	1	84.53	45.93
9Li21	8855	Gamma	23-35	1	106.7	40.39
9Li21	8855	Gamma	23-35	1	46.07	32.1
9Li21	8855	Gamma	23-35	1	68.73	29.41
9Li21	8855	Gamma	23-35	1	85.76	43.65
9Li21	8855	Gamma	23-35	1	79.53	39.63
9Li21	8855	Gamma	23-35	1	81.37	45.38
9Li21	8855	Gamma	23-35	1	66.56	45.09
9Li21	8855	Gamma	23-35	1	100.6	46.05
9Li21	8855	Gamma	23-35	1	76.63	44.2
9Li21	8855	Gamma	23-35	1	75.27	50.42
9Li21	8855	Gamma	23-35	1	110.25	60.57

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8855	Gamma	23-35	1	56.31	40.99
9Li21	8855	Gamma	23-35	1	93.31	44.58
9Li21	8855	Gamma	23-35	1	54.43	43.08
9Li21	8855	Gamma	23-35	1	70.77	39.67
9Li21	8855	Gamma	23-35	1	68.9	43.62
9Li21	8855	Gamma	23-35	1	64.68	40.13
9Li21	8855	Gamma	23-35	1	80.66	40.99
9Li21	8855	Gamma	23-35	1	49.09	29.83
9Li21	8855	Gamma	23-35	1	73.47	47.22
9Li21	8855	Gamma	23-35	1	69.05	46.5
9Li21	8855	Gamma	23-35	1	72.64	44.42
9Li21	8855	Gamma	23-35	1	83.01	51.5
9Li21	8855	Gamma	23-35	1	86.34	53.64
9Li21	8855	Gamma	23-35	1	71.27	46.64
9Li21	8855	Gamma	23-35	1	66.6	28.57
9Li21	8855	Gamma	23-35	1	56.23	38.39
9Li21	8855	Gamma	23-35	1	66.04	49.42
9Li21	8855	Gamma	23-35	1	58.91	36.22
9Li21	8855	Gamma	23-35	1	59.68	33.23
9Li21	8855	Gamma	23-35	1	91.67	56.27
9Li21	8855	Gamma	23-35	1	59.11	45.26
9Li21	8855	Gamma	23-35	1	100.76	48.81
9Li21	8855	Gamma	23-35	1	53.31	23.02
9Li21	8855	Gamma	23-35	1	46.02	33.47
9Li21	8855	Gamma	23-35	1	64.6	37.84
9Li21	8855	Gamma	23-35	1	66.04	41.64
9Li21	8855	Gamma	23-35	1	61.75	38.47
9Li21	8855	Gamma	23-35	1	61.13	37.99
9Li21		N501 E80	0-10		67.56	49.31
9Li21		N501 E80	0-10		71.46	61.45
9Li21		N501 E80	0-10		50.88	40.14
9Li21		N501 E80	0-10		46.79	47.86
9Li21		N501 E80	0-10		53.74	32.9
9Li21		N501 E80	0-10		44.17	44.21
9Li21		N501 E80	0-10		60.7	41.92
9Li21		N501 E80	0-10		66.53	43.06
9Li21		N501 E80	0-10		45.4	30.22
9Li21		N501 E80	0-10		86.82	45.86
9Li21		N501 E80	0-10		77.9	51.95
9Li21		N501 E80	0-10		71.27	45.28
9Li21		N501 E80	0-10		39.36	29.77
9Li21		N501 E80	0-10		68.33	53.06
9Li21		N501 E80	0-10		61.73	36.13
9Li21		N501 E80	0-10		50.23	40.38
9Li21		N501 E80	0-10		58.14	45.13
9Li21		N501 E80	0-10		54.42	37.28
9Li21		N501 E80	0-10		55.1	45.94
9Li21		N501 E80	0-10		80.07	47.66
9Li21		N501 E80	0-10		57.56	44.06
9Li21		N501 E80	0-10		65.23	43.64

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21		N501 E80	0-10		64.19	35.13
9Li21		N501 E80	0-10		44.01	35.48
9Li21		N501 E80	0-10		76.18	56.85
9Li21		N501 E80	0-10		54.28	40.8
9Li21		N501 E80	0-10		91.75	51.92
9Li21		N501 E80	0-10		58.41	39.72
9Li21		N501 E80	0-10		69.92	50.12
9Li21		N501 E80	0-10		82.27	55.65
9Li21		N501 E80	0-10		88.54	59.73
9Li21		N501 E80	0-10		64.13	38.52
9Li21		N501 E80	0-10		67.14	49.27
9Li21		N501 E80	0-10		81.45	55.77
9Li21		N501 E80	0-10		66.5	32.12
9Li21		N501 E80	0-10		74.77	40.44
9Li21		N501 E80	0-10		68.08	36.24
9Li21		N501 E80	0-10		84.06	54.75
9Li21		N501 E80	0-10		59.74	44.75
9Li21		N501 E80	0-10		54.78	41.58
9Li21		N501 E80	0-10		59.18	41.15
9Li21		N501 E80	0-10		58.47	47.68
9Li21		N501 E80	0-10		52.16	40.78
9Li21		N501 E80	0-10		66.11	32.79
9Li21		N501 E80	0-10		66.87	41.07
9Li21		N501 E80	0-10		63.83	38.91
9Li21		N501 E80	0-10		75.18	33.79
9Li21		N501 E80	0-10		86.1	41.21
9Li21		N501 E80	0-10		53.76	45.66
9Li21		N501 E80	0-10		47.78	38.75
9Li21		N501 E80	10-20		77.14	40.46
9Li21		N501 E80	10-20		68.93	44.06
9Li21		N501 E80	10-20		62	43.46
9Li21		N501 E80	10-20		55.96	38.71
9Li21		N501 E80	10-20		48.96	33.7
9Li21		N501 E80	10-20		63.86	41.35
9Li21		N501 E80	10-20		65.1	42.58
9Li21		N501 E80	10-20		60.46	41.57
9Li21		N501 E80	10-20		44.6	36.56
9Li21		N501 E80	10-20		79.3	44.3
9Li21		N501 E80	10-20		80.06	46.48
9Li21		N501 E80	10-20		65.63	39.68
9Li21		N501 E80	10-20		50.83	34.2
9Li21		N501 E80	10-20		61.98	35.01
9Li21		N501 E80	10-20		92.97	50
9Li21		N501 E80	10-20		71.57	47.55
9Li21		N501 E80	10-20		69.39	32.19
9Li21		N501 E80	10-20		87.09	50.75
9Li21		N501 E80	10-20		53.17	40.21
9Li21		N501 E80	10-20		45.9	34.71
9Li21		N501 E80	10-20		54.53	35.36
9Li21		N501 E80	10-20		50.33	31.45

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21		N501 E80	10-20		77.86	49.61
9Li21		N501 E80	10-20		77.68	43.3
9Li21		N501 E80	10-20		63.01	45.37
9Li21		N501 E80	10-20		65.52	44.47
9Li21		N501 E80	10-20		67.33	49.73
9Li21		N501 E80	10-20		86.71	52.99
9Li21		N501 E80	10-20		81.5	49.86
9Li21		N501 E80	10-20		80.94	37.36
9Li21		N501 E80	10-20		61.41	36.15
9Li21		N501 E80	10-20		83.27	47.52
9Li21		N501 E80	10-20		65.19	42.27
9Li21		N501 E80	10-20		66.23	38.41
9Li21		N501 E80	10-20		72.22	44.98
9Li21		N501 E80	10-20		83.06	47.04
9Li21		N501 E80	10-20		63.47	44.69
9Li21		N501 E80	10-20		67.97	45.5
9Li21		N501 E80	10-20		60.94	38.09
9Li21		N501 E80	10-20		63.41	40.66
9Li21		N501 E80	10-20		83.81	47.51
9Li21		N501 E80	10-20		59.05	35.66
9Li21		N501 E80	10-20		64.03	50.4
9Li21		N501 E80	10-20		70.4	42.97
9Li21		N501 E80	10-20		55.17	47.41
9Li21		N501 E80	10-20		85.27	51.45
9Li21		N501 E80	10-20		54.16	41.86
9Li21		N501 E80	10-20		65.65	44.92
9Li21		N501 E80	10-20		52.88	39.52
9Li21		N501 E80	10-20		64.53	45.06
9Li21		N501 E80	10-20		68.13	39.89
9Li21		N501 E80	10-20		73.94	47.47
9Li21		N501 E80	10-20		86.88	52.08
9Li21		N501 E80	10-20		48.36	38.08
9Li21		N501 E80	10-20		65.89	42.47
9Li21		N501 E80	10-20		79.64	46.68
9Li21		N501 E80	10-20		54.1	31.5
9Li21		N501 E80	10-20		73.01	44.33
9Li21		N501 E80	10-20		58.37	39.77
9Li21		N501 E80	10-20		97.79	60.99
9Li21		N501 E80	10-20		63.01	38.6
9Li21		N501 E80	10-20		52.21	35.67
9Li21		N501 E80	10-20		59.68	43.7
9Li21		N501 E80	10-20		69.74	46.97
9Li21		N501 E80	10-20		76.48	42.45
9Li21		N501 E80	10-20		68.47	49.1
9Li21		N501 E80	10-20		75.77	47.68
9Li21		N501 E80	10-20		65.01	40.27
9Li21		N501 E80	10-20		58.78	40.95
9Li21		N501 E80	10-20		62.62	54.34
9Li21		N501 E80	10-20		59.24	41.64
9Li21		N501 E80	10-20		68.77	57.56

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21		N501 E80	10-20		56.29	47.75
9Li21		N501 E80	20-30		61.86	43.1
9Li21		N501 E80	20-30		88.01	58.2
9Li21		N501 E80	20-30		61.87	41.47
9Li21		N501 E80	20-30		63.91	40.23
9Li21		N501 E80	20-30		47.32	31.82
9Li21		N501 E80	20-30		60.82	36.66
9Li21		N501 E80	20-30		41.28	29.18
9Li21		N501 E80	20-30		69.81	49.42
9Li21		N501 E80	20-30		57.41	36.33
9Li21		N501 E80	20-30		61.42	45.64
9Li21		N501 E80	20-30		71.89	41.81
9Li21		N501 E80	20-30		81.43	53.69
9Li21		N501 E80	20-30		66.46	43.88
9Li21		N501 E80	20-30		51.77	35.9
9Li21		N501 E80	20-30		74.42	46.78
9Li21		N501 E80	20-30		103.07	43.9
9Li21		N501 E80	20-30		58.91	38.53
9Li21		N501 E80	20-30		89.32	67.34
9Li21		N501 E80	20-30		55.71	39.87
9Li21		N501 E80	20-30		62.91	41.46
9Li21		N501 E80	20-30		76.92	54.81
9Li21		N501 E80	20-30		74.92	41.56
9Li21		N501 E80	20-30		91.47	55.72
9Li21		N501 E80	20-30		74.13	51.27
9Li21		N501 E80	20-30		71.61	47.98
9Li21		N501 E80	20-30		62.93	44.17
9Li21		N501 E80	20-30		86.46	51.02
9Li21		N501 E80	20-30		66.45	45.23
9Li21		N501 E80	20-30		38.72	30.81
9Li21		N501 E80	20-30		59.08	43.76
9Li21		N501 E80	20-30		78.14	47.36
9Li21		N501 E80	20-30		50.75	36.69
9Li21		N501 E80	20-30		55.93	35.55
9Li21		N501 E80	20-30		62.61	40.55
9Li21		N501 E80	20-30		63.96	33.81
9Li21		N501 E80	20-30		67.76	43.74
9Li21		N501 E80	20-30		69.63	43.38
9Li21		N501 E80	20-30		54.68	41.38
9Li21		N501 E80	20-30		63.06	46.93
9Li21		N501 E80	20-30		75.73	47.21
9Li21		N501 E80	20-30		50.78	41.2
9Li21		N501 E80	20-30		53.74	45.87
9Li21		N501 E80	20-30		87.48	60.46
9Li21		N501 E80	20-30		65.7	42.95
9Li21		N501 E80	20-30		67.41	54.67
9Li21		N501 E80	20-30		61	39.93
9Li21		N501 E80	20-30		67.45	47.98
9Li21		N501 E80	20-30		54.47	35.97
9Li21		N501 E80	20-30		56.05	41.63

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21		N501 E80	20-30		61.31	46.26
9Li21		N501 E80	20-30		63.49	41.85
9Li21		N501 E80	20-30		43.88	33.44
9Li21		N501 E80	20-30		68.61	44.82
9Li21		N501 E80	20-30		42.24	27.77
9Li21		N501 E80	20-30		67.93	42
9Li21		N501 E80	20-30		64.85	45.32
9Li21		N501 E80	20-30		63.99	43.31
9Li21		N501 E80	20-30		74.45	49.41
9Li21		N501 E80	20-30		74.48	48.11
9Li21		N501 E80	20-30		83.46	51.43
9Li21		N501 E80	20-30		81.91	53.33
9Li21	5908	N501 E80	30-40		79.24	43.67
9Li21	5908	N501 E80	30-40		74.6	28.74
9Li21	5908	N501 E80	30-40		75.49	41.25
9Li21	5908	N501 E80	30-40		59.09	42.42
9Li21	5908	N501 E80	30-40		70.57	40.51
9Li21	5908	N501 E80	30-40		67.06	53.43
9Li21	5908	N501 E80	30-40		85	53.77
9Li21	5908	N501 E80	30-40		56.12	39.1
9Li21	5908	N501 E80	30-40		142.01	35.02
9Li21	5908	N501 E80	30-40		78.69	50.36
9Li21	5908	N501 E80	30-40		84.11	60.04
9Li21	5908	N501 E80	30-40		73.22	49.65
9Li21	5908	N501 E80	30-40		75.3	42.15
9Li21	5908	N501 E80	30-40		124.17	35.69
9Li21	5908	N501 E80	30-40		68.07	43.07
9Li21	5908	N501 E80	30-40		131.7	52.45
9Li21	5908	N501 E80	30-40		114.02	32.75
9Li21	5908	N501 E80	30-40		90.45	51.77
9Li21	5908	N501 E80	30-40		109.89	38.25
9Li21	5908	N501 E80	30-40		74.21	39.5
9Li21	5908	N501 E80	30-40		61.52	36.09
9Li21	5908	N501 E80	30-40		68.86	50.02
9Li21	5908	N501 E80	30-40		67.45	46.75
9Li21	5908	N501 E80	30-40		98.48	34.22
9Li21	5908	N501 E80	30-40		57.48	48.41
9Li21	5908	N501 E80	30-40		118.57	37.97
9Li21	5908	N501 E80	30-40		103.16	36.17
9Li21	5908	N501 E80	30-40		78.73	52.99
9Li21	5908	N501 E80	30-40		61.34	45.27
9Li21	5908	N501 E80	30-40		80.73	48.4
9Li21	5908	N501 E80	30-40		80.77	51.71
9Li21	5908	N501 E80	30-40		119.24	49.87
9Li21	5908	N501 E80	30-40		63.4	50.24
9Li21	5908	N501 E80	30-40		45.46	34.99
9Li21	5908	N501 E80	30-40		70.73	47.83
9Li21	5908	N501 E80	30-40		93.56	42.49
9Li21	5908	N501 E80	30-40		71.77	42.24
9Li21	5908	N501 E80	30-40		53.96	36.61

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	5908	N501 E80	30-40		103.46	51.7
9Li21	5908	N501 E80	30-40		64.75	40.84
9Li21	5908	N501 E80	30-40		93.69	28.93
9Li21	5908	N501 E80	30-40		74.2	44.17
9Li21	5908	N501 E80	30-40		82.69	32.41
9Li21	5908	N501 E80	30-40		62.56	46.61
9Li21	5908	N501 E80	30-40		79.12	49.05
9Li21	5908	N501 E80	30-40		51.89	36.85
9Li21	5908	N501 E80	30-40		71.98	39.64
9Li21	5908	N501 E80	30-40		72.67	52.16
9Li21	5908	N501 E80	30-40		83.92	50.48
9Li21	5908	N501 E80	30-40		73.32	53.34
9Li21	5908	N501 E80	30-40		60.11	42.47
9Li21	5908	N501 E80	30-40		52.86	38.51
9Li21	5908	N501 E80	30-40		45.2	36.87
9Li21	5908	N501 E80	30-40		84.89	56.38
9Li21	5908	N501 E80	30-40		134.37	45.21
9Li21	5908	N501 E80	30-40		59	39.91
9Li21	5908	N501 E80	30-40		92.99	53.93
9Li21	5908	N501 E80	30-40		50.06	36.95
9Li21	5908	N501 E80	30-40		65.87	42.31
9Li21	5908	N501 E80	30-40		30.85	27.85
9Li21	5908	N501 E80	30-40		39.83	34.23
9Li21	5908	N501 E80	30-40		114.99	40.51
9Li21	5908	N501 E80	30-40		60.22	41.19
9Li21	5908	N501 E80	30-40		48.98	40.1
9Li21	5908	N501 E80	30-40		63.47	50.31
9Li21	5908	N501 E80	30-40		53.66	42.99
9Li21	5908	N501 E80	30-40		85.65	44.73
9Li21	5908	N501 E80	30-40		59	37.61
9Li21	5908	N501 E80	30-40		49.56	42.81
9Li21	5908	N501 E80	30-40		48.06	34.95
9Li21	5908	N501 E80	30-40		73.95	40.66
9Li21	5908	N501 E80	30-40		75.82	52.29
9Li21	5908	N501 E80	30-40		65.42	41.84
9Li21	5908	N501 E80	30-40		68.27	27.78
9Li21	5908	N501 E80	30-40		37.13	30.92
9Li21	5908	N501 E80	30-40		66.61	44.28
9Li21	5908	N501 E80	30-40		85.48	49.92
9Li21	5908	N501 E80	30-40		76.06	39.28
9Li21	5908	N501 E80	30-40		57.64	42.44
9Li21	5908	N501 E80	30-40		53.71	35.09
9Li21	5908	N501 E80	30-40		52.57	36.61
9Li21	5908	N501 E80	30-40		109.23	34.61
9Li21	5908	N501 E80	30-40		62.68	44.11
9Li21	5908	N501 E80	30-40		78.98	52.17
9Li21	5908	N501 E80	30-40		60.21	57.97
9Li21	5908	N501 E80	30-40		79.1	50.86
9Li21	5908	N501 E80	30-40		94.51	78.27
9Li21	5908	N501 E80	30-40		84.2	47.3

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	5908	N501 E80	30-40		48.12	44.35
9Li21	5908	N501 E80	30-40		87.26	48.26
9Li21	5908	N501 E80	30-40		56.43	44.1
9Li21	5909	N501 E80	40-50		65.35	41.27
9Li21	5909	N501 E80	40-50		83.14	46.79
9Li21	5909	N501 E80	40-50		70.23	45.57
9Li21	5909	N501 E80	40-50		65.85	34.85
9Li21	5909	N501 E80	40-50		69.94	45.96
9Li21	5909	N501 E80	40-50		58.83	27.33
9Li21	5909	N501 E80	40-50		76.78	49.1
9Li21	5909	N501 E80	40-50		75.2	60.06
9Li21	5909	N501 E80	40-50		62.05	32.63
9Li21	5909	N501 E80	40-50		66.2	42.33
9Li21	5909	N501 E80	40-50		173	42.61
9Li21	5909	N501 E80	40-50		66.3	49.36
9Li21	5909	N501 E80	40-50		80.93	42.81
9Li21	5909	N501 E80	40-50		58.83	37.89
9Li21	5909	N501 E80	40-50		67.65	45.63
9Li21	5909	N501 E80	40-50		100.93	44.23
9Li21	5909	N501 E80	40-50		70.14	47.21
9Li21	5909	N501 E80	40-50		55.54	29.82
9Li21	5909	N501 E80	40-50		78.87	35.89
9Li21	5909	N501 E80	40-50		80.12	47.96
9Li21	5909	N501 E80	40-50		101.82	52.1
9Li21	5909	N501 E80	40-50		103.65	56.41
9Li21	5909	N501 E80	40-50		64.51	34.91
9Li21	5909	N501 E80	40-50		79.34	39.27
9Li21	5909	N501 E80	40-50		83.16	43.4
9Li21	5909	N501 E80	40-50		63.65	33.82
9Li21	5909	N501 E80	40-50		69.15	27.94
9Li21	5909	N501 E80	40-50		63.53	45.71
9Li21	5909	N501 E80	40-50		71.39	44.97
9Li21	5909	N501 E80	40-50		130.92	46.73
9Li21	5909	N501 E80	40-50		60.42	46.74
9Li21	5909	N501 E80	40-50		52.64	43.83
9Li21	5909	N501 E80	40-50		71.27	47.64
9Li21	5909	N501 E80	40-50		56.29	30.91
9Li21	5909	N501 E80	40-50		58.42	31.68
9Li21	5909	N501 E80	40-50		50.3	41.23
9Li21	5909	N501 E80	40-50		56.09	38.02
9Li21	5909	N501 E80	40-50		67.51	52.06
9Li21	5909	N501 E80	40-50		46.77	32.01
9Li21	5909	N501 E80	40-50		82.27	49.73
9Li21	5909	N501 E80	40-50		56.45	42.1
9Li21	5909	N501 E80	40-50		60.01	47.03
9Li21	5909	N501 E80	40-50		116.95	44.65
9Li21	5909	N501 E80	40-50		67.17	44.65
9Li21	5909	N501 E80	40-50		96.47	56.99
9Li21	5909	N501 E80	40-50		53.51	32.99
9Li21	5909	N501 E80	40-50		76.14	38.33

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	5909	N501 E80	40-50		60.45	39.5
9Li21	5909	N501 E80	40-50		78.39	45.1
9Li21	5909	N501 E80	40-50		74.58	54.55
9Li21	5909	N501 E80	40-50		86.38	44.04
9Li21	5909	N501 E80	40-50		73.96	35.19
9Li21	5909	N501 E80	40-50		69.29	48.87
9Li21	5909	N501 E80	40-50		71.43	48.83
9Li21	5909	N501 E80	40-50		112.45	64.16
9Li21	5909	N501 E80	40-50		43.18	28.83
9Li21	5909	N501 E80	40-50		61.26	43.89
9Li21	5909	N501 E80	40-50		102.64	51.52
9Li21	5909	N501 E80	40-50		54.77	32.47
9Li21	5909	N501 E80	40-50		71.24	42.64
9Li21	5909	N501 E80	40-50		57.64	40.13
9Li21	5909	N501 E80	40-50		97.36	46.93
9Li21	5909	N501 E80	40-50		67.78	40.75
9Li21	5909	N501 E80	40-50		80.39	32.59
9Li21	5910	N501 E80	50-60		72.11	46.24
9Li21	5910	N501 E80	50-60		77.39	56.71
9Li21	5910	N501 E80	50-60		72.2	45.55
9Li21	5910	N501 E80	50-60		113.29	45.01
9Li21	5910	N501 E80	50-60		56.35	38.45
9Li21	5910	N501 E80	50-60		51.3	37.39
9Li21	5910	N501 E80	50-60		85.36	41.53
9Li21	5910	N501 E80	50-60		61.61	43.2
9Li21	5910	N501 E80	50-60		92.16	49.09
9Li21	5910	N501 E80	50-60		69.38	41.35
9Li21	5910	N501 E80	50-60		67.65	45
9Li21	5910	N501 E80	50-60		58.11	36.76
9Li21	5910	N501 E80	50-60		54.41	37.76
9Li21	5910	N501 E80	50-60		69.22	46.32
9Li21	5910	N501 E80	50-60		59.15	42.53
9Li21	5910	N501 E80	50-60		85.15	36.8
9Li21	5910	N501 E80	50-60		80.68	53.67
9Li21	5910	N501 E80	50-60		51.33	38.1
9Li21	5910	N501 E80	50-60		58.39	46.61
9Li21	5910	N501 E80	50-60		71.92	42.46
9Li21	5910	N501 E80	50-60		70.77	34.83
9Li21	5910	N501 E80	50-60		108.29	42.6
9Li21	5910	N501 E80	50-60		59.54	38.19
9Li21	5910	N501 E80	50-60		49.11	31.8
9Li21	5910	N501 E80	50-60		69.57	43.32
9Li21	5910	N501 E80	50-60		64.53	40.13
9Li21	5910	N501 E80	50-60		107.48	43.02
9Li21	5910	N501 E80	50-60		44.07	37.18
9Li21	5910	N501 E80	50-60		79.35	45.06
9Li21	5910	N501 E80	50-60		51.87	41.35
9Li21	5910	N501 E80	50-60		64.36	45.7
9Li21	5910	N501 E80	50-60		69	45.81
9Li21	5910	N501 E80	50-60		64.31	45.13

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	5910	N501 E80	50-60		44	40.04
9Li21	5910	N501 E80	50-60		54.51	32.39
9Li21	5910	N501 E80	50-60		63.78	43.1
9Li21	5910	N501 E80	50-60		50.17	42.14
9Li21	5910	N501 E80	50-60		50.23	42.95
9Li21	5910	N501 E80	50-60		58.34	33.43
9Li21	5910	N501 E80	50-60		71.77	36.15
9Li21	5910	N501 E80	50-60		99.31	37.13
9Li21	5910	N501 E80	50-60		76.08	55.37
9Li21	5910	N501 E80	50-60		73.28	42.88
9Li21	5910	N501 E80	50-60		44.53	32.1
9Li21	5910	N501 E80	50-60		59.43	46.04
9Li21	5910	N501 E80	50-60		80.93	45.79
9Li21	5910	N501 E80	50-60		66.17	43.2
9Li21	5910	N501 E80	50-60		96.43	41.65
9Li21	5910	N501 E80	50-60		78.36	51.84
9Li21	5910	N501 E80	50-60		49.81	38.65
9Li21	5910	N501 E80	50-60		56.28	42.26
9Li21	5910	N501 E80	50-60		63.14	45.46
9Li21	5910	N501 E80	50-60		75.29	42.03
9Li21	5910	N501 E80	50-60		117.15	61.44
9Li21	5910	N501 E80	50-60		54.47	39.28
9Li21	5910	N501 E80	50-60		104.92	67.34
9Li21	5910	N501 E80	50-60		57.23	41.19
9Li21	5910	N501 E80	50-60		63.93	38.74
9Li21	5910	N501 E80	50-60		64.67	47.11
9Li21	5910	N501 E80	50-60		68.61	43.9
9Li21	5910	N501 E80	50-60		67.51	40.69
9Li21	5910	N501 E80	50-60		49.36	44.74
9Li21	5910	N501 E80	50-60		66.72	45.3
9Li21	5910	N501 E80	50-60		60.48	40.09
9Li21	5910	N501 E80	50-60		79.01	41.52
9Li21	5910	N501 E80	50-60		64.86	30.27
9Li21	5910	N501 E80	50-60		71.35	52.77
9Li21	5910	N501 E80	50-60		59.53	39.23
9Li21	5910	N501 E80	50-60		54.47	40.11
9Li21	5910	N501 E80	50-60		93.69	35.57
9Li21	5910	N501 E80	50-60		94.82	38.66
9Li21	5910	N501 E80	50-60		81.86	37.99
9Li21	5910	N501 E80	50-60		71.72	50.12
9Li21	5910	N501 E80	50-60		73.07	47.45
9Li21	5910	N501 E80	50-60		79.84	48.99
9Li21	5910	N501 E80	50-60		44.87	31.44
9Li21	5910	N501 E80	50-60		107.08	35.84
9Li21	5910	N501 E80	50-60		71.03	47.41
9Li21	5910	N501 E80	50-60		76.79	49.79
9Li21	5910	N501 E80	50-60		54.62	41.77
9Li21	5910	N501 E80	50-60		69.7	41.9
9Li21	5911	N501 E80	60-70		65.33	37.27
9Li21	5911	N501 E80	60-70		64.14	43.33

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	5911	N501 E80	60-70		51.16	32.17
9Li21	5911	N501 E80	60-70		50.8	29.24
9Li21	5911	N501 E80	60-70		59.95	43.15
9Li21	5911	N501 E80	60-70		42.03	33.91
9Li21	5911	N501 E80	60-70		62.43	31.56
9Li21	5911	N501 E80	60-70		112.3	41.48
9Li21	5911	N501 E80	60-70		58.98	50.7
9Li21	5911	N501 E80	60-70		108.03	46.97
9Li21	5911	N501 E80	60-70		68.5	40.18
9Li21	5911	N501 E80	60-70		96.78	42.07
9Li21	5911	N501 E80	60-70		71.41	42.51
9Li21	5911	N501 E80	60-70		67.66	38.88
9Li21	5911	N501 E80	60-70		62.69	42.29
9Li21	5911	N501 E80	60-70		58.47	43.06
9Li21	5911	N501 E80	60-70		44.48	29.37
9Li21	5911	N501 E80	60-70		73.31	42.97
9Li21	5911	N501 E80	60-70		49.15	38.77
9Li21	5911	N501 E80	60-70		67.01	38.14
9Li21	5911	N501 E80	60-70		56.33	43.72
9Li21	5911	N501 E80	60-70		82.78	61.2
9Li21	5911	N501 E80	60-70		57.46	24.49
9Li21	5911	N501 E80	60-70		71.01	45.03
9Li21	5911	N501 E80	60-70		96.05	61.97
9Li21	5911	N501 E80	60-70		71.45	50.56
9Li21	5911	N501 E80	60-70		64.23	50.08
9Li21	5911	N501 E80	60-70		61.13	40.77
9Li21	5911	N501 E80	60-70		79.5	51.74
9Li21	5911	N501 E80	60-70		109.63	34.38
9Li21	5911	N501 E80	60-70		51.02	39.64
9Li21	5911	N501 E80	60-70		61.55	45.24
9Li21	5911	N501 E80	60-70		63.23	47.12
9Li21	5911	N501 E80	60-70		72.8	33.28
9Li21	5911	N501 E80	60-70		66.31	47.53
9Li21	5911	N501 E80	60-70		61.6	47.54
9Li21	5911	N501 E80	60-70		68.88	37.31
9Li21	5911	N501 E80	60-70		46.34	40.02
9Li21	5911	N501 E80	60-70		57.07	40.8
9Li21	5911	N501 E80	60-70		53.85	36.02
9Li21	5911	N501 E80	60-70		51.54	45.08
9Li21	5911	N501 E80	60-70		59.43	45.96
9Li21	5911	N501 E80	60-70		45.02	34.1
9Li21	5911	N501 E80	60-70		66.15	42.49
9Li21	5911	N501 E80	60-70		74.02	45.4
9Li21	5911	N501 E80	60-70		63.6	38.34
9Li21	5911	N501 E80	60-70		69.72	44.8
9Li21	5911	N501 E80	60-70		70.12	50.22
9Li21	5911	N501 E80	60-70		60.75	47.57
9Li21	5911	N501 E80	60-70		86.34	35.6
9Li21	5911	N501 E80	60-70		81.21	38.92
9Li21	5911	N501 E80	60-70		74.68	45.58

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	5911	N501 E80	60-70		73.02	42.78
9Li21	5911	N501 E80	60-70		64.68	42.13
9Li21	5911	N501 E80	60-70		72.55	49.37
9Li21	5911	N501 E80	60-70		100.06	43.45
9Li21	5911	N501 E80	60-70		58.57	38.72
9Li21	5911	N501 E80	60-70		81.2	50.64
9Li21	5911	N501 E80	60-70		62.88	41.9
9Li21	5911	N501 E80	60-70		74.23	38.75
9Li21	5911	N501 E80	60-70		76.47	54.21
9Li21	5911	N501 E80	60-70		58.68	42.07
9Li21	5911	N501 E80	60-70		60.34	38.68
9Li21	5911	N501 E80	60-70		71.72	42.53
9Li21	5911	N501 E80	60-70		40.5	28.6
9Li21	5911	N501 E80	60-70		74.49	26.01
9Li21	5911	N501 E80	60-70		82.43	48.87
9Li21	5911	N501 E80	60-70		62.04	46.1
9Li21	5911	N501 E80	60-70		53.97	42.68
9Li21	5911	N501 E80	60-70		62.84	49.23
9Li21	5911	N501 E80	60-70		60.36	44.43
9Li21	5911	N501 E80	60-70		89.41	41.91
9Li21	5911	N501 E80	60-70		56.84	44.64
9Li21	5911	N501 E80	60-70		83.72	43.98
9Li21	5911	N501 E80	60-70		85.1	38.56
9Li21	5911	N501 E80	60-70		62.54	43.09
9Li21	5911	N501 E80	60-70		77.63	47.27
9Li21	5911	N501 E80	60-70		73.44	39.18
9Li21	5911	N501 E80	60-70		67.82	44.49
9Li21	5911	N501 E80	60-70		63.6	39.67
9Li21	5911	N501 E80	60-70		54.34	30.53
9Li21	5912	N501 E80	70-80		51.52	38.9
9Li21	5912	N501 E80	70-80		63.43	36.57
9Li21	5912	N501 E80	70-80		47.33	34.53
9Li21	5912	N501 E80	70-80		59.96	41.35
9Li21	5912	N501 E80	70-80		74.11	56.48
9Li21	5912	N501 E80	70-80		60.51	43.46
9Li21	5912	N501 E80	70-80		97.67	48.96
9Li21	5912	N501 E80	70-80		69.05	38.35
9Li21	5912	N501 E80	70-80		65.89	36.07
9Li21	5912	N501 E80	70-80		61.86	44.41
9Li21	5912	N501 E80	70-80		74.2	39.69
9Li21	5912	N501 E80	70-80		85.47	42.92
9Li21	5912	N501 E80	70-80		50.72	34.34
9Li21	5912	N501 E80	70-80		59.26	46.97
9Li21	5912	N501 E80	70-80		72.95	35.11
9Li21	5912	N501 E80	70-80		88.45	51.72
9Li21	5912	N501 E80	70-80		94.68	47.54
9Li21	5912	N501 E80	70-80		57.4	31.79
9Li21	5912	N501 E80	70-80		56.44	38.05
9Li21	5912	N501 E80	70-80		70.94	41.98
9Li21	5912	N501 E80	70-80		59.03	48.94

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	5912	N501 E80	70-80		63.03	41.17
9Li21	5912	N501 E80	70-80		65.72	49.82
9Li21	5912	N501 E80	70-80		66.02	40.69
9Li21	5912	N501 E80	70-80		64.35	45.91
9Li21	5912	N501 E80	70-80		79.65	49.47
9Li21	5912	N501 E80	70-80		54.91	42.09
9Li21	5912	N501 E80	70-80		58	37.1
9Li21	5912	N501 E80	70-80		63.58	43.15
9Li21	5912	N501 E80	70-80		63.18	48.93
9Li21	5912	N501 E80	70-80		67.07	42.36
9Li21	5912	N501 E80	70-80		56.42	34.08
9Li21	5912	N501 E80	70-80		94.04	48.16
9Li21	5912	N501 E80	70-80		86.96	45.6
9Li21	5912	N501 E80	70-80		67.44	36.58
9Li21	5912	N501 E80	70-80		68.62	40.24
9Li21	5912	N501 E80	70-80		66.36	44.7
9Li21	5912	N501 E80	70-80		60.85	49.93
9Li21	5912	N501 E80	70-80		68.83	39.45
9Li21	5912	N501 E80	70-80		73.06	39.36
9Li21	5912	N501 E80	70-80		75.74	31.16
9Li21	5912	N501 E80	70-80		71.9	47.24
9Li21	5912	N501 E80	70-80		56.26	37.34
9Li21	5912	N501 E80	70-80		52.66	43.37
9Li21	5912	N501 E80	70-80		64.43	40.01
9Li21	5912	N501 E80	70-80		51.95	33.93
9Li21	5912	N501 E80	70-80		57.12	34.71
9Li21	5912	N501 E80	70-80		63.85	45.22
9Li21	5912	N501 E80	70-80		65.37	33.25
9Li21	5912	N501 E80	70-80		74.37	32.12
9Li21	5912	N501 E80	70-80		77.77	42.31
9Li21	5912	N501 E80	70-80		60.18	42.5
9Li21	5912	N501 E80	70-80		74.45	42.24
9Li21	5912	N501 E80	70-80		50.94	34.07
9Li21	5912	N501 E80	70-80		65.87	47.19
9Li21	5912	N501 E80	70-80		48.77	33.25
9Li21	5912	N501 E80	70-80		68.73	54.32
9Li21	5912	N501 E80	70-80		80.87	54.4
9Li21	5912	N501 E80	70-80		44.49	29.49
9Li21	5912	N501 E80	70-80		85.55	47.98
9Li21	5912	N501 E80	70-80		95.13	49.81
9Li21	5913	N501 E80	80-90		78.47	43.77
9Li21	5913	N501 E80	80-90		63.61	37.99
9Li21	5913	N501 E80	80-90		82.63	61.03
9Li21	5913	N501 E80	80-90		66.86	44.3
9Li21	5913	N501 E80	80-90		66.05	39.83
9Li21	5913	N501 E80	80-90		78.47	41.72
9Li21	5913	N501 E80	80-90		61.99	38.39
9Li21	5913	N501 E80	80-90		72.01	39.34
9Li21	5913	N501 E80	80-90		45.25	32.21
9Li21	5913	N501 E80	80-90		50.48	30.26

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	5913	N501 E80	80-90		73.66	40.69
9Li21	5913	N501 E80	80-90		66.11	44.64
9Li21	5913	N501 E80	80-90		37.25	31.65
9Li21	5913	N501 E80	80-90		44.44	33.51
9Li21	5913	N501 E80	80-90		58.24	39.89
9Li21	5913	N501 E80	80-90		55.86	27.96
9Li21	5913	N501 E80	80-90		51.79	34.39
9Li21	5913	N501 E80	80-90		60.07	30.49
9Li21	5913	N501 E80	80-90		55.65	42.45
9Li21	5913	N501 E80	80-90		59.68	41.59
9Li21	5913	N501 E80	80-90		57.42	37.5
9Li21	5913	N501 E80	80-90		46.07	26.76
9Li21	5913	N501 E80	80-90		68.61	39.15
9Li21	5913	N501 E80	80-90		82.76	43.18
9Li21	9073	Theta	0-17		93.94	52.99
9Li21	9073	Theta	0-17		66.47	37.59
9Li21	9073	Theta	0-17		59.4	46.74
9Li21	9073	Theta	0-17		92.01	56.78
9Li21	9073	Theta	0-17		68.37	49.54
9Li21	9073	Theta	0-17		69.89	45.72
9Li21	9073	Theta	0-17		57.66	37.09
9Li21	9073	Theta	0-17		74.73	45.81
9Li21	9073	Theta	0-17		80.22	50.84
9Li21	9073	Theta	0-17		58.56	48.28
9Li21	9073	Theta	0-17		72.49	47.67
9Li21	9073	Theta	0-17		101.39	31.73
9Li21	9073	Theta	0-17		143.85	48.65
9Li21	9073	Theta	0-17		84.2	44.12
9Li21	9073	Theta	0-17		79.7	46.79
9Li21	9073	Theta	0-17		91.02	43.27
9Li21	9073	Theta	0-17		106.74	57.07
9Li21	9073	Theta	0-17		62.74	37.71
9Li21	9073	Theta	0-17		136.86	49.49
9Li21	9073	Theta	0-17		79.95	43.02
9Li21	9073	Theta	0-17		92.32	60.4
9Li21	9073	Theta	0-17		103.23	56.98
9Li21	9073	Theta	0-17		85.68	46.76
9Li21	9073	Theta	0-17		63.26	49.82
9Li21	9073	Theta	0-17		54.81	46.46
9Li21	9073	Theta	0-17		99.94	42.07
9Li21	9073	Theta	0-17		109.22	55.81
9Li21	9073	Theta	0-17		74.47	37.78
9Li21	9073	Theta	0-17		74.28	45.42
9Li21	9073	Theta	0-17		60.58	40.31
9Li21	9073	Theta	0-17		43.26	31.65
9Li21	9073	Theta	0-17		57.75	40.52
9Li21	9073	Theta	0-17		93.24	50.27
9Li21	9073	Theta	0-17		93.24	48.64
9Li21	9073	Theta	0-17		70.52	38
9Li21	9073	Theta	0-17		90.22	46.78

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	9073	Theta	0-17		63.96	59.32
9Li21	9073	Theta	0-17		98.14	50.94
9Li21	9073	Theta	0-17		64.87	57.77
9Li21	9073	Theta	0-17		68.02	48.33
9Li21	9073	Theta	0-17		86.34	45.01
9Li21	9073	Theta	0-17		136.97	51.25
9Li21	9073	Theta	0-17		77.01	40.45
9Li21	9073	Theta	0-17		88.71	46.82
9Li21	9073	Theta	0-17		137.98	52.61
9Li21	9073	Theta	0-17		94.79	55.27
9Li21	9073	Theta	0-17		77.34	40.64
9Li21	9073	Theta	0-17		82.65	40.98
9Li21	9073	Theta	0-17		70.94	52.55
9Li21	9073	Theta	0-17		86.98	43.02
9Li21	9073	Theta	0-17		77.99	47.92
9Li21	9073	Theta	0-17		86.17	46.27
9Li21	9073	Theta	0-17		104.71	58.45
9Li21	9073	Theta	0-17		79.46	44.86
9Li21	9073	Theta	0-17		74.62	40.56
9Li21	9073	Theta	0-17		68.04	42.93
9Li21	9073	Theta	0-17		61.91	34.1
9Li21	9073	Theta	0-17		54.99	41.87
9Li21	9073	Theta	0-17		86.19	52.8
9Li21	9073	Theta	0-17		117.12	58.09
9Li21	9073	Theta	0-17		128.53	53.69
9Li21	9073	Theta	0-17		89.21	38.96
9Li21	9073	Theta	0-17		77.69	47.41
9Li21	9073	Theta	0-17		100.67	47.72
9Li21	9073	Theta	0-17		80.26	54.71
9Li21	9073	Theta	0-17		80.68	54.5
9Li21	9073	Theta	0-17		51.15	36.02
9Li21	9073	Theta	0-17		55.07	46.21
9Li21	9073	Theta	0-17		85.06	47.07
9Li21	9073	Theta	0-17		118.56	61.12
9Li21	9073	Theta	0-17		60.98	42.63
9Li21	9073	Theta	0-17		62.54	27.67
9Li21	9073	Theta	0-17		68.73	35
9Li21	9073	Theta	0-17		52.47	33.86
9Li21	9073	Theta	0-17		73.42	43.13
9Li21	9073	Theta	0-17		75.67	49.46
9Li21	9073	Theta	0-17		76	50.49
9Li21	9073	Theta	0-17		62.35	39.14
9Li21	9073	Theta	0-17		99.81	48.4
9Li21	9073	Theta	0-17		129.02	54.37
9Li21	9073	Theta	0-17		79.56	53.3
9Li21	9076	Theta	17-27		89.3	48.1
9Li21	9076	Theta	17-27		65.06	39.04
9Li21	9076	Theta	17-27		74.07	44.85
9Li21	9076	Theta	17-27		110.4	52.76
9Li21	9076	Theta	17-27		109.28	49.34

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	9076	Theta	17-27		75.49	45.37
9Li21	9076	Theta	17-27		71.06	55.01
9Li21	9076	Theta	17-27		52.2	40.43
9Li21	9076	Theta	17-27		61.46	36.6
9Li21	9076	Theta	17-27		79.08	55.99
9Li21	9076	Theta	17-27		113.65	48.69
9Li21	9076	Theta	17-27		53.54	34.8
9Li21	9076	Theta	17-27		123.55	69.12
9Li21	9076	Theta	17-27		112.28	50.72
9Li21	9076	Theta	17-27		98	50.49
9Li21	9076	Theta	17-27		56.92	35.29
9Li21	9076	Theta	17-27		64.06	30.45
9Li21	9076	Theta	17-27		103.04	51.03
9Li21	9076	Theta	17-27		91.46	48.89
9Li21	9076	Theta	17-27		64.56	41.87
9Li21	9076	Theta	17-27		119.8	46.92
9Li21	9076	Theta	17-27		82.48	55.96
9Li21	9076	Theta	17-27		75.52	47.69
9Li21	9076	Theta	17-27		70.16	45.88
9Li21	9076	Theta	17-27		75.21	40.73
9Li21	9076	Theta	17-27		91.25	42.4
9Li21	9076	Theta	17-27		67.38	38.97
9Li21	9076	Theta	17-27		73.78	49.93
9Li21	9076	Theta	17-27		63.49	33.29
9Li21	9076	Theta	17-27		86.58	44.08
9Li21	9076	Theta	17-27		80.28	44.58
9Li21	9076	Theta	17-27		111.92	46.74
9Li21	9076	Theta	17-27		84.61	59.24
9Li21	9076	Theta	17-27		70.66	44.14
9Li21	9076	Theta	17-27		68.62	44
9Li21	9076	Theta	17-27		129.14	58.49
9Li21	9076	Theta	17-27		72.21	41.17
9Li21	9076	Theta	17-27		66.85	40.57
9Li21	9076	Theta	17-27		79.35	43.74
9Li21	9076	Theta	17-27		103.49	60.9
9Li21	9076	Theta	17-27		67.74	39.35
9Li21	9076	Theta	17-27		73.26	54.42
9Li21	9076	Theta	17-27		68.54	39.18
9Li21	9076	Theta	17-27		133.52	45.6
9Li21	9076	Theta	17-27		100.66	58.13
9Li21	9076	Theta	17-27		57.45	39.29
9Li21	9076	Theta	17-27		58.63	41.13
9Li21	9076	Theta	17-27		77.91	46.51
9Li21	9076	Theta	17-27		67.27	46.98
9Li21	9076	Theta	17-27		68.71	47.96
9Li21	9076	Theta	17-27		96	60.6
9Li21	9076	Theta	17-27		63.7	43.66
9Li21	9076	Theta	17-27		87.43	60.22
9Li21	9076	Theta	17-27		88.99	56.86
9Li21	9076	Theta	17-27		83.1	53.48

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	9076	Theta	17-27		61.07	44.36
9Li21	9076	Theta	17-27		66.81	37.32
9Li21	9076	Theta	17-27		96.3	56.36
9Li21	9076	Theta	17-27		63.85	44.57
9Li21	9076	Theta	17-27		86	58.54
9Li21	9076	Theta	17-27		118.9	51.19
9Li21	9076	Theta	17-27		76.49	56.05
9Li21	9076	Theta	17-27		75.51	36.56
9Li21	9076	Theta	17-27		87.92	59.91
9Li21	9076	Theta	17-27		91.02	47.67
9Li21	9076	Theta	17-27		94.43	42.57
9Li21	9076	Theta	17-27		82.37	46.72
9Li21	9076	Theta	17-27		72.24	49.03
9Li21	9076	Theta	17-27		71.55	40.23
9Li21	9076	Theta	17-27		64.89	44.86
9Li21	9076	Theta	17-27		61.68	44.99
9Li21	9076	Theta	17-27		58.82	53.13
9Li21	9076	Theta	17-27		69.82	44.08
9Li21	9076	Theta	17-27		89.55	51.66
9Li21	9076	Theta	17-27		96.11	58.1
9Li21	9076	Theta	17-27		62.87	41.69
9Li21	9076	Theta	17-27		57.61	42.21
9Li21	9076	Theta	17-27		70.5	45.62
9Li21	9076	Theta	17-27		67.09	38.39
9Li21	9076	Theta	17-27		98.49	41.87
9Li21	9076	Theta	17-27		56.69	42.92
9Li21	9186	Theta	27-37		60.09	54.94
9Li21	9186	Theta	27-37		106.03	62.3
9Li21	9186	Theta	27-37		64.93	40.32
9Li21	9186	Theta	27-37		79.71	36.5
9Li21	9186	Theta	27-37		76.58	40.16
9Li21	9186	Theta	27-37		89.52	45.48
9Li21	9186	Theta	27-37		57.96	39.01
9Li21	9186	Theta	27-37		102.18	61.99
9Li21	9186	Theta	27-37		85.7	53.25
9Li21	9186	Theta	27-37		100	53.38
9Li21	9186	Theta	27-37		102.36	71.86
9Li21	9186	Theta	27-37		115.63	57.05
9Li21	9186	Theta	27-37		58.69	44.07
9Li21	9186	Theta	27-37		63.22	38.67
9Li21	9186	Theta	27-37		80.05	50.08
9Li21	9186	Theta	27-37		80.16	41.24
9Li21	9186	Theta	27-37		59.88	33.35
9Li21	9186	Theta	27-37		68.46	43.69
9Li21	9186	Theta	27-37		60.94	53.11
9Li21	9186	Theta	27-37		62.83	43.17
9Li21	9186	Theta	27-37		73.43	49.03
9Li21	9186	Theta	27-37		69.43	50.84
9Li21	9186	Theta	27-37		78.65	53.98
9Li21	9186	Theta	27-37		55.91	46.07

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	9186	Theta	27-37		108.77	42.75
9Li21	9186	Theta	27-37		92.7	54.43
9Li21	9186	Theta	27-37		61.86	46.44
9Li21	9186	Theta	27-37		94.27	51.9
9Li21	9186	Theta	27-37		114.41	61.6
9Li21	9186	Theta	27-37		100.35	64.2
9Li21	9186	Theta	27-37		65.34	43.9
9Li21	9186	Theta	27-37		83.74	45.42
9Li21	9186	Theta	27-37		65.41	44.07
9Li21	9186	Theta	27-37		69.24	46.43
9Li21	9186	Theta	27-37		66.06	52.13
9Li21	9186	Theta	27-37		84.22	46.96
9Li21	9186	Theta	27-37		72.1	48.12
9Li21	9186	Theta	27-37		73.35	53.38
9Li21	9186	Theta	27-37		77.03	49.23
9Li21	9186	Theta	27-37		65.02	44.81
9Li21	9186	Theta	27-37		109.76	39.48
9Li21	9186	Theta	27-37		122.5	58.56
9Li21	9186	Theta	27-37		66.73	49.75
9Li21	9186	Theta	27-37		58.32	36.7
9Li21	9186	Theta	27-37		73.49	47.63
9Li21	9186	Theta	27-37		56.83	33.58
9Li21	9186	Theta	27-37		95.31	43.75
9Li21	9186	Theta	27-37		87.52	60
9Li21	9186	Theta	27-37		92.32	52.06
9Li21	9186	Theta	27-37		59.87	48.58
9Li21	9186	Theta	27-37		121.72	46.21
9Li21	9186	Theta	27-37		120.6	40.51
9Li21	9186	Theta	27-37		71.24	44.06
9Li21	9186	Theta	27-37		70.93	43.47
9Li21	9186	Theta	27-37		60.06	44.7
9Li21	9186	Theta	27-37		63.58	45.59
9Li21	9186	Theta	27-37		72.69	40.42
9Li21	9186	Theta	27-37		68.72	36.42
9Li21	9186	Theta	27-37		70.69	45.05
9Li21	9186	Theta	27-37		87.88	57.53
9Li21	9186	Theta	27-37		109.18	73.89
9Li21	9186	Theta	27-37		90.77	47.01
9Li21	9186	Theta	27-37		90.51	44.3
9Li21	9186	Theta	27-37		119.17	50.7
9Li21	9186	Theta	27-37		71.83	36.17
9Li21	9186	Theta	27-37		56.8	28.7
9Li21	9186	Theta	27-37		63.39	34.49
9Li21	9186	Theta	27-37		71.77	39.49
9Li21	9186	Theta	27-37		87.18	56.94
9Li21	9186	Theta	27-37		54.76	51.67
9Li21	9186	Theta	27-37		56.57	31.73
9Li21	9186	Theta	27-37		66.92	43.04
9Li21	9186	Theta	27-37		57.6	37.37
9Li21	9186	Theta	27-37		97.58	50.34

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	9186	Theta	27-37		115.93	48.82
9Li21	9186	Theta	27-37		48.77	36.52
9Li21	9186	Theta	27-37		44.26	23.51
9Li21	9186	Theta	27-37		83.04	62.64
9Li21	9186	Theta	27-37		109.17	71.27
9Li21	9186	Theta	27-37		85.3	53.04
9Li21	9186	Theta	27-37		68.82	44.55
9Li21	9114	Theta	37-47		67.68	46.73
9Li21	9114	Theta	37-47		151.85	35.55
9Li21	9114	Theta	37-47		96.7	54.8
9Li21	9114	Theta	37-47		122.06	43.26
9Li21	9114	Theta	37-47		86.07	47.58
9Li21	9114	Theta	37-47		97.51	45.69
9Li21	9114	Theta	37-47		94.94	39.16
9Li21	9114	Theta	37-47		85.48	46.29
9Li21	9114	Theta	37-47		84.2	37.76
9Li21	9114	Theta	37-47		57.03	25.45
9Li21	9114	Theta	37-47		79.07	43.28
9Li21	9114	Theta	37-47		82.99	47.65
9Li21	9114	Theta	37-47		115.56	41.6
9Li21	9114	Theta	37-47		105.73	63.49
9Li21	9114	Theta	37-47		89.87	57.53
9Li21	9114	Theta	37-47		99.94	38.54
9Li21	9114	Theta	37-47		80.78	59.71
9Li21	9114	Theta	37-47		79.08	46.76
9Li21	9114	Theta	37-47		110.11	44.67
9Li21	9114	Theta	37-47		76.03	46.96
9Li21	9114	Theta	37-47		82.85	53.03
9Li21	9114	Theta	37-47		94	47.69
9Li21	9114	Theta	37-47		78.77	42.14
9Li21	9114	Theta	37-47		74.75	38.81
9Li21	9114	Theta	37-47		103.66	44.91
9Li21	9114	Theta	37-47		94.43	41.2
9Li21	9114	Theta	37-47		104.07	46.34
9Li21	9114	Theta	37-47		69.58	46.23
9Li21	9114	Theta	37-47		62.53	40.49
9Li21	9114	Theta	37-47		92.32	43.66
9Li21	9114	Theta	37-47		81.88	44.22
9Li21	9114	Theta	37-47		116.16	33.52
9Li21	9114	Theta	37-47		102.55	48.43
9Li21	9114	Theta	37-47		65.97	42
9Li21	9114	Theta	37-47		58.94	41.99
9Li21	9114	Theta	37-47		77.34	40.05
9Li21	9114	Theta	37-47		60.71	42.65
9Li21	9114	Theta	37-47		103.29	47.93
9Li21	9114	Theta	37-47		76.35	41.31
9Li21	9114	Theta	37-47		74.79	43.26
9Li21	9114	Theta	37-47		72.33	42.11
9Li21	9114	Theta	37-47		79.76	46.44
9Li21	9114	Theta	37-47		88.02	43.67

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	9114	Theta	37-47		81.16	42.37
9Li21	9114	Theta	37-47		51.01	28.16
9Li21	9114	Theta	37-47		62.62	42.62
9Li21	9114	Theta	37-47		75.74	59.84
9Li21	9114	Theta	37-47		150.66	60.48
9Li21	9114	Theta	37-47		63.09	38.98
9Li21	9114	Theta	37-47		96	41.41
9Li21	9114	Theta	37-47		86.9	44.5
9Li21	9114	Theta	37-47		79.02	45.99
9Li21	9114	Theta	37-47		82.14	36.75
9Li21	9114	Theta	37-47		130.58	45.08
9Li21	9114	Theta	37-47		94.47	39.29
9Li21	9114	Theta	37-47		84.51	50.41
9Li21	9114	Theta	37-47		62.65	41.32
9Li21	9114	Theta	37-47		61.36	28.22
9Li21	9114	Theta	37-47		80.55	49.03
9Li21	9114	Theta	37-47		74.87	29.68
9Li21	9114	Theta	37-47		57.45	42.2
9Li21	9114	Theta	37-47		99.69	37.75
9Li21	9114	Theta	37-47		76.59	42.06
9Li21	9114	Theta	37-47		59.23	42.28
9Li21	9114	Theta	37-47		66.17	46.1
9Li21	9114	Theta	37-47		61.65	52.74
9Li21	9114	Theta	37-47		80.81	37.52
9Li21	9114	Theta	37-47		80.21	55.34
9Li21	9114	Theta	37-47		61.04	37
9Li21	9114	Theta	37-47		64.7	45.82
9Li21	9114	Theta	37-47		113.71	51.25
9Li21	9114	Theta	37-47		61.93	37.46
9Li21	9114	Theta	37-47		83.58	38.45
9Li21	9114	Theta	37-47		60.72	38.26
9Li21	9114	Theta	37-47		75.56	39.01
9Li21	9114	Theta	37-47		68.55	38.68
9Li21	9114	Theta	37-47		98.23	51.46
9Li21	9114	Theta	37-47		74.77	43.54
9Li21	9114	Theta	37-47		94.95	32.47
9Li21	9114	Theta	37-47		84.15	44.07
9Li21	9114	Theta	37-47		50.3	39.77
9Li21	9116	Theta	47-57		67.62	40.39
9Li21	9116	Theta	47-57		93.76	47.41
9Li21	9116	Theta	47-57		84.81	46.73
9Li21	9116	Theta	47-57		53.75	40.94
9Li21	9116	Theta	47-57		97.36	56.01
9Li21	9116	Theta	47-57		113.73	54.15
9Li21	9116	Theta	47-57		120.27	49.88
9Li21	9116	Theta	47-57		105.45	56.6
9Li21	9116	Theta	47-57		71.24	44.75
9Li21	9116	Theta	47-57		134	52.53
9Li21	9116	Theta	47-57		114.51	44.53
9Li21	9116	Theta	47-57		129.33	40.24

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	9116	Theta	47-57		71.05	51.94
9Li21	9116	Theta	47-57		82.34	48.44
9Li21	9116	Theta	47-57		104.71	43.41
9Li21	9116	Theta	47-57		92.23	36.34
9Li21	9116	Theta	47-57		61.23	49.56
9Li21	9116	Theta	47-57		66.81	49.71
9Li21	9116	Theta	47-57		95.48	51.49
9Li21	9116	Theta	47-57		89.72	48.6
9Li21	9116	Theta	47-57		82.09	45.14
9Li21	9116	Theta	47-57		100.62	56.26
9Li21	9116	Theta	47-57		75.55	48.05
9Li21	9116	Theta	47-57		66.19	39.02
9Li21	9116	Theta	47-57		113.73	53.75
9Li21	9116	Theta	47-57		82.75	53.59
9Li21	9116	Theta	47-57		91.31	44.28
9Li21	9116	Theta	47-57		77.2	52.29
9Li21	9116	Theta	47-57		80.41	52.94
9Li21	9116	Theta	47-57		73.9	41.41
9Li21	9116	Theta	47-57		89.72	47.78
9Li21	9116	Theta	47-57		110.06	45.43
9Li21	9116	Theta	47-57		89.57	48.41
9Li21	9116	Theta	47-57		130.58	45.71
9Li21	9116	Theta	47-57		101.04	52.32
9Li21	9116	Theta	47-57		68.99	47.11
9Li21	9116	Theta	47-57		102.37	58.05
9Li21	9116	Theta	47-57		103.29	50.32
9Li21	9116	Theta	47-57		87.61	43.07
9Li21	9116	Theta	47-57		80.19	57.04
9Li21	9116	Theta	47-57		100.79	51.26
9Li21	9116	Theta	47-57		49.02	38.44
9Li21	9116	Theta	47-57		85.18	46.03
9Li21	9116	Theta	47-57		91.26	41.79
9Li21	9116	Theta	47-57		76.56	56.97
9Li21	9116	Theta	47-57		87.97	44.72
9Li21	9116	Theta	47-57		74.13	32.73
9Li21	9116	Theta	47-57		72.62	51.81
9Li21	9116	Theta	47-57		84.24	53.33
9Li21	9116	Theta	47-57		106.77	48.48
9Li21	9116	Theta	47-57		102.28	45.54
9Li21	9116	Theta	47-57		81.53	44.43
9Li21	9116	Theta	47-57		88.13	48.93
9Li21	9116	Theta	47-57		74.06	47.28
9Li21	9116	Theta	47-57		85.79	45.52
9Li21	9116	Theta	47-57		148.78	43.34
9Li21	9116	Theta	47-57		85.2	52.8
9Li21	9116	Theta	47-57		103.44	49.15
9Li21	9116	Theta	47-57		84.4	44.39
9Li21	9116	Theta	47-57		93.4	39.48
9Li21	9116	Theta	47-57		84.61	49.72
9Li21	9116	Theta	47-57		74.35	52.76

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	9116	Theta	47-57		81.32	46.35
9Li21	9116	Theta	47-57		76.5	49.17
9Li21	9116	Theta	47-57		109.8	52.89
9Li21	9116	Theta	47-57		80.35	54.67
9Li21	9116	Theta	47-57		90.93	45.14
9Li21	9116	Theta	47-57		82.52	51.84
9Li21	9116	Theta	47-57		89.37	43.04
9Li21	9116	Theta	47-57		70.56	42.53
9Li21	9116	Theta	47-57		74.83	45.8
9Li21	9116	Theta	47-57		54.98	31.06
9Li21	9116	Theta	47-57		73.88	46.29
9Li21	9116	Theta	47-57		115.77	56.52
9Li21	9116	Theta	47-57		96.88	54.11
9Li21	9116	Theta	47-57		87.37	48.9
9Li21	9116	Theta	47-57		87.69	45.87
9Li21	9116	Theta	47-57		68.76	48.89
9Li21	9116	Theta	47-57		68.97	45.75
9Li21	9116	Theta	47-57		88.27	49.28
9Li21	9116	Theta	47-57		66.36	42.52
9Li21	8949	Epsilon	0-10		85.63	50.81
9Li21	8949	Epsilon	0-10		79.52	45.3
9Li21	8949	Epsilon	0-10		64.3	39
9Li21	8949	Epsilon	0-10		87.81	42.17
9Li21	8949	Epsilon	0-10		71.4	44.82
9Li21	8949	Epsilon	0-10		72.37	38.55
9Li21	8949	Epsilon	0-10		87.79	46.54
9Li21	8949	Epsilon	0-10		103.27	55.41
9Li21	8949	Epsilon	0-10		90.43	56.13
9Li21	8949	Epsilon	0-10		77.51	42.67
9Li21	8949	Epsilon	0-10		61.11	50.31
9Li21	8949	Epsilon	0-10		93.57	62.71
9Li21	8949	Epsilon	0-10		128.38	58.69
9Li21	8949	Epsilon	0-10		111.62	56.36
9Li21	8949	Epsilon	0-10		95.11	50.18
9Li21	8949	Epsilon	0-10		102.91	40.73
9Li21	8949	Epsilon	0-10		124.8	53.96
9Li21	8949	Epsilon	0-10		115.34	47.74
9Li21	8949	Epsilon	0-10		84.79	48.6
9Li21	8949	Epsilon	0-10		87.62	50.71
9Li21	8949	Epsilon	0-10		60.5	40.29
9Li21	8949	Epsilon	0-10		88.84	47.39
9Li21	8949	Epsilon	0-10		89.44	46.29
9Li21	8949	Epsilon	0-10		70.72	43.27
9Li21	8949	Epsilon	0-10		73.32	37.09
9Li21	8949	Epsilon	0-10		71.91	35.63
9Li21	8949	Epsilon	0-10		114.78	54.95
9Li21	8949	Epsilon	0-10		111.99	56.67
9Li21	8949	Epsilon	0-10		69.74	38.04
9Li21	8949	Epsilon	0-10		93.88	42.03
9Li21	8949	Epsilon	0-10		53.17	32.93

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8949	Epsilon	0-10		96.13	53.68
9Li21	8949	Epsilon	0-10		76.27	45.25
9Li21	8949	Epsilon	0-10		106	50.66
9Li21	8949	Epsilon	0-10		52.95	39.3
9Li21	8949	Epsilon	0-10		69.9	46.53
9Li21	8949	Epsilon	0-10		102.88	68.25
9Li21	8949	Epsilon	0-10		84.92	49.87
9Li21	8949	Epsilon	0-10		106.09	54.67
9Li21	8949	Epsilon	0-10		85.9	48.83
9Li21	8949	Epsilon	0-10		69.24	43.35
9Li21	8949	Epsilon	0-10		111.86	52.09
9Li21	8949	Epsilon	0-10		62.34	34.2
9Li21	8949	Epsilon	0-10		87.9	51.43
9Li21	8949	Epsilon	0-10		94.6	49.95
9Li21	8949	Epsilon	0-10		67.57	42.4
9Li21	8949	Epsilon	0-10		76.96	41.37
9Li21	8949	Epsilon	0-10		68.76	40.93
9Li21	8949	Epsilon	0-10		114.89	53.53
9Li21	8949	Epsilon	0-10		62.65	37.14
9Li21	8949	Epsilon	0-10		79.58	30.38
9Li21	8949	Epsilon	0-10		68.81	42.74
9Li21	8949	Epsilon	0-10		66.46	49.86
9Li21	8949	Epsilon	0-10		94.54	63.96
9Li21	8949	Epsilon	0-10		87.72	55.44
9Li21	8949	Epsilon	0-10		79.87	52.4
9Li21	8949	Epsilon	0-10		73.65	43.1
9Li21	8949	Epsilon	0-10		99.1	44.5
9Li21	8949	Epsilon	0-10		61.23	36.56
9Li21	8949	Epsilon	0-10		101.13	55.87
9Li21	8953	Epsilon	10-20		74.08	52.88
9Li21	8953	Epsilon	10-20		65.92	39.18
9Li21	8953	Epsilon	10-20		101.2	46.97
9Li21	8953	Epsilon	10-20		74.18	47.02
9Li21	8953	Epsilon	10-20		152.01	45.41
9Li21	8953	Epsilon	10-20		105.44	59.32
9Li21	8953	Epsilon	10-20		76.84	57.55
9Li21	8953	Epsilon	10-20		64.63	42.6
9Li21	8953	Epsilon	10-20		79.74	60.23
9Li21	8953	Epsilon	10-20		81.42	53.4
9Li21	8953	Epsilon	10-20		101.7	46.31
9Li21	8953	Epsilon	10-20		73.3	40.45
9Li21	8953	Epsilon	10-20		71.12	42.54
9Li21	8953	Epsilon	10-20		88.88	59.07
9Li21	8953	Epsilon	10-20		124.7	60.22
9Li21	8953	Epsilon	10-20		87.38	47.58
9Li21	8953	Epsilon	10-20		110.37	56.87
9Li21	8953	Epsilon	10-20		85.77	61.01
9Li21	8953	Epsilon	10-20		63.1	35.81
9Li21	8953	Epsilon	10-20		102.62	66.72
9Li21	8953	Epsilon	10-20		108.49	58.33

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8953	Epsilon	10-20		65.76	48.08
9Li21	8953	Epsilon	10-20		133.6	57.03
9Li21	8953	Epsilon	10-20		93.73	50.22
9Li21	8953	Epsilon	10-20		53.3	39.86
9Li21	8953	Epsilon	10-20		98.84	43.69
9Li21	8953	Epsilon	10-20		103.08	55.91
9Li21	8953	Epsilon	10-20		109.3	51.8
9Li21	8953	Epsilon	10-20		62.12	38.69
9Li21	8953	Epsilon	10-20		90.88	51.23
9Li21	8953	Epsilon	10-20		100.97	47.81
9Li21	8953	Epsilon	10-20		64.08	41.28
9Li21	8953	Epsilon	10-20		105.21	55.95
9Li21	8953	Epsilon	10-20		70.93	48.57
9Li21	8953	Epsilon	10-20		82	51.34
9Li21	8953	Epsilon	10-20		101.97	47.52
9Li21	8953	Epsilon	10-20		80.02	44.02
9Li21	8953	Epsilon	10-20		103.04	46.33
9Li21	8953	Epsilon	10-20		90.42	53.5
9Li21	8953	Epsilon	10-20		74.63	48.55
9Li21	8953	Epsilon	10-20		84.78	50.2
9Li21	8953	Epsilon	10-20		91.24	48.43
9Li21	8953	Epsilon	10-20		51.78	34.16
9Li21	8953	Epsilon	10-20		56.28	42.79
9Li21	8953	Epsilon	10-20		60.89	48.43
9Li21	8953	Epsilon	10-20		79.88	44.87
9Li21	8953	Epsilon	10-20		72.44	46.95
9Li21	8953	Epsilon	10-20		115.59	58.61
9Li21	8953	Epsilon	10-20		86.79	44.52
9Li21	8953	Epsilon	10-20		57.64	45.15
9Li21	8953	Epsilon	10-20		64.82	38.62
9Li21	8953	Epsilon	10-20		82.96	49.59
9Li21	8953	Epsilon	10-20		84.37	52.65
9Li21	8953	Epsilon	10-20		116.79	38.27
9Li21	8953	Epsilon	10-20		75.05	49.64
9Li21	8953	Epsilon	10-20		61.51	43.45
9Li21	8953	Epsilon	10-20		74.7	44.77
9Li21	8953	Epsilon	10-20		98.9	55.65
9Li21	8953	Epsilon	10-20		61.02	34.31
9Li21	8953	Epsilon	10-20		76.78	57.77
9Li21	8953	Epsilon	10-20		96.41	50.55
9Li21	8953	Epsilon	10-20		60.97	33.39
9Li21	8953	Epsilon	10-20		107.26	65.76
9Li21	8953	Epsilon	10-20		70.2	51.49
9Li21	8953	Epsilon	10-20		65.83	46.71
9Li21	8953	Epsilon	10-20		109.27	44.45
9Li21	8953	Epsilon	10-20		80.62	48.86
9Li21	8953	Epsilon	10-20		71.39	43.21
9Li21	8953	Epsilon	10-20		61.14	40.64
9Li21	8953	Epsilon	10-20		74.42	58.17
9Li21	8953	Epsilon	10-20		85.24	46.7

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8953	Epsilon	10-20		63.28	41.29
9Li21	8953	Epsilon	10-20		77.27	47
9Li21	8953	Epsilon	10-20		101.29	52
9Li21	8953	Epsilon	10-20		69.03	49
9Li21	8953	Epsilon	10-20		114.4	43.97
9Li21	8953	Epsilon	10-20		82.55	45.39
9Li21	8953	Epsilon	10-20		76.71	43.82
9Li21	8953	Epsilon	10-20		57.62	46.08
9Li21	8953	Epsilon	10-20		60.72	44.18
9Li21	8953	Epsilon	10-20		77.22	44.38
9Li21	8951	Epsilon	20-30		75.12	49.77
9Li21	8951	Epsilon	20-30		110.24	42.46
9Li21	8951	Epsilon	20-30		91.98	50.44
9Li21	8951	Epsilon	20-30		104.61	62.35
9Li21	8951	Epsilon	20-30		53.43	45.19
9Li21	8951	Epsilon	20-30		90.19	52.45
9Li21	8951	Epsilon	20-30		90.16	38.76
9Li21	8951	Epsilon	20-30		106.9	46.43
9Li21	8951	Epsilon	20-30		120.27	52.02
9Li21	8951	Epsilon	20-30		73.96	50.9
9Li21	8951	Epsilon	20-30		89.15	50.47
9Li21	8951	Epsilon	20-30		144.7	56.65
9Li21	8951	Epsilon	20-30		88.78	40.18
9Li21	8951	Epsilon	20-30		93.34	50.61
9Li21	8951	Epsilon	20-30		97.87	59
9Li21	8951	Epsilon	20-30		112.81	47.5
9Li21	8951	Epsilon	20-30		139.54	47.79
9Li21	8951	Epsilon	20-30		95.06	43.4
9Li21	8951	Epsilon	20-30		127.94	41.83
9Li21	8951	Epsilon	20-30		95.36	59.74
9Li21	8951	Epsilon	20-30		70.65	33.57
9Li21	8951	Epsilon	20-30		82.89	36.48
9Li21	8951	Epsilon	20-30		56.88	41.15
9Li21	8951	Epsilon	20-30		61.9	40.66
9Li21	8951	Epsilon	20-30		65.28	44.83
9Li21	8951	Epsilon	20-30		99.97	58.1
9Li21	8951	Epsilon	20-30		86.18	56.88
9Li21	8951	Epsilon	20-30		151.63	45.9
9Li21	8951	Epsilon	20-30		111.57	44.63
9Li21	8951	Epsilon	20-30		66.75	50.68
9Li21	8951	Epsilon	20-30		68.35	47.44
9Li21	8951	Epsilon	20-30		71.77	63.02
9Li21	8951	Epsilon	20-30		102.43	54.55
9Li21	8951	Epsilon	20-30		82.87	44.03
9Li21	8951	Epsilon	20-30		58.66	39.03
9Li21	8951	Epsilon	20-30		54.58	38.34
9Li21	8951	Epsilon	20-30		78	36.5
9Li21	8951	Epsilon	20-30		69.98	37.13
9Li21	8951	Epsilon	20-30		83.01	44.44
9Li21	8951	Epsilon	20-30		75.46	51.89

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8951	Epsilon	20-30		89.3	40.86
9Li21	8951	Epsilon	20-30		66.98	45.78
9Li21	8951	Epsilon	20-30		130.88	60.4
9Li21	8951	Epsilon	20-30		95.26	59.54
9Li21	8951	Epsilon	20-30		86.08	31.99
9Li21	8951	Epsilon	20-30		73.8	47.21
9Li21	8951	Epsilon	20-30		81.88	34.95
9Li21	8951	Epsilon	20-30		84.36	45.81
9Li21	8951	Epsilon	20-30		81.85	32.71
9Li21	8951	Epsilon	20-30		95.54	50.61
9Li21	8951	Epsilon	20-30		79.02	36.2
9Li21	8951	Epsilon	20-30		90.98	48.18
9Li21	8951	Epsilon	20-30		53.42	32
9Li21	8951	Epsilon	20-30		86.34	44.16
9Li21	8951	Epsilon	20-30		72.55	42.44
9Li21	8951	Epsilon	20-30		108.12	50.1
9Li21	8951	Epsilon	20-30		54.11	36.14
9Li21	8951	Epsilon	20-30		89.22	38.23
9Li21	8951	Epsilon	20-30		91.94	61.49
9Li21	8951	Epsilon	20-30		94.11	56.48
9Li21	8951	Epsilon	20-30		99.09	47.61
9Li21	8951	Epsilon	20-30		96.12	43.87
9Li21	8951	Epsilon	20-30		95.3	58.63
9Li21	8951	Epsilon	20-30		84.16	54.04
9Li21	8951	Epsilon	20-30		80.12	47.02
9Li21	8951	Epsilon	20-30		64.64	39.59
9Li21	8951	Epsilon	20-30		73.86	44.12
9Li21	8951	Epsilon	20-30		110.15	42.1
9Li21	8951	Epsilon	20-30		93.87	55.55
9Li21	8951	Epsilon	20-30		53.12	36.94
9Li21	8951	Epsilon	20-30		57.19	32.85
9Li21	8951	Epsilon	20-30		123.03	41.13
9Li21	8951	Epsilon	20-30		94.81	39.81
9Li21	8951	Epsilon	20-30		91.95	58.75
9Li21	8951	Epsilon	20-30		82.13	56.05
9Li21	8951	Epsilon	20-30		68.51	43.44
9Li21	8951	Epsilon	20-30		57.86	37.05
9Li21	8951	Epsilon	20-30		86.25	45.96
9Li21	8951	Epsilon	20-30		60.47	47.24
9Li21	8951	Epsilon	20-30		73.76	44.49
9Li21	8951	Epsilon	20-30		60.89	35.45
9Li21	8951	Epsilon	20-30		56.76	38.15
9Li21	8951	Epsilon	20-30		67.81	36.11
9Li21	8951	Epsilon	20-30		76.1	46.4
9Li21	8951	Epsilon	20-30		67.61	44.63
9Li21	8951	Epsilon	20-30		57.23	30.76
9Li21	8951	Epsilon	20-30		61.91	37.44
9Li21	8951	Epsilon	20-30		93.04	27.28
9Li21	8951	Epsilon	20-30		63.12	41.85
9Li21	8951	Epsilon	20-30		88.97	37.24

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8951	Epsilon	20-30		47.67	37.24
9Li21	8951	Epsilon	20-30		65.58	43.94
9Li21	8951	Epsilon	20-30		59.72	33.93
9Li21	8951	Epsilon	20-30		97.18	47.56
9Li21	8951	Epsilon	20-30		73.6	35.93
9Li21	8951	Epsilon	20-30		74.65	37.69
9Li21	8951	Epsilon	20-30		54.36	40.36
9Li21	8951	Epsilon	20-30		61.3	38.83
9Li21	8951	Epsilon	20-30		65.37	42.15
9Li21	8951	Epsilon	20-30		60.46	37.74
9Li21	8951	Epsilon	20-30		57.98	35.07
9Li21	8951	Epsilon	20-30		72.24	40.77
9Li21	8951	Epsilon	20-30		50.85	34.62
9Li21	8951	Epsilon	20-30		59.34	35.26
9Li21	8951	Epsilon	20-30		54.92	38.9
9Li21	8951	Epsilon	20-30		59.53	36.69
9Li21	8900	Beta	5-15		78.52	51.99
9Li21	8900	Beta	5-15		69.36	38.99
9Li21	8900	Beta	5-15		63.32	43.04
9Li21	8900	Beta	5-15		107.19	51.13
9Li21	8900	Beta	5-15		84.23	51.81
9Li21	8900	Beta	5-15		98.91	54.13
9Li21	8900	Beta	5-15		92.04	26.25
9Li21	8900	Beta	5-15		78.67	39.4
9Li21	8900	Beta	5-15		90.21	42.69
9Li21	8900	Beta	5-15		69.02	44.65
9Li21	8900	Beta	5-15		137.92	46.79
9Li21	8900	Beta	5-15		53.08	45.3
9Li21	8900	Beta	5-15		93	35.99
9Li21	8900	Beta	5-15		76.09	52.68
9Li21	8900	Beta	5-15		87.26	45.25
9Li21	8900	Beta	5-15		57.62	35.35
9Li21	8900	Beta	5-15		76.16	33.89
9Li21	8900	Beta	5-15		63.35	54.65
9Li21	8900	Beta	5-15		80	41.29
9Li21	8900	Beta	5-15		69.16	30.45
9Li21	8900	Beta	5-15		63.64	37.85
9Li21	8900	Beta	5-15		58.16	36.65
9Li21	8900	Beta	5-15		96.53	34.95
9Li21	8900	Beta	5-15		70.59	42.39
9Li21	8900	Beta	5-15		80.05	39.1
9Li21	8900	Beta	5-15		128.64	50.18
9Li21	8900	Beta	5-15		139.46	45.86
9Li21	8900	Beta	5-15		90.41	33.94
9Li21	8900	Beta	5-15		70.44	54.76
9Li21	8900	Beta	5-15		109.36	43.62
9Li21	8900	Beta	5-15		102.49	52.34
9Li21	8900	Beta	5-15		78.89	64.61
9Li21	8900	Beta	5-15		72.23	52.19
9Li21	8900	Beta	5-15		60.24	37.28

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8900	Beta	5-15		67.61	43.74
9Li21	8900	Beta	5-15		62.6	43.71
9Li21	8900	Beta	5-15		120.3	38.89
9Li21	8900	Beta	5-15		64.87	48.44
9Li21	8900	Beta	5-15		64.13	43.13
9Li21	8900	Beta	5-15		82.44	40.19
9Li21	8900	Beta	5-15		77.37	41.17
9Li21	8900	Beta	5-15		154.34	57.6
9Li21	8900	Beta	5-15		108.6	55.59
9Li21	8900	Beta	5-15		57.48	41.05
9Li21	8900	Beta	5-15		81.66	43.4
9Li21	8900	Beta	5-15		64.45	42.31
9Li21	8900	Beta	5-15		60.91	40.71
9Li21	8900	Beta	5-15		78.71	39.19
9Li21	8900	Beta	5-15		58.12	37.05
9Li21	8900	Beta	5-15		45.36	37.8
9Li21	8900	Beta	5-15		65.01	45.58
9Li21	8900	Beta	5-15		59.23	46.07
9Li21	8900	Beta	5-15		64.21	39.74
9Li21	8900	Beta	5-15		59.41	44.43
9Li21	8900	Beta	5-15		62.12	33.07
9Li21	8900	Beta	5-15		61.46	38.42
9Li21	8900	Beta	5-15		70.81	52.45
9Li21	8900	Beta	5-15		63.34	38.42
9Li21	8900	Beta	5-15		80.96	51.16
9Li21	8900	Beta	5-15		56.66	31.64
9Li21	8900	Beta	5-15		70.45	37.71
9Li21	8900	Beta	5-15		75.78	59.9
9Li21	8900	Beta	5-15		56.09	39.88
9Li21	8900	Beta	5-15		54.01	42.72
9Li21	8900	Beta	5-15		67.32	46.57
9Li21	8900	Beta	5-15		62.87	45.72
9Li21	8900	Beta	5-15		59.52	28.29
9Li21	8900	Beta	5-15		72.71	42.72
9Li21	8900	Beta	5-15		87.32	35.72
9Li21	8900	Beta	5-15		58.78	40.15
9Li21	8900	Beta	5-15		73.63	41.78
9Li21	8900	Beta	5-15		73.69	28.03
9Li21	8900	Beta	5-15		53.81	43.44
9Li21	8900	Beta	5-15		48.87	34.07
9Li21	8900	Beta	5-15		43.14	34.61
9Li21	8900	Beta	5-15		52.73	37.02
9Li21	8900	Beta	5-15		46.92	34.14
9Li21	8900	Beta	5-15		40.14	14.47
9Li21	8900	Beta	5-15		173	40.37
9Li21	8906	Beta	15-25		112.65	57.6
9Li21	8906	Beta	15-25		140.43	45.55
9Li21	8906	Beta	15-25		83.46	45.47
9Li21	8906	Beta	15-25		76.66	31.93
9Li21	8906	Beta	15-25		73.4	32.42

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8906	Beta	15-25		77.93	53.38
9Li21	8906	Beta	15-25		68.48	34.48
9Li21	8906	Beta	15-25		108.29	31.67
9Li21	8906	Beta	15-25		92.46	44.4
9Li21	8906	Beta	15-25		79.96	53.12
9Li21	8906	Beta	15-25		72.91	48.11
9Li21	8906	Beta	15-25		108.27	41.87
9Li21	8906	Beta	15-25		81.04	37.44
9Li21	8906	Beta	15-25		133.32	42.75
9Li21	8906	Beta	15-25		105.05	31.25
9Li21	8906	Beta	15-25		74.3	39.33
9Li21	8906	Beta	15-25		78.15	53.18
9Li21	8906	Beta	15-25		65.48	53.2
9Li21	8906	Beta	15-25		103.62	39.87
9Li21	8906	Beta	15-25		71.55	41.5
9Li21	8906	Beta	15-25		82.02	28.23
9Li21	8906	Beta	15-25		66.7	42.39
9Li21	8906	Beta	15-25		59.12	31.39
9Li21	8906	Beta	15-25		116.81	49.09
9Li21	8906	Beta	15-25		75.95	39.75
9Li21	8906	Beta	15-25		89.52	45.83
9Li21	8906	Beta	15-25		153.06	47.31
9Li21	8906	Beta	15-25		132.67	47.56
9Li21	8906	Beta	15-25		82.15	54.51
9Li21	8906	Beta	15-25		151.1	37.4
9Li21	8906	Beta	15-25		79.24	55.25
9Li21	8906	Beta	15-25		78.94	34.95
9Li21	8906	Beta	15-25		132.27	30.11
9Li21	8906	Beta	15-25		89.39	45.24
9Li21	8906	Beta	15-25		115.27	53.42
9Li21	8906	Beta	15-25		82.38	44.72
9Li21	8906	Beta	15-25		92.02	31.68
9Li21	8906	Beta	15-25		76.07	37.98
9Li21	8906	Beta	15-25		53.53	43.03
9Li21	8906	Beta	15-25		117.1	44.11
9Li21	8906	Beta	15-25		119.29	42.27
9Li21	8906	Beta	15-25		144.03	46.73
9Li21	8906	Beta	15-25		123.1	51.91
9Li21	8906	Beta	15-25		116.22	46.61
9Li21	8906	Beta	15-25		73.93	56.29
9Li21	8906	Beta	15-25		82.95	42.12
9Li21	8906	Beta	15-25		104.51	36.89
9Li21	8906	Beta	15-25		82.98	52.67
9Li21	8906	Beta	15-25		165	45.71
9Li21	8906	Beta	15-25		73.59	35.4
9Li21	8906	Beta	15-25		109.02	41.11
9Li21	8906	Beta	15-25		63.51	44.53
9Li21	8906	Beta	15-25		89.55	42.62
9Li21	8906	Beta	15-25		79.33	38.85
9Li21	8906	Beta	15-25		149.77	47.57

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8906	Beta	15-25		90.18	36.59
9Li21	8906	Beta	15-25		82.12	40.52
9Li21	8906	Beta	15-25		110.83	40.46
9Li21	8906	Beta	15-25		75.22	47.96
9Li21	8906	Beta	15-25		119.04	39.63
9Li21	8906	Beta	15-25		89.94	32.19
9Li21	8906	Beta	15-25		67.63	35.03
9Li21	8906	Beta	15-25		75.9	42.36
9Li21	8906	Beta	15-25		79.66	56.31
9Li21	8906	Beta	15-25		120.3	46.18
9Li21	8906	Beta	15-25		145.64	36.79
9Li21	8906	Beta	15-25		85.1	32.64
9Li21	8906	Beta	15-25		130.11	43.78
9Li21	8906	Beta	15-25		71.82	25.33
9Li21	8906	Beta	15-25		146.81	62.71
9Li21	8906	Beta	15-25		112.51	34.99
9Li21	8906	Beta	15-25		78.46	47.43
9Li21	8906	Beta	15-25		76.65	37.91
9Li21	8906	Beta	15-25		133.74	40.51
9Li21	8906	Beta	15-25		141.25	35.59
9Li21	8906	Beta	15-25		83.75	36.38
9Li21	8906	Beta	15-25		76.27	32.14
9Li21	8906	Beta	15-25		98.86	48.56
9Li21	8906	Beta	15-25		67.88	47.85
9Li21	8906	Beta	15-25		88.21	42.95
9Li21	8906	Beta	15-25		87.34	35.98
9Li21	8906	Beta	15-25		65.87	42.12
9Li21	8906	Beta	15-25		100.82	40.32
9Li21	8906	Beta	15-25		58.06	36.09
9Li21	8906	Beta	15-25		68.19	42.11
9Li21	8906	Beta	15-25		54.48	33.93
9Li21	8904	Beta	25-35		112.71	36.69
9Li21	8904	Beta	25-35		119.49	42.22
9Li21	8904	Beta	25-35		154.23	40.72
9Li21	8904	Beta	25-35		100.65	41.94
9Li21	8904	Beta	25-35		69.37	44.53
9Li21	8904	Beta	25-35		64.76	35.92
9Li21	8904	Beta	25-35		74.93	52.27
9Li21	8904	Beta	25-35		78.56	42.25
9Li21	8904	Beta	25-35		107.02	33.25
9Li21	8904	Beta	25-35		80.98	46.85
9Li21	8904	Beta	25-35		135.68	50.15
9Li21	8904	Beta	25-35		123.92	50.92
9Li21	8904	Beta	25-35		94.18	48.35
9Li21	8904	Beta	25-35		147.55	47.61
9Li21	8904	Beta	25-35		96.79	38.89
9Li21	8904	Beta	25-35		123.48	47.38
9Li21	8904	Beta	25-35		89.25	44.01
9Li21	8904	Beta	25-35		133.44	40.82
9Li21	8904	Beta	25-35		124.19	43

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8904	Beta	25-35		74.83	43.47
9Li21	8904	Beta	25-35		100.32	48.48
9Li21	8904	Beta	25-35		95.54	39.86
9Li21	8904	Beta	25-35		105.9	52.91
9Li21	8904	Beta	25-35		122.61	38.19
9Li21	8904	Beta	25-35		71.26	42.72
9Li21	8904	Beta	25-35		105.26	39.27
9Li21	8904	Beta	25-35		125.63	51.83
9Li21	8904	Beta	25-35		131.52	47.37
9Li21	8904	Beta	25-35		96.43	60.87
9Li21	8904	Beta	25-35		146.26	47.81
9Li21	8904	Beta	25-35		82.15	28.86
9Li21	8904	Beta	25-35		73.59	59.32
9Li21	8904	Beta	25-35		109.06	66.51
9Li21	8904	Beta	25-35		106.31	46.1
9Li21	8904	Beta	25-35		118.59	63.98
9Li21	8904	Beta	25-35		84.33	35.18
9Li21	8904	Beta	25-35		92.65	42.11
9Li21	8904	Beta	25-35		54.05	41.83
9Li21	8904	Beta	25-35		87.33	50.02
9Li21	8904	Beta	25-35		91.15	46.4
9Li21	8904	Beta	25-35		82.89	36.38
9Li21	8904	Beta	25-35		82.19	47.78
9Li21	8904	Beta	25-35		89.19	49.31
9Li21	8904	Beta	25-35		94.5	43.68
9Li21	8904	Beta	25-35		82.21	55.59
9Li21	8904	Beta	25-35		84.75	37.78
9Li21	8904	Beta	25-35		87.34	45.68
9Li21	8904	Beta	25-35		87.53	37.66
9Li21	8904	Beta	25-35		84.9	44.91
9Li21	8904	Beta	25-35		93.1	41.55
9Li21	8904	Beta	25-35		75.81	43.47
9Li21	8904	Beta	25-35		67.17	40.07
9Li21	8904	Beta	25-35		76.54	44.48
9Li21	8904	Beta	25-35		79.8	42.56
9Li21	8904	Beta	25-35		78.99	59.26
9Li21	8904	Beta	25-35		88.58	51.03
9Li21	8904	Beta	25-35		72.67	54.68
9Li21	8904	Beta	25-35		82.85	34.05
9Li21	8904	Beta	25-35		91.98	42.93
9Li21	8904	Beta	25-35		120.53	45.58
9Li21	8904	Beta	25-35		108.27	42.33
9Li21	8904	Beta	25-35		134.1	41.48
9Li21	8904	Beta	25-35		187	52.17
9Li21	8904	Beta	25-35		73.84	51.37
9Li21	8904	Beta	25-35		93.87	49
9Li21	8904	Beta	25-35		81.75	47.63
9Li21	8904	Beta	25-35		89.3	42.52
9Li21	8904	Beta	25-35		107.09	41.22
9Li21	8904	Beta	25-35		120.6	64.32

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8904	Beta	25-35		109.53	41.63
9Li21	8904	Beta	25-35		90.66	48.41
9Li21	8904	Beta	25-35		47.92	41.21
9Li21	8904	Beta	25-35		92.87	30.95
9Li21	8904	Beta	25-35		66.15	45.36
9Li21	8904	Beta	25-35		84.22	41.89
9Li21	8904	Beta	25-35		93.57	44.92
9Li21	8904	Beta	25-35		72.55	43.39
9Li21	8904	Beta	25-35		68.71	44.64
9Li21	8904	Beta	25-35		90.81	30.62
9Li21	8904	Beta	25-35		57.84	34.5
9Li21	8904	Beta	25-35		60.84	34.84
9Li21	8904	Beta	25-35		77.31	36.94
9Li21	8904	Beta	25-35		97.27	40.63
9Li21	8904	Beta	25-35		64.68	37.72
9Li21	8904	Beta	25-35		71.24	30.31
9Li21	8904	Beta	25-35		66.01	23.66
9Li21	8904	Beta	25-35		53.26	35.74
9Li21	8904	Beta	25-35		60.17	35.62
9Li21	8904	Beta	25-35		67.56	47.59
9Li21	8904	Beta	25-35		59.5	32.2
9Li21	8904	Beta	25-35		59.64	29.28
9Li21	8920	Beta	35-45		107.05	44.16
9Li21	8920	Beta	35-45		131.23	60.81
9Li21	8920	Beta	35-45		119.74	43.76
9Li21	8920	Beta	35-45		135	49.2
9Li21	8920	Beta	35-45		122.8	34.04
9Li21	8920	Beta	35-45		127.39	32.67
9Li21	8920	Beta	35-45		101.58	37.39
9Li21	8920	Beta	35-45		121.99	47.52
9Li21	8920	Beta	35-45		104.48	55.29
9Li21	8920	Beta	35-45		77.73	47.89
9Li21	8920	Beta	35-45		114.23	66.39
9Li21	8920	Beta	35-45		97.95	43.33
9Li21	8920	Beta	35-45		71.47	38.18
9Li21	8920	Beta	35-45		92.16	40.91
9Li21	8920	Beta	35-45		98.51	47.01
9Li21	8920	Beta	35-45		87.28	53.51
9Li21	8920	Beta	35-45		98.53	43.75
9Li21	8920	Beta	35-45		133.04	50.52
9Li21	8920	Beta	35-45		85.64	43.11
9Li21	8920	Beta	35-45		96.03	33.96
9Li21	8920	Beta	35-45		109.58	31.13
9Li21	8920	Beta	35-45		155.86	33.55
9Li21	8920	Beta	35-45		97.56	44.28
9Li21	8920	Beta	35-45		117.06	49.01
9Li21	8920	Beta	35-45		94.15	35.77
9Li21	8920	Beta	35-45		117.57	44.17
9Li21	8920	Beta	35-45		134.11	36.1
9Li21	8920	Beta	35-45		154.88	45.47

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8920	Beta	35-45		96.23	43.71
9Li21	8920	Beta	35-45		88.41	39.05
9Li21	8920	Beta	35-45		100.93	36.51
9Li21	8920	Beta	35-45		71.02	40.31
9Li21	8920	Beta	35-45		80.56	46.91
9Li21	8920	Beta	35-45		92.84	39.73
9Li21	8920	Beta	35-45		61.47	40.97
9Li21	8920	Beta	35-45		57.85	38.74
9Li21	8920	Beta	35-45		54.99	27.59
9Li21	8920	Beta	35-45		93.87	39.4
9Li21	8920	Beta	35-45		108.91	45.11
9Li21	8920	Beta	35-45		92.35	40.49
9Li21	8920	Beta	35-45		57.09	38.61
9Li21	8920	Beta	35-45		106.86	35.12
9Li21	8920	Beta	35-45		77.78	39.57
9Li21	8920	Beta	35-45		94.07	36.66
9Li21	8920	Beta	35-45		101.93	35.91
9Li21	8920	Beta	35-45		71.42	42.52
9Li21	8920	Beta	35-45		88.56	34.92
9Li21	8920	Beta	35-45		80.86	31.11
9Li21	8920	Beta	35-45		67.96	58.21
9Li21	8920	Beta	35-45		81.43	27.06
9Li21	8920	Beta	35-45		88.14	47.63
9Li21	8920	Beta	35-45		80.74	34.6
9Li21	8920	Beta	35-45		81.84	46.73
9Li21	8920	Beta	35-45		105.29	62.39
9Li21	8920	Beta	35-45		58.7	44.88
9Li21	8920	Beta	35-45		59.41	48.2
9Li21	8920	Beta	35-45		71.57	41.16
9Li21	8920	Beta	35-45		77.74	40.59
9Li21	8920	Beta	35-45		112.43	40.9
9Li21	8920	Beta	35-45		118.6	44.97
9Li21	8920	Beta	35-45		73.25	48.38
9Li21	8920	Beta	35-45		68.08	55.27
9Li21	8920	Beta	35-45		100.13	26.08
9Li21	8920	Beta	35-45		83.96	34.58
9Li21	8920	Beta	35-45		73.47	41.82
9Li21	8920	Beta	35-45		59.88	38.43
9Li21	8920	Beta	35-45		80.9	44.12
9Li21	8920	Beta	35-45		81.12	43.36
9Li21	8920	Beta	35-45		68.91	44.68
9Li21	8920	Beta	35-45		86.2	33.7
9Li21	8920	Beta	35-45		94.51	46.23
9Li21	8920	Beta	35-45		90.28	52.49
9Li21	8920	Beta	35-45		124.59	32.24
9Li21	8920	Beta	35-45		92.52	41.15
9Li21	8920	Beta	35-45		84.36	37.88
9Li21	8920	Beta	35-45		82.31	47.42
9Li21	8920	Beta	35-45		91.32	42.14
9Li21	8920	Beta	35-45		90.95	55.94

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8920	Beta	35-45		66.51	34.19
9Li21	8920	Beta	35-45		103.8	42.85
9Li21	8920	Beta	35-45		66.66	29.21
9Li21	8920	Beta	35-45		97.55	47.91
9Li21	8920	Beta	35-45		57.61	56.79
9Li21	8920	Beta	35-45		80.36	32.41
9Li21	8920	Beta	35-45		79.76	29.16
9Li21	8920	Beta	35-45		65.99	32.83
9Li21	8920	Beta	35-45		103.89	44.69
9Li21	8920	Beta	35-45		99.28	33.4
9Li21	8920	Beta	35-45		76.42	44.46
9Li21	8920	Beta	35-45		84.13	44.34
9Li21	8920	Beta	35-45		85.06	41.84
9Li21	8920	Beta	35-45		80.17	34.6
9Li21	8920	Beta	35-45		67.54	35.3
9Li21	8920	Beta	35-45		94.93	43.34
9Li21	8920	Beta	35-45		58.65	33.53
9Li21	8920	Beta	35-45		76.65	45.99
9Li21	8920	Beta	35-45		99.55	40.34
9Li21	8920	Beta	35-45		75.71	39.15
9Li21	8920	Beta	35-45		59.48	35.26
9Li21	8920	Beta	35-45		73.38	37.47
9Li21	8921	Beta	45-55		113.75	34.3
9Li21	8921	Beta	45-55		147.36	51.45
9Li21	8921	Beta	45-55		126	36.97
9Li21	8921	Beta	45-55		125.57	40.71
9Li21	8921	Beta	45-55		68.41	37.05
9Li21	8921	Beta	45-55		106.83	30.65
9Li21	8921	Beta	45-55		84.07	35.19
9Li21	8921	Beta	45-55		82.65	44.45
9Li21	8921	Beta	45-55		175	50.4
9Li21	8921	Beta	45-55		118.85	42.13
9Li21	8921	Beta	45-55		121.26	55.12
9Li21	8921	Beta	45-55		86.64	55.27
9Li21	8921	Beta	45-55		83.54	31.71
9Li21	8921	Beta	45-55		122.66	41.31
9Li21	8921	Beta	45-55		92.81	40.32
9Li21	8921	Beta	45-55		114.39	43.47
9Li21	8921	Beta	45-55		98.59	40.32
9Li21	8921	Beta	45-55		88.99	43.31
9Li21	8921	Beta	45-55		84.92	54.19
9Li21	8921	Beta	45-55		87.15	36.61
9Li21	8921	Beta	45-55		74.98	37.91
9Li21	8921	Beta	45-55		66.48	44.21
9Li21	8921	Beta	45-55		100.31	37.69
9Li21	8921	Beta	45-55		99.37	42.02
9Li21	8921	Beta	45-55		108.28	51.46
9Li21	8921	Beta	45-55		74.53	33.51
9Li21	8921	Beta	45-55		122.6	41.32
9Li21	8921	Beta	45-55		103.52	40.27

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8921	Beta	45-55		125.79	51.78
9Li21	8921	Beta	45-55		165	46.09
9Li21	8921	Beta	45-55		112.29	60.04
9Li21	8921	Beta	45-55		80.47	47.25
9Li21	8921	Beta	45-55		131.22	33.77
9Li21	8921	Beta	45-55		90.9	50.96
9Li21	8921	Beta	45-55		136.73	56.02
9Li21	8921	Beta	45-55		96.88	42.02
9Li21	8921	Beta	45-55		106.23	38.05
9Li21	8921	Beta	45-55		117.74	44.95
9Li21	8921	Beta	45-55		84.57	54.94
9Li21	8921	Beta	45-55		118	44.04
9Li21	8921	Beta	45-55		169	41.68
9Li21	8921	Beta	45-55		84.3	39.09
9Li21	8921	Beta	45-55		80.77	38.72
9Li21	8921	Beta	45-55		65.71	45.9
9Li21	8921	Beta	45-55		79.35	30.29
9Li21	8921	Beta	45-55		90.68	38.88
9Li21	8921	Beta	45-55		75.32	53.18
9Li21	8921	Beta	45-55		128.39	37.27
9Li21	8921	Beta	45-55		89.2	34.39
9Li21	8921	Beta	45-55		86.8	53.25
9Li21	8921	Beta	45-55		92.7	48.15
9Li21	8921	Beta	45-55		75.51	38.11
9Li21	8921	Beta	45-55		116.43	46.65
9Li21	8921	Beta	45-55		71.45	34.64
9Li21	8921	Beta	45-55		97.84	40.88
9Li21	8921	Beta	45-55		74.61	42.15
9Li21	8921	Beta	45-55		91.83	31.09
9Li21	8921	Beta	45-55		90.2	40.48
9Li21	8921	Beta	45-55		93.78	38.69
9Li21	8921	Beta	45-55		107.96	58.64
9Li21	8921	Beta	45-55		76.04	35.92
9Li21	8921	Beta	45-55		73.71	38.88
9Li21	8921	Beta	45-55		96.92	44.37
9Li21	8921	Beta	45-55		161	41.45
9Li21	8921	Beta	45-55		84.47	38.77
9Li21	8921	Beta	45-55		105.7	47.09
9Li21	8921	Beta	45-55		97.38	33.55
9Li21	8921	Beta	45-55		55.46	33.98
9Li21	8921	Beta	45-55		82.28	42.37
9Li21	8921	Beta	45-55		82.87	44.25
9Li21	8921	Beta	45-55		94.72	38.57
9Li21	8921	Beta	45-55		67.3	32.6
9Li21	8921	Beta	45-55		109.66	35.63
9Li21	8921	Beta	45-55		63.82	42.18
9Li21	8921	Beta	45-55		81.62	43.45
9Li21	8921	Beta	45-55		64.36	29.66
9Li21	8921	Beta	45-55		88.53	44.05
9Li21	8921	Beta	45-55		86.5	42.17

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8921	Beta	45-55		60.76	48.54
9Li21	8921	Beta	45-55		59.44	35.23
9Li21	8921	Beta	45-55		57.21	38.73
9Li21	8921	Beta	45-55		69.01	39.34
9Li21	8921	Beta	45-55		73.04	47.21
9Li21	8921	Beta	45-55		65.86	39.01
9Li21	8921	Beta	45-55		75.61	49.96
9Li21	8921	Beta	45-55		71.38	45.73
9Li21	8921	Beta	45-55		63.53	39.69
9Li21	8921	Beta	45-55		103.13	27.46
9Li21	8921	Beta	45-55		91.81	47.51
9Li21	8921	Beta	45-55		67.46	41.16
9Li21	8921	Beta	45-55		78.37	39.51
9Li21	8921	Beta	45-55		58.84	44.78
9Li21	8922	Beta	55-65		104.63	39.25
9Li21	8922	Beta	55-65		147.61	43
9Li21	8922	Beta	55-65		82.37	44.37
9Li21	8922	Beta	55-65		78.84	25.78
9Li21	8922	Beta	55-65		89.33	37.7
9Li21	8922	Beta	55-65		67.86	34.81
9Li21	8922	Beta	55-65		74.46	43.36
9Li21	8922	Beta	55-65		80.82	44.23
9Li21	8922	Beta	55-65		91.59	48.64
9Li21	8922	Beta	55-65		60.7	41.38
9Li21	8922	Beta	55-65		127.2	43.11
9Li21	8922	Beta	55-65		95.28	33.49
9Li21	8922	Beta	55-65		127.35	28.69
9Li21	8922	Beta	55-65		90.29	45.92
9Li21	8922	Beta	55-65		82.47	38.75
9Li21	8922	Beta	55-65		64.06	38.01
9Li21	8922	Beta	55-65		82.52	38.86
9Li21	8922	Beta	55-65		69.02	22.46
9Li21	8922	Beta	55-65		71.25	31.04
9Li21	8922	Beta	55-65		86.91	59.15
9Li21	8922	Beta	55-65		66.27	41.41
9Li21	8922	Beta	55-65		96.9	35.61
9Li21	8922	Beta	55-65		87.85	46.1
9Li21	8922	Beta	55-65		71.13	36.63
9Li21	8922	Beta	55-65		83.05	47.08
9Li21	8922	Beta	55-65		101.84	42.73
9Li21	8922	Beta	55-65		125.89	53.31
9Li21	8922	Beta	55-65		67.86	43.45
9Li21	8922	Beta	55-65		99.44	43.5
9Li21	8922	Beta	55-65		90.6	45.89
9Li21	8922	Beta	55-65		101.79	49.65
9Li21	8922	Beta	55-65		131.53	41.36
9Li21	8922	Beta	55-65		72.61	40.41
9Li21	8922	Beta	55-65		85.71	32
9Li21	8922	Beta	55-65		83.84	39.87
9Li21	8922	Beta	55-65		122.87	38.33

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8922	Beta	55-65		87.34	34.89
9Li21	8922	Beta	55-65		101.2	61.51
9Li21	8922	Beta	55-65		114.34	43.89
9Li21	8922	Beta	55-65		171	46.55
9Li21	8922	Beta	55-65		84.72	36.09
9Li21	8922	Beta	55-65		80.82	48.46
9Li21	8922	Beta	55-65		106.94	34.73
9Li21	8922	Beta	55-65		87.4	52.01
9Li21	8922	Beta	55-65		97.57	45.23
9Li21	8922	Beta	55-65		98.9	43.62
9Li21	8922	Beta	55-65		91.24	41.76
9Li21	8922	Beta	55-65		80.81	42.12
9Li21	8922	Beta	55-65		61.94	47.05
9Li21	8922	Beta	55-65		74.64	55.23
9Li21	8922	Beta	55-65		96.34	38.03
9Li21	8922	Beta	55-65		70.26	33.25
9Li21	8922	Beta	55-65		82.6	46.01
9Li21	8922	Beta	55-65		115.5	36.42
9Li21	8922	Beta	55-65		102.12	71.81
9Li21	8922	Beta	55-65		85.25	36.66
9Li21	8922	Beta	55-65		110.09	40.23
9Li21	8922	Beta	55-65		69.13	43.61
9Li21	8922	Beta	55-65		88	36.16
9Li21	8922	Beta	55-65		91.03	49
9Li21	8922	Beta	55-65		80.41	43.24
9Li21	8922	Beta	55-65		83.96	52.11
9Li21	8922	Beta	55-65		87.88	51.13
9Li21	8922	Beta	55-65		143.8	40.06
9Li21	8922	Beta	55-65		73.35	39.06
9Li21	8922	Beta	55-65		91.52	41.11
9Li21	8922	Beta	55-65		98.81	39.79
9Li21	8922	Beta	55-65		70.36	45.3
9Li21	8922	Beta	55-65		83.3	38.38
9Li21	8922	Beta	55-65		74.23	38.28
9Li21	8922	Beta	55-65		104.32	37.53
9Li21	8922	Beta	55-65		64.83	38.47
9Li21	8922	Beta	55-65		63.22	37.59
9Li21	8922	Beta	55-65		75.39	23.98
9Li21	8922	Beta	55-65		70.37	33.05
9Li21	8922	Beta	55-65		66.45	38.04
9Li21	8922	Beta	55-65		46.82	38.99
9Li21	8922	Beta	55-65		54.52	31.53
9Li21	8922	Beta	55-65		64.43	30.54
9Li21	8922	Beta	55-65		79.59	38.26
9Li21	8922	Beta	55-65		66.01	35.44
9Li21	8922	Beta	55-65		106.2	47.01
9Li21	8922	Beta	55-65		82.12	42.37
9Li21	8922	Beta	55-65		51.53	30.65
9Li21	8922	Beta	55-65		100.68	38.03
9Li21	8922	Beta	55-65		81.27	38.21

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8922	Beta	55-65		75.78	23.46
9Li21	8922	Beta	55-65		79.94	37.37
9Li21	8922	Beta	55-65		62.78	38.02
9Li21	8922	Beta	55-65		80.01	45.22
9Li21	8922	Beta	55-65		83.94	32.46
9Li21	8922	Beta	55-65		40.12	36.04
9Li21	8922	Beta	55-65		65.62	34.76
9Li21	8998	Eta	0-10		53.26	37.46
9Li21	8998	Eta	0-10		75.52	41.8
9Li21	8998	Eta	0-10		54.79	34.34
9Li21	8998	Eta	0-10		93.63	46.06
9Li21	8998	Eta	0-10		57.42	36.64
9Li21	8998	Eta	0-10		83.11	44.74
9Li21	8998	Eta	0-10		68.2	40.61
9Li21	8998	Eta	0-10		69.03	36.63
9Li21	8998	Eta	0-10		49.66	33.12
9Li21	8998	Eta	0-10		58.73	32.51
9Li21	8998	Eta	0-10		73.42	39.12
9Li21	8998	Eta	0-10		50.3	39.2
9Li21	8998	Eta	0-10		70.73	34.84
9Li21	8998	Eta	0-10		63.91	31.18
9Li21	8998	Eta	0-10		53.38	33.58
9Li21	8998	Eta	0-10		80.44	37.24
9Li21	8998	Eta	0-10		61.52	33.44
9Li21	8998	Eta	0-10		91.61	34.18
9Li21	8998	Eta	0-10		76.38	39.81
9Li21	8998	Eta	0-10		62.6	36.45
9Li21	8998	Eta	0-10		75.98	31.54
9Li21	8998	Eta	0-10		91.6	42.93
9Li21	8998	Eta	0-10		103.89	45.55
9Li21	8998	Eta	0-10		82.08	46.6
9Li21	8998	Eta	0-10		70.87	36.17
9Li21	8998	Eta	0-10		64.73	42.11
9Li21	8998	Eta	0-10		69.95	42.5
9Li21	8998	Eta	0-10		58.56	41.24
9Li21	8998	Eta	0-10		92.54	44.98
9Li21	8998	Eta	0-10		100.55	47.76
9Li21	8998	Eta	0-10		57.36	35.61
9Li21	8998	Eta	0-10		76.25	37.62
9Li21	8998	Eta	0-10		48.91	29.6
9Li21	8998	Eta	0-10		73	38.64
9Li21	8998	Eta	0-10		61.57	34.15
9Li21	8998	Eta	0-10		61.71	32.86
9Li21	8998	Eta	0-10		75.86	46.44
9Li21	8998	Eta	0-10		63.49	30.4
9Li21	8998	Eta	0-10		81.22	46.06
9Li21	8998	Eta	0-10		69.36	37.55
9Li21	8998	Eta	0-10		76.49	43.98
9Li21	8998	Eta	0-10		67.54	37.03
9Li21	8998	Eta	0-10		64.49	39.34

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8998	Eta	0-10		119.26	42.12
9Li21	8998	Eta	0-10		74.63	40.93
9Li21	8998	Eta	0-10		61.83	38.8
9Li21	8998	Eta	0-10		58.59	33.7
9Li21	8998	Eta	0-10		66.73	42.2
9Li21	8998	Eta	0-10		97.37	51.76
9Li21	8998	Eta	0-10		84.83	40.65
9Li21	8998	Eta	0-10		60.87	31.24
9Li21	8998	Eta	0-10		68.23	41.02
9Li21	8998	Eta	0-10		55.31	35.68
9Li21	8998	Eta	0-10		76.9	40.75
9Li21	8998	Eta	0-10		82.02	46.1
9Li21	8998	Eta	0-10		58.07	38.17
9Li21	8998	Eta	0-10		70.15	40.22
9Li21	8998	Eta	0-10		127.47	44.84
9Li21	8998	Eta	0-10		57.15	35.74
9Li21	8998	Eta	0-10		80.35	46.14
9Li21	8998	Eta	0-10		66.09	31.91
9Li21	8998	Eta	0-10		90.3	40.13
9Li21	8998	Eta	0-10		81.09	42.99
9Li21	8998	Eta	0-10		78.71	38.33
9Li21	8998	Eta	0-10		49.39	31.88
9Li21	8998	Eta	0-10		78.78	42.52
9Li21	8998	Eta	0-10		91.86	44.4
9Li21	8998	Eta	0-10		64.87	36.65
9Li21	8998	Eta	0-10		54.2	28.7
9Li21	8998	Eta	0-10		75.24	35.4
9Li21	8998	Eta	0-10		53.38	30.95
9Li21	8998	Eta	0-10		88.57	39.34
9Li21	8998	Eta	0-10		71.91	32.86
9Li21	8998	Eta	0-10		93.12	48.35
9Li21	8998	Eta	0-10		105.22	47.13
9Li21	8998	Eta	0-10		76.96	46.89
9Li21	8998	Eta	0-10		91.31	38.54
9Li21	8998	Eta	0-10		93.14	52.23
9Li21	8998	Eta	0-10		91.58	46.31
9Li21	8998	Eta	0-10		80.52	49.06
9Li21	8998	Eta	0-10		78.53	46.26
9Li21	8998	Eta	0-10		42.46	37.63
9Li21	8998	Eta	0-10		66.61	48.14
9Li21	8998	Eta	0-10		75.64	41.67
9Li21	8998	Eta	0-10		75.12	48.36
9Li21	8998	Eta	0-10		72.13	33.4
9Li21	8998	Eta	0-10		50.84	37.47
9Li21	8998	Eta	0-10		87.42	40.99
9Li21	8998	Eta	0-10		61.12	39.08
9Li21	8998	Eta	0-10		99.97	48.51
9Li21	8998	Eta	0-10		90.94	41.41
9Li21	8998	Eta	0-10		82.03	47.54
9Li21	8998	Eta	0-10		79.17	46.83

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8998	Eta	0-10		92.36	46.34
9Li21	8998	Eta	0-10		57.2	35.97
9Li21	8998	Eta	0-10		51.91	28.84
9Li21	8998	Eta	0-10		77.61	37.73
9Li21	8998	Eta	0-10		51.77	51.75
9Li21	8998	Eta	0-10		74.85	43.8
9Li21	8998	Eta	0-10		69.67	35.18
9Li21	8998	Eta	0-10		56.23	36.36
9Li21	8998	Eta	0-10		87.51	56.51
9Li21	8998	Eta	0-10		59.94	39.14
9Li21	8998	Eta	0-10		75	42.38
9Li21	8998	Eta	0-10		57.26	39.25
9Li21	8998	Eta	0-10		53.57	44.32
9Li21	8998	Eta	0-10		50.74	38.06
9Li21	8998	Eta	0-10		68.51	43
9Li21	8998	Eta	0-10		91.39	46.71
9Li21	8998	Eta	0-10		72.5	45.79
9Li21	8998	Eta	0-10		93.47	41.7
9Li21	8998	Eta	0-10		77.31	49.51
9Li21	8998	Eta	0-10		66.36	39.93
9Li21	8998	Eta	0-10		70.77	35.98
9Li21	8998	Eta	0-10		71.54	36.11
9Li21	8998	Eta	0-10		65.44	43.29
9Li21	8998	Eta	0-10		55.33	39.52
9Li21	8998	Eta	0-10		48.37	33.5
9Li21	8998	Eta	0-10		90.99	43.9
9Li21	8998	Eta	0-10		97.23	56.56
9Li21	8998	Eta	0-10		68.61	47.07
9Li21	8998	Eta	0-10		52.01	33.96
9Li21	8998	Eta	0-10		87.75	56.07
9Li21	8998	Eta	0-10		60.99	40.44
9Li21	8998	Eta	0-10		69.77	36.2
9Li21	8998	Eta	0-10		57.23	44.08
9Li21	8998	Eta	0-10		68.78	33.64
9Li21	8998	Eta	0-10		70.71	44.09
9Li21	8998	Eta	0-10		60.76	41.16
9Li21	8998	Eta	0-10		68.01	41.78
9Li21	8998	Eta	0-10		117.91	48.87
9Li21	8998	Eta	0-10		67.45	42.01
9Li21	8998	Eta	0-10		65.09	47.09
9Li21	8998	Eta	0-10		53.78	34.61
9Li21	8998	Eta	0-10		75.67	36.98
9Li21	8998	Eta	0-10		79.07	41.33
9Li21	8998	Eta	0-10		65.5	36.97
9Li21	8998	Eta	0-10		75.3	39.42
9Li21	8998	Eta	0-10		62.88	39.4
9Li21	8998	Eta	0-10		81.95	48.61
9Li21	8998	Eta	0-10		49.54	34.21
9Li21	8998	Eta	0-10		58.57	32.95
9Li21	8998	Eta	0-10		57.89	43.77

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8998	Eta	0-10		65.39	51.93
9Li21	8998	Eta	0-10		39.55	28.28
9Li21	8998	Eta	0-10		84.06	53.3
9Li21	8998	Eta	0-10		75.09	46.16
9Li21	8998	Eta	0-10		56.83	44.44
9Li21	8998	Eta	0-10		58.39	32.1
9Li21	8998	Eta	0-10		48.17	29.89
9Li21	8998	Eta	0-10		59.17	41.68
9Li21	8998	Eta	0-10		126.82	45.57
9Li21	8998	Eta	0-10		55.35	37.14
9Li21	8998	Eta	0-10		71.16	42.69
9Li21	8998	Eta	0-10		78.83	43.9
9Li21	8997	Eta	10-20		111.26	53.02
9Li21	8997	Eta	10-20		76.79	45.06
9Li21	8997	Eta	10-20		98.87	45.67
9Li21	8997	Eta	10-20		70.7	37.58
9Li21	8997	Eta	10-20		74.51	44.22
9Li21	8997	Eta	10-20		78.8	49.04
9Li21	8997	Eta	10-20		111.12	56.65
9Li21	8997	Eta	10-20		94.78	46.77
9Li21	8997	Eta	10-20		69.16	45.54
9Li21	8997	Eta	10-20		123.02	49.99
9Li21	8997	Eta	10-20		55.74	42.93
9Li21	8997	Eta	10-20		79.19	53.47
9Li21	8997	Eta	10-20		82.2	53.56
9Li21	8997	Eta	10-20		75.91	38.12
9Li21	8997	Eta	10-20		119.37	56.31
9Li21	8997	Eta	10-20		85.82	41.61
9Li21	8997	Eta	10-20		70.93	35.58
9Li21	8997	Eta	10-20		87.83	66.42
9Li21	8997	Eta	10-20		102.35	50.52
9Li21	8997	Eta	10-20		81.23	46.67
9Li21	8997	Eta	10-20		61.49	40.71
9Li21	8997	Eta	10-20		85.03	44.88
9Li21	8997	Eta	10-20		88.89	38.12
9Li21	8997	Eta	10-20		84	44.48
9Li21	8997	Eta	10-20		80.87	52.86
9Li21	8997	Eta	10-20		58.17	38.22
9Li21	8997	Eta	10-20		84.09	39.39
9Li21	8997	Eta	10-20		62.15	34.51
9Li21	8997	Eta	10-20		56.29	27.75
9Li21	8997	Eta	10-20		76.98	55.41
9Li21	8997	Eta	10-20		77.92	51.53
9Li21	8997	Eta	10-20		59.1	46.41
9Li21	8997	Eta	10-20		93.42	44.18
9Li21	8997	Eta	10-20		99.73	28.51
9Li21	8997	Eta	10-20		74.11	40.3
9Li21	8997	Eta	10-20		55.86	33.25
9Li21	8997	Eta	10-20		60.93	53
9Li21	8997	Eta	10-20		91.21	42.05

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8997	Eta	10-20		68.4	43.13
9Li21	8997	Eta	10-20		91.76	43.23
9Li21	8997	Eta	10-20		77.29	43.45
9Li21	8997	Eta	10-20		70.26	42.57
9Li21	8997	Eta	10-20		53.1	27.58
9Li21	8997	Eta	10-20		99.75	48.59
9Li21	8997	Eta	10-20		79.66	39.67
9Li21	8997	Eta	10-20		81.28	40.48
9Li21	8997	Eta	10-20		68.87	44.17
9Li21	8997	Eta	10-20		68.03	45.35
9Li21	8997	Eta	10-20		61.99	41.8
9Li21	8997	Eta	10-20		64	41.2
9Li21	8997	Eta	10-20		54.62	29.97
9Li21	8997	Eta	10-20		67.41	45.51
9Li21	8997	Eta	10-20		47.54	27.74
9Li21	8997	Eta	10-20		69.17	39.88
9Li21	8997	Eta	10-20		57.39	41.73
9Li21	8997	Eta	10-20		65.97	36.37
9Li21	8997	Eta	10-20		81.55	43
9Li21	8997	Eta	10-20		72.88	37.46
9Li21	8997	Eta	10-20		76.23	44.61
9Li21	8997	Eta	10-20		65.37	42.65
9Li21	8997	Eta	10-20		86.51	46.41
9Li21	8997	Eta	10-20		68.8	42.69
9Li21	8997	Eta	10-20		92.32	45.34
9Li21	8997	Eta	10-20		82.77	45.91
9Li21	8997	Eta	10-20		71.86	40.63
9Li21	8997	Eta	10-20		78.57	42.29
9Li21	8997	Eta	10-20		77.46	39.02
9Li21	8997	Eta	10-20		82.6	34.1
9Li21	8997	Eta	10-20		55.3	36.14
9Li21	8997	Eta	10-20		51.61	40.22
9Li21	8997	Eta	10-20		69.37	49.13
9Li21	8997	Eta	10-20		71.98	39.22
9Li21	8997	Eta	10-20		57.23	36.41
9Li21	8997	Eta	10-20		61.09	40.94
9Li21	8997	Eta	10-20		54.86	32.6
9Li21	8997	Eta	10-20		90.35	46.8
9Li21	8997	Eta	10-20		62.57	46.94
9Li21	8997	Eta	10-20		69.86	47.23
9Li21	8997	Eta	10-20		66.77	40.62
9Li21	8997	Eta	10-20		53.83	40.92
9Li21	8997	Eta	10-20		105.27	56.01
9Li21	8997	Eta	10-20		89.37	40.97
9Li21	8997	Eta	10-20		67.78	43.05
9Li21	8997	Eta	10-20		65.67	49.75
9Li21	8997	Eta	10-20		85.93	36.86
9Li21	8997	Eta	10-20		71.89	43.02
9Li21	8997	Eta	10-20		54.69	50.74
9Li21	8997	Eta	10-20		70.34	38.36

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8997	Eta	10-20		56.26	40.14
9Li21	9062	Eta	20-30		86.43	37.27
9Li21	9062	Eta	20-30		85.11	43.29
9Li21	9062	Eta	20-30		67.9	40.95
9Li21	9062	Eta	20-30		99.1	35.43
9Li21	9062	Eta	20-30		62.76	54.2
9Li21	9062	Eta	20-30		78.65	51.12
9Li21	9062	Eta	20-30		41.61	36.14
9Li21	9062	Eta	20-30		80.45	40.11
9Li21	9062	Eta	20-30		81.81	37.37
9Li21	9062	Eta	20-30		75.8	38.93
9Li21	9062	Eta	20-30		74.62	50.94
9Li21	9062	Eta	20-30		114.9	45.33
9Li21	9062	Eta	20-30		95.11	47.21
9Li21	9062	Eta	20-30		73.87	38.41
9Li21	9062	Eta	20-30		75.66	44.65
9Li21	9062	Eta	20-30		106.54	54.85
9Li21	9062	Eta	20-30		111.26	52.18
9Li21	9062	Eta	20-30		86.67	42.69
9Li21	9062	Eta	20-30		68.42	44.54
9Li21	9062	Eta	20-30		102.63	46.25
9Li21	9062	Eta	20-30		48.54	32.31
9Li21	9062	Eta	20-30		102.17	42.11
9Li21	9062	Eta	20-30		61.37	42.75
9Li21	9062	Eta	20-30		69.4	44.94
9Li21	9062	Eta	20-30		80.6	47.14
9Li21	9062	Eta	20-30		68.93	29.12
9Li21	9062	Eta	20-30		72.94	52.18
9Li21	9062	Eta	20-30		99.78	37.15
9Li21	9062	Eta	20-30		111.91	51.34
9Li21	9062	Eta	20-30		83.88	41.48
9Li21	9062	Eta	20-30		110.03	41.94
9Li21	9062	Eta	20-30		68.32	59.41
9Li21	9062	Eta	20-30		85.43	48.38
9Li21	9062	Eta	20-30		79.15	42.88
9Li21	9062	Eta	20-30		79.96	52.49
9Li21	9062	Eta	20-30		68.63	40.7
9Li21	9062	Eta	20-30		82.3	41.32
9Li21	9062	Eta	20-30		99.12	40.66
9Li21	9062	Eta	20-30		60.11	32
9Li21	9062	Eta	20-30		76.66	42.23
9Li21	9062	Eta	20-30		96.76	38.97
9Li21	9062	Eta	20-30		80.33	45.02
9Li21	9062	Eta	20-30		70.53	40.95
9Li21	9062	Eta	20-30		119.63	53.83
9Li21	9062	Eta	20-30		87.27	51.97
9Li21	9062	Eta	20-30		61.73	39.8
9Li21	9062	Eta	20-30		86.31	38.38
9Li21	9062	Eta	20-30		86.44	43.07
9Li21	9062	Eta	20-30		62.72	28.23

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	9062	Eta	20-30		78.11	44.18
9Li21	9062	Eta	20-30		49.91	40.88
9Li21	9062	Eta	20-30		66.13	45.48
9Li21	9062	Eta	20-30		68.68	43.87
9Li21	9062	Eta	20-30		72.98	36.88
9Li21	9062	Eta	20-30		58.1	37.54
9Li21	9062	Eta	20-30		78.9	43.14
9Li21	9062	Eta	20-30		87.53	45.05
9Li21	9062	Eta	20-30		52.46	30.6
9Li21	9062	Eta	20-30		62.33	40.58
9Li21	9062	Eta	20-30		51.36	38.76
9Li21	9062	Eta	20-30		84.57	49.07
9Li21	9062	Eta	20-30		75.95	33.81
9Li21	9062	Eta	20-30		56.33	33.75
9Li21	9062	Eta	20-30		76.28	59.05
9Li21	9062	Eta	20-30		61.34	46.49
9Li21	9062	Eta	20-30		88.64	40.97
9Li21	9062	Eta	20-30		55.26	35.36
9Li21	9062	Eta	20-30		70.55	47.19
9Li21	9062	Eta	20-30		32.33	18.81
9Li21	9062	Eta	20-30		67.19	32.08
9Li21	9062	Eta	20-30		63.92	35.93
9Li21	9062	Eta	20-30		70.62	39.1
9Li21	9062	Eta	20-30		65.31	41.74
9Li21	9062	Eta	20-30		58.39	31.59
9Li21	9062	Eta	20-30		52.54	36.86
9Li21	9062	Eta	20-30		81.8	34.19
9Li21	9062	Eta	20-30		74.51	35.3
9Li21	9062	Eta	20-30		64.49	36.46
9Li21	9062	Eta	20-30		103.27	39.48
9Li21	9062	Eta	20-30		62.48	40.23
9Li21	9062	Eta	20-30		32.79	26.56
9Li21	9062	Eta	20-30		61.86	37.89
9Li21	9062	Eta	20-30		66.75	43.17
9Li21	9062	Eta	20-30		59.24	41.32
9Li21	9062	Eta	20-30		91.86	39.17
9Li21	9062	Eta	20-30		73.19	44.04
9Li21	9062	Eta	20-30		55.44	39.46
9Li21	9062	Eta	20-30		63.13	36.55
9Li21	9062	Eta	20-30		85.91	41.74
9Li21	9062	Eta	20-30		86.79	49.31
9Li21	9062	Eta	20-30		57.46	32.74
9Li21	9062	Eta	20-30		68.47	41.21
9Li21	9062	Eta	20-30		66.81	42.31
9Li21	9062	Eta	20-30		55.05	30.21
9Li21	9067	Eta	30-40		130.6	42.01
9Li21	9067	Eta	30-40		70.64	39.36
9Li21	9067	Eta	30-40		81.35	38.18
9Li21	9067	Eta	30-40		81.66	47.88
9Li21	9067	Eta	30-40		64.16	37.64

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	9067	Eta	30-40		65.51	39.47
9Li21	9067	Eta	30-40		79.02	51.64
9Li21	9067	Eta	30-40		73.17	34.96
9Li21	9067	Eta	30-40		67.29	38.49
9Li21	9067	Eta	30-40		64.26	46.8
9Li21	9067	Eta	30-40		64.73	41.44
9Li21	9067	Eta	30-40		48.97	35.82
9Li21	9067	Eta	30-40		73.55	45.16
9Li21	9067	Eta	30-40		53.36	34.8
9Li21	9067	Eta	30-40		82.99	37.35
9Li21	9067	Eta	30-40		47.03	29.52
9Li21	9067	Eta	30-40		97.56	49.26
9Li21	9067	Eta	30-40		65.58	43.97
9Li21	9067	Eta	30-40		79.64	33.08
9Li21	9067	Eta	30-40		67.95	46.26
9Li21	9067	Eta	30-40		58.1	37.54
9Li21	9067	Eta	30-40		72.76	33.66
9Li21	9067	Eta	30-40		65.61	45.44
9Li21	9067	Eta	30-40		70.05	42.08
9Li21	9067	Eta	30-40		79.41	52.53
9Li21	9067	Eta	30-40		57.6	27.64
9Li21	9067	Eta	30-40		42.44	19.63
9Li21	9067	Eta	30-40		30.35	23.09
9Li21	9067	Eta	30-40		35.87	39.21
9Li21	9067	Eta	30-40		44.18	26.78
9Li21	9067	Eta	30-40		49.04	21.33
9Li21	8990	Zeta	0-10		77.86	31.02
9Li21	8990	Zeta	0-10		82.32	31.27
9Li21	8990	Zeta	0-10		124.38	55.67
9Li21	8990	Zeta	0-10		86.05	44.16
9Li21	8990	Zeta	0-10		60.43	44.63
9Li21	8990	Zeta	0-10		90.84	47.82
9Li21	8990	Zeta	0-10		92.35	47.9
9Li21	8990	Zeta	0-10		67.46	38.43
9Li21	8990	Zeta	0-10		89.09	50.97
9Li21	8990	Zeta	0-10		48.21	33.4
9Li21	8990	Zeta	0-10		72.99	39
9Li21	8990	Zeta	0-10		67.23	29.01
9Li21	8990	Zeta	0-10		88.12	56.96
9Li21	8990	Zeta	0-10		68.56	41
9Li21	8990	Zeta	0-10		141.17	52.23
9Li21	8990	Zeta	0-10		67.15	40.08
9Li21	8990	Zeta	0-10		141.09	34.97
9Li21	8990	Zeta	0-10		105.5	49.71
9Li21	8990	Zeta	0-10		73.06	41.83
9Li21	8990	Zeta	0-10		121.49	41.61
9Li21	8990	Zeta	0-10		104.61	43.15
9Li21	8990	Zeta	0-10		98.87	35.55
9Li21	8990	Zeta	0-10		64.17	36.64
9Li21	8990	Zeta	0-10		75.8	51.01

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8990	Zeta	0-10		77.58	60.21
9Li21	8990	Zeta	0-10		63.45	36.01
9Li21	8990	Zeta	0-10		91.83	50.69
9Li21	8990	Zeta	0-10		65.12	37.98
9Li21	8990	Zeta	0-10		74.64	40.35
9Li21	8990	Zeta	0-10		69.35	39.46
9Li21	8990	Zeta	0-10		96.71	37.92
9Li21	8990	Zeta	0-10		54.19	37.28
9Li21	8990	Zeta	0-10		78.33	36.96
9Li21	8990	Zeta	0-10		73.52	46.05
9Li21	8990	Zeta	0-10		70.68	30.67
9Li21	8990	Zeta	0-10		69.73	46.87
9Li21	8990	Zeta	0-10		74.21	38.48
9Li21	8990	Zeta	0-10		61.52	41.26
9Li21	8990	Zeta	0-10		75.28	46.67
9Li21	8990	Zeta	0-10		103.8	37.74
9Li21	8990	Zeta	0-10		67.56	43.97
9Li21	8990	Zeta	0-10		76.88	44.88
9Li21	8990	Zeta	0-10		79.03	47.26
9Li21	8990	Zeta	0-10		108.35	64.4
9Li21	8990	Zeta	0-10		113.06	41.33
9Li21	8990	Zeta	0-10		54.55	40.91
9Li21	8990	Zeta	0-10		143.78	43.72
9Li21	8990	Zeta	0-10		66.94	57.85
9Li21	8990	Zeta	0-10		63.35	41.18
9Li21	8990	Zeta	0-10		88.39	55.75
9Li21	8990	Zeta	0-10		83.61	53.51
9Li21	8990	Zeta	0-10		92.24	57.45
9Li21	8990	Zeta	0-10		135.11	58.32
9Li21	8990	Zeta	0-10		66.16	45.06
9Li21	8990	Zeta	0-10		73.24	42.19
9Li21	8990	Zeta	0-10		90.24	48.5
9Li21	8990	Zeta	0-10		87.83	36.81
9Li21	8990	Zeta	0-10		67.74	50.36
9Li21	8990	Zeta	0-10		67.27	45.25
9Li21	8990	Zeta	0-10		66.83	48.3
9Li21	8990	Zeta	0-10		87.21	51.24
9Li21	8990	Zeta	0-10		80.66	64
9Li21	8990	Zeta	0-10		50.73	38.1
9Li21	8990	Zeta	0-10		57.09	40.05
9Li21	8990	Zeta	0-10		57.94	40.71
9Li21	8990	Zeta	0-10		77.01	31.55
9Li21	8990	Zeta	0-10		90.23	47.36
9Li21	8990	Zeta	0-10		107.92	43.01
9Li21	8990	Zeta	0-10		64.58	27.12
9Li21	8990	Zeta	0-10		86.66	48.01
9Li21	8990	Zeta	0-10		81.68	49.26
9Li21	8990	Zeta	0-10		70.73	37.67
9Li21	8990	Zeta	0-10		98.44	38.06
9Li21	8990	Zeta	0-10		48.73	34.98

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8990	Zeta	0-10		79.8	43.13
9Li21	8990	Zeta	0-10		65.93	36.96
9Li21	8990	Zeta	0-10		66.7	41.5
9Li21	8990	Zeta	0-10		76.07	52.76
9Li21	8990	Zeta	0-10		83.73	62.88
9Li21	8990	Zeta	0-10		66.87	43.28
9Li21	8990	Zeta	0-10		81.27	42.38
9Li21	8986	Zeta	10-20		95.11	43.52
9Li21	8986	Zeta	10-20		68.72	37.68
9Li21	8986	Zeta	10-20		82.9	51.27
9Li21	8986	Zeta	10-20		77.32	57.22
9Li21	8986	Zeta	10-20		101.01	46.27
9Li21	8986	Zeta	10-20		94.17	66.32
9Li21	8986	Zeta	10-20		106.75	61.87
9Li21	8986	Zeta	10-20		67.86	41.73
9Li21	8986	Zeta	10-20		72.47	48.68
9Li21	8986	Zeta	10-20		117.77	54.33
9Li21	8986	Zeta	10-20		61.38	44.82
9Li21	8986	Zeta	10-20		75.13	32.79
9Li21	8986	Zeta	10-20		79.86	36.49
9Li21	8986	Zeta	10-20		131.67	71.76
9Li21	8986	Zeta	10-20		87.79	53.38
9Li21	8986	Zeta	10-20		132.18	39.52
9Li21	8986	Zeta	10-20		73.16	44.8
9Li21	8986	Zeta	10-20		68.95	41.67
9Li21	8986	Zeta	10-20		83.59	44.13
9Li21	8986	Zeta	10-20		72.05	47.92
9Li21	8986	Zeta	10-20		85.38	63.23
9Li21	8986	Zeta	10-20		90.9	59.72
9Li21	8986	Zeta	10-20		74.72	42.83
9Li21	8986	Zeta	10-20		127.83	75.02
9Li21	8986	Zeta	10-20		93.66	41.85
9Li21	8986	Zeta	10-20		120.64	61.55
9Li21	8986	Zeta	10-20		66.5	40.74
9Li21	8986	Zeta	10-20		126.53	53.34
9Li21	8986	Zeta	10-20		69.74	41.66
9Li21	8986	Zeta	10-20		79.82	49.08
9Li21	8986	Zeta	10-20		153.01	59.63
9Li21	8986	Zeta	10-20		65.26	51.21
9Li21	8986	Zeta	10-20		137.99	45.16
9Li21	8986	Zeta	10-20		138.43	56.9
9Li21	8986	Zeta	10-20		155.41	42.17
9Li21	8986	Zeta	10-20		107.36	38.74
9Li21	8986	Zeta	10-20		115.49	64.97
9Li21	8986	Zeta	10-20		86.01	40.87
9Li21	8986	Zeta	10-20		74.64	51.33
9Li21	8986	Zeta	10-20		134.56	36.21
9Li21	8986	Zeta	10-20		80.86	55.38
9Li21	8986	Zeta	10-20		86.38	51.39
9Li21	8986	Zeta	10-20		86.46	55.51

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8986	Zeta	10-20		67.58	47.01
9Li21	8986	Zeta	10-20		98.7	44.83
9Li21	8986	Zeta	10-20		76.28	41.32
9Li21	8986	Zeta	10-20		124.27	41.02
9Li21	8986	Zeta	10-20		127.57	39.01
9Li21	8986	Zeta	10-20		80.34	35.86
9Li21	8986	Zeta	10-20		85.91	63.22
9Li21	8986	Zeta	10-20		74.88	38.79
9Li21	8986	Zeta	10-20		76.94	40.55
9Li21	8986	Zeta	10-20		76.28	41.01
9Li21	8986	Zeta	10-20		110.5	46.38
9Li21	8986	Zeta	10-20		66.39	45.62
9Li21	8986	Zeta	10-20		155	37.78
9Li21	8986	Zeta	10-20		95.29	45.38
9Li21	8986	Zeta	10-20		72.58	45.88
9Li21	8986	Zeta	10-20		67.41	43.58
9Li21	8986	Zeta	10-20		88.9	72.1
9Li21	8986	Zeta	10-20		115.78	44.72
9Li21	8986	Zeta	10-20		63.62	42.59
9Li21	8986	Zeta	10-20		74.49	42.11
9Li21	8986	Zeta	10-20		72.35	56.53
9Li21	8986	Zeta	10-20		78.96	45.44
9Li21	8986	Zeta	10-20		59.17	46.46
9Li21	8986	Zeta	10-20		108.23	43.8
9Li21	8986	Zeta	10-20		99.75	37.56
9Li21	8986	Zeta	10-20		77.88	42.7
9Li21	8986	Zeta	10-20		82.41	48.17
9Li21	8986	Zeta	10-20		91.37	60.95
9Li21	8986	Zeta	10-20		57.06	44.03
9Li21	8986	Zeta	10-20		86.26	50.71
9Li21	8986	Zeta	10-20		82.59	48.23
9Li21	8986	Zeta	10-20		65.84	48.4
9Li21	8986	Zeta	10-20		59.23	38.94
9Li21	8986	Zeta	10-20		65.18	40.27
9Li21	8986	Zeta	10-20		73.89	48.28
9Li21	8986	Zeta	10-20		57.68	38.95
9Li21	8986	Zeta	10-20		96.13	44.48
9Li21	8986	Zeta	10-20		54	33.94
9Li21	8986	Zeta	10-20		78.66	54.22
9Li21	8986	Zeta	10-20		57.43	31.47
9Li21	8986	Zeta	10-20		74.19	46.74
9Li21	8986	Zeta	10-20		54.81	36.05
9Li21	8986	Zeta	10-20		51.08	35.19
9Li21	8996	Zeta	20-30		86.82	47.53
9Li21	8996	Zeta	20-30		61.99	40.13
9Li21	8996	Zeta	20-30		111.62	42.57
9Li21	8996	Zeta	20-30		77.91	54.49
9Li21	8996	Zeta	20-30		65.24	42.3
9Li21	8996	Zeta	20-30		82.25	51.17
9Li21	8996	Zeta	20-30		64.31	32.29

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8996	Zeta	20-30		80.99	40.71
9Li21	8996	Zeta	20-30		90.4	58.31
9Li21	8996	Zeta	20-30		98.55	39.46
9Li21	8996	Zeta	20-30		73.77	43.07
9Li21	8996	Zeta	20-30		141.2	42.86
9Li21	8996	Zeta	20-30		69.7	36.8
9Li21	8996	Zeta	20-30		69.65	34.53
9Li21	8996	Zeta	20-30		64.39	48.77
9Li21	8996	Zeta	20-30		66.63	43.89
9Li21	8996	Zeta	20-30		64.38	46.24
9Li21	8996	Zeta	20-30		67.78	36.9
9Li21	8996	Zeta	20-30		79.71	44.37
9Li21	8996	Zeta	20-30		77.15	41.05
9Li21	8996	Zeta	20-30		78.86	45.86
9Li21	8996	Zeta	20-30		59.59	34.34
9Li21	8996	Zeta	20-30		82.9	58.06
9Li21	8996	Zeta	20-30		69.05	42.03
9Li21	8996	Zeta	20-30		70.08	45.47
9Li21	8996	Zeta	20-30		88.37	50.82
9Li21	8996	Zeta	20-30		66	48.01
9Li21	8996	Zeta	20-30		68.83	39.91
9Li21	8996	Zeta	20-30		73.79	52.86
9Li21	8996	Zeta	20-30		98.07	59.98
9Li21	8996	Zeta	20-30		65.01	36.25
9Li21	8996	Zeta	20-30		81.49	52.54
9Li21	8996	Zeta	20-30		184.5	39.02
9Li21	8996	Zeta	20-30		126.38	39.41
9Li21	8996	Zeta	20-30		58.22	62.11
9Li21	8996	Zeta	20-30		55.61	28.49
9Li21	8996	Zeta	20-30		95.25	44.6
9Li21	8996	Zeta	20-30		74.18	47.35
9Li21	8996	Zeta	20-30		74.05	59.56
9Li21	8996	Zeta	20-30		94.61	42.32
9Li21	8996	Zeta	20-30		60.93	41.9
9Li21	8996	Zeta	20-30		105.94	39.26
9Li21	8996	Zeta	20-30		76.35	47.1
9Li21	8996	Zeta	20-30		69.92	39.19
9Li21	8996	Zeta	20-30		91.86	74.4
9Li21	8996	Zeta	20-30		39.17	26.42
9Li21	8996	Zeta	20-30		70.79	46.95
9Li21	8996	Zeta	20-30		72.31	50.02
9Li21	8996	Zeta	20-30		82.05	57.09
9Li21	8996	Zeta	20-30		94.43	56.49
9Li21	8996	Zeta	20-30		89.17	51.34
9Li21	8996	Zeta	20-30		109.84	61.26
9Li21	8996	Zeta	20-30		91.36	38.27
9Li21	8996	Zeta	20-30		101.21	61.55
9Li21	8996	Zeta	20-30		68.35	40.57
9Li21	8996	Zeta	20-30		111.6	48.42
9Li21	8996	Zeta	20-30		69.85	26.95

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8996	Zeta	20-30		82.66	56.68
9Li21	8996	Zeta	20-30		111.55	39.23
9Li21	8996	Zeta	20-30		42.22	28.52
9Li21	8996	Zeta	20-30		123.17	57.51
9Li21	8996	Zeta	20-30		87.85	58.44
9Li21	8996	Zeta	20-30		111.76	62.37
9Li21	8996	Zeta	20-30		84.65	35.17
9Li21	8996	Zeta	20-30		105.96	45.14
9Li21	8996	Zeta	20-30		99.85	56.6
9Li21	8996	Zeta	20-30		97.84	57.88
9Li21	8996	Zeta	20-30		67.78	45.87
9Li21	8996	Zeta	20-30		94.76	64.62
9Li21	8996	Zeta	20-30		91.99	42.69
9Li21	8996	Zeta	20-30		62.21	43.51
9Li21	8996	Zeta	20-30		71.52	51.93
9Li21	8996	Zeta	20-30		74.89	45.59
9Li21	8996	Zeta	20-30		96.09	45.6
9Li21	8996	Zeta	20-30		91.12	36.74
9Li21	8996	Zeta	20-30		67.71	46.92
9Li21	8996	Zeta	20-30		64.93	40.82
9Li21	8996	Zeta	20-30		69.63	50.16
9Li21	8996	Zeta	20-30		56.87	50.07
9Li21	8996	Zeta	20-30		55.15	42.1
9Li21	8996	Zeta	20-30		86.97	57.83
9Li21	8996	Zeta	20-30		69.59	45.49
9Li21	8996	Zeta	20-30		95.07	49.52
9Li21	8996	Zeta	20-30		121.16	36.53
9Li21	8996	Zeta	20-30		96.92	38.39
9Li21	8996	Zeta	20-30		110.29	41.1
9Li21	8996	Zeta	20-30		78.55	43.67
9Li21	8996	Zeta	20-30		172.5	47.43
9Li21	8996	Zeta	20-30		103.72	57.72
9Li21	8996	Zeta	20-30		119.37	46.42
9Li21	8996	Zeta	20-30		88.22	50.48
9Li21	8996	Zeta	20-30		92.11	54.48
9Li21	8996	Zeta	20-30		93.66	44.62
9Li21	8981	Zeta	30-40		102.24	40.4
9Li21	8981	Zeta	30-40		73.35	36.2
9Li21	8981	Zeta	30-40		64.24	29.5
9Li21	8981	Zeta	30-40		73.24	33.11
9Li21	8981	Zeta	30-40		86.44	36.79
9Li21	8981	Zeta	30-40		74.19	44.72
9Li21	8981	Zeta	30-40		94.74	52.07
9Li21	8981	Zeta	30-40		85.79	37.57
9Li21	8981	Zeta	30-40		94.5	38.55
9Li21	8981	Zeta	30-40		110.53	46.19
9Li21	8981	Zeta	30-40		73.55	49.48
9Li21	8981	Zeta	30-40		122.24	39.97
9Li21	8981	Zeta	30-40		77.41	37.46
9Li21	8981	Zeta	30-40		94.43	36.11

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8981	Zeta	30-40		64.26	41.48
9Li21	8981	Zeta	30-40		73.74	39.42
9Li21	8981	Zeta	30-40		63.72	37.03
9Li21	8981	Zeta	30-40		86.33	54.87
9Li21	8981	Zeta	30-40		84.77	39.31
9Li21	8981	Zeta	30-40		104.81	35.04
9Li21	8981	Zeta	30-40		88.69	35.98
9Li21	8981	Zeta	30-40		58.52	37.81
9Li21	8981	Zeta	30-40		70.51	44.44
9Li21	8981	Zeta	30-40		85.33	38.5
9Li21	8981	Zeta	30-40		123.12	65.86
9Li21	8981	Zeta	30-40		96.45	44.14
9Li21	8981	Zeta	30-40		90.07	47.1
9Li21	8981	Zeta	30-40		72.58	43.41
9Li21	8981	Zeta	30-40		110.88	58.67
9Li21	8981	Zeta	30-40		75.96	39.68
9Li21	8981	Zeta	30-40		88.21	54.82
9Li21	8981	Zeta	30-40		119.41	35.16
9Li21	8981	Zeta	30-40		98.18	37.1
9Li21	8981	Zeta	30-40		77.15	40.11
9Li21	8981	Zeta	30-40		78.01	40.16
9Li21	8981	Zeta	30-40		76.62	39.29
9Li21	8981	Zeta	30-40		115.79	52.74
9Li21	8981	Zeta	30-40		98.29	28.35
9Li21	8981	Zeta	30-40		72.65	49.42
9Li21	8981	Zeta	30-40		74.29	38.24
9Li21	8981	Zeta	30-40		104.66	34.07
9Li21	8981	Zeta	30-40		113.82	49.85
9Li21	8981	Zeta	30-40		79.71	54.65
9Li21	8981	Zeta	30-40		86.21	46.84
9Li21	8981	Zeta	30-40		102.88	45.66
9Li21	8981	Zeta	30-40		87.26	35.14
9Li21	8981	Zeta	30-40		67.88	35.72
9Li21	8981	Zeta	30-40		75.97	41.52
9Li21	8981	Zeta	30-40		100.86	48.52
9Li21	8981	Zeta	30-40		74.66	43.25
9Li21	8981	Zeta	30-40		75.7	51.91
9Li21	8981	Zeta	30-40		92.04	47.25
9Li21	8981	Zeta	30-40		81.57	43.49
9Li21	8981	Zeta	30-40		101.82	39.95
9Li21	8981	Zeta	30-40		117.57	48.87
9Li21	8981	Zeta	30-40		70.94	34.73
9Li21	8981	Zeta	30-40		87.88	38.81
9Li21	8981	Zeta	30-40		133.79	45.49
9Li21	8981	Zeta	30-40		62.15	42.81
9Li21	8981	Zeta	30-40		88.54	48.79
9Li21	8981	Zeta	30-40		70.98	37.53
9Li21	8981	Zeta	30-40		97.98	41.23
9Li21	8981	Zeta	30-40		95.12	35.34
9Li21	8981	Zeta	30-40		119.09	39.55

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8981	Zeta	30-40		68.29	38.63
9Li21	8981	Zeta	30-40		73.25	37.26
9Li21	8981	Zeta	30-40		100.69	49.77
9Li21	8981	Zeta	30-40		83.72	32.91
9Li21	8981	Zeta	30-40		94.47	41.99
9Li21	8981	Zeta	30-40		110.19	44.9
9Li21	8981	Zeta	30-40		63.53	37.25
9Li21	8981	Zeta	30-40		62.88	41.31
9Li21	8981	Zeta	30-40		80.04	33.64
9Li21	8981	Zeta	30-40		53.81	38.34
9Li21	8981	Zeta	30-40		134.77	33.06
9Li21	8981	Zeta	30-40		85.31	37.7
9Li21	8981	Zeta	30-40		64.59	41.36
9Li21	8981	Zeta	30-40		72.4	36.26
9Li21	8981	Zeta	30-40		82.74	39.73
9Li21	8981	Zeta	30-40		72.64	46.85
9Li21	8981	Zeta	30-40		117.95	34.59
9Li21	8981	Zeta	30-40		86.65	44.12
9Li21	8981	Zeta	30-40		70.79	42.12
9Li21	8981	Zeta	30-40		90.76	53.39
9Li21	8981	Zeta	30-40		78.74	34.24
9Li21	8981	Zeta	30-40		87.91	43.42
9Li21	8981	Zeta	30-40		68.8	45.18
9Li21	8981	Zeta	30-40		98.88	36.3
9Li21	8981	Zeta	30-40		136.44	43.14
9Li21	8981	Zeta	30-40		111.31	40.15
9Li21	8981	Zeta	30-40		142.55	46.56
9Li21	8981	Zeta	30-40		91.44	36.25
9Li21	8981	Zeta	30-40		88.08	37.42
9Li21	8981	Zeta	30-40		82.42	49.01
9Li21	8981	Zeta	30-40		84.01	55.66
9Li21	8981	Zeta	30-40		63.21	33.28
9Li21	8981	Zeta	30-40		67.2	40.79
9Li21	8981	Zeta	30-40		103.23	41.81
9Li21	8981	Zeta	30-40		149.4	37.07
9Li21	8981	Zeta	30-40		149.76	45.49
9Li21	8981	Zeta	30-40		65.17	42.09
9Li21	8978	Zeta	40-50		104.2	42.21
9Li21	8978	Zeta	40-50		105.4	46.22
9Li21	8978	Zeta	40-50		116.32	51.69
9Li21	8978	Zeta	40-50		106.49	52.25
9Li21	8978	Zeta	40-50		103.92	60.88
9Li21	8978	Zeta	40-50		100.56	42.53
9Li21	8978	Zeta	40-50		145.68	45.8
9Li21	8978	Zeta	40-50		137.6	44.22
9Li21	8978	Zeta	40-50		96.35	41.37
9Li21	8978	Zeta	40-50		92.92	48.1
9Li21	8978	Zeta	40-50		101.16	48.26
9Li21	8978	Zeta	40-50		106.24	47.94
9Li21	8978	Zeta	40-50		87.99	44.34

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8978	Zeta	40-50		123.95	48.76
9Li21	8978	Zeta	40-50		78.23	41.34
9Li21	8978	Zeta	40-50		76.42	52.64
9Li21	8978	Zeta	40-50		58.75	41.94
9Li21	8978	Zeta	40-50		81.46	52.69
9Li21	8978	Zeta	40-50		125.6	57.83
9Li21	8978	Zeta	40-50		101.02	35.96
9Li21	8978	Zeta	40-50		127.33	40.8
9Li21	8978	Zeta	40-50		102.76	48.94
9Li21	8978	Zeta	40-50		91.98	62.11
9Li21	8978	Zeta	40-50		90.63	31.08
9Li21	8978	Zeta	40-50		77.25	38.4
9Li21	8978	Zeta	40-50		114.41	29.5
9Li21	8978	Zeta	40-50		83.3	51.73
9Li21	8978	Zeta	40-50		105.74	47.67
9Li21	8978	Zeta	40-50		103.14	42.7
9Li21	8978	Zeta	40-50		53.24	38.14
9Li21	8978	Zeta	40-50		101.88	43.5
9Li21	8978	Zeta	40-50		88.2	43.33
9Li21	8978	Zeta	40-50		68.32	27.69
9Li21	8978	Zeta	40-50		61.44	47.57
9Li21	8978	Zeta	40-50		75.65	43.46
9Li21	8978	Zeta	40-50		96.19	57.68
9Li21	8978	Zeta	40-50		69.37	42.97
9Li21	8978	Zeta	40-50		140.59	51.29
9Li21	8978	Zeta	40-50		64.34	39.55
9Li21	8978	Zeta	40-50		59.9	47.58
9Li21	8978	Zeta	40-50		91.07	40.95
9Li21	8978	Zeta	40-50		74.83	41.67
9Li21	8978	Zeta	40-50		68.49	40.88
9Li21	8978	Zeta	40-50		48.55	29.14
9Li21	8978	Zeta	40-50		89.17	40.08
9Li21	8978	Zeta	40-50		69.33	43.51
9Li21	8978	Zeta	40-50		110.87	39.09
9Li21	8978	Zeta	40-50		80.76	50.29
9Li21	8978	Zeta	40-50		95.51	35.97
9Li21	8978	Zeta	40-50		77	49.41
9Li21	8978	Zeta	40-50		75.32	56.22
9Li21	8978	Zeta	40-50		63.64	31.68
9Li21	8978	Zeta	40-50		67.44	38.13
9Li21	8978	Zeta	40-50		109.75	53.87
9Li21	8978	Zeta	40-50		82.34	45.23
9Li21	8978	Zeta	40-50		76.16	42.9
9Li21	8978	Zeta	40-50		81.82	45.59
9Li21	8978	Zeta	40-50		67	45.85
9Li21	8978	Zeta	40-50		65	50.94
9Li21	8978	Zeta	40-50		105.27	41.03
9Li21	8978	Zeta	40-50		70.12	53.02
9Li21	8978	Zeta	40-50		82.14	36.47
9Li21	8978	Zeta	40-50		73.03	37.23

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	8978	Zeta	40-50		87.65	32.16
9Li21	8978	Zeta	40-50		57.98	40.68
9Li21	8978	Zeta	40-50		61.83	30.7
9Li21	8978	Zeta	40-50		142.4	37.88
9Li21	8978	Zeta	40-50		64.11	41.13
9Li21	8978	Zeta	40-50		140.78	34.11
9Li21	8978	Zeta	40-50		135.45	41.07
9Li21	8978	Zeta	40-50		79.36	47.83
9Li21	8978	Zeta	40-50		72	33.04
9Li21	8978	Zeta	40-50		78.37	49.97
9Li21	8978	Zeta	40-50		80.1	41.3
9Li21	8978	Zeta	40-50		76.45	38.62
9Li21	8978	Zeta	40-50		86.93	42.13
9Li21	8978	Zeta	40-50		126.22	33.51
9Li21	8978	Zeta	40-50		66.64	48.33
9Li21	8978	Zeta	40-50		102.56	41.45
9Li21	8978	Zeta	40-50		58.45	31.02
9Li21	8978	Zeta	40-50		92.96	47.07
9Li21	8978	Zeta	40-50		99.95	61.03
9Li21	8978	Zeta	40-50		77.58	46.51
9Li21	8978	Zeta	40-50		57.91	35.42
9Li21	8978	Zeta	40-50		104.65	28.32
9Li21	8978	Zeta	40-50		71.18	33.39
9Li21	8978	Zeta	40-50		117.01	37.87
9Li21	8978	Zeta	40-50		80.95	50.89
9Li21	8978	Zeta	40-50		93.54	42.94
9Li21	8978	Zeta	40-50		66.73	36.71
9Li21	8978	Zeta	40-50		65.19	35.97
9Li21	8978	Zeta	40-50		55.31	43.86
9Li21	8978	Zeta	40-50		77.21	42.52
9Li21	8978	Zeta	40-50		59.03	31.73
9Li21	8978	Zeta	40-50		49.44	40.18
9Li21	8978	Zeta	40-50		65.67	44.31
9Li21	8978	Zeta	40-50		95.4	28.83
9Li21	8978	Zeta	40-50		84.04	29.5
9Li21	8978	Zeta	40-50		73.88	24.89
9Li21	8978	Zeta	40-50		74.86	32.94
9Li21	8978	Zeta	40-50		52.62	36.98
9Li21	8978	Zeta	40-50		71.27	41.53
9Li21	8978	Zeta	40-50		63.29	38.27
9Li21	8978	Zeta	40-50		53.65	33.22
9Li21	8978	Zeta	40-50		48.73	35.41
9Li21	9066	Zeta	50-60		116.59	55.7
9Li21	9066	Zeta	50-60		104.81	35.06
9Li21	9066	Zeta	50-60		96.33	48.04
9Li21	9066	Zeta	50-60		97.86	54.52
9Li21	9066	Zeta	50-60		66.61	40.69
9Li21	9066	Zeta	50-60		99.29	35.37
9Li21	9066	Zeta	50-60		135.59	42.82
9Li21	9066	Zeta	50-60		119.54	39.72

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	9066	Zeta	50-60		120.32	30.68
9Li21	9066	Zeta	50-60		92.55	51.67
9Li21	9066	Zeta	50-60		92.49	58.49
9Li21	9066	Zeta	50-60		89.73	51.02
9Li21	9066	Zeta	50-60		150.53	47.73
9Li21	9066	Zeta	50-60		84.38	53.53
9Li21	9066	Zeta	50-60		80.94	50.34
9Li21	9066	Zeta	50-60		73.92	45.14
9Li21	9066	Zeta	50-60		85.5	42.08
9Li21	9066	Zeta	50-60		85.72	48.59
9Li21	9066	Zeta	50-60		137.11	67.7
9Li21	9066	Zeta	50-60		86.35	57.32
9Li21	9066	Zeta	50-60		85.97	49.19
9Li21	9066	Zeta	50-60		116.15	45.95
9Li21	9066	Zeta	50-60		92.4	57.17
9Li21	9066	Zeta	50-60		97.37	58.17
9Li21	9066	Zeta	50-60		92.81	50.88
9Li21	9066	Zeta	50-60		75.97	50.65
9Li21	9066	Zeta	50-60		79.65	44.39
9Li21	9066	Zeta	50-60		90.46	39.98
9Li21	9066	Zeta	50-60		80.51	55.3
9Li21	9066	Zeta	50-60		73.65	45.05
9Li21	9066	Zeta	50-60		131.37	60.11
9Li21	9066	Zeta	50-60		69.69	50.45
9Li21	9066	Zeta	50-60		81.37	54.64
9Li21	9066	Zeta	50-60		69.65	31.57
9Li21	9066	Zeta	50-60		114.53	51.94
9Li21	9066	Zeta	50-60		77.11	48.36
9Li21	9066	Zeta	50-60		80.87	41.69
9Li21	9066	Zeta	50-60		71.09	36.96
9Li21	9066	Zeta	50-60		99.77	51.65
9Li21	9066	Zeta	50-60		63.93	38.79
9Li21	9066	Zeta	50-60		92.78	59.69
9Li21	9066	Zeta	50-60		85.26	34.81
9Li21	9066	Zeta	50-60		90.75	56.26
9Li21	9066	Zeta	50-60		107.2	53.37
9Li21	9066	Zeta	50-60		94.59	43.55
9Li21	9066	Zeta	50-60		84.35	47.05
9Li21	9066	Zeta	50-60		102.78	40.35
9Li21	9066	Zeta	50-60		72.01	43.35
9Li21	9066	Zeta	50-60		72.76	47.67
9Li21	9066	Zeta	50-60		94.21	42.94
9Li21	9066	Zeta	50-60		91.83	40.86
9Li21	9066	Zeta	50-60		91.82	57.46
9Li21	9066	Zeta	50-60		67.87	35.9
9Li21	9066	Zeta	50-60		73.57	47.75
9Li21	9066	Zeta	50-60		73.22	25.55
9Li21	9066	Zeta	50-60		72.17	61.29
9Li21	9066	Zeta	50-60		52.26	36.17
9Li21	9066	Zeta	50-60		85.97	43.14

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	9066	Zeta	50-60		57.87	40.21
9Li21	9066	Zeta	50-60		70.06	48.9
9Li21	9066	Zeta	50-60		69.12	32.57
9Li21	9066	Zeta	50-60		55.77	30.34
9Li21	9066	Zeta	50-60		71.42	39.68
9Li21	9066	Zeta	50-60		68.12	34.22
9Li21	9066	Zeta	50-60		98.68	41.61
9Li21	9066	Zeta	50-60		78.31	50.53
9Li21	9066	Zeta	50-60		87.67	41.14
9Li21	9066	Zeta	50-60		78.95	37.93
9Li21	9066	Zeta	50-60		78.7	35.51
9Li21	9066	Zeta	50-60		65.73	45.39
9Li21	9066	Zeta	50-60		85.1	48.43
9Li21	9066	Zeta	50-60		94.77	44.2
9Li21	9066	Zeta	50-60		95.45	34.84
9Li21	9066	Zeta	50-60		79.16	37.46
9Li21	9066	Zeta	50-60		109.69	35.23
9Li21	9066	Zeta	50-60		80.06	35.63
9Li21	9066	Zeta	50-60		84.84	36.81
9Li21	9066	Zeta	50-60		59.06	44.33
9Li21	9066	Zeta	50-60		66.7	41.44
9Li21	9066	Zeta	50-60		75.65	44.97
9Li21	9066	Zeta	50-60		79.83	53.76
9Li21	9066	Zeta	50-60		70.41	48.45
9Li21	9066	Zeta	50-60		72.87	46.94
9Li21	9066	Zeta	50-60		83.34	41.72
9Li21	9066	Zeta	50-60		83.28	29.7
9Li21	9066	Zeta	50-60		100.46	31.08
9Li21	9066	Zeta	50-60		106.16	42.91
9Li21	9066	Zeta	50-60		75.07	47.34
9Li21	9066	Zeta	50-60		68.34	38.18
9Li21	9066	Zeta	50-60		68.47	45.77
9Li21	9066	Zeta	50-60		73.48	45.31
9Li21	9066	Zeta	50-60		131.84	43.17
9Li21	9066	Zeta	50-60		75.7	48.17
9Li21	9064	Zeta	60-66		109.61	49.91
9Li21	9064	Zeta	60-66		64.23	36.93
9Li21	9064	Zeta	60-66		100.62	66.16
9Li21	9064	Zeta	60-66		66.52	48.87
9Li21	9064	Zeta	60-66		71.84	35.47
9Li21	9064	Zeta	60-66		75.77	45.05
9Li21	9064	Zeta	60-66		118.76	40.51
9Li21	9064	Zeta	60-66		78.83	50.83
9Li21	9064	Zeta	60-66		82.48	49.66
9Li21	9064	Zeta	60-66		72.13	50.45
9Li21	9064	Zeta	60-66		107.89	53.56
9Li21	9064	Zeta	60-66		78.73	32.33
9Li21	9064	Zeta	60-66		85.33	54.29
9Li21	9064	Zeta	60-66		113.1	59.07
9Li21	9064	Zeta	60-66		99.07	41.51

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	9064	Zeta	60-66		113.75	57.22
9Li21	9064	Zeta	60-66		95.43	41.13
9Li21	9064	Zeta	60-66		119.65	61.89
9Li21	9064	Zeta	60-66		77.47	50.18
9Li21	9064	Zeta	60-66		68.58	47.44
9Li21	9064	Zeta	60-66		64.55	48.3
9Li21	9064	Zeta	60-66		66.85	41.78
9Li21	9064	Zeta	60-66		65.55	42.87
9Li21	9064	Zeta	60-66		83.52	27.97
9Li21	9064	Zeta	60-66		114.57	58.56
9Li21	9064	Zeta	60-66		101.23	36.85
9Li21	9064	Zeta	60-66		82.02	50.98
9Li21	9064	Zeta	60-66		95.79	40.33
9Li21	9064	Zeta	60-66		85.56	39.76
9Li21	9064	Zeta	60-66		83.39	52.12
9Li21	9064	Zeta	60-66		56.45	40.23
9Li21	9064	Zeta	60-66		69.43	47.06
9Li21	9064	Zeta	60-66		123.94	62.04
9Li21	9064	Zeta	60-66		72.94	42.22
9Li21	9064	Zeta	60-66		74.69	40.4
9Li21	9064	Zeta	60-66		75.48	41.15
9Li21	9064	Zeta	60-66		49.34	35.29
9Li21	9064	Zeta	60-66		84.34	22.43
9Li21	9064	Zeta	60-66		95.79	49.02
9Li21	9064	Zeta	60-66		84.51	31.27
9Li21	9064	Zeta	60-66		67.71	41.34
9Li21	9064	Zeta	60-66		64.03	47.06
9Li21	9064	Zeta	60-66		86.71	38.44
9Li21	9064	Zeta	60-66		55.7	40.87
9Li21	9064	Zeta	60-66		67.02	40.14
9Li21	9064	Zeta	60-66		90.02	46.04
9Li21	9064	Zeta	60-66		79.17	51.48
9Li21	9064	Zeta	60-66		126.67	34.82
9Li21	9064	Zeta	60-66		116.19	32.07
9Li21	9064	Zeta	60-66		55.81	26.78
9Li21	9064	Zeta	60-66		63.13	40.54
9Li21	9064	Zeta	60-66		57.69	33.29
9Li21	9064	Zeta	60-66		68.6	43.92
9Li21	9064	Zeta	60-66		97.42	45.89
9Li21	9064	Zeta	60-66		52.69	37.44
9Li21	9064	Zeta	60-66		82.66	49.84
9Li21	9064	Zeta	60-66		88.19	44.32
9Li21	9064	Zeta	60-66		88.85	36.95
9Li21	9064	Zeta	60-66		67.39	36.62
9Li21	9064	Zeta	60-66		54.7	41.69
9Li21	9064	Zeta	60-66		68.36	38.02
9Li21	9064	Zeta	60-66		76.86	58.03
9Li21	9064	Zeta	60-66		59.88	30.82
9Li21	9064	Zeta	60-66		72.69	44.85
9Li21	9064	Zeta	60-66		63.22	35.36

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	9064	Zeta	60-66		84.88	44.44
9Li21	9064	Zeta	60-66		86.87	53.61
9Li21	9064	Zeta	60-66		66.01	38.12
9Li21	9064	Zeta	60-66		80.56	43.87
9Li21	9064	Zeta	60-66		92.43	42.89
9Li21	9064	Zeta	60-66		92.33	47.55
9Li21	9064	Zeta	60-66		86.99	35.39
9Li21	9064	Zeta	60-66		105.01	56.72
9Li21	9064	Zeta	60-66		71.89	34.04
9Li21	9064	Zeta	60-66		89.38	34.69
9Li21	9064	Zeta	60-66		96.88	59.25
9Li21	9064	Zeta	60-66		84.88	50.68
9Li21	9064	Zeta	60-66		78.27	34.41
9Li21	9064	Zeta	60-66		58.08	37.19
9Li21	9064	Zeta	60-66		91.65	57.83
9Li21	9064	Zeta	60-66		60.74	43.33
9Li21	9064	Zeta	60-66		87.5	59.24
9Li21	9064	Zeta	60-66		63.21	45.46
9Li21	9064	Zeta	60-66		31.99	18.84
9Li21	9064	Zeta	60-66		64.48	35.64
9Li21	9064	Zeta	60-66		78.56	49.97
9Li21	9064	Zeta	60-66		71.13	32.98
9Li21	9064	Zeta	60-66		66.14	45.19
9Li21	9064	Zeta	60-66		58.86	38.66
9Li21	9064	Zeta	60-66		74.1	35.94
9Li21	9064	Zeta	60-66		65.88	30.73
9Li21	9064	Zeta	60-66		57.93	39.45
9Li21	9064	Zeta	60-66		72.06	52.91
9Li21	9064	Zeta	60-66		76.84	39.08
9Li21	9064	Zeta	60-66		71.96	54.57
9Li21	9080	Zeta		3	88.29	35.63
9Li21	9080	Zeta		3	61.23	33.72
9Li21	9080	Zeta		3	89.53	32.84
9Li21	9080	Zeta		3	70.77	35.66
9Li21	9080	Zeta		3	111.81	40.41
9Li21	9080	Zeta		3	64.81	35.6
9Li21	9080	Zeta		3	78.18	27.1
9Li21	9080	Zeta		3	73.34	38.5
9Li21	9080	Zeta		3	65.99	42.61
9Li21	9080	Zeta		3	96.3	40.93
9Li21	9080	Zeta		3	37.93	32.17
9Li21	9080	Zeta		3	92.58	37.83
9Li21	9080	Zeta		3	72	46.8
9Li21	9080	Zeta		3	111.98	38.97
9Li21	9080	Zeta		3	62.77	24.55
9Li21	9080	Zeta		3	71.96	43.08
9Li21	9080	Zeta		3	133.68	73.82
9Li21	9080	Zeta		3	145.82	32
9Li21	9080	Zeta		3	67.13	41.77
9Li21	9080	Zeta		3	73.62	46.19

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li21	9080	Zeta		3	48.38	29.55
9Li21	9080	Zeta		3	121.47	36.22
9Li21	9080	Zeta		3	77.61	38.8
9Li21	9080	Zeta		3	71.44	44.36
9Li21	9080	Zeta		3	74.71	38.03
9Li21	9080	Zeta		3	101.34	33.91
9Li21	9080	Zeta		3	81.31	45.77
9Li21	9080	Zeta		3	84.97	35.58
9Li21	9080	Zeta		3	87.49	42.39
9Li21	9080	Zeta		3	79.48	58.98
9Li21	9080	Zeta		3	63.9	38.83
9Li21	9080	Zeta		3	96.75	50.74
9Li21	9080	Zeta		3	74.47	49.43
9Li21	9080	Zeta		3	58.5	38.47
9Li21	9080	Zeta		3	60.19	39.52
9Li21	9080	Zeta		3	80.32	43.86
9Li21	9080	Zeta		3	66.19	35.83
9Li21	9080	Zeta		3	56.41	43.42
9Li21	9080	Zeta		3	69.25	48.88
9Li21	9080	Zeta		3	63.14	28.85
9Li21	9080	Zeta		3	65.14	35.82
9Li21	9080	Zeta		3	50.86	38.16
9Li21	9080	Zeta		3	58.01	30.52
9Li21	9080	Zeta		3	91.26	34.11
9Li21	9080	Zeta		3	64.91	38.33
9Li21	9080	Zeta		3	50.69	32.64
9Li21	9080	Zeta		3	89.1	39.7
9Li21	9080	Zeta		3	71.88	37.5
9Li21	9080	Zeta		3	53.62	29.27
9Li21	9080	Zeta		3	72.49	36.67
9Li21	9080	Zeta		3	52.34	27.71
9Li21	9080	Zeta		3	75.78	32.45
9Li21	9080	Zeta		3	68.81	47.16
9Li21	9080	Zeta		3	62.46	30.11
9Li21	9080	Zeta		3	63.7	43.94
9Li21	9080	Zeta		3	53.99	25.9
9Li21	9080	Zeta		3	58.94	17.19
9Li21	9080	Zeta		3	42.98	30.74
9Li21	9080	Zeta		3	36.23	30.22
9Li21	9080	Zeta		3	34.32	19.91
9Li21	9080	Zeta		3	50.55	22.21
9Li21	9080	Zeta		3	67.65	35.29
9Li21	9080	Zeta		3	68.14	47.92
9Li21	9080	Zeta		3	48.29	30.86
9Li21	9080	Zeta		3	60.39	37.45
9Li230	9132	Iota	0-10		81.39	47.57
9Li230	9132	Iota	0-10		63.86	40.37
9Li230	9132	Iota	0-10		109.32	59.87
9Li230	9132	Iota	0-10		89.76	51.78
9Li230	9132	Iota	0-10		73.5	53.11

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li230	9132	Iota	0-10		70.81	54.08
9Li230	9132	Iota	0-10		60.36	45.69
9Li230	9132	Iota	0-10		51.52	37.33
9Li230	9132	Iota	0-10		81.93	39.73
9Li230	9132	Iota	0-10		65.42	50.04
9Li230	9132	Iota	0-10		83.12	48.72
9Li230	9132	Iota	0-10		74.19	50.85
9Li230	9132	Iota	0-10		88	44.09
9Li230	9132	Iota	0-10		105.8	55.01
9Li230	9132	Iota	0-10		73.59	50.1
9Li230	9132	Iota	0-10		63.16	42.07
9Li230	9132	Iota	0-10		69.27	35.92
9Li230	9132	Iota	0-10		73.24	56.78
9Li230	9132	Iota	0-10		79.49	56.95
9Li230	9132	Iota	0-10		66.17	42.36
9Li230	9132	Iota	0-10		68.44	36.25
9Li230	9132	Iota	0-10		58.26	40.52
9Li230	9132	Iota	0-10		42.66	32.65
9Li230	9132	Iota	0-10		62.29	44.61
9Li230	9132	Iota	0-10		86.94	49.39
9Li230	9132	Iota	0-10		106.68	53.98
9Li230	9132	Iota	0-10		85.47	47.48
9Li230	9132	Iota	0-10		106.18	57.03
9Li230	9132	Iota	0-10		98.48	47.02
9Li230	9132	Iota	0-10		82.3	41.72
9Li230	9132	Iota	0-10		60.03	37.43
9Li230	9132	Iota	0-10		75.99	40.31
9Li230	9132	Iota	0-10		76.05	38.22
9Li230	9132	Iota	0-10		76.19	42.88
9Li230	9132	Iota	0-10		62.46	44.97
9Li230	9132	Iota	0-10		65.77	47.62
9Li230	9132	Iota	0-10		51.35	38.63
9Li230	9188	Iota	10-20		69.31	34.2
9Li230	9188	Iota	10-20		114.55	56.95
9Li230	9188	Iota	10-20		96.9	57.42
9Li230	9188	Iota	10-20		75.54	37.25
9Li230	9188	Iota	10-20		69.97	35.49
9Li230	9188	Iota	10-20		85.33	56.56
9Li230	9188	Iota	10-20		82.91	52.09
9Li230	9188	Iota	10-20		80.97	54.3
9Li230	9188	Iota	10-20		77.04	51.22
9Li230	9188	Iota	10-20		82.88	58.42
9Li230	9188	Iota	10-20		80.79	37.73
9Li230	9188	Iota	10-20		106.8	46.64
9Li230	9188	Iota	10-20		83.79	43.13
9Li230	9188	Iota	10-20		67.85	39.23
9Li230	9188	Iota	10-20		91.78	39.31
9Li230	9188	Iota	10-20		61.06	39.44
9Li230	9188	Iota	10-20		75.77	33.7
9Li230	9188	Iota	10-20		96.73	46.48

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li230	9188	Iota	10-20		105.11	68.77
9Li230	9188	Iota	10-20		114.9	43.12
9Li230	9188	Iota	10-20		67.68	45.53
9Li230	9188	Iota	10-20		66.05	37.28
9Li230	9188	Iota	10-20		77.16	49.66
9Li230	9188	Iota	10-20		121.45	44.83
9Li230	9188	Iota	10-20		127.89	67.19
9Li230	9188	Iota	10-20		84.19	51
9Li230	9188	Iota	10-20		49.72	36.76
9Li230	9188	Iota	10-20		91.07	45.41
9Li230	9188	Iota	10-20		79.27	43.84
9Li230	9188	Iota	10-20		85.31	47.7
9Li230	9188	Iota	10-20		113.09	46.36
9Li230	9188	Iota	10-20		79.4	47.78
9Li230	9188	Iota	10-20		64.9	38.11
9Li230	9188	Iota	10-20		98.44	43.91
9Li230	9188	Iota	10-20		70.8	45.95
9Li230	9188	Iota	10-20		94.79	58.2
9Li230	9188	Iota	10-20		61.76	38.89
9Li230	9188	Iota	10-20		137.74	70.02
9Li230	9188	Iota	10-20		95.77	52.59
9Li230	9188	Iota	10-20		69.41	48.02
9Li230	9188	Iota	10-20		104.21	45.9
9Li230	9188	Iota	10-20		75.72	52.45
9Li230	9188	Iota	10-20		84.34	41.01
9Li230	9188	Iota	10-20		72.17	39.55
9Li230	9188	Iota	10-20		68.15	42.83
9Li230	9188	Iota	10-20		73.97	49.79
9Li230	9188	Iota	10-20		90.58	47.57
9Li230	9188	Iota	10-20		77.81	68.83
9Li230	9188	Iota	10-20		70.08	43.79
9Li230	9188	Iota	10-20		110.39	43.44
9Li230	9188	Iota	10-20		102.01	48.45
9Li230	9188	Iota	10-20		103.21	45.81
9Li230	9188	Iota	10-20		61.8	40.27
9Li230	9188	Iota	10-20		82.53	60.95
9Li230	9188	Iota	10-20		92.13	53.48
9Li230	9188	Iota	10-20		91.4	44.95
9Li230	9188	Iota	10-20		83.98	45.56
9Li230	9188	Iota	10-20		88.64	63.59
9Li230	9188	Iota	10-20		81.7	58.7
9Li230	9188	Iota	10-20		113.13	43.65
9Li230	9188	Iota	10-20		58.99	38.39
9Li230	9188	Iota	10-20		75.03	49.37
9Li230	9188	Iota	10-20		81.93	57.73
9Li230	9188	Iota	10-20		97.65	50.75
9Li230	9188	Iota	10-20		73.03	48.98
9Li230	9188	Iota	10-20		66.24	50.82
9Li230	9188	Iota	10-20		108.68	52.13
9Li230	9188	Iota	10-20		80.57	47.42

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li230	9188	Iota	10-20		73.6	44.74
9Li230	9188	Iota	10-20		86.14	41.09
9Li230	9188	Iota	10-20		117.97	49.93
9Li230	9188	Iota	10-20		69.99	48.32
9Li230	9188	Iota	10-20		77.59	53.49
9Li230	9188	Iota	10-20		77.16	48.32
9Li230	9188	Iota	10-20		76.34	48.15
9Li230	9188	Iota	10-20		82.98	52.06
9Li230	9188	Iota	10-20		85.78	43.1
9Li230	9188	Iota	10-20		75.85	51.76
9Li230	9188	Iota	10-20		69.82	37.02
9Li230	9188	Iota	10-20		72.46	48.27
9Li230	9147	Iota	20-30		87.79	55.57
9Li230	9147	Iota	20-30		78.76	51.97
9Li230	9147	Iota	20-30		76.75	40.19
9Li230	9147	Iota	20-30		102.8	39.63
9Li230	9147	Iota	20-30		121.47	44.51
9Li230	9147	Iota	20-30		118.68	61.9
9Li230	9147	Iota	20-30		93.88	42.67
9Li230	9147	Iota	20-30		98.53	47.99
9Li230	9147	Iota	20-30		97.03	54.09
9Li230	9147	Iota	20-30		80.58	47.62
9Li230	9147	Iota	20-30		145.88	53.06
9Li230	9147	Iota	20-30		133.19	43.36
9Li230	9147	Iota	20-30		148.09	47.25
9Li230	9147	Iota	20-30		88.18	31.74
9Li230	9147	Iota	20-30		97.25	47.18
9Li230	9147	Iota	20-30		56.9	35.45
9Li230	9147	Iota	20-30		107.69	47.01
9Li230	9147	Iota	20-30		82.43	30.12
9Li230	9147	Iota	20-30		78.86	40.73
9Li230	9147	Iota	20-30		84.81	45.71
9Li230	9147	Iota	20-30		112.71	43.24
9Li230	9147	Iota	20-30		95.36	33.93
9Li230	9147	Iota	20-30		72.15	42.08
9Li230	9147	Iota	20-30		75.07	39.11
9Li230	9147	Iota	20-30		98.96	52.34
9Li230	9147	Iota	20-30		63.26	47.5
9Li230	9147	Iota	20-30		88.49	50.76
9Li230	9147	Iota	20-30		109.17	48.14
9Li230	9147	Iota	20-30		90.22	48.3
9Li230	9147	Iota	20-30		87.12	41.52
9Li230	9147	Iota	20-30		72.07	47.8
9Li230	9147	Iota	20-30		85.87	38.79
9Li230	9147	Iota	20-30		110.94	53.3
9Li230	9147	Iota	20-30		82.53	51.73
9Li230	9147	Iota	20-30		67.47	47.8
9Li230	9147	Iota	20-30		97.46	46.86
9Li230	9147	Iota	20-30		114.76	48.58
9Li230	9147	Iota	20-30		110.15	46.86

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li230	9147	Iota	20-30		108.42	53.06
9Li230	9147	Iota	20-30		94.77	41.77
9Li230	9147	Iota	20-30		70.17	47.84
9Li230	9147	Iota	20-30		118.43	42.76
9Li230	9147	Iota	20-30		82.07	41.53
9Li230	9147	Iota	20-30		75.76	42.55
9Li230	9147	Iota	20-30		72.69	42.87
9Li230	9147	Iota	20-30		81.83	56.66
9Li230	9147	Iota	20-30		92.96	50.21
9Li230	9147	Iota	20-30		84.93	48.25
9Li230	9147	Iota	20-30		95.75	39.97
9Li230	9147	Iota	20-30		79.4	38.52
9Li230	9147	Iota	20-30		98.69	43.28
9Li230	9147	Iota	20-30		65.24	45.2
9Li230	9147	Iota	20-30		114.73	63.32
9Li230	9147	Iota	20-30		99.96	40.79
9Li230	9147	Iota	20-30		82.3	45.29
9Li230	9147	Iota	20-30		87.82	57.24
9Li230	9147	Iota	20-30		94.83	46.77
9Li230	9147	Iota	20-30		89.83	39.76
9Li230	9147	Iota	20-30		62.01	42.8
9Li230	9147	Iota	20-30		128.02	35.39
9Li230	9147	Iota	20-30		91	52.28
9Li230	9147	Iota	20-30		74.78	39.89
9Li230	9147	Iota	20-30		101.05	47.98
9Li230	9147	Iota	20-30		61.34	43.4
9Li230	9147	Iota	20-30		74.51	42.91
9Li230	9147	Iota	20-30		65.33	49.43
9Li230	9147	Iota	20-30		113.57	41.5
9Li230	9147	Iota	20-30		84.64	39.14
9Li230	9147	Iota	20-30		80.33	34.36
9Li230	9147	Iota	20-30		101.35	47.26
9Li230	9147	Iota	20-30		82.54	48.57
9Li230	9147	Iota	20-30		77.32	42.79
9Li230	9147	Iota	20-30		64.34	42.61
9Li230	9147	Iota	20-30		92.61	37.81
9Li230	9147	Iota	20-30		86.04	52.53
9Li230	9147	Iota	20-30		76.37	45.17
9Li230	9147	Iota	20-30		70.05	37.56
9Li230	9147	Iota	20-30		83.69	32.56
9Li230	9147	Iota	20-30		104.2	40.53
9Li230	9147	Iota	20-30		63.66	41.56
9Li230	9147	Iota	20-30		60.49	30.43
9Li230	9147	Iota	20-30		65.66	38.64
9Li230	9147	Iota	20-30		146.89	43.51
9Li230	9147	Iota	20-30		60.69	45.55
9Li230	9147	Iota	20-30		72.78	34.56
9Li230	9147	Iota	20-30		72.86	46.12
9Li230	9147	Iota	20-30		69.44	33.9
9Li230	9147	Iota	20-30		56.72	40.74

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li230	9147	Iota	20-30		70.77	40.22
9Li230	9147	Iota	20-30		62.82	44.03
9Li230	9147	Iota	20-30		91.03	42.21
9Li230	9147	Iota	20-30		62.04	41.93
9Li230	9147	Iota	20-30		80.89	44.37
9Li230	9147	Iota	20-30		76.79	49.4
9Li230	9147	Iota	20-30		71.45	39.1
9Li230	9147	Iota	20-30		108.22	48.28
9Li230	9147	Iota	20-30		94.39	39.08
9Li230	9147	Iota	20-30		68.48	46.79
9Li230	9147	Iota	20-30		80.72	39.79
9Li230	9147	Iota	20-30		76.82	30.08
9Li230	9147	Iota	20-30		50.15	31.69
9Li230	9147	Iota	20-30		67.39	36.78
9Li230	9146	Iota	30-40		75.24	40.75
9Li230	9146	Iota	30-40		101.44	47.14
9Li230	9146	Iota	30-40		68.35	54.94
9Li230	9146	Iota	30-40		89.88	51.07
9Li230	9146	Iota	30-40		119.9	47.24
9Li230	9146	Iota	30-40		93.65	61.06
9Li230	9146	Iota	30-40		89.91	43.01
9Li230	9146	Iota	30-40		148.09	39.08
9Li230	9146	Iota	30-40		88.03	50.02
9Li230	9146	Iota	30-40		100.27	47.97
9Li230	9146	Iota	30-40		88.2	43.68
9Li230	9146	Iota	30-40		84.11	47.4
9Li230	9146	Iota	30-40		144.55	33.86
9Li230	9146	Iota	30-40		149.41	39.83
9Li230	9146	Iota	30-40		76.02	43.66
9Li230	9146	Iota	30-40		62.72	39.77
9Li230	9146	Iota	30-40		72.35	43.94
9Li230	9146	Iota	30-40		124.44	50.29
9Li230	9146	Iota	30-40		74.21	49.31
9Li230	9146	Iota	30-40		101.65	35.83
9Li230	9146	Iota	30-40		97.61	48.66
9Li230	9146	Iota	30-40		57.59	36.55
9Li230	9146	Iota	30-40		136.59	47.43
9Li230	9146	Iota	30-40		93.2	41.57
9Li230	9146	Iota	30-40		68.18	35.46
9Li230	9146	Iota	30-40		84.56	37.25
9Li230	9146	Iota	30-40		71.3	37.93
9Li230	9146	Iota	30-40		65.65	39.58
9Li230	9146	Iota	30-40		75.46	39.59
9Li230	9146	Iota	30-40		111.65	41.2
9Li230	9146	Iota	30-40		73.44	39.12
9Li230	9146	Iota	30-40		86.31	53.83
9Li230	9146	Iota	30-40		54.77	40.84
9Li230	9146	Iota	30-40		63.8	35.74
9Li230	9146	Iota	30-40		70.59	44.66
9Li230	9146	Iota	30-40		82.3	33.96

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li230	9146	Iota	30-40		89.22	42.15
9Li230	9146	Iota	30-40		70.94	33.07
9Li230	9146	Iota	30-40		96.28	49.01
9Li230	9146	Iota	30-40		76.27	48.63
9Li230	9146	Iota	30-40		58.8	39.47
9Li230	9146	Iota	30-40		93.07	40.31
9Li230	9146	Iota	30-40		64.85	33.73
9Li230	9146	Iota	30-40		100.7	37.6
9Li230	9146	Iota	30-40		97.61	38.81
9Li230	9146	Iota	30-40		69.41	45.47
9Li230	9146	Iota	30-40		82.51	48.3
9Li230	9146	Iota	30-40		146.74	42.77
9Li230	9146	Iota	30-40		93.04	40.58
9Li230	9146	Iota	30-40		89.26	55.4
9Li230	9146	Iota	30-40		116.47	47.31
9Li230	9146	Iota	30-40		77.99	58.9
9Li230	9146	Iota	30-40		79.34	32.46
9Li230	9146	Iota	30-40		78.35	49.65
9Li230	9146	Iota	30-40		83.29	32.97
9Li230	9146	Iota	30-40		83.73	35.35
9Li230	9146	Iota	30-40		100.18	52.26
9Li230	9146	Iota	30-40		79.59	37.39
9Li230	9146	Iota	30-40		117.58	52.29
9Li230	9146	Iota	30-40		71.27	36.11
9Li230	9146	Iota	30-40		67.65	30.91
9Li230	9146	Iota	30-40		78.49	45.07
9Li230	9146	Iota	30-40		52.7	36.35
9Li230	9146	Iota	30-40		71.12	48.2
9Li230	9146	Iota	30-40		71.76	28.34
9Li230	9146	Iota	30-40		106.78	47.35
9Li230	9146	Iota	30-40		63.44	43.36
9Li230	9146	Iota	30-40		66.32	47.52
9Li230	9146	Iota	30-40		78.11	49.31
9Li230	9146	Iota	30-40		68.37	49.01
9Li230	9146	Iota	30-40		90.33	48.21
9Li230	9146	Iota	30-40		86.52	45.1
9Li230	9146	Iota	30-40		71.55	34.37
9Li230	9146	Iota	30-40		69.6	32.58
9Li230	9146	Iota	30-40		54.4	32.86
9Li230	9146	Iota	30-40		87.72	35.55
9Li230	9146	Iota	30-40		88.29	30.77
9Li230	9146	Iota	30-40		136.13	45.64
9Li230	9146	Iota	30-40		66.73	40.26
9Li230	9146	Iota	30-40		46.36	36.56
9Li230	9146	Iota	30-40		78.28	38.92
9Li230	9146	Iota	30-40		79.43	46.42
9Li230	9146	Iota	30-40		68.17	50.2
9Li230	9146	Iota	30-40		69.96	49.32
9Li230	9146	Iota	30-40		116.07	42.1
9Li230	9146	Iota	30-40		84.92	48.5

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li230	9146	Iota	30-40		77.39	41.06
9Li230	9146	Iota	30-40		109.87	56.27
9Li230	9146	Iota	30-40		88.93	43.29
9Li230	9146	Iota	30-40		104.59	27.17
9Li230	9146	Iota	30-40		67.02	37.32
9Li230	9146	Iota	30-40		79.3	43.99
9Li230	9146	Iota	30-40		69.93	44.55
9Li230	9146	Iota	30-40		84.7	36.41
9Li230	9146	Iota	30-40		68.21	44.54
9Li229	10334	N191 E84	0-10		111.78	39.8
9Li229	10334	N191 E84	0-10		72.93	42.92
9Li229	10334	N191 E84	0-10		68.55	50.32
9Li229	10334	N191 E84	0-10		73.41	44.96
9Li229	10334	N191 E84	0-10		89.44	65.54
9Li229	10334	N191 E84	0-10		49.84	24.51
9Li229	10334	N191 E84	0-10		61.64	30.2
9Li229	10334	N191 E84	0-10		89.86	37.17
9Li229	10334	N191 E84	0-10		43.78	31.73
9Li229	10334	N191 E84	0-10		83.96	40.48
9Li229	10334	N191 E84	0-10		87.55	41.58
9Li229	10334	N191 E84	0-10		111.32	53.61
9Li229	10334	N191 E84	0-10		81.21	43.12
9Li229	10334	N191 E84	0-10		99.79	41.51
9Li229	10334	N191 E84	0-10		62.19	38.19
9Li229	10334	N191 E84	0-10		65.3	30.65
9Li229	10334	N191 E84	0-10		83.78	40.62
9Li229	10334	N191 E84	0-10		92.89	41.34
9Li229	10334	N191 E84	0-10		81.32	47.75
9Li229	10334	N191 E84	0-10		105.39	42
9Li229	10334	N191 E84	0-10		103.51	31.38
9Li229	10334	N191 E84	0-10		81.2	56.89
9Li229	10334	N191 E84	0-10		72.26	43.72
9Li229	10334	N191 E84	0-10		78.37	47.83
9Li229	10334	N191 E84	0-10		53.74	36.73
9Li229	10334	N191 E84	0-10		67	43.22
9Li229	10334	N191 E84	0-10		49.97	36.16
9Li229	10334	N191 E84	0-10		64.39	25.97
9Li229	10334	N191 E84	0-10		51.35	35.64
9Li229	10334	N191 E84	0-10		58.11	31.49
9Li229	10334	N191 E84	0-10		98.66	45.3
9Li229	10334	N191 E84	0-10		116.73	70.74
9Li229	10334	N191 E84	0-10		110.9	43.29
9Li229	10334	N191 E84	0-10		81.75	47.45
9Li229	10334	N191 E84	0-10		108.44	47.81
9Li229	10334	N191 E84	0-10		67.98	55.92
9Li229	10334	N191 E84	0-10		103.83	43.94
9Li229	10334	N191 E84	0-10		65.19	41.53
9Li229	10334	N191 E84	0-10		77.58	37.83
9Li229	10334	N191 E84	0-10		67.8	40.14
9Li229	10334	N191 E84	0-10		87.05	51.98

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li229	10334	N191 E84	0-10		66.46	31.89
9Li229	10334	N191 E84	0-10		175	41.05
9Li229	10334	N191 E84	0-10		53.78	46.7
9Li229	10334	N191 E84	0-10		100.48	53.68
9Li229	10334	N191 E84	0-10		77.09	45.69
9Li229	10334	N191 E84	0-10		54.26	38.59
9Li229	10334	N191 E84	0-10		62.49	29.02
9Li229	10334	N191 E84	0-10		74.99	46.46
9Li229	10334	N191 E84	0-10		59.85	39.83
9Li229	10334	N191 E84	0-10		77.9	50.85
9Li229	10334	N191 E84	0-10		75.12	48.84
9Li229	10334	N191 E84	0-10		141.43	57.01
9Li229	10334	N191 E84	0-10		84.63	47.06
9Li229	10334	N191 E84	0-10		73.9	52.17
9Li229	10334	N191 E84	0-10		102.34	42.08
9Li229	10334	N191 E84	0-10		94.87	41.65
9Li229	10334	N191 E84	0-10		69.33	42.04
9Li229	10334	N191 E84	0-10		71.91	50.71
9Li229	10334	N191 E84	0-10		56.49	38.09
9Li229	10334	N191 E84	0-10		79.3	40.44
9Li229	10334	N191 E84	0-10		52.79	41.25
9Li229	10334	N191 E84	0-10		50.55	38.45
9Li229	10334	N191 E84	0-10		64.38	43.67
9Li229	10334	N191 E84	0-10		107.47	46.84
9Li229	10334	N191 E84	0-10		61.36	51.14
9Li229	10334	N191 E84	0-10		73.94	40.12
9Li229	10334	N191 E84	0-10		69.77	40.25
9Li229	10334	N191 E84	0-10		60.52	38.42
9Li229	10334	N191 E84	0-10		62.46	30.97
9Li229	10334	N191 E84	0-10		46.57	37.36
9Li229	10334	N191 E84	0-10		65.11	35.26
9Li229	10334	N191 E84	0-10		56.72	41.09
9Li229	10334	N191 E84	0-10		49.13	29.78
9Li229	10334	N191 E84	0-10		49.81	34.9
9Li229	10334	N191 E84	0-10		55.64	35.08
9Li229	10334	N191 E84	0-10		89.98	53.55
9Li229	10334	N191 E84	0-10		74.67	53.79
9Li229	10334	N191 E84	0-10		104.57	47.68
9Li229	10334	N191 E84	0-10		64.97	48.16
9Li229	10336	N191 E84	10-20		88.18	49.48
9Li229	10336	N191 E84	10-20		76.22	41.03
9Li229	10336	N191 E84	10-20		79.99	33.47
9Li229	10336	N191 E84	10-20		107.59	41.38
9Li229	10336	N191 E84	10-20		75.44	46.6
9Li229	10336	N191 E84	10-20		83.29	43.73
9Li229	10336	N191 E84	10-20		79.61	36.44
9Li229	10336	N191 E84	10-20		79.46	48.49
9Li229	10336	N191 E84	10-20		76.76	34.18
9Li229	10336	N191 E84	10-20		61	32.27
9Li229	10336	N191 E84	10-20		77.15	46.06

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li229	10336	N191 E84	10-20		72.61	43.62
9Li229	10336	N191 E84	10-20		81.42	51.76
9Li229	10336	N191 E84	10-20		68.08	57.34
9Li229	10336	N191 E84	10-20		82.54	54.02
9Li229	10336	N191 E84	10-20		124.58	40.51
9Li229	10336	N191 E84	10-20		72.01	37.94
9Li229	10336	N191 E84	10-20		85.05	39.06
9Li229	10336	N191 E84	10-20		70.59	49.96
9Li229	10336	N191 E84	10-20		79.43	30.13
9Li229	10336	N191 E84	10-20		54.14	41.33
9Li229	10336	N191 E84	10-20		56.63	25.79
9Li229	10336	N191 E84	10-20		94.09	47.84
9Li229	10336	N191 E84	10-20		70.57	51.38
9Li229	10336	N191 E84	10-20		51.66	42.26
9Li229	10336	N191 E84	10-20		94.97	44.49
9Li229	10336	N191 E84	10-20		66.62	34.57
9Li229	10336	N191 E84	10-20		57.13	44.22
9Li229	10336	N191 E84	10-20		76.97	45.94
9Li229	10336	N191 E84	10-20		61.12	51
9Li229	10336	N191 E84	10-20		100.43	51.14
9Li229	10336	N191 E84	10-20		65.33	43.66
9Li229	10336	N191 E84	10-20		78.37	50.03
9Li229	10336	N191 E84	10-20		77.71	37.65
9Li229	10336	N191 E84	10-20		109.18	47.6
9Li229	10336	N191 E84	10-20		69.82	43.56
9Li229	10336	N191 E84	10-20		64.04	33.86
9Li229	10336	N191 E84	10-20		55.5	35.45
9Li229	10336	N191 E84	10-20		84.61	46.85
9Li229	10336	N191 E84	10-20		100.45	49.71
9Li229	10336	N191 E84	10-20		85.83	65.29
9Li229	10336	N191 E84	10-20		106.96	55.46
9Li229	10336	N191 E84	10-20		82.92	41.58
9Li229	10336	N191 E84	10-20		106.85	47.02
9Li229	10336	N191 E84	10-20		73.07	45.29
9Li229	10336	N191 E84	10-20		73.65	51.6
9Li229	10336	N191 E84	10-20		97.85	55.33
9Li229	10336	N191 E84	10-20		107.99	37.05
9Li229	10336	N191 E84	10-20		110.29	42.06
9Li229	10336	N191 E84	10-20		95.57	33.69
9Li229	10336	N191 E84	10-20		89.24	55.38
9Li229	10336	N191 E84	10-20		56.82	30.97
9Li229	10336	N191 E84	10-20		86.81	43.44
9Li229	10336	N191 E84	10-20		98.1	46.23
9Li229	10336	N191 E84	10-20		76.24	46.61
9Li229	10336	N191 E84	10-20		109.1	56.9
9Li229	10336	N191 E84	10-20		107.35	37.63
9Li229	10336	N191 E84	10-20		89.74	48.62
9Li229	10336	N191 E84	10-20		89.58	49.69
9Li229	10336	N191 E84	10-20		135.87	45.93
9Li229	10336	N191 E84	10-20		142.99	33.63

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li229	10336	N191 E84	10-20		78.51	49.58
9Li229	10336	N191 E84	10-20		90.91	42.43
9Li229	10336	N191 E84	10-20		118.04	33.4
9Li229	10336	N191 E84	10-20		91.47	40.04
9Li229	10336	N191 E84	10-20		106.1	51.6
9Li229	10336	N191 E84	10-20		78.07	47.07
9Li229	10336	N191 E84	10-20		98	28.72
9Li229	10336	N191 E84	10-20		83.01	38.98
9Li229	10336	N191 E84	10-20		89.03	59.78
9Li229	10336	N191 E84	10-20		68.18	37.98
9Li229	10336	N191 E84	10-20		66.3	45.69
9Li229	10336	N191 E84	10-20		65.32	43.43
9Li229	10336	N191 E84	10-20		48.58	30.18
9Li229	10336	N191 E84	10-20		51.22	34.6
9Li229	10336	N191 E84	10-20		59.21	33.15
9Li229	10336	N191 E84	10-20		61.65	35.01
9Li229	10336	N191 E84	10-20		75.98	45.35
9Li229	10336	N191 E84	10-20		133.48	48.62
9Li229	10336	N191 E84	10-20		116.32	52.7
9Li229	10336	N191 E84	10-20		95.07	43.15
9Li229	10337	N191 E84	20-30		110.13	41.15
9Li229	10337	N191 E84	20-30		91.82	45.88
9Li229	10337	N191 E84	20-30		106.44	56.91
9Li229	10337	N191 E84	20-30		63.3	43.61
9Li229	10337	N191 E84	20-30		72.08	44.79
9Li229	10337	N191 E84	20-30		74.8	49.75
9Li229	10337	N191 E84	20-30		67.09	35.46
9Li229	10337	N191 E84	20-30		76.65	38.15
9Li229	10337	N191 E84	20-30		100.42	47.28
9Li229	10337	N191 E84	20-30		104.39	59.9
9Li229	10337	N191 E84	20-30		80.76	51.75
9Li229	10337	N191 E84	20-30		118.93	57.38
9Li229	10337	N191 E84	20-30		81.14	44.15
9Li229	10337	N191 E84	20-30		89.55	47.24
9Li229	10337	N191 E84	20-30		79.42	37.08
9Li229	10337	N191 E84	20-30		55.9	44.1
9Li229	10337	N191 E84	20-30		83.29	47.68
9Li229	10337	N191 E84	20-30		82.6	52.62
9Li229	10337	N191 E84	20-30		88.02	38
9Li229	10337	N191 E84	20-30		93.33	41.59
9Li229	10337	N191 E84	20-30		109.87	52.13
9Li229	10337	N191 E84	20-30		111.09	47.37
9Li229	10337	N191 E84	20-30		107.58	44.92
9Li229	10337	N191 E84	20-30		122.73	45.18
9Li229	10337	N191 E84	20-30		67.76	40.26
9Li229	10337	N191 E84	20-30		100.19	34.89
9Li229	10337	N191 E84	20-30		74.08	47.57
9Li229	10337	N191 E84	20-30		125.26	36.61
9Li229	10337	N191 E84	20-30		92.64	43.42
9Li229	10337	N191 E84	20-30		114.55	53.59

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li229	10337	N191 E84	20-30		55.88	39.75
9Li229	10337	N191 E84	20-30		69.2	40.16
9Li229	10337	N191 E84	20-30		60.08	34.66
9Li229	10337	N191 E84	20-30		113.77	43.99
9Li229	10337	N191 E84	20-30		73.13	46.64
9Li229	10337	N191 E84	20-30		89.82	45.05
9Li229	10337	N191 E84	20-30		113.15	51.23
9Li229	10337	N191 E84	20-30		68.36	40.86
9Li229	10337	N191 E84	20-30		76.21	37.02
9Li229	10337	N191 E84	20-30		106.95	48.34
9Li229	10337	N191 E84	20-30		111.95	57.57
9Li229	10337	N191 E84	20-30		104.59	48.62
9Li229	10337	N191 E84	20-30		75.77	52.02
9Li229	10337	N191 E84	20-30		80.11	54.93
9Li229	10337	N191 E84	20-30		59.77	44.96
9Li229	10337	N191 E84	20-30		104.39	37.98
9Li229	10337	N191 E84	20-30		84.4	44.45
9Li229	10337	N191 E84	20-30		103.25	42.14
9Li229	10337	N191 E84	20-30		73.84	35.71
9Li229	10337	N191 E84	20-30		60.09	40.6
9Li229	10337	N191 E84	20-30		63.94	45.14
9Li229	10337	N191 E84	20-30		107.81	49.01
9Li229	10337	N191 E84	20-30		130.88	42.22
9Li229	10337	N191 E84	20-30		108.46	58.96
9Li229	10337	N191 E84	20-30		83.94	38.45
9Li229	10337	N191 E84	20-30		109.39	43.59
9Li229	10337	N191 E84	20-30		129.58	55.26
9Li229	10337	N191 E84	20-30		96.95	78.59
9Li229	10337	N191 E84	20-30		96.1	34.2
9Li229	10337	N191 E84	20-30		94.95	50.81
9Li229	10337	N191 E84	20-30		68.3	43.4
9Li229	10337	N191 E84	20-30		87.3	46.5
9Li229	10337	N191 E84	20-30		80.87	41.69
9Li229	10337	N191 E84	20-30		71.77	44.2
9Li229	10337	N191 E84	20-30		69.13	47.32
9Li229	10337	N191 E84	20-30		65.43	51.69
9Li229	10337	N191 E84	20-30		94.45	45.06
9Li229	10337	N191 E84	20-30		82.34	43.51
9Li229	10337	N191 E84	20-30		80.95	48.52
9Li229	10337	N191 E84	20-30		68.54	43.13
9Li229	10337	N191 E84	20-30		119.15	36.09
9Li229	10337	N191 E84	20-30		73.98	37.83
9Li229	10337	N191 E84	20-30		88.89	43.64
9Li229	10337	N191 E84	20-30		121.9	49.23
9Li229	10337	N191 E84	20-30		128.36	42.57
9Li229	10337	N191 E84	20-30		118.96	45.78
9Li229	10337	N191 E84	20-30		75.09	44.66
9Li229	10337	N191 E84	20-30		80.25	41.7
9Li229	10337	N191 E84	20-30		80.6	54.61
9Li229	10337	N191 E84	20-30		67.97	46.56

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li229	10335	N191 E84	30-40		77.96	49.62
9Li229	10335	N191 E84	30-40		115.29	40.27
9Li229	10335	N191 E84	30-40		75.14	52.12
9Li229	10335	N191 E84	30-40		75.18	48.15
9Li229	10335	N191 E84	30-40		65.91	29.89
9Li229	10335	N191 E84	30-40		55.5	31.25
9Li229	10335	N191 E84	30-40		57.81	31.67
9Li229	10335	N191 E84	30-40		68.36	43.15
9Li229	10335	N191 E84	30-40		65.97	48.61
9Li229	10335	N191 E84	30-40		80.62	43.57
9Li229	10335	N191 E84	30-40		85.46	53.89
9Li229	10335	N191 E84	30-40		66.09	40
9Li229	10335	N191 E84	30-40		86.92	48.65
9Li229	10335	N191 E84	30-40		76.93	47.81
9Li229	10335	N191 E84	30-40		74.23	49.19
9Li229	10335	N191 E84	30-40		90.3	46.87
9Li229	10335	N191 E84	30-40		71.66	45.3
9Li229	10335	N191 E84	30-40		102.42	38.39
9Li229	10335	N191 E84	30-40		61.95	37.45
9Li229	10335	N191 E84	30-40		62.49	34.26
9Li229	10335	N191 E84	30-40		107.55	39.09
9Li229	10335	N191 E84	30-40		116.71	42.67
9Li229	10335	N191 E84	30-40		54.46	40.37
9Li229	10335	N191 E84	30-40		50.37	37.18
9Li229	10335	N191 E84	30-40		57.97	34.19
9Li229	10335	N191 E84	30-40		79.49	40.1
9Li229	10335	N191 E84	30-40		99.36	56.97
9Li229	10335	N191 E84	30-40		59.4	41.51
9Li229	10335	N191 E84	30-40		56.65	34.37
9Li229	10335	N191 E84	30-40		100.8	43.06
9Li229	10335	N191 E84	30-40		103.33	62.25
9Li229	10335	N191 E84	30-40		89.63	57.92
9Li229	10335	N191 E84	30-40		99.35	54.86
9Li229	10335	N191 E84	30-40		73.97	48.03
9Li229	10335	N191 E84	30-40		74.74	52.67
9Li229	10335	N191 E84	30-40		69.42	54.88
9Li229	10335	N191 E84	30-40		72.92	52.39
9Li229	10335	N191 E84	30-40		78.61	52.9
9Li229	10335	N191 E84	30-40		82.77	55.58
9Li229	10335	N191 E84	30-40		61.72	40.54
9Li229	10335	N191 E84	30-40		68.84	45.04
9Li229	10335	N191 E84	30-40		68.73	37.77
9Li229	10335	N191 E84	30-40		81.41	44.9
9Li229	10335	N191 E84	30-40		70.42	40.25
9Li229	10335	N191 E84	30-40		72.35	55.11
9Li229	10335	N191 E84	30-40		61.17	43.02
9Li229	10335	N191 E84	30-40		92.01	50.82
9Li229	10335	N191 E84	30-40		79.08	42.68
9Li229	10335	N191 E84	30-40		73.07	47.64
9Li229	10335	N191 E84	30-40		55.73	40.11

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li229	10335	N191 E84	30-40		56.29	38
9Li229	10335	N191 E84	30-40		80.59	52.65
9Li229	10335	N191 E84	30-40		71.35	43.05
9Li229	10335	N191 E84	30-40		56.74	41.74
9Li229	10335	N191 E84	30-40		91.41	56.59
9Li229	10335	N191 E84	30-40		79.41	36.23
9Li229	10335	N191 E84	30-40		59.5	31.49
9Li229	10335	N191 E84	30-40		94.94	62.34
9Li229	10335	N191 E84	30-40		110.41	36.81
9Li229	10335	N191 E84	30-40		81.02	48.24
9Li229	10335	N191 E84	30-40		86.55	48.49
9Li229	10335	N191 E84	30-40		123.13	55.65
9Li229	10335	N191 E84	30-40		68.69	40.81
9Li229	10335	N191 E84	30-40		84.77	41
9Li229	10335	N191 E84	30-40		96.25	46.38
9Li229	10335	N191 E84	30-40		80.77	54.98
9Li229	10335	N191 E84	30-40		66.28	60.15
9Li229	10335	N191 E84	30-40		57.3	40.05
9Li229	10335	N191 E84	30-40		56.19	47.94
9Li229	10335	N191 E84	30-40		125.62	58.39
9Li229	10335	N191 E84	30-40		114.95	45
9Li229	10335	N191 E84	30-40		63.82	43.98
9Li229	10335	N191 E84	30-40		100.95	60.61
9Li229	10335	N191 E84	30-40		81.44	57.44
9Li229	10335	N191 E84	30-40		70.83	46.76
9Li229	10335	N191 E84	30-40		77.16	49.87
9Li229	10335	N191 E84	30-40		76.52	49.75
9Li229	10335	N191 E84	30-40		80.7	40.84
9Li229	10335	N191 E84	30-40		85.71	35.76
9Li229	10335	N191 E84	30-40		66.32	52.96
9Li229	10335	N191 E84	30-40		85.12	57.13
9Li229	9994	N165 E159	0-10		142.42	44.46
9Li229	9994	N165 E159	0-10		91.05	74.37
9Li229	9994	N165 E159	0-10		92.77	44.77
9Li229	9994	N165 E159	0-10		135.25	43.34
9Li229	9994	N165 E159	0-10		128.7	52.47
9Li229	9994	N165 E159	0-10		79.3	46.63
9Li229	9994	N165 E159	0-10		96.94	47.49
9Li229	9994	N165 E159	0-10		90.98	62.88
9Li229	9994	N165 E159	0-10		93.17	57.32
9Li229	9994	N165 E159	0-10		118	53.14
9Li229	9994	N165 E159	0-10		110.9	73.21
9Li229	9994	N165 E159	0-10		87.92	48.28
9Li229	9994	N165 E159	0-10		73.15	43.37
9Li229	9994	N165 E159	0-10		92.26	52.39
9Li229	9994	N165 E159	0-10		100.82	54.5
9Li229	9994	N165 E159	0-10		65.61	41.65
9Li229	9994	N165 E159	0-10		73.48	33.85
9Li229	9994	N165 E159	0-10		81.09	54.98
9Li229	9994	N165 E159	0-10		85.63	55.93

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li229	9994	N165 E159	0-10		54.38	27.99
9Li229	9994	N165 E159	0-10		87.88	46.81
9Li229	9994	N165 E159	0-10		75.81	45.87
9Li229	9994	N165 E159	0-10		107.37	44.6
9Li229	9994	N165 E159	0-10		71.95	47.02
9Li229	9994	N165 E159	0-10		96.21	53.07
9Li229	9994	N165 E159	0-10		65.32	40.35
9Li229	9994	N165 E159	0-10		72.51	48.77
9Li229	9994	N165 E159	0-10		98.06	53.6
9Li229	9994	N165 E159	0-10		107.99	63.46
9Li229	9994	N165 E159	0-10		92.55	59.54
9Li229	9994	N165 E159	0-10		74.49	44.7
9Li229	9994	N165 E159	0-10		80.87	50.02
9Li229	9994	N165 E159	0-10		94.45	46.9
9Li229	9994	N165 E159	0-10		61.12	43.49
9Li229	9994	N165 E159	0-10		90.62	48.06
9Li229	9994	N165 E159	0-10		76.56	44.48
9Li229	9994	N165 E159	0-10		104.83	52.52
9Li229	9994	N165 E159	0-10		86	47.84
9Li229	9994	N165 E159	0-10		118.79	39.15
9Li229	9994	N165 E159	0-10		85.03	52.84
9Li229	9994	N165 E159	0-10		73.46	58.85
9Li229	9994	N165 E159	0-10		62.7	38.36
9Li229	9994	N165 E159	0-10		76.53	59.25
9Li229	9994	N165 E159	0-10		103.59	70.09
9Li229	9994	N165 E159	0-10		67.38	44.3
9Li229	9994	N165 E159	0-10		84.61	50.56
9Li229	9994	N165 E159	0-10		62.93	44.06
9Li229	9994	N165 E159	0-10		72.49	51.31
9Li229	9994	N165 E159	0-10		153.2	48.29
9Li229	9994	N165 E159	0-10		71.93	53.12
9Li229	9994	N165 E159	0-10		59.32	26.13
9Li229	9994	N165 E159	0-10		82.41	36.8
9Li229	9994	N165 E159	0-10		81.83	51.05
9Li229	9994	N165 E159	0-10		59.7	42.83
9Li229	9994	N165 E159	0-10		116.19	46.02
9Li229	9994	N165 E159	0-10		73.35	55.55
9Li229	9994	N165 E159	0-10		97.4	43.27
9Li229	9994	N165 E159	0-10		65.28	36.7
9Li229	9994	N165 E159	0-10		83.05	58.49
9Li229	9994	N165 E159	0-10		69.34	45.16
9Li229	9994	N165 E159	0-10		75.3	40.59
9Li229	9994	N165 E159	0-10		87.91	44.12
9Li229	9994	N165 E159	0-10		84.93	45.74
9Li229	9994	N165 E159	0-10		85.04	35.33
9Li229	9994	N165 E159	0-10		113.19	44.98
9Li229	9994	N165 E159	0-10		77.98	44.17
9Li229	9994	N165 E159	0-10		70.76	53.79
9Li229	9994	N165 E159	0-10		95.47	43.2
9Li229	9994	N165 E159	0-10		67.73	42.5

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li229	9994	N165 E159	0-10		78.79	44.03
9Li229	9994	N165 E159	0-10		56.08	41.14
9Li229	9994	N165 E159	0-10		67.92	66.95
9Li229	9994	N165 E159	0-10		70.47	41.28
9Li229	9994	N165 E159	0-10		85.81	56.86
9Li229	9994	N165 E159	0-10		73.14	55.16
9Li229	9994	N165 E159	0-10		57.38	35.08
9Li229	9994	N165 E159	0-10		57.05	35.17
9Li229	9994	N165 E159	0-10		67.25	47.56
9Li229	9994	N165 E159	0-10		62.43	41.31
9Li229	9994	N165 E159	0-10		56.81	39.07
9Li229	10163	N165 E159	10-20		96.53	45.72
9Li229	10163	N165 E159	10-20		104.42	48.75
9Li229	10163	N165 E159	10-20		88.97	37.81
9Li229	10163	N165 E159	10-20		115.7	48.1
9Li229	10163	N165 E159	10-20		117.89	61.98
9Li229	10163	N165 E159	10-20		83.92	55.14
9Li229	10163	N165 E159	10-20		93.66	46.31
9Li229	10163	N165 E159	10-20		53.72	48.58
9Li229	10163	N165 E159	10-20		127.72	44.84
9Li229	10163	N165 E159	10-20		87.02	48.5
9Li229	10163	N165 E159	10-20		81.75	44.73
9Li229	10163	N165 E159	10-20		58.1	41.87
9Li229	10163	N165 E159	10-20		87.65	50.27
9Li229	10163	N165 E159	10-20		94.16	45.94
9Li229	10163	N165 E159	10-20		105.3	70.4
9Li229	10163	N165 E159	10-20		52.51	42.72
9Li229	10163	N165 E159	10-20		64.42	41.01
9Li229	10163	N165 E159	10-20		72.16	36.59
9Li229	10163	N165 E159	10-20		71.72	51.65
9Li229	10163	N165 E159	10-20		84.78	48.07
9Li229	10163	N165 E159	10-20		64.74	47.54
9Li229	10163	N165 E159	10-20		126.11	41.56
9Li229	10163	N165 E159	10-20		93.22	43.3
9Li229	10163	N165 E159	10-20		60.42	38.82
9Li229	10163	N165 E159	10-20		54.64	41.59
9Li229	10163	N165 E159	10-20		76.26	44.38
9Li229	10163	N165 E159	10-20		69.27	32.2
9Li229	10163	N165 E159	10-20		71.37	30.03
9Li229	10163	N165 E159	10-20		88.94	36.24
9Li229	10163	N165 E159	10-20		74.61	48.5
9Li229	10163	N165 E159	10-20		84.1	58.9
9Li229	10163	N165 E159	10-20		63.36	49.25
9Li229	10163	N165 E159	10-20		72.34	45.01
9Li229	10163	N165 E159	10-20		61.44	40.85
9Li229	10163	N165 E159	10-20		75.72	57.49
9Li229	10163	N165 E159	10-20		77.39	36.14
9Li229	10163	N165 E159	10-20		58.72	44.82
9Li229	10163	N165 E159	10-20		99.77	37.37
9Li229	10163	N165 E159	10-20		82.36	44.57

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li229	10163	N165 E159	10-20		116.4	45.76
9Li229	10163	N165 E159	10-20		59.57	45.01
9Li229	10163	N165 E159	10-20		86.09	36.53
9Li229	10163	N165 E159	10-20		110.23	41.87
9Li229	10163	N165 E159	10-20		50.04	30.9
9Li229	10163	N165 E159	10-20		62.57	33.82
9Li229	10163	N165 E159	10-20		69.02	44.19
9Li229	10163	N165 E159	10-20		69.4	41.86
9Li229	10163	N165 E159	10-20		77.58	44.45
9Li229	10163	N165 E159	10-20		83.76	53.82
9Li229	10163	N165 E159	10-20		61.81	46.94
9Li229	10163	N165 E159	10-20		61.23	46.22
9Li229	10163	N165 E159	10-20		63.84	48.06
9Li229	10163	N165 E159	10-20		58.65	45.62
9Li229	10163	N165 E159	10-20		94.14	50.44
9Li229	10163	N165 E159	10-20		61.06	38.05
9Li229	10163	N165 E159	10-20		117.05	53.53
9Li229	10163	N165 E159	10-20		83.56	47
9Li229	10163	N165 E159	10-20		81.04	26.57
9Li229	10163	N165 E159	10-20		76.49	36.23
9Li229	10163	N165 E159	10-20		77.21	53.58
9Li229	10163	N165 E159	10-20		46.72	39.61
9Li229	10163	N165 E159	10-20		74.6	55.27
9Li229	10163	N165 E159	10-20		62.86	40.55
9Li229	10163	N165 E159	10-20		98.18	60.68
9Li229	10163	N165 E159	10-20		80.47	38.26
9Li229	10163	N165 E159	10-20		99.75	63.78
9Li229	10163	N165 E159	10-20		89.72	45.09
9Li229	10163	N165 E159	10-20		94.44	43.08
9Li229	10163	N165 E159	10-20		66.39	45.39
9Li229	10163	N165 E159	10-20		109.13	73.48
9Li229	10163	N165 E159	10-20		61.88	52.88
9Li229	10163	N165 E159	10-20		41.29	19.05
9Li229	10163	N165 E159	10-20		54.57	44.63
9Li229	10163	N165 E159	10-20		61.14	43.13
9Li229	10163	N165 E159	10-20		58.78	38.21
9Li229	10163	N165 E159	10-20		71.03	36.96
9Li229	10163	N165 E159	10-20		61.56	39.24
9Li229	10163	N165 E159	10-20		67.54	40.56
9Li229	10163	N165 E159	10-20		66.9	33.35
9Li229	10163	N165 E159	10-20		92.13	48.78
9Li229	10155	N165 E159	20-30		90.88	44.52
9Li229	10155	N165 E159	20-30		75.86	52.36
9Li229	10155	N165 E159	20-30		106.49	32.28
9Li229	10155	N165 E159	20-30		107.79	54.11
9Li229	10155	N165 E159	20-30		102.57	56.39
9Li229	10155	N165 E159	20-30		65.04	33.36
9Li229	10155	N165 E159	20-30		101.58	42.18
9Li229	10155	N165 E159	20-30		58.52	40.12
9Li229	10155	N165 E159	20-30		115.8	55.1

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li229	10155	N165 E159	20-30		91.04	46.77
9Li229	10155	N165 E159	20-30		82.87	54.55
9Li229	10155	N165 E159	20-30		77.94	53.72
9Li229	10155	N165 E159	20-30		76.61	47.74
9Li229	10155	N165 E159	20-30		111.52	54.5
9Li229	10155	N165 E159	20-30		98.86	49.92
9Li229	10155	N165 E159	20-30		67.41	49.72
9Li229	10155	N165 E159	20-30		101.96	41.66
9Li229	10155	N165 E159	20-30		63.22	44.81
9Li229	10155	N165 E159	20-30		70.22	39.27
9Li229	10155	N165 E159	20-30		81.79	49.68
9Li229	10155	N165 E159	20-30		89.86	39.12
9Li229	10155	N165 E159	20-30		98.08	44.99
9Li229	10155	N165 E159	20-30		73.81	51.86
9Li229	10155	N165 E159	20-30		85.57	44.46
9Li229	10155	N165 E159	20-30		120.94	42.04
9Li229	10155	N165 E159	20-30		124.34	49.46
9Li229	10155	N165 E159	20-30		66.5	46.2
9Li229	10155	N165 E159	20-30		83.31	55.9
9Li229	10155	N165 E159	20-30		87.61	52.47
9Li229	10155	N165 E159	20-30		69	43.83
9Li229	10155	N165 E159	20-30		87.85	43.15
9Li229	10155	N165 E159	20-30		80.19	32.12
9Li229	10155	N165 E159	20-30		98.71	57.69
9Li229	10155	N165 E159	20-30		78.38	47.85
9Li229	10155	N165 E159	20-30		81.16	48.57
9Li229	10155	N165 E159	20-30		70.33	44.04
9Li229	10155	N165 E159	20-30		78.38	33.16
9Li229	10155	N165 E159	20-30		81.98	50.72
9Li229	10155	N165 E159	20-30		66.6	34.89
9Li229	10155	N165 E159	20-30		95.95	50.41
9Li229	10155	N165 E159	20-30		92.22	54.69
9Li229	10155	N165 E159	20-30		58.52	42.79
9Li229	10155	N165 E159	20-30		90.07	47.66
9Li229	10155	N165 E159	20-30		69.57	53.21
9Li229	10155	N165 E159	20-30		65.07	39.54
9Li229	10155	N165 E159	20-30		89.55	38.18
9Li229	10155	N165 E159	20-30		91.82	42.67
9Li229	10155	N165 E159	20-30		93.83	41.67
9Li229	10155	N165 E159	20-30		75.91	47.61
9Li229	10155	N165 E159	20-30		83.57	35.82
9Li229	10155	N165 E159	20-30		82.12	45.32
9Li229	10155	N165 E159	20-30		64.36	43.98
9Li229	10155	N165 E159	20-30		90.94	56.5
9Li229	10155	N165 E159	20-30		136.73	51.79
9Li229	10155	N165 E159	20-30		183	56.89
9Li229	10155	N165 E159	20-30		96.85	43.67
9Li229	10155	N165 E159	20-30		85.28	45.76
9Li229	10155	N165 E159	20-30		107.66	45.97
9Li229	10155	N165 E159	20-30		101.28	39.79

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li229	10155	N165 E159	20-30		68.46	47.5
9Li229	10155	N165 E159	20-30		59.02	41.02
9Li229	10155	N165 E159	20-30		79.51	42.9
9Li229	10155	N165 E159	20-30		67.26	36.86
9Li229	10155	N165 E159	20-30		87.87	43.62
9Li229	10155	N165 E159	20-30		72.73	45.91
9Li229	10155	N165 E159	20-30		97.79	35.91
9Li229	10155	N165 E159	20-30		73.62	58.2
9Li229	10155	N165 E159	20-30		60.73	37.42
9Li229	10155	N165 E159	20-30		101.36	46.74
9Li229	10155	N165 E159	20-30		72.36	47.66
9Li229	10155	N165 E159	20-30		109.52	57.2
9Li229	10155	N165 E159	20-30		99.73	55.58
9Li229	10155	N165 E159	20-30		102.54	34.45
9Li229	10155	N165 E159	20-30		129.44	43.4
9Li229	10155	N165 E159	20-30		77.26	40.02
9Li229	10155	N165 E159	20-30		78.11	49.31
9Li229	10155	N165 E159	20-30		75.87	48.24
9Li229	10155	N165 E159	20-30		95.06	47.21
9Li229	10155	N165 E159	20-30		94.46	68.56
9Li229	10155	N165 E159	20-30		63.96	47.4
9Li229	10160	N165 E159	30-40		84.23	50.38
9Li229	10160	N165 E159	30-40		116.71	36.87
9Li229	10160	N165 E159	30-40		70.61	45.13
9Li229	10160	N165 E159	30-40		116.48	49.12
9Li229	10160	N165 E159	30-40		82.25	39.23
9Li229	10160	N165 E159	30-40		81.8	51.98
9Li229	10160	N165 E159	30-40		68.2	40.66
9Li229	10160	N165 E159	30-40		81	64.7
9Li229	10160	N165 E159	30-40		66.96	45.87
9Li229	10160	N165 E159	30-40		93.78	34.92
9Li229	10160	N165 E159	30-40		109.88	59.32
9Li229	10160	N165 E159	30-40		76.3	50.32
9Li229	10160	N165 E159	30-40		88.85	49.13
9Li229	10160	N165 E159	30-40		75.41	45.78
9Li229	10160	N165 E159	30-40		76.01	54.8
9Li229	10160	N165 E159	30-40		69.11	46.91
9Li229	10160	N165 E159	30-40		89.58	50.42
9Li229	10160	N165 E159	30-40		74.82	37.54
9Li229	10160	N165 E159	30-40		92.49	34.39
9Li229	10160	N165 E159	30-40		64.79	38.56
9Li229	10160	N165 E159	30-40		86.04	44.06
9Li229	10160	N165 E159	30-40		90.26	60.34
9Li229	10160	N165 E159	30-40		78.13	38.97
9Li229	10160	N165 E159	30-40		79.14	41.01
9Li229	10160	N165 E159	30-40		63.29	42.06
9Li229	10160	N165 E159	30-40		67.29	39.2
9Li229	10160	N165 E159	30-40		57.15	50.85
9Li229	10160	N165 E159	30-40		67.48	44.01
9Li229	10160	N165 E159	30-40		101.93	58.71

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li229	10160	N165 E159	30-40		62.15	45.76
9Li229	10160	N165 E159	30-40		73	40.32
9Li229	10160	N165 E159	30-40		117.57	64.85
9Li229	10160	N165 E159	30-40		84.36	47.2
9Li229	10160	N165 E159	30-40		77.82	50.7
9Li229	10160	N165 E159	30-40		63.28	45.65
9Li229	10160	N165 E159	30-40		132.37	52.72
9Li229	10160	N165 E159	30-40		76.84	36.49
9Li229	10160	N165 E159	30-40		82.85	56.52
9Li229	10160	N165 E159	30-40		79.49	55.06
9Li229	10160	N165 E159	30-40		80.51	54.82
9Li229	10160	N165 E159	30-40		91.34	45.94
9Li229	10160	N165 E159	30-40		104.76	44.78
9Li229	10160	N165 E159	30-40		80.77	44.91
9Li229	10160	N165 E159	30-40		79.33	45.44
9Li229	10160	N165 E159	30-40		122.64	48.8
9Li229	10160	N165 E159	30-40		99.35	43.98
9Li229	10160	N165 E159	30-40		74.28	55.28
9Li229	10160	N165 E159	30-40		68.2	41.21
9Li229	10160	N165 E159	30-40		92.51	49.8
9Li229	10160	N165 E159	30-40		66.63	46.03
9Li229	10160	N165 E159	30-40		104.11	46.07
9Li229	10160	N165 E159	30-40		70.76	49.81
9Li229	10160	N165 E159	30-40		78.18	52.17
9Li229	10160	N165 E159	30-40		64.97	46.62
9Li229	10160	N165 E159	30-40		74.71	44.72
9Li229	10160	N165 E159	30-40		74.7	49.88
9Li229	10160	N165 E159	30-40		57.78	40.73
9Li229	10160	N165 E159	30-40		82.08	53.9
9Li229	10160	N165 E159	30-40		74.02	53.65
9Li229	10160	N165 E159	30-40		66.62	44.36
9Li229	10160	N165 E159	30-40		83.48	39.7
9Li229	10160	N165 E159	30-40		98.64	43.09
9Li229	10160	N165 E159	30-40		80.19	48.42
9Li229	10160	N165 E159	30-40		62.75	43.03
9Li229	10160	N165 E159	30-40		65.2	47.62
9Li229	10160	N165 E159	30-40		63.72	42.24
9Li229	10160	N165 E159	30-40		68.44	44.77
9Li229	10160	N165 E159	30-40		66.45	53.7
9Li229	10160	N165 E159	30-40		64.84	48.95
9Li229	10160	N165 E159	30-40		78.92	57.41
9Li229	10160	N165 E159	30-40		67.38	38.93
9Li229	10160	N165 E159	30-40		67.35	42.3
9Li229	10160	N165 E159	30-40		72.53	43.87
9Li229	10160	N165 E159	30-40		83.12	48.69
9Li229	10160	N165 E159	30-40		60.64	31.84
9Li229	10160	N165 E159	30-40		74.49	46.74
9Li229	10160	N165 E159	30-40		83.23	50.8
9Li229	10160	N165 E159	30-40		85.42	41.52
9Li229	10160	N165 E159	30-40		86.44	56.94

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li229	10160	N165 E159	30-40		87.83	53.83
9Li229	10148	N165 E159	30-40	3	65.45	47.65
9Li229	10148	N165 E159	30-40	3	83.06	39.24
9Li229	10148	N165 E159	30-40	3	91.08	40.93
9Li229	10148	N165 E159	30-40	3	96.2	44.5
9Li229	10148	N165 E159	30-40	3	71.46	52.86
9Li229	10148	N165 E159	30-40	3	62.53	43.02
9Li229	10148	N165 E159	30-40	3	85.5	37.55
9Li229	10148	N165 E159	30-40	3	55.29	37.33
9Li229	10148	N165 E159	30-40	3	73.3	45.57
9Li229	10148	N165 E159	30-40	3	70.91	36.29
9Li229	10148	N165 E159	30-40	3	75.06	46.13
9Li229	10148	N165 E159	30-40	3	120.28	44.12
9Li229	10148	N165 E159	30-40	3	60.5	44.73
9Li229	10148	N165 E159	30-40	3	68.54	40.59
9Li229	10148	N165 E159	30-40	3	84.29	30.69
9Li229	10148	N165 E159	30-40	3	57.39	45.12
9Li229	10148	N165 E159	30-40	3	75.41	46.45
9Li229	10148	N165 E159	30-40	3	117.62	68.27
9Li229	10148	N165 E159	30-40	3	79.86	49.71
9Li229	10148	N165 E159	30-40	3	70.82	48.51
9Li229	10224	N165 E159	40-50		79.13	43.75
9Li229	10224	N165 E159	40-50		79.1	60.5
9Li229	10224	N165 E159	40-50		78.96	51.48
9Li229	10224	N165 E159	40-50		73.34	57.92
9Li229	10224	N165 E159	40-50		71.78	51.12
9Li229	10224	N165 E159	40-50		73.36	43.79
9Li229	10224	N165 E159	40-50		119.36	45.4
9Li229	10224	N165 E159	40-50		139.55	44.56
9Li229	10224	N165 E159	40-50		93.96	49.65
9Li229	10224	N165 E159	40-50		68.31	41.42
9Li229	10224	N165 E159	40-50		77.96	49.29
9Li229	10224	N165 E159	40-50		96.71	48.28
9Li229	10224	N165 E159	40-50		66.64	34.44
9Li229	10224	N165 E159	40-50		80.45	49.56
9Li229	10224	N165 E159	40-50		120.44	60.7
9Li229	10224	N165 E159	40-50		76.07	49.54
9Li229	10224	N165 E159	40-50		95.59	31.21
9Li229	10224	N165 E159	40-50		61.18	41.57
9Li229	10224	N165 E159	40-50		76.38	44.16
9Li229	10224	N165 E159	40-50		87.99	44.92
9Li229	10224	N165 E159	40-50		67.02	46.32
9Li229	10224	N165 E159	40-50		80.65	34.51
9Li229	10224	N165 E159	40-50		55.46	39.91
9Li229	10224	N165 E159	40-50		105.69	42.31
9Li229	10224	N165 E159	40-50		68.02	39.2
9Li229	10224	N165 E159	40-50		58.1	44.61
9Li229	10224	N165 E159	40-50		101.19	53.05
9Li229	10224	N165 E159	40-50		94.99	35
9Li229	10224	N165 E159	40-50		52.89	41.51

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li229	10224	N165 E159	40-50		84.91	34.6
9Li229	10224	N165 E159	40-50		63.58	41.9
9Li229	10224	N165 E159	40-50		70.07	41.11
9Li229	10224	N165 E159	40-50		73.95	48.9
9Li229	10224	N165 E159	40-50		73.18	44.75
9Li229	10224	N165 E159	40-50		60.39	39.51
9Li229	10224	N165 E159	40-50		74.11	54.54
9Li229	10224	N165 E159	40-50		63.33	50.58
9Li229	10224	N165 E159	40-50		70.68	44.87
9Li229	10224	N165 E159	40-50		101.02	44.47
9Li229	10224	N165 E159	40-50		109.75	37.49
9Li229	10224	N165 E159	40-50		63.75	43.69
9Li229	10224	N165 E159	40-50		63.41	45.7
9Li229	10224	N165 E159	40-50		71.4	48.2
9Li229	10224	N165 E159	40-50		84.81	47.03
9Li229	10224	N165 E159	40-50		62.46	40.37
9Li229	10224	N165 E159	40-50		55.77	38.26
9Li229	10224	N165 E159	40-50		57.87	51.03
9Li229	10224	N165 E159	40-50		80.19	53.63
9Li229	10224	N165 E159	40-50		118.12	54.38
9Li229	10224	N165 E159	40-50		65.66	41.85
9Li229	10224	N165 E159	40-50		152.62	49.54
9Li229	10224	N165 E159	40-50		54.17	47.3
9Li229	10224	N165 E159	40-50		95.1	46.38
9Li229	10224	N165 E159	40-50		64.77	46.25
9Li229	10224	N165 E159	40-50		86.49	56.68
9Li229	10224	N165 E159	40-50		106.91	50.38
9Li229	10224	N165 E159	40-50		53.26	45.1
9Li229	10224	N165 E159	40-50		82.99	61.94
9Li229	10224	N165 E159	40-50		76.5	49.28
9Li229	10224	N165 E159	40-50		82.04	47.27
9Li229	10224	N165 E159	40-50		75.76	38.76
9Li229	10224	N165 E159	40-50		89.46	40.31
9Li229	10224	N165 E159	40-50		95.22	42.17
9Li229	10224	N165 E159	40-50		72.6	53.17
9Li229	10224	N165 E159	40-50		66.57	40.32
9Li229	10224	N165 E159	40-50		87.9	54.93
9Li229	10224	N165 E159	40-50		71.32	47.76
9Li229	10224	N165 E159	40-50		99.27	58.24
9Li229	10224	N165 E159	40-50		72.65	54.9
9Li229	10224	N165 E159	40-50		69.18	39.42
9Li229	10224	N165 E159	40-50		80.05	37.55
9Li229	10224	N165 E159	40-50		60.02	40.97
9Li229	10224	N165 E159	40-50		64.26	41.82
9Li229	10224	N165 E159	40-50		57.84	38.53
9Li229	10224	N165 E159	40-50		71.35	31.24
9Li229	10224	N165 E159	40-50		50.72	48.94
9Li229	10224	N165 E159	40-50		54.79	36.37
9Li229	10224	N165 E159	40-50		67.56	37.89
9Li229	10224	N165 E159	40-50		89.05	51.28

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li229	10224	N165 E159	40-50		119.01	44.84
9Li229	10227	N165 E159	40-50	3	75.38	52.71
9Li229	10227	N165 E159	40-50	3	72.1	39.14
9Li229	10227	N165 E159	40-50	3	85.75	46.27
9Li229	10227	N165 E159	40-50	3	63	42.24
9Li229	10227	N165 E159	40-50	3	67.62	38.6
9Li229	10227	N165 E159	40-50	3	76.82	54.11
9Li229	10227	N165 E159	40-50	3	56.56	41.38
9Li229	10227	N165 E159	40-50	3	58.66	50.65
9Li229	10227	N165 E159	40-50	3	73.31	51.99
9Li229	10227	N165 E159	40-50	3	71.52	44.32
9Li229	10227	N165 E159	40-50	3	95.31	55.3
9Li229	10227	N165 E159	40-50	3	70.54	59.46
9Li229	10227	N165 E159	40-50	3	93.35	55.74
9Li229	10227	N165 E159	40-50	3	74.15	61.35
9Li229	10227	N165 E159	40-50	3	71.84	44.78
9Li229	10227	N165 E159	40-50	3	75.01	42.5
9Li229	10227	N165 E159	40-50	3	73.69	42.5
9Li229	10227	N165 E159	40-50	3	62.39	50.35
9Li229	10227	N165 E159	40-50	3	70.19	45.52
9Li229	10227	N165 E159	40-50	3	65.13	42.58
9Li229	10225	N165 E159	50-60		62.77	30.85
9Li229	10225	N165 E159	50-60		58.61	39.27
9Li229	10225	N165 E159	50-60		47.76	36.82
9Li229	10225	N165 E159	50-60		54.49	42.7
9Li229	10225	N165 E159	50-60		64.43	46.38
9Li229	10225	N165 E159	50-60		107.51	42.39
9Li229	10225	N165 E159	50-60		62.97	42.25
9Li229	10225	N165 E159	50-60		91.26	44.27
9Li229	10225	N165 E159	50-60		54.24	35.47
9Li229	10225	N165 E159	50-60		55.85	45.38
9Li229	10225	N165 E159	50-60		65.17	36.42
9Li229	10225	N165 E159	50-60		52.72	37.08
9Li229	10225	N165 E159	50-60		54.9	35.86
9Li229	10225	N165 E159	50-60		60.89	36.82
9Li229	10225	N165 E159	50-60		55.53	40.1
9Li229	10225	N165 E159	50-60		73.49	49.06
9Li229	10225	N165 E159	50-60		53.63	36.07
9Li229	10225	N165 E159	50-60		90.63	43.02
9Li229	10225	N165 E159	50-60		70.72	33.1
9Li229	10225	N165 E159	50-60		61.74	49.8
9Li229	10225	N165 E159	50-60		66.24	34.92
9Li229	10225	N165 E159	50-60		47.58	31.09
9Li229	10225	N165 E159	50-60		82.76	32.11
9Li229	10225	N165 E159	50-60		86.62	48.4
9Li229	10225	N165 E159	50-60		56.88	38.06
9Li229	10225	N165 E159	50-60		87.18	37.86
9Li229	10225	N165 E159	50-60		62.15	34.51
9Li229	10225	N165 E159	50-60		97.61	38.74
9Li229	10225	N165 E159	50-60		82.35	57.73

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li229	10225	N165 E159	50-60		83.79	50.44
9Li229	10225	N165 E159	50-60		42.87	31.35
9Li229	10225	N165 E159	50-60		51.09	30.7
9Li229	10225	N165 E159	50-60		73.68	35.39
9Li229	10225	N165 E159	50-60		60.71	37.22
9Li229	10225	N165 E159	50-60		61	40.53
9Li229	10225	N165 E159	50-60		123.29	37.88
9Li229	10225	N165 E159	50-60		57.07	40.93
9Li229	10225	N165 E159	50-60		58.41	44.58
9Li229	10225	N165 E159	50-60		74.26	53.32
9Li229	10225	N165 E159	50-60		70.78	55.68
9Li229	10225	N165 E159	50-60		75.76	47.38
9Li229	10225	N165 E159	50-60		64.6	47.24
9Li229	10225	N165 E159	50-60		93.07	38.81
9Li229	10225	N165 E159	50-60		76.44	38.88
9Li229	10225	N165 E159	50-60		71.1	45.8
9Li229	10225	N165 E159	50-60		75.23	32.34
9Li229	10225	N165 E159	50-60		68.48	40.3
9Li229	10225	N165 E159	50-60		73.3	32.57
9Li229	10225	N165 E159	50-60		60.57	50.56
9Li229	10225	N165 E159	50-60		67.6	46.68
9Li229	10225	N165 E159	50-60		61.97	44.03
9Li229	10225	N165 E159	50-60		64.94	43.43
9Li229	10225	N165 E159	50-60		63.65	38.93
9Li229	10225	N165 E159	50-60		64.44	34.86
9Li229	10225	N165 E159	50-60		67.23	41.76
9Li229	10225	N165 E159	50-60		52.58	43.9
9Li229	10225	N165 E159	50-60		60.34	41.58
9Li229	10225	N165 E159	50-60		73.17	35.67
9Li229	10225	N165 E159	50-60		60.53	38.89
9Li229	10225	N165 E159	50-60		50.66	36.25
9Li229	9993	N179 E84	0-10		72.94	58.52
9Li229	9993	N179 E84	0-10		68.35	37.26
9Li229	9993	N179 E84	0-10		61.31	37.82
9Li229	9993	N179 E84	0-10		65.73	32.31
9Li229	9993	N179 E84	0-10		60.45	38.68
9Li229	9993	N179 E84	0-10		72.17	48.37
9Li229	9993	N179 E84	0-10		89.91	56.21
9Li229	9993	N179 E84	0-10		84.46	54.96
9Li229	9993	N179 E84	0-10		41.15	34.38
9Li229	9993	N179 E84	0-10		56.64	34.11
9Li229	9993	N179 E84	0-10		44.49	34.8
9Li229	9993	N179 E84	0-10		48.16	34.24
9Li229	9993	N179 E84	0-10		79.28	46.65
9Li229	9993	N179 E84	0-10		62.04	46.7
9Li229	9993	N179 E84	0-10		83.92	42.26
9Li229	9993	N179 E84	0-10		47.69	36.06
9Li229	9993	N179 E84	0-10		37.7	28.73
9Li229	9993	N179 E84	0-10		61.33	33.71
9Li229	9993	N179 E84	0-10		65.32	32.77

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li229	9993	N179 E84	0-10		63.43	42.75
9Li229	9993	N179 E84	0-10		58	42.89
9Li229	9993	N179 E84	0-10		51.77	37.84
9Li229	9993	N179 E84	0-10		65.8	40.27
9Li229	9993	N179 E84	0-10		59.11	41.81
9Li229	9993	N179 E84	0-10		58.06	38.63
9Li229	9993	N179 E84	0-10		44.39	32.72
9Li229	9993	N179 E84	0-10		105.21	53.46
9Li229	9993	N179 E84	0-10		90.27	56.91
9Li229	9993	N179 E84	0-10		46.3	25.82
9Li229	9993	N179 E84	0-10		61.38	43.51
9Li229	9993	N179 E84	0-10		59.61	24.84
9Li229	9993	N179 E84	0-10		82.6	42.17
9Li229	9993	N179 E84	0-10		73.36	45.27
9Li229	9993	N179 E84	0-10		84.46	54.03
9Li229	9993	N179 E84	0-10		111.4	44.63
9Li229	9993	N179 E84	0-10		75.5	44.14
9Li229	9993	N179 E84	0-10		58.37	36.08
9Li229	9993	N179 E84	0-10		60.34	32.68
9Li229	9993	N179 E84	0-10		45.43	33.05
9Li229	9993	N179 E84	0-10		51.81	32.3
9Li229	9993	N179 E84	0-10		51.1	40.57
9Li229	9993	N179 E84	0-10		95.55	56.6
9Li229	9993	N179 E84	0-10		79.65	43.21
9Li229	9993	N179 E84	0-10		33.74	27.1
9Li229	10144	N179 E84	10-20		96.01	45.02
9Li229	10144	N179 E84	10-20		78.86	39
9Li229	10144	N179 E84	10-20		77.37	43.48
9Li229	10144	N179 E84	10-20		77.95	30.41
9Li229	10144	N179 E84	10-20		49.19	43.18
9Li229	10144	N179 E84	10-20		68.17	51.78
9Li229	10144	N179 E84	10-20		65.05	38.89
9Li229	10144	N179 E84	10-20		73.43	39.11
9Li229	10144	N179 E84	10-20		82.62	34.91
9Li229	10144	N179 E84	10-20		87.72	42.73
9Li229	10144	N179 E84	10-20		38.67	23.47
9Li229	10144	N179 E84	10-20		89.38	48.88
9Li229	10144	N179 E84	10-20		73.44	43.72
9Li229	10144	N179 E84	10-20		84.91	40.94
9Li229	10144	N179 E84	10-20		49.7	38.01
9Li229	10144	N179 E84	10-20		53.22	36.46
9Li229	10144	N179 E84	10-20		54.54	25.14
9Li229	10144	N179 E84	10-20		78.3	44.99
9Li229	10144	N179 E84	10-20		44.28	30.05
9Li229	10144	N179 E84	10-20		39	32.71
9Li229	10144	N179 E84	10-20		58.04	36.91
9Li229	10144	N179 E84	10-20		82.08	47.81
9Li229	10144	N179 E84	10-20		36.91	31.41
9Li229	10144	N179 E84	10-20		98.41	37.3
9Li229	10144	N179 E84	10-20		51.44	35.26

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li229	10144	N179 E84	10-20		160	53.96
9Li229	10144	N179 E84	10-20		73.59	37.37
9Li229	10144	N179 E84	10-20		80	47.38
9Li229	10144	N179 E84	10-20		113.29	44.67
9Li229	10144	N179 E84	10-20		71.55	37.23
9Li229	10144	N179 E84	10-20		75.86	41.39
9Li229	10144	N179 E84	10-20		81.43	64.28
9Li229	10144	N179 E84	10-20		60.53	42.82
9Li229	10144	N179 E84	10-20		86.64	48
9Li229	10144	N179 E84	10-20		44.89	31.25
9Li229	10144	N179 E84	10-20		58.62	37.08
9Li229	10144	N179 E84	10-20		84.83	47.32
9Li229	10144	N179 E84	10-20		51.71	31.53
9Li229	10144	N179 E84	10-20		79.05	45.07
9Li229	10144	N179 E84	10-20		55.44	43.9
9Li229	10144	N179 E84	10-20		95.63	47.54
9Li229	10144	N179 E84	10-20		66.81	40.63
9Li229	10144	N179 E84	10-20		71.47	59.67
9Li229	10144	N179 E84	10-20		58.4	36.97
9Li229	10144	N179 E84	10-20		77.75	29.13
9Li229	10144	N179 E84	10-20		66.19	39.39
9Li229	10144	N179 E84	10-20		60.3	38.89
9Li229	10144	N179 E84	10-20		46.2	37.25
9Li229	10144	N179 E84	10-20		70.28	36.61
9Li229	10144	N179 E84	10-20		93.37	57.05
9Li229	10144	N179 E84	10-20		112.29	44.71
9Li229	10144	N179 E84	10-20		113.25	37.57
9Li229	10144	N179 E84	10-20		78.5	59.03
9Li229	10144	N179 E84	10-20		60.65	37.37
9Li229	10144	N179 E84	10-20		59.61	45.68
9Li229	10144	N179 E84	10-20		78.17	34.91
9Li229	10144	N179 E84	10-20		64.26	40.56
9Li229	10144	N179 E84	10-20		93.73	55.76
9Li229	10140	N179 E84	20-30		99.62	50.71
9Li229	10140	N179 E84	20-30		104.75	51.17
9Li229	10140	N179 E84	20-30		44.47	36.48
9Li229	10140	N179 E84	20-30		67.7	41.6
9Li229	10140	N179 E84	20-30		68.43	41.78
9Li229	10140	N179 E84	20-30		92.65	48.22
9Li229	10140	N179 E84	20-30		62.86	37.23
9Li229	10140	N179 E84	20-30		74.92	33.35
9Li229	10140	N179 E84	20-30		88.49	51.47
9Li229	10140	N179 E84	20-30		84.46	41.55
9Li229	10140	N179 E84	20-30		67.28	44.38
9Li229	10140	N179 E84	20-30		64.49	37.36
9Li229	10140	N179 E84	20-30		89.38	51.27
9Li229	10140	N179 E84	20-30		93.21	34.09
9Li229	10140	N179 E84	20-30		50.39	30.77
9Li229	10140	N179 E84	20-30		61.12	28.15
9Li229	10140	N179 E84	20-30		55.45	31.76

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li229	10140	N179 E84	20-30		41.85	32.91
9Li229	10140	N179 E84	20-30		52.27	33.01
9Li229	10140	N179 E84	20-30		73.64	58.16
9Li229	10140	N179 E84	20-30		57.24	36.56
9Li229	10140	N179 E84	20-30		58.28	30.58
9Li229	10140	N179 E84	20-30		69.9	41.17
9Li229	10140	N179 E84	20-30		57.59	34.73
9Li229	10140	N179 E84	20-30		48.22	41.02
9Li229	10140	N179 E84	20-30		81.71	33.7
9Li229	10140	N179 E84	20-30		57.03	42.64
9Li229	10140	N179 E84	20-30		48.13	33.88
9Li229	10140	N179 E84	20-30		53.97	36.04
9Li229	10140	N179 E84	20-30		57.75	34.42
9Li229	10140	N179 E84	20-30		82.19	45.09
9Li229	10140	N179 E84	20-30		84.65	36.6
9Li229	10140	N179 E84	20-30		88.76	29.33
9Li229	10140	N179 E84	20-30		120.31	37.77
9Li229	10140	N179 E84	20-30		42.05	27.52
9Li229	10140	N179 E84	20-30		56.38	42.71
9Li229	10140	N179 E84	20-30		37.22	31
9Li229	10140	N179 E84	20-30		74.38	45.88
9Li229	10140	N179 E84	20-30		76.73	43.24
9Li229	10140	N179 E84	20-30		62.37	35.49
9Li229	10140	N179 E84	20-30		58.11	31.7
9Li229	10140	N179 E84	20-30		60.54	32.54
9Li229	10140	N179 E84	20-30		67.18	40.8
9Li229	10140	N179 E84	20-30		83.1	41.04
9Li229	10140	N179 E84	20-30		51.8	38.39
9Li229	10140	N179 E84	20-30		53.87	31.04
9Li229	10140	N179 E84	20-30		75.19	51.33
9Li229	10140	N179 E84	20-30		53.77	22.2
9Li229	10140	N179 E84	20-30		70.02	39.64
9Li229	10140	N179 E84	20-30		91.66	39.83
9Li229	10140	N179 E84	20-30		68.52	41.64
9Li229	10140	N179 E84	20-30		118.17	48.7
9Li229	10140	N179 E84	20-30		50.79	31.45
9Li229	10140	N179 E84	20-30		67.53	43.28
9Li229	10140	N179 E84	20-30		81.87	56.56
9Li229	10140	N179 E84	20-30		77.2	55.66
9Li229	10140	N179 E84	20-30		80.51	55.11
9Li229	10140	N179 E84	20-30		55.63	49.61
9Li229	10140	N179 E84	20-30		63.47	47.12
9Li229	10140	N179 E84	20-30		55.02	37.46
9Li229	10140	N179 E84	20-30		53.86	38.39
9Li229	10140	N179 E84	20-30		75.84	51.69
9Li229	10140	N179 E84	20-30		59.22	39.58
9Li229	10140	N179 E84	20-30		73.65	41.25
9Li229	10140	N179 E84	20-30		100.97	36.04
9Li229	10140	N179 E84	20-30		78.14	34.63
9Li229	10140	N179 E84	20-30		54.69	34.42

APPENDIX E—(*Continued*)

Site #	Bag No.	Unit	Level	Feature	Height, mm	Length, mm
9Li229	10140	N179 E84	20-30		64.51	40.91
9Li229	10140	N179 E84	20-30		72.74	36.24
9Li229	10140	N179 E84	20-30		94.13	47.7
9Li229	10140	N179 E84	20-30		39.97	28.17
9Li229	10140	N179 E84	20-30		114.97	31.63
9Li229	10140	N179 E84	20-30		95.61	32.57
9Li229	10140	N179 E84	20-30		87.52	39.12
9Li229	10140	N179 E84	20-30		49.8	39.25
9Li229	10140	N179 E84	20-30		52.27	31.44
9Li229	10140	N179 E84	20-30		58.29	41.11
9Li229	10140	N179 E84	20-30		113.15	70.55
9Li229	10140	N179 E84	20-30		69.93	47.8
9Li229	10140	N179 E84	20-30		57.13	35.81
9Li229	10138	N179 E84	30-40		54.23	31.4
9Li229	10138	N179 E84	30-40		60.12	30.26
9Li229	10138	N179 E84	30-40		65.91	46.58
9Li229	10138	N179 E84	30-40		61.91	47.67
9Li229	10138	N179 E84	30-40		37.79	30.29
9Li229	10138	N179 E84	30-40		74.92	52.27
9Li229	10138	N179 E84	30-40		90.2	37.98
9Li229	10138	N179 E84	30-40		55.16	42.02
9Li229	10138	N179 E84	30-40		72.04	37.14
9Li229	10138	N179 E84	30-40		47.81	36.88
9Li229	10138	N179 E84	30-40		45.83	29.59
9Li229	10138	N179 E84	30-40		78.7	50
9Li229	10138	N179 E84	30-40		108.08	33.95
9Li229	10138	N179 E84	30-40		52.7	26.26
9Li229	10138	N179 E84	30-40		65.63	42
9Li229	10138	N179 E84	30-40		85.65	65.44
9Li229	10138	N179 E84	30-40		59.68	51.49
9Li229	10138	N179 E84	30-40		49.6	34.82
9Li229	10138	N179 E84	30-40		83.35	50.45
9Li229	10138	N179 E84	30-40		67.07	33.86
9Li229	10138	N179 E84	30-40		47	24.14
9Li229	10138	N179 E84	30-40		49.01	32.82
9Li229	10138	N179 E84	30-40		77.19	48.4
9Li229	10138	N179 E84	30-40		48.85	31.28
9Li229	10138	N179 E84	30-40		49.48	36.83
9Li229	10138	N179 E84	30-40		85.53	64.87
9Li229	10138	N179 E84	30-40		61.72	24.01
9Li229	10138	N179 E84	30-40		51.38	28.06
9Li229	10138	N179 E84	30-40		65.11	48.78
9Li229	10138	N179 E84	30-40		105.48	57.45
9Li229	10138	N179 E84	30-40		66.38	41.35
9Li229	10138	N179 E84	30-40		111.66	54.46
9Li229	10138	N179 E84	30-40		62.29	35.67

APPENDIX F

CLAM MEASUREMENTS

Site #	Unit	Level	Side	VL, mm	VW, mm	HW, mm	AS, mm	Wght, g
9Li229	N165 E159	0-10	Left	51.83	32.15	8.65	15.34	15.174
9Li229	N165 E159	0-10	Left	68.5	47.58	11.46	19.05	37.012
9Li229	N165 E159	0-10	Left	73.97	47.94	12.29	20.07	47.839
9Li229	N165 E159	0-10	Left	63.16	41.38	11.24	16.61	28.891
9Li229	N165 E159	0-10	Left	68.11	43.74	12.84	17.82	36.293
9Li229	N165 E159	0-10	Left	63.09	45.81	11.03	15.93	31.948
9Li229	N165 E159	0-10	Left	41.99	29.49	6.67	12.69	8.047
9Li229	N165 E159	0-10	Left	45.44	30.18	7.28	13.17	10.421
9Li229	N165 E159	0-10	Left	52.79	32.17	8.91	15.12	16.382
9Li229	N165 E159	0-10	Left	50.93	39.2	9.1	15.25	16.174
9Li229	N165 E159	0-10	Left	56.38	34.93	9.06	15.16	18.639
9Li229	N165 E159	0-10	Left	63.78	43.84	10.86	17.47	29.114
9Li229	N165 E159	0-10	Left	—	—	10.93	—	19.669
9Li229	N165 E159	0-10	Left	—	—	8.65	—	10.519
9Li229	N165 E159	0-10	Left	—	—	5.11	—	3.129
9Li229	N165 E159	0-10	Left	—	36.79	8.28	15.11	12.266
9Li229	N165 E159	0-10	Left	45.81	30.01	7.8	12.78	10.971
9Li229	N165 E159	0-10	Left	54.02	36.36	8.44	15.18	16.961
9Li229	N165 E159	0-10	Left	68.61	47.49	13.22	19.55	38.642
9Li229	N165 E159	10-20	Left	41.4	26.69	6.91	12.02	7.722
9Li229	N165 E159	10-20	Left	45.79	33.09	8.3	13.66	10.192
9Li229	N165 E159	10-20	Left	53.99	37.91	8.25	15.93	16.961
9Li229	N165 E159	10-20	Left	52	37.55	8.72	14.77	15.252
9Li229	N165 E159	30-40	Left	53.88	35.17	9.05	15.66	15.072
9Li229	N165 E159	30-40	Left	69.37	45.67	11.74	18.06	34.722
9Li229	N165 E159	30-40	Left	77.09	50.72	12.53	20.55	35.473
9Li229	N165 E159	30-40	Left	57.24	42.38	11.75	16.52	25.338
9Li229	N165 E159	50-60	Left	71.06	49.97	12.61	19.48	43.161
9Li229	N191 E84	0-10	Left	49.5	32.37	8.86	13.41	11.938
9Li229	N191 E84	0-10	Left	65.86	42.74	10.87	16.57	26.909
9Li229	N191 E84	10.-20	Left	47.69	35.41	7.1	13	8.92
9Li229	N191 E84	10.-20	Left	60.28	49.3	10.32	17.11	22.27
9Li229	N191 E84	30-40	Left	91.92	56.73	13.78	23.5	61.363
9Li230	Iota	20-30	Left	82.69	77.7	14.8	19.93	70.962
9Li21	Alpha	10-20	Right	—	—	8.73	13.32	—
9Li21	Alpha	41-51	Right	50.5	47.1	7.01	12.83	12.853
9Li21	Alpha	10-20	Right	86.67	80.43	14.89	22	76.37
9Li21	Alpha	10-20	Right	73.23	69.06	12.67	17.48	41.583
9Li21	Alpha	10-20	Right	—	51.05	8.43	15.48	18.112
9Li21	Alpha	10-20	Right	—	—	13.67	20.58	—
9Li21	Alpha	10-20	Right	—	—	14.39	22.22	—
9Li21	Alpha	20-30	Right	55.32	50.48	8.26	15.62	15.722
9Li21	Alpha	20-30	Right	59.63	55.2	10.45	15	21.941
9Li21	Alpha	20-30	Right	49.59	44.76	7.09	12.97	12.186
9Li21	Alpha	20-30	Right	62.87	57.43	10.59	15.58	—
9Li21	Alpha	20-30	Right	44.36	41.86	7.04	11.35	10.369
9Li21	Alpha	31-41	Right	66.62	60.13	10.05	17.86	29.078
9Li21	Alpha	41-51	Right	60.56	52.12	8.72	15.21	17.576
9Li21	Alpha	41-51	Right	63.73	58.55	10.85	18.15	28.028

APPENDIX F—(*Continued*)

Site #	Unit	Level	Side	VL, mm	VW, mm	HW, mm	AS, mm	Wght, g
9Li21	Alpha	20-30	Right	71.97	64.85	10.51	18.49	—
9Li21	Alpha	20-30	Right	62.09	55.48	9.13	14.63	22.81
9Li21	Alpha	20-30	Right	66.25	59.59	10.61	17.66	—
9Li21	Alpha	30-31	Right	57.6	51.88	8.58	15.19	17.233
9Li21	Beta	35-45	Right	52.28	47.59	7.91	27.07	—
9Li21	Beta	45-55	Right	55.76	45.25	9.72	25.37	—
9Li21	Beta	25-35	Right	51.44	46.95	7.7	13.78	12.406
9Li21	Beta	45-55	Right	49.86	45.31	7.22	11.45	12.053
9Li21	Epsilon	20-30	Left	62.77	57.54	9.78	15.93	26.701
9Li21	Epsilon	20-30	Left	43.59	38.74	6.31	10.98	7.522
9Li21	Epsilon	20-30	Left	—	39.59	5.87	—	—
9Li21	Epsilon	10-20	Left	58.11	52.82	8.42	14.58	17.564
9Li21	Epsilon	10-20	Left	66.1	57.08	9.79	16.05	26.393
9Li21	Eta	0-10	Left	71.84	—	12.09	20.03	—
9Li21	Eta	10.-20	Left	48.35	45.58	6.85	11.9	10.286
9Li21	Eta	10.-20	Left	—	—	12.05	—	—
9Li21	Eta	20-30	Left	64.67	60.91	10.75	17.29	25.408
9Li21	Eta	20-30	Left	41.71	37.76	6.04	11.37	7.092
9Li21	Eta	30-40	Left	60.66	55.36	9.02	15.84	19.494
9Li21	Eta	20-30	Left	81.37	76.55	12.7	19.68	46.143
9Li21	Eta	20-30	Left	57.36	53.94	8.94	14.88	—
9Li21	Eta	20-30	Left	61.98	56.48	8.41	16.61	20.844
9Li21	Eta	20-30	Left	38.32	36.61	5.49	10.96	6.14
9Li21	Eta	20-30	Left	61.56	58.38	8.61	15.85	17.889
9Li21	Eta	20-30	Left	—	—	9.62	15.95	—
9Li21	Eta	10.-20	Left	70.58	66.58	12.77	18.53	36.211
9Li21	Eta	10.-20	Left	39.49	36.66	7.39	11.66	6.633
9Li21	Eta	10.-20	Left	49.09	46.94	7.45	12.45	12.965
9Li21	Eta	10.-20	Left	54.45	50.51	8.45	13.72	—
9Li21	N501 E80	30-40	Left	56.1	52.25	—	15.05	17.832
9Li21	N501 E80	30-40	Left	49.75	—	7.44	13.17	—
9Li21	N501 E80	30-40	Left	—	65.15	9.78	—	—
9Li21	N501 E80	40-50	Left	59.1	52.45	8.15	16.39	—
9Li21	N501 E80	30-40	Left	70.73	62.61	11.36	17.71	35.595
9Li21	N501 E80	30-40	Left	64.01	59.08	9.39	15.34	—
9Li21	N501 E80	40-50	Left	78.4	68.55	12.11	19.54	—
9Li21	N501 E80	20-30	Left	70.7	—	10.32	17.36	—
9Li21	N501 E80	20-30	Left	75.62	—	11.85	19.29	—
9Li21	Theta	17-27	Right	—	—	14.29	22.9	—
9Li21	Theta	37-47	Right	62.32	55.56	10.34	31.06	—
9Li21	Zeta	40-50	Left	66.17	61.04	9.83	15.8	33.728
9Li21	Zeta	40-50	Left	67.78	61.36	9.44	18.35	29.159
9Li21	Zeta	40-50	Left	—	69.62	10.74	—	—
9Li21	Zeta	50-60	Left	—	71.18	11.92	—	—
9Li21	Zeta	20-30	Left	60.42	56.08	9.09	15.82	23.751
9Li21	Zeta	20-30	Left	62.45	57.85	8.6	16.19	22.868
9Li21	Zeta	20-30	Left	82.71	73.16	11.48	21.24	—
9Li21	Zeta	20-30	Left	66.95	61.11	9.73	17.38	—
9Li21	Zeta	40-50	Left	60.43	55.54	8.69	16.26	20.243
9Li21	Zeta	40-50	Left	52.3	48.34	7.71	13.95	13.955

APPENDIX F—(*Continued*)

Site #	Unit	Level	Side	VL, mm	VW, mm	HW, mm	AS, mm	Wght, g
9Li21	Zeta	40-50	Left	63.72	—	9.88	16.62	—
9Li21	Zeta	50-60	Left	61.8	55.4	9.31	17.76	25.479
9Li21	Zeta	40-50	Left	75.21	67.49	11.02	20.73	44.072
9Li207	N587 E437	49.03-48.83	Left	49.6	46.1	6.61	14.1	13.976
9Li207	N587 E437	48.83-48.73	Left	84.44	77.33	11.53	20.93	51.7
9Li207	N587 E437	48.93-48.83	Left	57.39	53.15	7.81	15.56	22.778
9Li207	N587 E437	48.93-48.83	Left	85.81	80.66	13.66	21.77	74.102
9Li207	N587 E437	48.93-48.83	Left	63.83	56.92	9.72	17.59	26.918
9Li207	N587 E437	48.93-48.83	Left	75.14	65.41	10.27	19.4	38.428
9Li207	N587 E437	48.93-48.83	Left	63.48	58.79	10.16	15.76	35.138
9Li207	N587 E437	48.93-48.83	Left	70.84	66.2	12.67	17.21	45.371
9Li207	N587 E437	48.93-48.83	Left	78.79	73.6	12.29	20.58	56.972
9Li207	N587 E437	48.93-48.83	Left	75.58	68.13	12.36	18.36	47.783
9Li207	N587 E437	48.93-48.83	Left	68.16	60.97	10.17	17.06	25.869
9Li207	N587 E437	48.93-48.83	Left	64.07	59.39	10.18	16.72	29.128
9Li207	N587 E437	48.93-48.83	Left	80.58	70.52	11.5	20.06	43.292
9Li207	N587 E437	48.93-48.83	Left	51.59	50.62	8.79	13.48	19.211
9Li207	N587 E437	48.93-48.83	Left	70.77	63.34	12.73	16.97	36.914
9Li207	N587 E437	48.93-48.83	Left	60.27	54.49	9.63	15.12	29.01
9Li207	N587 E437	48.93-48.83	Left	58.56	51.68	8.56	15.05	20.476
9Li207	N587 E437	48.93-48.83	Left	82.7	75.05	14.37	22.45	64.255
9Li207	N587 E437	48.73-48.63	Left	90.35	82.19	14.02	22.32	74.733
9Li207	N587 E437	48.73-48.63	Left	90.26	81.13	14	21.92	77.505
9Li207	N587 E437	48.73-48.63	Left	70.03	62.31	11.31	17.25	38.859
9Li207	N587 E437	48.73-48.63	Left	52.13	48.79	8.66	13.47	16.1
9Li207	N587 E437	48.93-48.83	Left	72.35	65.29	12.08	16.41	37.323
9Li207	N587 E437	48.73-48.63	Left	65.02	58.95	9.88	16.15	27.981
9Li207	N587 E437	48.73-48.63	Left	73	65.38	10.32	19.57	37.852
9Li207	N587 E437	48.73-48.63	Left	73.48	67.55	10.82	19.49	50.208
9Li207	N587 E437	48.73-48.63	Left	74.64	69.02	11.21	20.21	42.422
9Li207	N587 E437	48.73-48.63	Left	75.53	68.18	11.18	20.86	41. 976
9Li207	N587 E437	48.73-48.63	Left	60.88	55.58	11.71	15.13	28.191
9Li207	N587 E437	48.73-48.63	Left	80.31	73.01	11.61	19.29	49.786
9Li207	N587 E437	48.73-48.63	Left	62.71	59.2	10.3	16.33	32.595
9Li207	N587 E437	48.73-48.63	Left	65.83	62.17	10.57	18.61	32.954
9Li207	N587 E437	48.73-48.63	Left	58.96	53.57	8.9	15.62	19.735
9Li207	N587 E437	48.93-48.83	Left	73.9	64.91	11.09	19.12	38.796
9Li207	N587 E437	48.73-48.63	Left	61.36	55.62	9.3	16.94	22.499
9Li207	N587 E437	48.83-48.73	Left	93.75	85.86	12.61	24.2	75.2
9Li207	N587 E437	48.83-48.73	Left	92.79	83.06	15.11	23.08	88.05
9Li207	N587 E437	48.83-48.73	Left	91.82	87.72	14.66	24.95	90.099
9Li207	N587 E437	48.83-48.73	Left	90.46		13.68	23.49	75.398
9Li207	N587 E437	48.83-48.73	Left	63.45	56.77	9.64	17.04	29.871
9Li207	N587 E437	48.83-48.73	Left	56.22	52.18	8.61	14.78	22.859
9Li207	N587 E437	48.83-48.73	Left	94.14	84.92	14.1	22.45	78.238
9Li207	N587 E437	48.83-48.73	Left	68.82	61.95	10.16	18.74	34.015
9Li207	N587 E437	48.83-48.73	Left	88.97	79.71	11.38	22.01	65.676
9Li207	N587 E437	48.93-48.83	Left	59.01	54.39	8.69	15.43	21.215
9Li207	N587 E437	48.83-48.73	Left	59.05	54.31	9.31	14.94	20.458
9Li207	N587 E437	48.83-48.73	Left	65.23	59.29	9.57	16.53	26.53

APPENDIX F—(*Continued*)

Site #	Unit	Level	Side	VL, mm	VW, mm	HW, mm	AS, mm	Wght, g
9Li207	N587 E437	48.83-48.73	Left	83.28	76.33	12.28	21.46	64.819
9Li207	N587 E437	48.83-48.73	Left	56.5	51.09	9.69	14.85	25.186
9Li207	N587 E437	48.83-48.73	Left	76.3	69.23	10.52	19.27	44.91
9Li207	N587 E437	48.83-48.73	Left	76.26	67.51	10.56	20.36	44.593
9Li207	N587 E437	48.83-48.73	Left	83.04	76.86	11.87	21.18	58.653
9Li207	N587 E437	49.03-48.93	Left	62.29	56.39	9.96	16.25	23.718
9Li207	N587 E437	49.03-48.93	Left	82.55	80.5	14.02	25.31	74.416
9Li207	N587 E437	48.83-48.73	Left	76.63	69.77	11.79	21.77	40.891
9Li207	N587 E437	48.83-48.73	Left	94.32	86.82	14.62	24.03	86.065
9Li207	N587 E437	48.83-48.73	Left	85.19	78.82	13.03	22.28	61.73
9Li207	N587 E437	48.83-48.73	Left	95.75	86.59	13.91	23.38	80.815
9Li207	N586 E441	49.09-48.99	Left	51.91	46.85	7.97	14.03	13.139
9Li207	N586 E441	48.79-48.69	Left	48.46	44.8	7.47	12.75	12.614
9Li207	N586 E441	48.99-48.89	Left	72.65	65.13	11.65	16.89	48.253
9Li207	N586 E441	48.99-48.89	Left	59.75	56.72	10.59	17.23	26.911
9Li207	N586 E441	48.99-48.89	Left	53.96	50.42	8.07	14.06	17.516
9Li207	N586 E441	48.99-48.89	Left	61.49	56.64	10.19	15.74	25.211
9Li207	N586 E441	48.89-48.79	Left	57.14	50.7	8.84	14.02	16.627
9Li207	N586 E441	48.89-48.79	Left	84.46	76.21	14.05	21.9	60.137
9Li207	N586 E441	48.79-48.69	Left	52.09	48.26	8.21	14.1	14.22
9Li207	N586 E441	48.79-48.69	Left	55.47	49.62	8.12	13.6	17.223
9Li207	N586 E441	48.79-48.69	Left	57.25	53.53	10.03	14.71	21.961
9Li207	N576 E453	49.03-48.93	Left	62.63	59.29	10.1	15.73	27.004
9Li207	N576 E453	48.83-48.73	Left	49.84	44.98	6.9	13.21	11.983
9Li207	N576 E453	48.93-48.83	Left	52.2	46.2	7.49	14.72	13.585
9Li207	N576 E453	48.93-48.83	Left	75.48	68.19	10.61	19.29	39.959
9Li207	N576 E453	48.93-48.83	Left	64.74	60.68	10.39	19.38	28.238
9Li207	N576 E453	48.93-48.83	Left	62.53	54.39	9.42	15.73	21.082
9Li207	N576 E453	48.93-48.83	Left	83.97	77.11	11.79	20.92	61.684
9Li207	N576 E453	49.03-48.93	Left	53.38	47.72	7.92	15.12	14.935
9Li207	N576 E453	49.03-48.93	Left	47.8	43.62	7.01	12.88	12.02
9Li207	N576 E453	49.03-48.93	Left	53.37	46.62	8.38	13.82	14.084
9Li207	N576 E453	49.03-48.93	Left	48.83	44.62	7.71	12.47	14.406
9Li207	N576 E453	49.03-48.93	Left	77.58	66.35	11.21	19.94	44.343
9Li207	N576 E453	48.93-48.83	Left	53.33	48.16	8.48	13.78	14.781
9Li207	N576 E453	48.93-48.83	Left	65.95	64.57	12.68	18.2	38.367
9Li207	N576 E453	48.93-48.83	Left	62.44	57.83	9.74	16.44	28.828
9Li207	N576 E453	48.93-48.83	Left	58.21	50.41	8.54	13.97	19.682
9Li207	N576 E453	48.93-48.83	Left	72.38	65.33	10.22	17.54	37.41
9Li207	N576 E453	48.93-48.83	Left	69.98	64.61	10.36	18.76	32.372
9Li207	N575 E453	49.09-48.99	Left	63.34	58.72	10.45	16.07	31.989
9Li207	N575 E453	48.89-48.79	Left	69.42	64.27	10.89	18.56	38.918
9Li207	N575 E453	48.89-48.79	Left	76.75	65.68	10.76	20.31	32.753
9Li207	N575 E453	48.89-48.79	Left	54.47	48.53	8.4	14.68	16.367
9Li207	N575 E453	48.89-48.79	Left	50.27	46.63	7.45	13.78	13.733
9Li207	N575 E453	48.89-48.79	Left	57.82	52.52	9.05	16.2	20.869
9Li207	N575 E453	48.89-48.79	Left	52.86	47.78	8.06	14.63	13.149
9Li207	N575 E453	48.89-48.79	Left	76.26	66.11	11.09	18.85	46.691
9Li207	N575 E453	48.89-48.79	Left	62.1	58.44	9.43	17.48	23.92
9Li207	N575 E453	48.89-48.79	Left	77.49	71.54	11.4	20.04	45.984

APPENDIX F—(*Continued*)

Site #	Unit	Level	Side	VL, mm	VW, mm	HW, mm	AS, mm	Wght, g
9Li207	N575 E453	48.89-48.79	Left	69.36	61.52	10.29	18.45	31.919
9Li207	N575 E453	48.99-48.89	Left	67.02	60.19	10.03	17.06	30.37
9Li207	N575 E453	48.99-48.89	Left	—	48.5	9.26	—	16.117
9Li207	N575 E453	48.99-48.89	Left	48.9	44.6	7.63	13.3	14.116
9Li207	N575 E453	48.99-48.89	Left	52.65	49.07	8.24	14.76	14.921
9Li207	N575 E453	48.99-48.89	Left	50.63	46.3	7.8	12.76	14.619
9Li207	N575 E453	48.99-48.89	Left	—	72.68	13.29	—	49.08
9Li207	N575 E453	48.99-48.89	Left	63.53	58.35	10.16	17.29	28.757
9Li207	N575 E453	48.99-48.89	Left	53.9	—	9.06	15.19	16.736
9Li207	N575 E453	49.09-48.99	Left	51.37	46.97	8.06	14.15	15.185
9Li207	N575 E453	49.09-48.99	Left	59.66	54.53	9.85	13.75	25.098
9Li207	N575 E453	49.09-48.99	Left	65.36	59.99	10.72	17.08	36.872
9Li207	N575 E453	48.99-48.89	Left	67.6	61.04	10.4	16.44	33.13
9Li207	N575 E453	48.79-48.69	Left	93.8	85.25	15.81	22.6	99.334
9Li207	N575 E453	48.99-48.89	Left	76.35	65.32	10.44	19.7	36.256
9Li207	N575 E453	48.99-48.89	Left	47.48	45.44	6.96	12.71	10.427
9Li207	N575 E453	48.89-48.79	Left	78.38	66.48	11.47	19.38	45.244
9Li207	N575 E453	48.89-48.79	Left	68.07	61.1	10.6	18.28	33.02
9Li207	N575 E453	48.89-48.79	Left	80.78	70.37	10.91	18.26	51.253
9Li207	N575 E453	48.89-48.79	Left	55.04	50.26	8.21	15.05	15.833
9Li207	N569 E458	48.77-48.67	Left	82.09	76.08	12.11	12.56	59.477
9Li207	N569 E458	48.77-48.67	Left	78.1	69.73	9.63	16.92	41.676
9Li207	N569 E458	48.77-48.67	Left	48.63	45.93	6.47	11.5	13.382
9Li207	TP VII	48.85-48.75	Left	55.18	51.52	8.59	14.61	21.006
9Li207	TP VII	49.75-48.67	Left	47.68	43.8	7.47	12.92	11.27
9Li207	TP VII	49.75-48.67	Left	72.91	67.83	12.23	17.9	45.079
9Li207	TP VII	49.75-48.67	Left	47.45	42.32	6.89	12.37	11.342
9Li207	TP VII	49.75-48.67	Left	62.08	56.05	—	15.55	29.043
9Li207	TP VII	49.75-48.67	Left	53.42	48	7.44	14.03	14.565
9Li207	TP VII	49.75-48.67	Left	43.01	38.24	6.03	11.33	8.03
9Li207	TP VII	49.75-48.67	Left	73.29	67.63	11.98	18.4	46.07
9Li207	TP VII	49.75-48.67	Left	78.01	71.48	10.53	19.81	44.206
9Li207	TP VII	49.75-48.67	Left	58.27	52.24	8.39	14.96	19.139
9Li207	TP VII	49.75-48.67	Left	68.66	63.99	10.89	17.54	32.7
9Li207	TP VII	48.85-48.75	Left	51.56	47.82	8.11	13.46	15.914
9Li207	TP VII	49.75-48.67	Left	82.81	74.19	13.83	21.28	52.714
9Li207	TP VII	49.75-48.67	Left	47.13	43.88	6.8	11.66	8.517
9Li207	TP VII	49.75-48.67	Left	—	47.49	8.95	—	14.498
9Li207	TP VII	49.75-48.67	Left	82.65	78.1	12.65	20.99	54.519
9Li207	TP VII	48.65-48.55	Left	72.26	69.6	11.7	18.04	43.08
9Li207	TP VII	48.85-48.75	Left	65.21	60.8	9.81	16.97	32.815
9Li207	TP VII	48.85-48.75	Left	74.4	68.68	12.21	19.66	52.836
9Li207	TP VII	48.85-48.75	Left	73.76	68.36	12.09	19.36	43.903
9Li207	TP VII	48.85-48.75	Left	86.93	78.89	13.44	22.5	62.773
9Li207	TP VII	48.85-48.75	Left	78.11	72.84	12.08	18.06	57.724
9Li207	TP VII	48.85-48.75	Left	65.78	61.31	10.52	16.53	29.457
9Li207	TP VII	49.75-48.67	Left	58.71	53.38	9.5	14.14	23.029
9Li207	TP VI	48.88-48.78	Left	54.26	49.21	7.42	13.55	15.734
9Li207	TP VI	48.68-48.58	Left	55.74	51.4	7.34	15.38	15.283
9Li207	TP VI	48.88-48.78	Left	81.29	73.84	11.84	19.33	51.606

APPENDIX F—(*Continued*)

Site #	Unit	Level	Side	VL, mm	VW, mm	HW, mm	AS, mm	Wght, g
9Li207	TP VI	48.88-48.78	Left	67.53	63.27	10.69	18.72	35.171
9Li207	TP VI	48.88-48.78	Left	80.9	73.28	11.21	21.06	47. 878
9Li207	TP VI	48.88-48.78	Left	75.97	66.58	9.54	20.24	40.349
9Li207	TP VI	48.88-48.78	Left	61.66	56.19	8.48	16.45	26. 568
9Li207	TP VI	48.88-48.78	Left	60.57	55.73	8.84	14.73	26.492
9Li207	TP VI	48.88-48.78	Left	65.83	61.67	9.36	18.41	29.774
9Li207	TP VI	48.88-48.78	Left	51.87	47.76	8.24	14.36	18.483
9Li207	TP VI	48.68-48.58	Left	94.19	89.23	16.44	24.26	105.144
9Li207	TP VI	48.88-48.78	Left	72.51	67.32	11.42	19.34	42.971
9Li207	TP VI	48.68-48.58	Left	66.07	60.59	9.8	18.08	29.379
9Li207	TP VI	48.68-48.58	Left	64.61	57.7	8.82	16.76	28.22
9Li207	TP VI	48.68-48.58	Left	64.63	59.52	9.72	17.51	26.894
9Li207	TP VI	48.68-48.58	Left	47.89	44.57	6.51	13.21	11.52
9Li207	TP VI	48.68-48.58	Left	81.38	74.51	12.85	21.58	57.383
9Li207	TP VI	48.68-48.58	Left	86.41	72.52	12.26	21.86	56.314
9Li207	TP VI	48.68-48.58	Left	74.55	68.05	10.14	17.03	40.485
9Li207	TP VI	48.68-48.58	Left	48.63	44.5	6.82	13.93	11.764
9Li207	TP VI	48.68-48.58	Left	58.9	53.51	9.93	15.79	23.276
9Li207	TP VI	48.68-48.58	Left	68.07	62.08	10.93	17.09	37.397
9Li207	TP VI	48.88-48.78	Left	75.73	69.92	11.31	20.15	43.192
9Li207	TP VI	48.68-48.58	Left	79.54	71.86	13.56	18.85	58.806
9Li207	TP VI	48.68-48.58	Left	65.24	56.22	9.43	16.17	25.366
9Li207	TP VI	48.68-48.58	Left	46.41	33.53	7.69	14.27	13.551
9Li207	TP VI	48.68-48.58	Left	64.26	57.64	8.61	15.92	25.009
9Li207	TP VI	48.68-48.58	Left	59.33	55.21	9.72	16.12	23.822
9Li207	TP VI	48.68-48.58	Left	61.21	55.5	10.97	16.65	25.804
9Li207	TP VI	48.78-48.68	Left	70.92	66.32	12.17	19.14	41.671
9Li207	TP VI	48.68-48.58	Left	68.24	62.71	10.6	17.74	33.919
9Li207	TP VI	48.68-48.58	Left	70.38	65.93	10.59	16.7	34.952
9Li207	TP VI	48.68-48.58	Left	57.94	54.96	9.27	15.15	22.193
9Li207	TP VI	48.68-48.58	Left	63.77	57.83	8.55	16.82	24.124
9Li207	TP VI	48.68-48.58	Left	78.21	71.23	12.04	19.94	51.554
9Li207	N584 E466	48.78-48.68	Left	83.11	78.09	13.07	21.2	63.097
9Li207	N584 E466	48.58-48.48	Left	46.74	44.06	8.13	13.08	11.262
9Li207	N584 E466	48.88-48.78	Left	62.6	59.12	9.75	16.55	26.992
9Li207	N584 E466	48.88-48.78	Left	59.66	57.29	10.81	16.77	25.464
9Li207	N584 E466	48.88-48.78	Left	62.32	54.36	8.72	15.29	21.751
9Li207	N584 E466	48.88-48.78	Left	63.24	59.95	9.32	16.83	32.492
9Li207	N584 E466	48.88-48.78	Left	79.49	73.94	12.64	21.48	50.765
9Li207	N584 E466	48.88-48.78	Left	78.55	71.89	12.39	20.6	42.741
9Li207	N584 E466	48.88-48.78	Left	—	—	22.12	30.64	160.216
9Li207	N584 E466	48.48-48.38	Left	54.76	49.18	7.7	14.85	15.17
9Li207	N584 E466	48.78-48.68	Left	69.15	68.57	11.47	—	31.976
9Li207	N584 E466	48.78-48.68	Left	43.77	38.93	7.23	12.22	9.843
9Li207	N584 E466	48.78-48.68	Left	90.05	82.74	15.69	23	88.588
9Li207	N584 E466	48.78-48.68	Left	48.39	47.12	7.72	13.19	12.34
9Li207	N584 E466	48.78-48.68	Left	60.06	55.31	9.2	15.86	21.614
9Li207	N584 E466	48.68-48.58	Left	64.37	60.22	9.84	16.1	32.811
9Li207	N584 E466	48.68-48.58	Left	52.04	48.1	8.11	14.53	14.811
9Li207	N584 E466	48.78-48.68	Left	57	55.05	8.73	15.69	20.254

APPENDIX F—(*Continued*)

Site #	Unit	Level	Side	VL, mm	VW, mm	HW, mm	AS, mm	Wght, g
9Li207	N584 E466	48.78-48.68	Left	68.88	61.53	10.87	16.7	35.906
9Li207	N584 E466	48.78-48.68	Left	85.35	77.28	13.68	20.8	69.062
9Li207	N584 E466	48.78-48.68	Left	91.49	83.66	13.87	23.91	91.95
9Li207	N584 E466	48.68-48.58	Left	81.18	72.06	12.87	20.73	59.002
9Li207	N584 E466	48.68-48.58	Left	65.13	59.17	9.72	16.46	22.901
9Li207	N584 E466	48.68-48.58	Left	83.18	74.73	11.92	20.87	48.048
9Li207	TP VIII	sur-48.40	Left	54.76	49.49	8.65	14	17.645
9Li207	TP VIII	48.30-48.20	Left	49.36	45.44	7.74	13.24	12.527
9Li207	TP VIII	48.30-48.20	Left	63.63	56.89	8.77	16.93	22.703
9Li207	TP VIII	48.30-48.20	Left	91.43	78.48	12.27	21.5	64.715
9Li207	TP VIII	48.40-48.30	Left	57.17	52.38	9.39	14.91	19.683
9Li207	TP VIII	48.40-48.30	Left	77.17	68.78	11.8	19.37	44.342
9Li207	TP VIII	48.40-48.30	Left	54.92	51.67	9.69	15.5	20.953
9Li207	TP VIII	48.40-48.30	Left	43.57	38.81	7.44	11.8	8.918
9Li207	TP VIII	Surface-48.40	Left	50.34	46.49	8.64	13.4	13.983
9Li207	TP VIII	Surface-48.40	Left	55.03	48.51	8.71	15.03	16.238
9Li207	TP VIII	48.40-48.30	Left	68.31	63.53	10.75	18.3	31.202
9Li207	TP VIII	48.40-48.30	Left	49.77	48.18	8.82	13.63	16.972
9Li207	TP VIII	48.40-48.30	Left	59.45	55.3	9.76	15.13	21.909
9Li207	TP VIII	48.40-48.30	Left	56.31	50.71	8.22	14.4	15.763
9Li207	TP VIII	48.40-48.30	Left	74.92	68.33	12.72	19.5	50.824
9Li207	TP VIII	48.30-48.20	Left	81.36	73.06	12.87	19.94	53.541
9Li207	TP VIII	48.30-48.20	Left	52.5	48.85	7.83	14.48	16.249
9Li207	TP VIII	48.30-48.20	Left	70.97	65.59	11.51	17.26	33.557
9Li207	N557 E482	48.44-48.34	Left	49.2	46.19	7.41	13.63	12.754
9Li207	N557 E482	48.24-48.14	Left	54.06	49.56	8.27	—	13.833
9Li207	N557 E482	48.44-48.34	Left	78.11	70.18	10.9	19.65	46.863
9Li207	N557 E482	48.34-48.24	Left	49.73	44.57	7.54	12	14.089
9Li207	N557 E482	48.34-48.24	Left	55.42	50.44	7.99	13.25	15.497
9Li207	N557 E482	48.34-48.24	Left	72.92	67.8	11.18	19.43	37.433
9Li207	N557 E482	48.24-48.14	Left	62.24	55.28	9.58	15.64	27.382
9Li207	N557 E482	48.24-48.14	Left	51.92	44.68	7.49	13.3	13.075
9Li207	N557 E482	48.24-48.14	Left	68.17	62.51	10.57	16.81	33.536
9Li207	N557 E482	48.24-48.14	Left	51.89	46.66	7.15	13.3	10.797
9Li207	N513 E507	sur-50.15	Left	61.42	53.38	8.49	14.48	19.466
9Li207	N513 E507	50.05-49.95	Left	59.66	52.66	9.29	16.09	21.099
9Li207	N513 E507	50.05-49.95	Left	65.93	61.27	9.56	17.66	25.867
9Li207	N513 E507	50.05-49.95	Left	63.65	56.5	9.07	17.2	20.829
9Li207	N513 E507	50.05-49.95	Left	58.05	54.14	9.12	15.47	20.513
9Li207	N513 E507	50.05-49.95	Left	57.91	53.67	9.09	15.54	18.37
9Li207	N513 E507	50.05-49.95	Left	53.27	48.06	9.11	14.08	16.182
9Li207	N513 E507	50.05-49.95	Left	62.94	56.68	9.2	16.5	23.55
9Li207	N513 E507	50.05-49.95	Left	47.46	43.51	6.62	13.44	10.864
9Li207	N513 E507	50.05-49.95	Left	60.53	57.24	9.35	16.11	26.611
9Li207	N513 E507	50.05-49.95	Left	55.1	51.83	9.09	15.31	17.416
9Li207	N513 E507	50.15-50.05	Left	65	58.84	10.06	17.93	25.501
9Li207	N513 E507	50.05-49.95	Left	60.78	56.33	9.51	17.01	21.28
9Li207	N513 E507	50.15-50.05	Left	74.5	67.67	9.73	19.57	33.213
9Li207	N513 E507	50.15-50.05	Left	70.3	65.68	12.18	17.23	37.751
9Li207	N513 E507	50.15-50.05	Left	68.66	62.83	10.67	17.46	33.238

APPENDIX F—(*Continued*)

Site #	Unit	Level	Side	VL, mm	VW, mm	HW, mm	AS, mm	Wght, g
9Li207	N513 E507	50.05-49.95	Left	69.58	60.82	10.48	16.28	32.989
9Li207	N513 E507	50.05-49.95	Left	51.42	45.65	7.38	13.38	13.516
9Li207	N513 E507	50.05-49.95	Left	62.5	58.11	11.39	14.45	28.382
9Li207	N513 E507	50.05-49.95	Left	74.69	68.66	10.63	18.37	34.405
9Li207	N513 E507	50.05-49.95	Left	61.95	56.91	9.65	14.85	22.018
9Li207	N513 E507	50.05-49.95	Left	74.88	68.04	10.91	18.39	39.017
9Li207	TP IX	50.12-50.02	Left	66.27	61.52	8.94	17.65	23.031
9Li207	TP IX	49.92-49.82	Left	58.79	53.23	8.16	14.55	19.368
9Li207	TP IX	50.12-50.02	Left	80.19	73.41	14.48	20.06	65.075
9Li207	TP IX	50.12-50.02	Left	63.08	58.23	10.64	15.57	30.868
9Li207	TP IX	50.12-50.02	Left	64.77	59.32	10.54	16.75	31.49
9Li207	TP IX	50.12-50.02	Left	59.02	52.88	7.71	14.19	18.692
9Li207	TP IX	50.12-50.02	Left	67.6	62.09	12.34	17.09	39.888
9Li207	TP IX	50.12-50.02	Left	67.64	60.54	10.49	17.79	29.79
9Li207	TP IX	50.12-50.02	Left	46.29	42.82	7.36	12.41	10.443
9Li207	TP IX	50.12-50.02	Left	49.26	44.03	6.8	13.17	12.965
9Li207	TP IX	50.12-50.02	Left	47.8	42.31	7.25	12.01	11.659
9Li207	TP IX	50.12-50.02	Left	74.02	69.32	12.4	19.93	51.442
9Li207	TP IX	50.12-50.02	Left	61.78	56.37	9.75	15.92	20.756
9Li207	TP IX	50.12-50.02	Left	60.2	54.26	8.99	15.92	25.343
9Li207	TP IX	50.02-49.92	Left	82.75	76.45	12.93	19.56	56.61
9Li207	TP IX	50.02-49.92	Left	82.65	75.24	13.2	21.17	64.861
9Li207	TP IX	50.02-49.92	Left	63.28	57.01	8.73	16.33	21.045
9Li207	TP IX	50.02-49.92	Left	47.32	42.92	7.2	12.28	10.723
9Li207	TP IX	50.02-49.92	Left	47.44	42.53	6.02	13	9.247
9Li207	TP IX	50.02-49.92	Left	62.86	58.2	9.07	16.66	24.699
9Li207	TP IX	50.02-49.92	Left	47.6	43.99	7.55	13.74	12.662
9Li207	TP IX	50.02-49.92	Left	53.97	51.3	7.28	16.1	14.168
9Li207	TP IX	50.12-50.02	Left	72.8	67.03	11.28	18.89	36.635
9Li207	TP IX	50.02-49.92	Left	58.42	53.91	8.51	16.03	22.244
9Li207	TP IX	50.02-49.92	Left	52.22	46.74	7.67	13.96	12.514
9Li207	TP IX	50.02-49.92	Left	70.3	64.82	10.69	18.51	33.991
9Li207	TP IX	50.02-49.92	Left	70.46	63.98	10.54	18.35	32.137
9Li207	TP IX	50.12-50.02	Left	76.68	69.72	9.99	19.25	38.024
9Li207	TP IX	50.02-49.92	Left	47.02	41.1	6.46	11.78	10.918
9Li207	TP IX	50.02-49.92	Left	48.9	45.24	8.5	12.67	12.524
9Li207	TP IX	50.02-49.92	Left	62.84	57.19	8.91	16.27	25.498
9Li207	TP IX	50.02-49.92	Left	81.05	74.32	11.3	20.78	48.848
9Li207	TP IX	50.02-49.92	Left	82.93	74.65	12.47	20.54	47.677
9Li207	N488 E495	49.96-49.86	Left	85.45	78.13	13.66	20.41	55.815
9Li207	N488 E495	49.96-49.86	Left	71.5	67.28	10.53	18.85	37.352
9Li207	N488 E495	49.96-49.86	Left	69.34	64.84	10.76	17.58	37.772
9Li207	N488 E495	49.96-49.86	Left	66.12	60.64	10.75	17.63	32.253
9Li207	N488 E495	49.96-49.86	Left	59.64	55.25	9.45	15.75	21.602
9Li207	N488 E495	49.96-49.86	Left	65.84	58.23	9.94	17.52	23.73
9Li207	N488 E495	49.96-49.86	Left	49.63	48.91	8.12	14.44	16.312
9Li207	N488 E495	49.86-49.76	Left	75.87	69.78	12.28	17.52	46.817
9Li207	N493 E499	49.95-49.85	Left	60.31	53.04	9.65	15.17	21.914
9Li207	N493 E499	49.85-49.75	Left	72.54	65.73	12.37	18.14	39.091
9Li207	N493 E499	49.85-49.75	Left	68.88	64.06	11.92	18.14	39.107

APPENDIX F—(*Continued*)

Site #	Unit	Level	Side	VL, mm	VW, mm	HW, mm	AS, mm	Wght, g
9Li207	N493 E499	49.85-49.75	Left	85.36	79.11	15.16	21.45	73.669
9Li207	N493 E499	49.85-49.75	Left	72.69	64.97	11.37	17.65	39.379
9Li207	N493 E499	49.85-49.75	Left	62.03	56.3	9.48	15.44	23.679
9Li207	N493 E499	49.85-49.75	Left	68.05	60.2	10.39	17.09	29.505
9Li207	N493 E499	49.85-49.75	Left	75.15	70.39	10.81	19.45	40.476
9Li207	N493 E499	49.85-49.75	Left	66.17	59.59	11.06	16.84	31.576
9Li207	N493 E499	49.85-49.75	Left	80.84	73.28	12.25	19.61	47.784
9Li207	N493 E499	49.85-49.75	Left	63.56	58.39	10.28	16.79	33.235
9Li207	N493 E499	49.95-49.85	Left	54.45	50.04	8.52	15.16	19.194
9Li207	N493 E499	49.85-49.75	Left	80.48	74.02	12.15	20.84	50.078
9Li207	N493 E499	49.85-49.75	Left	71.07	62.64	9.04	16.8	30.163
9Li207	N493 E499	49.85-49.75	Left	65.84	60.64	10.75	16.4	28.535
9Li207	N493 E499	49.85-49.75	Left	45.92	42.43	7.31	12.57	10.789
9Li207	N493 E499	49.85-49.75	Left	74.53	69.43	12.5	17.83	45.037
9Li207	N493 E499	49.85-49.75	Left	79.67	75.79	12.47	19.66	61.347
9Li207	N493 E499	49.85-49.75	Left	64.47	58.21	9.47	16.02	25.109
9Li207	N493 E499	49.85-49.75	Left	66.58	61.08	10.71	15.8	35.035
9Li207	N493 E499	49.85-49.75	Left	62.49	57.66	9.3	16.09	25.562
9Li207	N493 E499	49.85-49.75	Left	80.24	72.36	13.16	19.96	58.568
9Li207	N493 E499	49.95-49.85	Left	67.18	61.05	10.55	17.29	30.127
9Li207	N493 E499	49.85-49.75	Left	79.74	72.32	12.37	20.59	51.694
9Li207	N493 E499	49.85-49.75	Left	69.22	62.45	10.51	18.76	32.993
9Li207	N493 E499	49.85-49.75	Left	84.39	77.77	12.46	19.09	55.887
9Li207	N493 E499	49.85-49.75	Left	88.33	80.56	12.4	19.85	63.608
9Li207	N493 E499	49.75-49.65	Left	68.83	61.44	9.9	17.3	28.08
9Li207	N493 E499	49.75-49.65	Left	78.06	67.82	10.39	18.98	38.924
9Li207	N493 E499	49.75-49.65	Left	57.37	50.53	7.01	14.01	14.471
9Li207	N493 E499	49.55-49.45	Left	66.64	60.85	9.88	16.47	27.635
9Li207	N493 E499	49.75-49.65	Left	70.79	63.44	11.39	18.13	38.288
9Li207	N493 E499	49.95-49.85	Left	67	64.37	11.56	18.12	33.076
9Li207	N493 E499	49.95-49.85	Left	50.05	46.21	7.69	14.18	14.35
9Li207	N493 E499	49.95-49.85	Left	78.46	70.97	10.63	18.68	39.898
9Li207	N493 E499	49.95-49.85	Left	70.19	64.26	10.28	18.9	33.745
9Li207	N493 E499	49.85-49.75	Left	64	58.06	8.92	16.09	22.448
9Li207	N493 E499	49.85-49.75	Left	64.23	55.8	9.11	16.21	22.552

APPENDIX G

BIOMASS REGRESSION FORMULAE

Taxon	N	Slope (b)	Y-intercept (log a)	r^2
Bivalvia	80	0.68	0.02	0.83
Anadara sp.	62	1.24	-1.05	0.73
Geukensia demissa	100	0.80	-0.22	0.86
Crassostrea virginica	100	0.97	-0.77	0.97
Tagelus plebeius	46	0.99	0.29	0.95
Mercenaria sp.	40	0.94	-0.50	0.95
Gastropoda	135	0.92	-0.16	0.89
Littorina irrorata	62	0.94	-0.34	0.97
Busycon carica	16	0.84	-0.12	0.92
Busycon canaliculatum	17	1.53	-1.07	0.93
Nassarius obsoletus	50	1.06	-0.44	0.93
Callinectes sapidus	11	0.82	0.99	0.58
Chondrichthys	17	0.86	1.68	0.85
Actinopterygii	393	0.81	0.90	0.80
Non-Perciformes	229	0.79	0.85	0.85
Lepisosteidae	26	0.87	1.13	0.96
Siluriformes	36	0.95	1.15	0.87
Perciformes	274	0.83	0.93	0.76
Serranidae	18	1.08	1.51	0.85
Centrarchidae	38	0.84	0.76	0.80
Carangidae	17	0.88	1.23	0.86
Sparidae	22	0.92	0.96	0.98
Sciaenidae	99	0.74	0.81	0.73
Pleuronectiformes	21	0.89	1.09	0.95
Testudines	26	0.67	0.51	0.55
Serpentes	26	1.01	1.17	0.97
Aves	307	0.91	1.04	0.97
Mammalia	97	0.90	1.12	0.94

Note: $Y=aX^b$ where Y is biomass or meat weight, X is bone weight, a is the Y-intercept, and b is the slope. N is the number of observations (Quitmyer and Reitz 2006; Reitz et al. 1987; Reitz and Wing 2008:234-242).

APPENDIX H

FISH BODY-SIZE REGRESSION FORMULAE

Taxon	N	Slope (b)	Y-intercept (log a)	r^2
Otolith Width (mm) to Standard Length (mm)				
Ariidae	214	1.1	1.35	0.76
Bairdiella chrysoura	68	1.09	1.32	0.92
Cynoscion sp.	94	1.83	0.98	0.93
Micropogonias undulatus	65	1.06	1.32	0.93
Stellifer lanceolatus	12	1.76	1.1	0.93
Otolith Length (mm) to Standard Length (mm)				
Cynoscion sp.	94	1.27	0.94	0.95
Leiostomus xanthurus	86	1.39	1.06	0.86
Menticirrhus sp.	45	1.27	1.13	0.97
Micropogonias undulatus	65	1.19	1.06	0.95
Pogonias cromis, Sciaenops ocellatus	75	1.238	1.05	0.91
Atlas Width (mm) to Standard Length (mm)				
Mugil sp.	55	0.852	1.803	0.96
Sciaenidae	152	0.61	1.93	0.65

Note: $Y=aX^b$, where Y is standard length, X is specimen measurement, a is the Y-intercept, and b is the slope. N is the number of observations (Sciaenidae formula is from Reitz and Wing 2008:68; Ariidae and Mugil formulae are from Colaninno 2010; individual sciaenid formulae are from measurements performed by Colaninno, the author, and UGA Zooarchaeology Lab staff, currently unpublished).

APPENDIX I

CATFISHES SECTIONED FOR GROWTH RATE STUDY

Sample #	Site #	Taxon	Unit	Level	Element	Side	Len, mm	Brt, mm	Wdh, mm	Th, mm	Wght, g
8	9Li1637	*Bagre marinus*	TP I	80-90	Otolith	Right	15.18	14.79	13.15	7.01	1.592
18	9Li1637	*Bagre marinus*	TP II	20-30	Otolith	Right	16.11	14.94	13.42	7.07	1.729
19	9Li1637	*Bagre marinus*	TP II	70-80	Otolith	Right	15.78	15.03	13.14	7.38	1.873
32	9Li207	*Ariopsis felis*	N584 E466	48.98-48.88	Otolith	Right	12.55	11.14	11.1	5.46	0.776
35	9Li207	*Ariopsis felis*	TP VI	48.78-48.68	Otolith	Right	11.1	9.9	9.49	4.68	0.515
36	9Li207	*Ariopsis felis*	TP VII	48.75-48.65	Otolith	Right	10.1	9.6	8.74	4.3	0.41
37	9Li207	*Ariopsis felis*	N569 E458	48.77-48.67	Otolith	Right	11.55	10.61	9.78	4.71	0.574
39	9Li207	*Bagre marinus*	N569 E458	48.77-48.67	Otolith	Right	13.81	13.08	11.43	6.41	1.135
41	9Li207	*Bagre marinus*	N586 E441	48.79-48.69	Otolith	Right	17.34	16.28	14.31	8.67	2.389
42	9Li207	*Bagre marinus*	N576 E453	49.03-49.93	Otolith	Right	12.07	11.65	10.43	5.63	0.8
43	9Li207	*Bagre marinus*	N575 E453	49.09-48.99	Otolith	Right	14	14.39	12.44	6.24	1.342
46	9Li207	*Bagre marinus*	N575 E453	48.89-48.79	Otolith	Right	11.96	11.71	10.15	5.19	0.702
64	9Li21	*Ariopsis felis*	Zeta	0-10	Otolith	Left	10.16	9.46	8.64	4.01	0.396
65	9Li21	*Ariopsis felis*	Epsilon	0-10	Otolith	Left	12.14	10.83	10.11	5.46	0.698
68	9Li21	*Ariopsis felis*	Gamma	10-20	Otolith	Right	8.85	8.49	7.69	4.33	0.327
69	9Li21	*Ariopsis felis*	N501 E80	30-40	Otolith	Right		10.63	9.71	4.37	0.498
70	9Li21	*Ariopsis felis*	N501 E80	40-50	Otolith	Right	11.68	10.44	10.19	4.59	0.569
71	9Li230	*Ariopsis felis*	Iota	30-40	Otolith	Left	10.09	9.11	8.85	5.2	0.412
72	9Li229	*Ariopsis felis*	N179 E84	10-20	Otolith	Right	9.23	8.59	8.2	3.86	0.307
73	9Li229	*Ariopsis felis*	N179 E84	10-20	Otolith	Right	10.37	9.67	8.98	5.14	0.524
74	9Li21	*Bagre marinus*	Gamma	20-35	Otolith	Left	15.9	15.84	13.69	6.99	1.812
75	9Li21	*Bagre marinus*	Alpha	10-20	Otolith	Right	16.37	15.87	13.81	7.37	1.987
76	9Li21	*Bagre marinus*	Alpha	0-10	Otolith	Right	14.74	14.5	12.77	6.95	1.532
78	9Li230	*Ariopsis felis*	Iota	30-40	Otolith	Right	7.4	7.53	6.73	3.55	0.18
83	9Li229	*Bagre marinus*	N179 E84	60-70	Otolith	Right	11.87	11.65	10.31	5.43	0.753
84	9Li229	*Bagre marinus*	N179 E84	10-20	Otolith	Right	12.33	12.55	10.92	5.63	0.926
85	9Li229	*Bagre marinus*	N179 E84	10-20	Otolith	Right	12.21	12.11	10.82	5.59	0.863
87	9Li229	*Bagre marinus*	N179 E84	10-20	Otolith	Right	15.12	14.82	12.95	7.39	1.768
88	9Li229	*Bagre marinus*	N179 E84	30-40	Otolith	Right	12.82	12.76	10.76	5.69	0.958