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DEPARTMENT OF ANTHROPOLOGY
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PREFACE

This volume presents the results of an archaeological investigation of Shelter Island, New York, that took place during the summer months of 1983 and 1984. Conducted as a field school project involving the collaboration of faculty and students from SUNY at Stony Brook, CUNY-Queens College and Suffolk County Community College, the investigation centered on the Mashomack Preserve, an approximately 825 hectare property located on the southeastern third of Shelter Island (see Figure 1). The Mashomack Preserve, owned and administrated by The Nature Conservancy, serves as an important sanctuary for many endangered plants and animals of eastern Long Island. Under the watchful eyes of Mashomack's ecologists, The Nature Conservancy granted us permission to undertake detailed subsurface survey work and limited excavation of selected archaeological remains.

The purpose of the project was to examine how prehistoric Native Americans adapted to a small woodland island of North-eastern America. Currently, there is considerable debate among archaeologists about the nature of human adaptations to coastal woodland environments. Interpretations vary concerning the pre-historic subsistence and settlement systems, especially along the lines of whether horticulture and sedentary life were widely adopted. From the outset we felt the study of Mashomack would provide an ideal opportunity to evaluate several issues of coastal adaptation in a small island environment.

The volume is organized in the following manner:

The first chapter outlines the theoretical issues that guided our study of prehistoric coastal adaptations on Shelter Island. The chapter begins with a discussion of the coastal sedentary model and the debate engendered by applying it to Long Island. The evaluation of nomadic forager and sedentary collector settlement systems using existing archaeological information is then considered. This discussion highlights significant shortcomings in our control of basic subsistence and settlement data, including the identification of site function, site size, site seasonality, and site subsistence patterns. Our research design was constructed to control for these basic data, and to evalute concepts concerning forager and collector settlement systems on Shelter Island.

The second chapter describes the present and past ecological conditions of Mashomack in some detail. Based in large part on the wealth of information contained in the Mashomack Preserve's Master Plan, which was compiled by various scientific special-ists, this discussion includes the vegetation, fauna, flora, geology, and topography of the study area. Six major habitats from the coastal and upland zones of Mashomack are described in detail.

The third chapter presents the first phase of the field research -- an intensive subsurface testing program designed to detect buried archaeological remains. Transect and block units were carefully surveyed to estimate the regional characteristics (density, diversity and spatial distribution) of prehistoric remains in different habitats of Mashomack.

The fourth chapter outlines the second phase of the field research -- the limited excavation of selected prehistoric remains detected during the survey. A variety of archaeological manifestations, including lithic scatters and shell middens, were selected for excavation in order to provide more detailed information on the natural and cultural stratigraphy, to augment the sample of artifactual material, to attempt to detect architectural features, and to collect well provenienced carbon-14 samples. Laboratory analyses of the excavated material included the study of lithic, ceramic and bone artifacts, the recovery and examination of floral and faunal remains, and the sectioning of *Mercenaria mercenaria* that provided information on the ecology and season of death of hard clams gathered by prehistoric people.

The fifth chapter sketches our interpretations of the regional settlement system of Mashomack's coastal hunter-gatherers. Based on the laboratory analysis of the survey and excavation materials, and a consideration of the spatial patterning of archaeological remains, we suggest that the Middle/Late Woodland people established small residential bases along the tidal creeks of Mashomack. From these bases of operation a variety of activities were performed in the near hinterland. The regional settlement pattern suggests that small homesteads of a relatively sedentary nature were dispersed across the coastal habitats of Shelter Island.

The final chapter summarizes the volume by attempting to answer several of the questions posed in the final pages of chapter one concerning coastal adaptations.

Limitations of the Field Project

It must be recognized from the outset that our study of the Mashomack is only a preliminary investigation of the island's rich archaeological record. The limitations of our study are threefold.

First, we limited our study to the precontact and contact period remains of Native Americans. For those who are interested in the historic Anglo-American occupation of the island, one can consult several books or articles (Duvall 1952; Mallmann 1899;

Dunhill 1982; Daniel 1982a) or obtain further information from the Shelter Island Public library and the Shelter Island Historical Society.

Second, our field investigation did not extend beyond the boundaries of the Mashomack Preserve, and our survey does not document a representative sample of prehistoric remains from the entire Shelter Island landscape. Previous research and observations from both professional and avocational archaeologists (Latham 1957; Dunhill 1982:4; Witek 1986; Norman Sanwald personal communication) indicate that there are a considerable number of Native American sites beyond the Mashomack Preserve. Any generalizations from our field sample to the total population of archaeological remains on Shelter Island must take this spatial limitation into account.

Finally, our study of Mashomack represents a detailed look at a very small area of the entire Preserve, with only about 5% of Mashomack actually field inspected. Given this small sample fraction, one must consider our results as preliminary at this time. Further field work, both within the Mashomack Preserve proper and in other areas of Shelter Island, may modify our interpretations of the Native American subsistence and settlement systems of this small wooded island in the future.

Acknowledgements

The Mashomack archaeological project was a team effort involving numerous specialists, students and volunteers. Without the assistance and cooperation of these many people the project would never have taken place. We owe a great debt of gratitude to the people who continually provided encouragement, vital resources, and an inspiring commitment to Long Island archaeology.

We are especially indepted to the graduate and undergraduate students of SUNY at Stony Brook, Queens College and Suffolk Community College who participated in the field work. The 1983 field season included Audrey Barnett, Geraldine Baldwin, Mitchel Cypes, Jacqueline Dauer, Dorothy Denonn, Jennifer Flood, Julie Horowitz, John Lore, Julian Mackay, Robin McMullen, Laurene Montero, Angela Moraitis, Bruce Stiriz, Carol Traynor and Adam Uhlan. The staff consisted of Robert Kalin, Owen Lindauer, Kent Lightfoot and Linda Wicks. The 1984 field season involved Thomas Cromwell, Douglas Doerr, Joan Failey, Don Ford, Gerald Gravina, Virginia Heisey, Sal Murgola, Barbara Manalili, Cindy Olsen, Fabiola Prahalis, Paul Sauter, Margaret Traynor, and Karen Shemet. The 1984 field staff consisted of Ellen Barcel, Robert Kalin, James Moore, Bernice Kirchin, Julian Mackay, Kent Lightfoot, Adam Uhlan and Wendy Rosfeld. Roberta Jewett served as chief consultant when any major field decisions were made.

A considerable amount of laboratory work was undertaken at SUNY at Stony Brook as part of the project. We are indebted to Adam Uhlan and Linda Wicks, who served as our first Laboratory Directors, and Mitchel Cypes, Aloysla Klebe, Gina Gelman, and Sal Murgola who washed, labeled and analyzed the artifacts from the 1983 field season. Linda Wicks and Robin McMullen cleaned, classified by species, and weighed the ample shellfish remains recovered during 1983.

Angela Gerardi served as the Laboratory Director during the period that the artifacts and shellfish remains from the 1984 field season were washed and catalogued. She was assisted by Thomas Cromwell, Michael Bonasera, Janet Hagopian, Jill Mayo, Cindy Olsen, Fabiola Prahalis, and Sal Murgola. Sal Murgola set up the flotation units at the Laboratory of Archaeology at SUNY at Stony Brook, and began the flotation of soil from Mashomack sites. He was later assisted by Lynn Hanson and Daniela Burroni, who processed a large quantity of soil through our flotation screens. The botanical remains recovered from the float samples were analyzed by Dr. Margaret Conover, Museum of Long Island Natural Sciences, SUNY at Stony Brook. The faunal remains were identified by Stephanie Rippel-Erikson of the Long Island Archaeological Project. Finally, the sectioning study of the Mercenaria mercenaria was directed by Dr. Robert Cerrato, Marine Sciences Research Center, SUNY at Stony Brook.

Special thanks are in order for Fran and Kathy Kalin, who served as the field school cooks for 1983 and 1984. Going beyond the call of duty repeatedly in their culinary skills, we have since learned that some students were enrolling in the field school course in order to sample the fine cuisine of the Kalin duo.

We owe a debt of gratitude to the Summer Session Office and the Continuing Education Department of SUNY at Stony Brook who provided much needed support for equipment and salaries. The summer field school program would not have been possible except for the generosity and enthusiasm of Megs Shea, Director of Summer Session; Fran Foster, Assistant to the Director; and Lester Paldy, the former Dean of Continuing Education.

A great many other Stony Brook administrators deserve special recognition for their close cooperation and continued assistance. These include Egon Neuberger, the Dean of the Social and Behavioral Sciences; Arthur Ammann of the Purchasing Department; Paul Madonna, Assistant Vice President; and Paul Chase of the President's office. We are very grateful to Gay Levine, Steven Englebright, and Muriel Porter Weaver who were instrumental in helping us set up the field program at the Mashomack Preserve.

The implementation of our field and laboratory program in Long Island archaeology has been greatly facilitated by Thomas Cramer, Deputy Commissioner, and Charles Voorhis, Director of Environmental Protection, Town of Brookhaven. The archaeology program at SUNY at Stony Brook prospered, in large part, because of their enthusiasm, support and friendship. We are delighted to thank these two community leaders on behalf of Long Island archaeology.

We greatly appreciate the generous assistance of University of California at Berkeley who provided the funding for this monograph. We are especially indebted to Gerald A. Mendelsohn, Dean of Social Sciences; William Simmons, Chair of the Anthropology Department; and John Graham, Coordinator of the Archaeological Research Facility, for supporting the publication of this volume in the Contributions of the Archaeological Research Facility. Suzanne Sundholm served as the production manager on all aspects of the monograph's publication. The illustrations were completed by Leslie Jungers and Joseph Muennig.

One of our greatest debts of gratitude is owed to the people of the Nature Conservancy who gave us permission to work and reside on the Mashomack Preserve. The archaeological crews were housed in the beautiful Victorian manor house that provided dormitory rooms, a huge kitchen, library, dining room and laboratory facilities. Our deepest thanks extend to Mike Laspia, the Director of the Mashomack Preserve, his wife Susan and their three children Erika, Novella and Jamie, who made us feel at home on the Preserve. Mike Laspia, known locally as the "Lord of the Manor", served as our close friend, consultant and liaison with The Nature Conservancy and the kind people of Shelter Island. Without the Laspia's continued support, assistance, and kindness the project would not have been possible.

CHAPTER ONE: THE RESEARCH GOALS

Currently, there is considerable debate on the lifeways of Long Island's prehistoric people. Interpretations among archaeologists vary markedly in the degree to which local populations adopted sedentary life, the degree to which they subsisted on wild and cultivated products, and the degree to which they aggregated into large residential settlements. Some archaeologists maintain that Long Island people were nomadic hunter-gatherers throughout the prehistoric period. Others suggest that sedentary communities evolved in some places and that horticulture was practiced.

The purpose of this chapter is to examine this debate in some detail, and to provide a brief overview on the state of Long Island archaeology. We begin the chapter with a discussion of the coastal sedentary model and the controversy it has engendered in applying it to Long Island. This discussion provides the framework for introducing concepts concerning forager and collector regional settlement systems, and for outlining basic research issues that need to be resolved on Long Island. The final section is an introduction to the regional field program being implemented in eastern Long Island. Here we justify why Shelter Island was chosen as our first study area, and the specific research questions we hoped to resolve through the study of Mashomack.

Coastal Sedentarism: The Model

A common theme in the literature on coastal archaeology is the relationship between productive coastlines and the evolution of sedentary communities. In a recent overview, Perlman (1980:261-263) has shown that coastal productivity varies substantially across both space and time, depending upon such factors as wave stress, and changes in the extent and topographic relief of the continental shelf. Changes in the resource base upon which hunter-gatherers depend would, of course, influence human adaptations to specific coastlines. Employing principles derived from optimal foraging models, Perlman (1976, 1980) examines how various coastal conditions might select for a wide range of different subsistence and settlement systems -- in some cases highly nomadic foragers, and in others more sedentary collectors. Perlman (1980:292-294) predicts that hunter-gatherer groups would establish sedentary communities in highly productive coastal areas characterized by broad and shallow continental shelves with low wave-stress estuaries. These communities would be larger and organized differently from typical hunter-gatherer band encampments. On the other hand, he suggests that more nomadic settlement systems would develop along less productive coastal environments characterized by steep continental shelves and high wave-stress shores.

Perlman's prediction concerning the relationship between sedentary life and productive coastal environments has been supported, in part, by other archaeologists. Their studies have been conducted in western North America (Ames 1985, King 1978, Matson 1983, Sheehan 1985), eastern North America (Ritchie 1969, McManamon 1984a, Spiess et al. 1983), Peru (Moseley 1975, Lanning 1967:59-65), the Spanish Cantabria (Clark 1983), the western Baltic (Rowley-Conwy 1983), and southern Scandinavia (Price 1985).

Many of these studies have noted that productive estuaries tend to facilitate sedentary life because of the diverse range of terrestrial, estuarine and marine resources packed within a limited space (see also, Yesner 1980, Gwynne 1982: 247-275). For example, in the temperate woodlands of North America and Europe, the coastal ecotone provides nuts, berries and deer along the woodland margin; freshwater and anadromous fish in streams discharging into estuaries; and shellfish, waterfowl, marine fish and marine mammals along the estuary and more open shelf waters. The spatial aggregation of these diverse resources might allow hunter-gatherers to minimize subsistence costs by locating residential bases in the ecotone, from which task groups could exploit resources within a limited catchment range (see Rowley-Conwy 1983:122-125, Clark 1983:99-102, Thomas et al. 1975:64-65).

There are other specific characteristics of coastal foods that would facilitate a sedentary existence. Clark (1983:93) notes that the timing of availability of many coastal resources overlap throughout much of the year. Some of these resources, like anadromous fish, can be harvested in bulk during specific seasons, and then dried and stored for use during periods of low productivity, such as the late winter and early spring months (Jochim 1983:217, Perlman 1980:290-292). Others are stable foods, like shellfish, that could serve as supplemental food sources year-round or as a dietary mainstay during periods of food scarcity (see Perlman 1980:286-290, Yesner 1980:279, Clark 1983:102, Bailey 1983:163). All of these factors have been argued to be important considerations in maintaining a year-round food supply.

Explanations concerning the evolution of coastal sedentary communities are often linked with post-Pleistocene sea level rise. That is, productive coastal habitats may not have formed until rather late in prehistory, when the rise in sea level began to slow, allowing estuaries and salt marshes to develop and expand (Braun 1974: 594, Custer and Stewart 1983, Yesner 1983:83, Gwynne 1982:186, Claassen 1986:26). With the stabilization of the coastline and the formation of estuaries, it is argued that expansive shellfish beds began to flourish and anadromous fish commenced to migrate up coastal streams. The upshot of this argument is that whenever eustatic-tectonic balances were reached that allowed estuaries to form, it is believed that the productivity of the coastal environment increased tremendously. Perlman (1980:284) proposes that as the level of productivity increased during the post-Pleistocene, so to did the degree to which people adopted sedentary settlement systems.

The stabilization of the coastline is dependent on the rate of sea level rise, local tectonic conditions, the gradient of the coast, and other such factors. Since much of the eastern seaboard is characterized by a rather gentle coastal gradient, minor changes in sea level could have had a significant impact on the formation of the coastal features (Fladmark 1983). Most studies suggest that coastal stability on the eastern seaboard did not begin to take shape until relatively late, probably sometime between 5000 to 1000 BP depending upon local conditions (see Braun 1974:586, Claassen 1986:26, Fladmark 1983:75, Custer 1984:91, Colquhoun and Brooks 1986:276).

Long Island: The Debate

The coastal sedentary model has important implications for Long Island archaeology. As part of the eastern seaboard of North America, Long Island is identified by Perlman (1980: 262-263, 271) as one of the most productive environments of the world. Its shores are characterized by a broad, shallow shelf containing numerous estuaries and bays. Although local tectonic movements (see Perlman 1980:266-270) and different models of sea level change complicate the picture, most scholars believe that a eustatic-tectonic balance took place during the Woodland period, or about 2000 to 3000 years ago (Edwards and Emery 1977, Bloom and Stuiver 1963:334, Stuiver and Daddario 1963:951, Engelbright 1982:301). Given Perlman's and others predictions, Long Island appears to be an excellent candidate for the rise of sedentary coastal communities, especially during the Woodland period.

Research in other nearby areas suggests that sedentary coastal settlements did evolve by the Woodland period. For example, year-round sites have been identified along the coastlines of eastern Massachusetts (McManamon 1984a:409), Martha's Vineyard (Ritchie 1969:41), Delaware (Custer and Stewart 1983:8), and Maine (Spiess et al. 1983).

The Controversy

When one turns to Long Island, the issue of sedentary life becomes complex and controversial. Although most scholars admit that considerable variation characterized the prehistoric populations of Long Island, there is a tendency to polarize subsistence and settlement models into two extremes of a continuum. At one end is a sedentary village model and at the other is the classic seasonal round hunter-gatherer model.

The former interpretation states that at least some prehistoric groups maintained semipermanent or permanent villages. Salwen (1983:92), basing his interpretation on ethnohistorical accounts of early French, English and Dutch explorers, suggests that the basic organizational unit of southern New England natives was the village.

> The basic face-to-face unit of population appears to have been the "village", defined here as a social unit utilizing the resources of a limited territory, usually part of a drainage system, or a section of the coastal plain. There was, indeed, a residential village, consisting of a cluster of houses... (Salwen 1983:92).

The houses were usually round, measuring 4 to 5 meters in diameter, although larger structures were sometimes built during the winter months. Village members had use rights to resources within their territories, and Salwen (1983:92-93) notes that they often spent a considerable amount of time away from the main village hunting, fishing and tending crops.

While Salwen's settlement model pertains primarily to the Contact and Late Woodland periods, some aspects of it may also apply to earlier prehistoric periods as well. Gretchen Gwynne (1982) has argued that Long Island estuaries would have been sufficiently productive to allow people to establish year-round communities after sea level stablized about 3000-4000 years ago. She notes that resources, like shellfish, nuts, deer, skunk cabbage, waterfowl and anadromous fish, which must have flourished at this time, would have provided ample food for year-round settlements (see Gwynne 1979).

On the other hand, the evidence for sedentary communities on Long Island is not overwhelming. Ceci (1980, 1982) notes that the vast majority of prehistoric sites are small, shallow and contain little evidence for house structures.

> For the long prehistoric period only very small settlement camps and isolated secondary burials can be clearly identified (Ceci 1980:71).

She argues that few prehistoric villages containing multiple house structures, storage pits or agricultural remains have been defined in any detail. While archaeologists have reported such villages in the past (i.e. Booth 1949, Smith 1950, Skinner 1919), only preliminary reports have been published, making it difficult to evaluate the village model.

In contrast to the village model, Ceci (1980, 1982) states that native people remained simple, nomadic hunter-gatherers throughout the prehistoric period. This alternative interpretation suggests that small bands practiced extensive seasonal round movements across Long Island and possibly into nearby regions as well. During the warm weather, it is believed that a transhumant pattern was practiced along coastal Long Island. Here multiple small camps were established from which shellfish, fish and other maritime resources could be exploited. During the cold months these groups either returned to winter residential bases in southern New England, mainland New York or Middle Atlantic states (Kaeser 1974) or set up small winter bases in protected coastal or interior locations of Long Island (see Wyatt 1977, Johannemann and Schroeder 1982:10).

The divergent interpretations raise a number of important questions about the nature of coastal adaptations on Long Island. Three of these are outlined below.

1) **Alternative Explanations.** Do coastal hunter-gatherers neccesarily establish sedentary communities in areas containing abundant predictable resources? A number of anthropologists have questioned this and some believe the relationship drawn between coastal productivity and sedentary life is too simplistic. Hitchcock (1982), Bender (1978:708) and others suggest that factors other than resource productivity may be equally important in stimulating people to settle down. Those suggested include demographic pressures, changing social parameters, and economic incentives like the development of regional exchange networks. Certainly, as Voorhies (1978:17) and Sanger (1982:22) note, coastal people have many settlement options available to them.

Ceci (1982) believes that sedentary life on Long Island was stimulated, not by resource abundance, but by the development of extensive regional trade networks. She argues that during the Contact period local natives had the opportunity to participate in an international trade system involving European goods, wampum and fur. Coastal New York natives produced wampum which was used by the Europeans as a medium of exchange in the northern fur trade. In return for wampum, the coastal natives received European goods and food. According to Ceci, the wampum trade encouraged some native groups to settle in large sedentary communities near deep harbors, where European ships could anchor and where ready sources of whelk and hard clam could be obtained for making wampum.

2) **Resource Productivity.** How productive must a coastal environment be to support sedentary communities? Some archaeologists suggest that the productivity of coastal environments has been overestimated, leading to exaggerated expectations for the indigenous development of permanent villages (see Sanders 1978: 270, Osborn 1977).

This issue is especially pertinent to an island setting. Some archaeologists feel that the limited size of Long Island would have hampered the development of prehistoric sedentary communities. Ponz (1984), for example, notes that the productivity of many local wild foods, such as deciduous nuts, varies substantially on a seasonal and annual basis. The combination of a widely fluctuating resource base in a rather limited island environment may not have provided a dependable enough food source to support year-round communities on Long Island. In addition, Ceci (1982:28) argues that local conditions were not conducive to agriculture, and that food production would have remained a "risky and experimental" practice on Long Island.

3) **Regional Diversity**. How do changing patterns of resource distributions influence the development of sedentary communities? Coastal environments are very dynamic, changing constantly due to sea level fluctations and tectonic movements. Coastal change is an important consideration that may have influenced subsistence-settlement systems over time. As pointed out above, some archaeologists believe that sedentary communities did not evolve until relatively late, when eustatic-tectonic balances were reached. Other archaeologists believe that prehistoric people intensively exploited coastal resources for many millenenia, and that these sites now lay inundated along the continental shelf (see Brennan 1976, Newman 1974:136). This latter view implies that sedentary coastal communities could have evolved at a much earlier date than generally recognized.

Studies of Long Island archaeology must take into account the dynamic coastal environment. Before the coastline stabilized in the Woodland period, a much greater land mass may have been available for human exploitation. Extensive areas of the shallow shelf surrounding Long Island would have been exposed during the last 10,000 years (see Edwards and Emery 1977), providing a constantly changing configuration of coastal and interior habitats. These changing conditions must have influenced the range of subsistence-settlement options employed by prehistoric people.

Even during the Woodland period regional differences in the spatial configuration of Long Island may have affected prehistoric adaptations. Today Long Island is characterized by considerable physiographic and climatic diversity, particularly along its east-west axis. The west end (especially Queens and Kings Counties) contains a much larger land mass and a somewhat more continental climatic regime since it is closer to the mainland. The east end (eastern Suffolk County) composed of the two east forks and several small islands (Shelter Island, Plum Island, Fishers Island, Gardiners Island, Robins Island -- see Figure 1), is characterized by a more maritime climate and a higher ratio of shoreline to interior area. The east end contains comparatively limited interior woodlands.

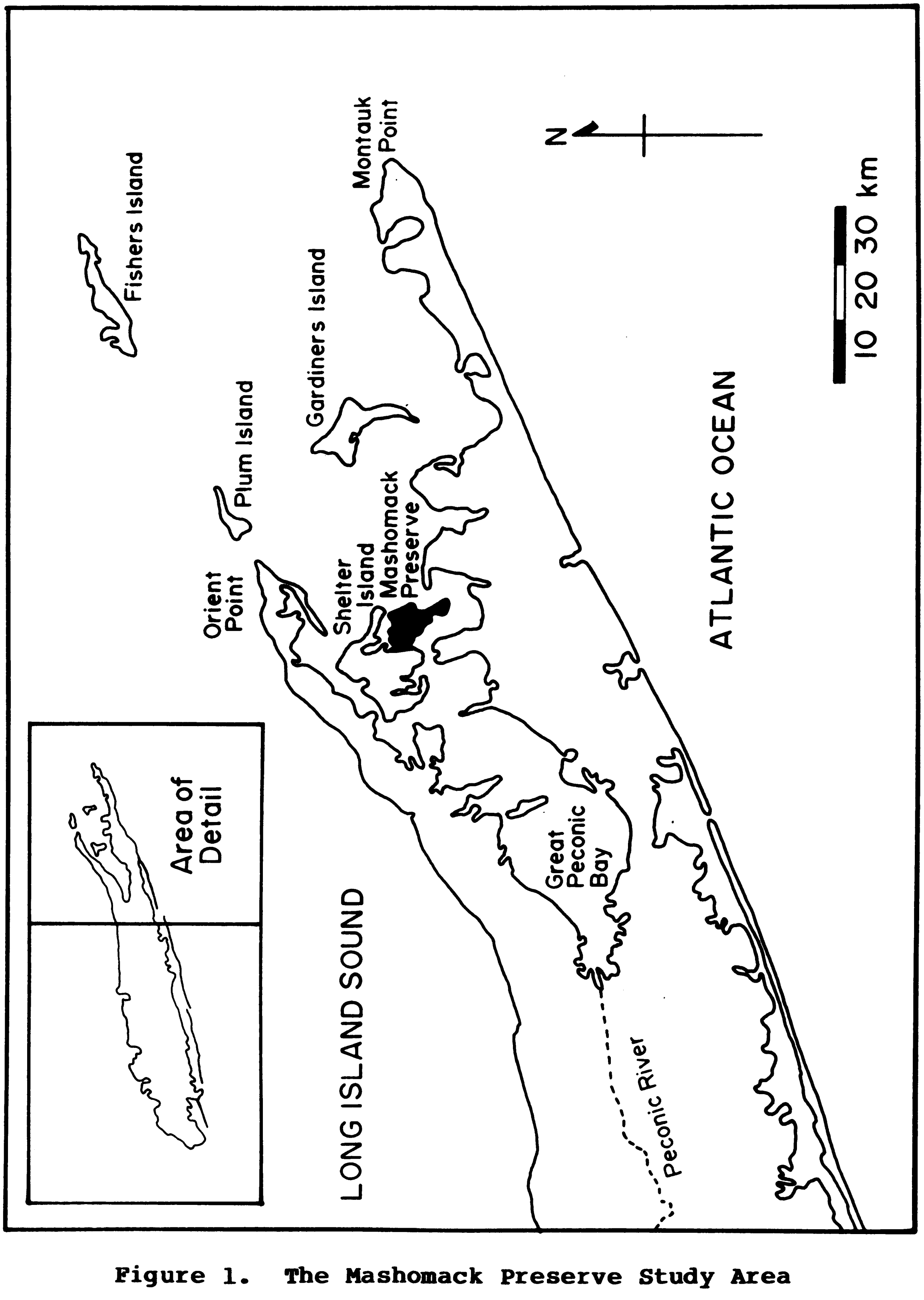

Figure 1. The Mashomack Preserve Study Area

Assuming that these conditions have existed since the coastlines stabilized, then one must consider whether Woodland populations would have settled the west end in the same manner as the eastern forks and small islands. Similarly, one must consider whether the eastern forks and small islands, like Shelter Island, could have supported hunter-gatherer communities on a year-round basis.

Long Island Archaeology

The above discussion demonstrates an important point -- there is little consensus about the diachronic nature of prehistoric coastal adaptations on Long Island. The varied interpretations suggest that we lack a clear understanding of many basic issues concerning prehistoric subsistence-settlement systems.

The interpretative problems of Long Island archaeology stem, in part, from 1) the nature of the archaeological record and, 2) the field work employed to study this rather elusive data base. In the best of circumstances Long Island archeology represents a stimulating challenge to study and interpret. The archaeological record consists of buried sites containing relatively crude quartz chipped stone artifacts and "soil stain" architectural features often found below the plowzone in now reforested areas. Accordingly, the methodologies used to detect and study such remains must be designed with these characteristics in mind. This requires a firm commitment to undertake labor intensive survey and excavation projects that operate under explicit research designs. Unfortunately, with a few exceptions, past field projects have tended to be under funded, under staffed, and short term commitments to the sample testing of a few archaeological sites. In general these projects have not provided the necessary scope to make sense of this rather ambiguous data base.

One obvious characteristic of the archaeological record is that most Long Island sites are difficult to locate and require survey strategies that incorporate subsurface testing and/or remote sensing to detect buried remains (McManamon 1984b). Relatively significant buried sites, unless disturbed by pothunters, erosion, etc., may be missed using standard pedestrian surface survey techniques, a matter discussed in more detail in Chapter Four. Since intensive subsurface survey programs have been implemented only recently on Long Island, there is some question as to whether the known sites are representative of the entire site population (see Lightfoot et al. 1985a, Lightfoot 1986). In addition, sites once having been detected are often examined in a very cursory manner. As Ceci (1982: 7), Snow (1980:279) and others note, there have been relatively few full-scale excavations of sites. In fact, most "excavations" are very limited tests of a very small fraction of the site areas.

The upshot of this discussion is that more detailed studies of Long Island archaeology must be undertaken before significant questions concerning coastal adaptations can be answered realistically. Field work and laboratory studies need to be directed toward very basic issues concerning coastal subsistence and settlement patterns. Most importantly, theoretical models need to be generated in order to evaluate the archaeological remains of Long Island.

The Field Program

A significant purpose of our field research was to provide the kind of theoretical perspective and data gathering methods necessary to begin evaluating the above questions concerning coastal adaptations. A joint field program involving faculty members and students from SUNY at Stony Brook, CUNY-Queens College and Suffolk County Community College was initiated in 1983. The multi-institutional research team was formed to maximize our survey coverage and to excavate multiple sites; to take advantage of participating members expertise in archaeology, geology, marine biology, paleobotany and vertebrate zoology; and to pool our limited resources in obtaining field and laboratory equipment.

To provide the necessary survey and excavation data to address the above questions, we proposed to select study areas from different coastal and interior habitats of eastern Long Island (Suffolk County) where relatively large tracts of undeveloped land remain. Specifically, we planned to select study areas from the north shore, south shore and small islands of eastern Long Island. In such a manner we could build a regional data base that would be suitable for evaluating issues concerning coastal hunter-gatherers.

For each study area selected, we planned to undertake a systematic survey that would provide a representative sample of archaeological remains from different habitats. The survey would incorporate methods of subsurface testing that would facilitate our ability to detect small buried sites. Furthermore, we intended to select a sample of survey sites for more detailed excavation.

The theoretical orientation that guided the field program concerns the study of forager and collector regional settlement systems as defined by Lewis Binford (1980, 1982). We felt the forager/collector continuum would provide an excellent framework for evaluating the competing interpretations of Ceci (1980), Gwynne (1982) and Salwen (1983). Furthermore, the problem oriented approach helped us to formulate a research design that would insure that appropriate field methods and collection gathering techniques were employed. The theoretical orientation also provided the basis for defining site types and varied analytical units as part of our overall evaluation of the competing Long Island settlement models.

The Theoretical Perspective: Foragers and Collectors

Foragers. At one end of the settlement continuum are nomadic foragers who make multiple residential moves during the year. Ceci's (1982) and others' interpretation of nomadic Long Island groups incorporates many of the traits of classic foragers. Depending upon the density and diversity of resources, foragers may follow a seasonal round in which they establish residential bases in diverse habitats. These settlements are bases of operation for family units where various domestic, subsistence and recreational activities take place (see for example Thomas 1983:73-79). They also serve as bases from which people operate to extract food-stuffs and raw materials from the nearby hinterland. Ethnographic and archaeological research shows that the distance from residential bases over which hunter-gatherers commonly exploit food resources on a daily basis, referred to as the catchment range, varies from 5 to 10 km (or about a one to two hour walk from camp) (Vita-Finzi and Higgs 1970, Roper 1979: 123-24, Bailey 1983:60). Of course the catchment range may vary depending upon modes of transportation (foot vs canoe) (see Clark 1983:102, Sanger 1983:188). The general principle of a foragers' economy is to move consumers to where food is available after the catchment range of a previous base has been depleted of resources (see Binford 1980: 5-10).

The archaeological expectations of nomadic foragers include multiple short-term **residential bases** established in diverse habitats. The short-term camps may be defined by seasonal occupations of a few weeks or months. In the nearby hinterland of these bases should be found **locations** or **non-site manifestations.** These low density scatters result from the low bulk extraction of food and raw materials by small foraging parties. The non-site manifestations commonly contain tools -- projectile points, knives, choppers, etc. -- that are lost or discarded during hunting or gathering forays (see Thomas 1975, Binford 1980:9, Nance 1983:316-320).

Collectors. At the other end of the continuum are more sedentary collectors who remain at one residential base throughout much of the year. Salwen's (1983) and Gwynne's (1982) interpretation of some Long Island communities exemplify a collector's settlement pattern. Collectors also forage for food and raw materials within the catchment range of the main residence. In addition, collectors exploit distant resources by dispatching specialized task groups to these locales. These groups harvest, process and transport the resources back to the main residence. The general principle of collectors is not to move the entire residential group when local resources become depleted or are seasonally unavailable, but rather to move food from distant habitats back to the primary consumers at the residential base. Here resources can be consumed by the entire residential group and/or stored for use during periods of low productivity. Binford (1980:10) defines this latter strategy as that of "logistically organized producer parties" who are "seeking products for social groups far larger than themselves" .

The archaeological remains produced by sedentary collectors would be similar, in many respects, to those produced by nomadic foragers. One should still find locations or non-site manifestations within the catchment range of the residential bases. The major differences concern the length of time spent at the residential bases and the manner in which resources are exploited beyond the catchment range. The residential bases should contain evidence of multi-seasonal occupations and storage facilities. In addition, beyond the catchment range of individual residential bases -- in what Binford (1982:7) defines as the logistical radius or range -- there should be **field camps,** overnight sites that are the focal point for harvesting and processing a specific resource found more than a day's travel from the residential base. These field camps serve as the temporary bases of hunters pursuing mobile game or gathering parties exploiting a dense resource patch. Binford (1980:10) also notes that food or tool **caches** and **observation posts** (stations) may be associated with these field camps.

Operationalizing Forager/Collector Concepts on Long Island

At this time there is a rather limited body of data on the regional characteristics of Long Island settlement patterns suitable for defining forager and collector strategies. As a prerequisite for operationalizing forager and collector concepts on Long Island, we identified four basic issues that must first be addressed. These issues concern the study of site function, site size, site seasonality and site subsistence patterns.

Issue One: Site Function

The vast majority of documented Long Island sites are shell middens found in rather restricted coastal areas of the north shore and eastern forks (Lightfoot et al. 1985a:61-62). The physical characteristics of these sites -- dense concentrations of hard and soft clam, oysters, and scallop shells along with artifacts and occasional architectural features -- make them among the most visible on the island. Given the rather crude survey methods of the past (see Lightfoot et al. 1985a: 62-64), these sites have been overemphasized at the expense of other less visible sites. This problem raises two related questions.

First, do shell middens represent the remains of residential bases or special purpose extraction sites? Studies of shell middens in other regions suggest a variety of activites can produce these remains (see Claassen 1986:26, Rowley-Conwy 1983: 119, Barber 1983). For example, Ceci (1984:63) suggests (after Meehan 1982) that Long Island shell middens may represent the remains of residential base trash dumps, special purpose processing sites, one meal stop-over points, or wampum production areas.

Second, if past survey techniques have been biased toward detecting shell midden, then what other kinds of remains have been missed? Do nonmidden sites represent the remains of residential bases, locations, or field camps? Identifying the functions of these nonmidden sites may be crucial for evaluating different components of past subsistence-settlement systems.

In evaluating these questions on site function, we have generated archaeological expectations for defining residential bases, field camps, caches and locations on Long Island. These expectations are based on Binford's (1980), Thomas's (1983) and others' theoretical discussions, as well as the pertinent literature on coastal New England archaeology.

1) **Residential Bases**. Since these settlements serve as the base of operations, one would expect to find a diverse range of artifacts, ecofacts (plant and animal remains), and architectural features at these sites. Thomas (1983: 73-79) lists many of these expected remains, which include evidence of tool production and repair, tools for preparing and cooking food, recreational equipment, architectural features (house remains, hearths, etc.), faunal and floral remains. What differentiates these sites from others is the overall diversity of remains -- the greatest range of tool types, plant remains and faunal remains should be found at these locations (see Thomas 1983: 77).

Some coastal residential bases that have been identified in the Northeast contain residential space segregated from nearby trash middens. It is possible that these manifestations may be found on Long Island. Skinner's (1909) pioneering work on Staten Island defined "village" sites associated with village garbage dumps -- large shell middens containing numerous tools, as well as faunal and floral remains. Other examples include Barber's (1983:117) paired settlement pattern in coastal Massachusetts characterized by a habitation site and associated shell midden, and Sanger's (1981: 39) "generalized dumping area" adjacent to house structures on some coastal Maine sites. As Sanger (1981:40) points out, a representative study of both the nonmidden and midden components is critical for understanding these sites.

2) **Field Camps**. As temporary operational centers for specialized task groups working within the extended logistical range, one would expect to find a relatively specific range of artifacts, ecofacts and architectural features at these places.

Depending upon the resources being extracted, one should find evidence of a limited range of procurement and processing tools, often consisting of curated materials, specialized plant or animal products, low diversity of by-products, and little investment in architectural features except what is needed for overnight comfort (see Thomas 1983:80).

Few field camps have been defined systematically on Long Island. However, one may expect to find these overnight camps near resource patches which could be harvested in bulk. These sites may be established near anadromous fish runs, productive shellfish beds, or prolific groves of mast producing trees.

3) **Caches**. There are two kinds of caches produced by hunter-gatherers -- resource caches and artifact caches (Thomas 1983:80). The former are often near places of bulk harvests, where resources are stored by food procurement parties some distance from the residential base. Here the resources may be cached until they can be transported back home. These storage caches are often associated with collector strategies and may be situated close to field camps. Artifact caches serve as storage places for tools used to exploit seasonally available resource patches. Instead of transporting the tools back home, the artifacts are cached for next season's harvest.

Few caches have been identified on Long Island, and the majority of these are artifact caches containing large blades (see Kaplan and Mills 1976, Witek 1986). Few resource caches have yet to be described in the archaeological record, although some nut caches are known from Rhode Island (Morenon 1985).

4) **Locations**. These archaeological manifestations are commonly found where daily extractive activities are carried out within the foraging range of residential bases (Thomas 1983:82). We suggest that two kinds of locations may be observed in the archaeological record of Long Island. The first are **low density procurement locations** (non-site manifestations) produced by the low bulk extraction of plant and animal resources. In some cases these scatters may be broadly dispersed across the landscape, especially within the foraging range of residential bases. The other are **bulk procurement locations** where the intensive harvesting and processing of specific resources take place. These bulk procurement locations are produced by logistically organized groups who bring the food back to be consumed and/or stored at the nearby residential base (see Binford 1980:10, Thomas 1983:83-84).

Both types of locations are commonly found on Long Island. We have detected low density procurement locations which probably resulted from foraging and hunting activities in several areas of eastern Long Island (Lightfoot et al. 1985a, Lightfoot et al. 1985b). These remains consist of broadly dispersed non-site manifestations. Bulk procurement locations have also been defined, especially those associated with the mass processing of shellfish remains. These special purpose middens, which are differentiated from residential base middens by the general paucity of artifacts and other floral and faunal remains, were first identified by Skinner (1909), and later defined by Salwen (1968, 1970) and Rothschild and Lavine (1977).

In employing Binford's (1980) general concepts, it is important to distinguish bulk procurement locations from field camps where the intensive processing of a few resources take place (in this volume we refer to the latter as field processing camps). While both are essentially special purpose extraction sites, the former should be found within the catchment range of the residential base and the latter in the logistical range where overnight camps are established. However, beyond the presence of resource caches and overnight equipment, there may be little to distinguish bulk processing activites that take place in the near and distant hinterlands of residential bases, a point reiterated later in this volume.

In summary, an important component of our field program would be the delineation of different site categories and archaeological manifestations across Long Island's landscape.

Issue Two: Site Size

Another important issue concerns the size range of the Long Island sites, especially those defined as residential bases. Although Ceci (1982) suggests that most Long Island sites are small, a position on which Johannemann and Schroeder (1978:6) concur, there is considerable variation in site size. Based on published information, we found that the average size is about 4300 m2. However, there is a significant standard deviation (8811 m2) associated with this mean (see Lightfoot et al. 1985a: 62). While some sites are very small (less than 1000 m2), others are very large (greater than 10,000 m2). The important question is not really the overall size of the sites, but rather the size of settlements during specific occupation episodes. As Luedtke (1985) and other have pointed out, productive coastal habitats tend to be reoccupied over extensive periods of time. She notes that many Northeastern coastal sites are shallow, disturbed and multi-component (1985:325). The complex occupation episodes of coastal places make these manifestations very difficult to interpret. A large site may be produced by an extensive population occupying the area during one occupation episode or it may be produced by multiple small groups reusing a place over hundreds or even thousands of years. Thus, the occupation history of residential bases is critical for evaluating the size of residential groups.

Future research must begin to address the formation processes of coastal sites in a detailed manner. This involves dating different areas of the site to evaluate the size of a settlement during a particular occupation episode (Luedtke 1985:325), a point which is especially relevant for Long Island. Since many of the coastal places were used over extensive periods, one must be careful about how sites are interpreted. For example, while Ceci (1982) notes that most native village sites containing multiple wigwams and agricultural remains are associated with historic materials, it is not a necessary conclusion that the intensive occupation of these places occurred in post-contact times. Thus, an important concern of our field program would be to define, whenever possible, the spatial parameters and occupation episodes of sites.

Issue Three: Site Seasonality

The issue of site seasonality is especially critical in defining forager and collector settlement systems. Forager residential bases should be characterized by relatively short occupations when compared to collector bases. Site seasonality is also important for defining field camps and bulk procurement locations, which should be represented by very short-term occupations (see Thomas 1983:80). Of course, these expectations may be complicated if the archaeological manifestations are characterized by complex occupation histories indicating repeated reuse over time (see Binford 1982:11-14, Thomas 1983:80).

On Long Island the warm weather occupation of prehistoric sites in not in question; rather it is whether "multi-seasonal" (especially winter and spring) occupations can be conclusively demonstrated (Wisniewski and Gwynne 1982:14). Some archaeologists believe that there is little evidence for winter and spring occupations of Long Island sites (i.e. Kaeser 1974, Ceci 1982). Others believe they have unearthed evidence of late fall or winter camp sites, like the Wading River site (Wyatt 1977, Ritchie 1959:78), the Cusano site (Wyatt 1977), Shoreham (Wyatt 1977) and the Merrick-Ocean site (Ottusch 1980). Still others, such a Gretchen Gwynne, argue that there is evidence for year-round occupations at the Pipestave Hollow site (Gwynne 1982), the Englebright site (Gramly and Gwynne 1979), the Tiger Lily site (Wisniewski and Gwynne 1982) and the Rudge-Breyer site (Gwynne 1985).

Yet with some exceptions (Gwynne 1982), few of these studies have evaluated systematically the occupation duration or season(s) of occupation of sites using faunal or ethnobotanical remains. Flotation analysis, a standard component of most excavations in the eastern woodlands (Moeller 1986:2-3), has rarely been employed on Long Island to recover faunal and/or ethnobotanical remains. Furthermore, studies of faunal remains that generate daily or monthly growth patterns, such as fish vertebrae, mammal teeth, and several species of shellfish, and which provide detailed estimates of site seasonality (see McManamon 1984a, Barber 1982), have not been implemented.

Thus, another avenue of research for our field program would be the systematic recovery of faunal and floral remains using flotation techniques, and the implementation of rigorous seasonality studies. We believe that the study of marine bivalves is especially suited for many Long Island coastal sites.

Issue Four: Site Subsistence

The strategies employed to exploit, process, and store subsistence resources play a significant role in distinguishing foragers from collectors. A careful analysis of floral and faunal remains recovered from low density procurement locations, bulk procurement locations, field processing camps and residential bases should provide insight into Long Island subsistence practices. Very different practices, involving various aspects of foraging and logistical movements, may have been employed to hunt game, to gather terrestrial plant foods, and to harvest estuarine resources. The methods of exploiting these resources may also have varied temporally and spatially across Long Island. Thus, a regional analysis of past subsistence practices would be a basic component of our field program.

Two subsistence practices -- shellfish gathering and agriculture -- would receive special investigation. The reasons for focusing on these practices are outlined below.

1) **Shellfish**. The study of shellfish remains has been an important component of Long Island archaeology for many years. Early interpretations of Long Island prehistory tended to focus on the importance of shellfish harvesting as the primary subsistence activity, supplemented by fishing, hunting, and plant gathering (Smith 1950, Ritchie 1959:47). More recent interpretations downplay shellfish as a dietary staple in coastal groups, suggesting that it served as an emergency source of food (Yesner 1980:729), a predictable daily supplement (Bailey 1983:163), or a supplement during times of low productivity, such as the late winter and early spring (Matson 1983:136, Osborn 1977, Clark 1983:102, Salwen 1983:88, Brennan 1981:45).

Current interpretations of shellfish gathering on Long Island differ from those of other archaeologists working on the eastern seaboard. Long Island archaeologists have long maintained that most prehistoric shellfish collecting took place during the warm season, when waters were not frozen and temperatures remained comfortable (Gwynne 1985:11, Kaeser 1974, Wyatt 1977:76, Werner 1982). Yet seasonality studies based on growth line patterns of hard and soft clams along the Atlantic coast point to a much more complex picture of seasonal utilization. At the very least, shellfish collecting appears to have been an important activity during the winter and early spring months (Claassen 1986:30, Hancock 1984, Barber 1983), a finding that supports the use of shellfish as a food souce during lean periods of the year. Claassen (1986:33) and McManamon (1984a:390-392) also suggest that by gathering shellfish during this season it would not have interfered with the cultivation or harvesting of agricultural products. Other shellfish studies indicate the resource was collected during the late spring, summer and fall months as well (Yesner 1983:89, Spiess et al. 1983, Bourque 1973, Sanger 1982, Barber 1983).

Thus, an important issue in need of resolution is whether shellfish procurement activities on Long Island differed substantially from those of other prehistoric people of the Northeast.

2) **Agriculture.** Prehistoric food production is a hotly debated issue on Long Island. Early investigators assumed that agriculture was a relatively important subsistence activity that served to supplement wild foods. Skinner (1909), Harrington (1924) and others recovered charred corn remains from native sites on Staten Island and Long Island. They postulated that cleared areas or "Indian fields" found near native residences were used for growing various agricultural products. More recent studies have also supported the idea of prehistoric agriculture on Long Island, at least in the Late Woodland period (Silver 1980, Salwen 1983:89). There is well documented evidence of corn being grown in other nearby areas by the Late Woodland (Ritchie 1969:54, Custer 1984:147, Snow 1980).

Recently, Ceci (1982) has challenged the idea that agriculture was widely practiced on Long Island during the prehistoric period. She argues that the environmental conditions of the island were not conducive to the production of corn, and that there was little incentive to curtail a hunter-gatherer economy. Furthermore, she notes that the few charred corn remains (often used to support arguments of prehistoric agriculture) have been found in questionable contexts. These contexts are often disturbed, multi-component deposits that raise the possiblity that later historical materials were mixed with prehistoric artifacts.

We proposed to evaluate three questions concerning agriculture in our field program. First, did Woodland groups practice agriculture on Long Island? Second, was its practice limited to specific areas of Long Island (i.e. Long Island proper vs the eastern forks and small islands)? Finally, if it was practiced, then what role did it play in the overall subsistence economy of prehistoric people?

Shelter Island: The First Study Area

The first study area selected to operationalize the evaluation of the forager and collector models was the 825 hectare Mashomack Preserve on Shelter Island, New York (see Figure 1). The reasons for selecting Mashomack are threefold:

1) **Coastal Settlement Patterns**. Mashomack provides an unique opportunity to investigate a considerable stretch of undeveloped coastline. One factor hindering the study of prehistoric settlement patterns on Long Island is the widespread development of coastal property for use as summer homes and condominiums. Mashomack offers a 16 km stretch of undeveloped coastline dotted by salt marshes, estuaries and small bays. The preserve also contains several hundred hectares of deciduous woodlands and numerous freshwater ponds and swamps (see Chapter Two).

2) **Small Island Habitat**. The investigation of Shelter Island also provides the opportunity to examine prehistoric adaptations to a small woodland island. As discussed above, the prehistoric settlement and use of this small island may have been very different from that of Long Island proper. We felt the investigation of Mashomack may produce interesting comparative information on how the size of an area's land mass influenced subsistence and settlement patterns.

3) **Historic Native American Occupation**. The final reason for selecting Mashomack is the ample evidence for prehistoric and historic sites on the island. Previous archaeological research, discussed in Chapter Two, and historic records on the Manhanset Indians suggest the island was occupied, at least intermittently, for 5000 years (from the Late Archaic to the late 1700s). We felt this long term temporal perspective has the potential to provide an excellent data base for examining diachronic changes in coastal subsistence and settlement patterns.

Specifically, we intended to evaluate the following questions about coastal adaptations using the Mashomack data base: Do shell middens represent the remains of residential bases or special purpose extraction sites (either field processing camps or bulk procurement locations)? What other types of archaeological remains are found at Mashomack? What was the season of use and size of local residential bases -- do they represent warm and/or cold weather occupations? Does Shelter Island appear to have been occupied year-round? What was the subsistence base of prehistoric groups, and is there any evidence for agriculture? What seasons were shellfish harvested? Does it appear the prehistoric groups practiced nomadic forager or sedentary collector strategies? Finally, did the subsistence and settlement systems change over time?

The Shelter Island Research Design

The research design generated for the study of the Mashomack Preserve involved the following phases of investigation.

The first phase was the subsurface survey of coastal and interior habitats on Mashomack. The habitats sampled are discussed in detail in Chapter Two. The field methods for detecting buried sites of various sizes in these habitats, as well as the results of the survey work, are outlined in Chapter Three.

The second phase was the excavation of selected survey sites. Recovery techniques were employed to collect representative samples of artifacts, as well as faunal and floral remains. The excavation methods and results are outlined in Chapter Four. We also describe in Chapter Four the methods and results used to define the function, size, season of use and subsistence patterns of excavated sites.

The third phase was to assess, using the survey and excavation data, the degree to which Shelter Island people practiced nomadic foraging or sedentary collector regional settlement systems. This issue is taken up in Chapters Five and Six.

CHAPTER TWO: THE MASHOMACK PRESERVE

Introduction

This chapter is a brief overview of the past and present natural and cultural environments of the Mashomack Preserve. We are fortunate in that Mashomack is one of the best studied properties on eastern Long Island. In the late 1970s The Nature Conservancy commissioned a detailed study of the geology, plants, animals, and history of the Mashomack Preserve as part of a comprehensive master plan. The study, completed in 1982, provides a wealth of ecological information that constitutes the bulk of this chapter.

We define the fauna and flora of three coastal habitats (coastal strip, tidal creek, salt pond) and three interior habitats (oak-heath woodlands, oak-sedge forests, freshwater wetlands) that dominate Mashomack's contemporay landscape. We then consider the affect of Pleistocene glacial activities on sea level rise and changes in the composition of Mashomack's flora and fauna. This section is followed by a brief overview on what is known about the Native Americans of Shelter Island based on previous archaeological work and historical accounts of the Manhanset Indians. In the final section we examine the impact of historic land use practices, such as agriculture and commercial logging, on the archaeological record of Mashomack.

Shelter Island: Ecological Background

Shelter Island is the largest of the glacially created islands situated in the Peconic and Gardiners Bays of eastern Long Island. Formed between 23,000 and 18,000 years ago as part of the "Peconic Bay" moraine, which includes Robbins Island to the west and Gardiners Island to the east, Shelter Island is today blanketed with sand/gravel drift and till deposits (Englebright 1982). Although numerous surface erratics are present, the Holocene stratigrapy consists primarily of sandy, highly permeable soils. Nine soil series are defined for Mashomack, but the majority consist of three outwash derived series (Carver, Plymouth and Riverhead) and one till derived series (Montauk) (Rozsa and Daniel 1982:332).

Coastal Habitats

Mashomack is surrounded on three sides (north, south, and east) by waters of the Peconic and Gardiners Bays. These offshore waters serve as an important nursery for bay scallops (Acquipecten irradians), providing one of the richest sources of this shellfish in the world. About 20% of the world's annual scallop harvest comes from Long Island, and of this 95% is collected in these waters (NOAA 1980, cited in Penny 1982a:15).

About 50 fish species visit the Peconic Bay seasonally, mostly during the warm season spanning from mid spring to mid fall. These fish include the American eel (Anguilla sp.), Atlantic mackerel (Scomber scombrus), striped bass (Roccus saxatilis), seabass (Centropristis striata), weakfish (Cynoscion regalis), summer flounder (Paralichthys dentatus), and bluefish (Pomatomus saltatrix). Some of these warm season fish are replaced by northern whiting (Menticirrhus saxatilis) and other cold water fish during the winter. The winter flounder (Pseudopleuronectes americanus) remains in the local waters year-round (Penny 1982a:15). The sea mammals which occasionally visit these waters are common dolphins (Delphinus delphis), bottle nosed dolphins (Tursiops trunatus), harbor porpoises (Phocoena phocoena), harbor seal (Phoca vitulina), and finback whales (Balaenoptera physalus) (Penny 1982b:457).

The coastal environment of Mashomack is characterized by a diverse range of resources which vary in seasonal availability and productivity. For the purposes of this report, we defined three major coastal habitats based on Penny's (1982a) field work. These habitats are the coastal strip, tidal creeks and salt ponds.

1) **Coastal Strip**. The exposed coastline of Mashomack contains fewer species of flora and fauna than the protected salt ponds and tidal creek habitats. Much of the east side of Mashomack is characterized by unprotected subtidal shoreline of cobble and boulders (Penny 1982a:22). Here scallops are quite common, but the diversity of fish species is rather low, with winter flounder (Pseudopleuronectes americanus), windowpane (Scophtalmus aquosus), and northern pipefish (Syngnathus fuscus) observed most frequently in field samples. The inter-tidal zone of this strip (between mean low and high waters) also contains fewer fauna and flora species than other marine habitats of Mashomack (Penny 1982a:30). Coecles Harbor, Majors Harbor and Smith Cove (Figure 2) provide some protection for the northern and southern coastal strips, and as a consequence these areas are more productive than the eastern strip of Mashomack.

Extensive beach and dune formations extend along most of the coastal strip, especially along Mashomack's east side. These sand and gravel deposits support various kinds of grasses [beach grass (Ammophila breviligulata), salt-meadow cord-grass (Spartina patens)], pigweed (Chenopodium album), Russian thistle (Salso lakali), bayberry (Murica pennsylvanica), and prickly-pear cactus (Opuntia compressa) to name a few. For a more detailed discussion see Rozsa and Metzler (1982: 134-137).

2) **Tidal Creeks**. Tidal creek habitats are protected embayments connected to the Peconic and Gardiners Bays waters into which freshwater discharges on a seasonal or year-round basis. These small estuaries contain brackish water whose

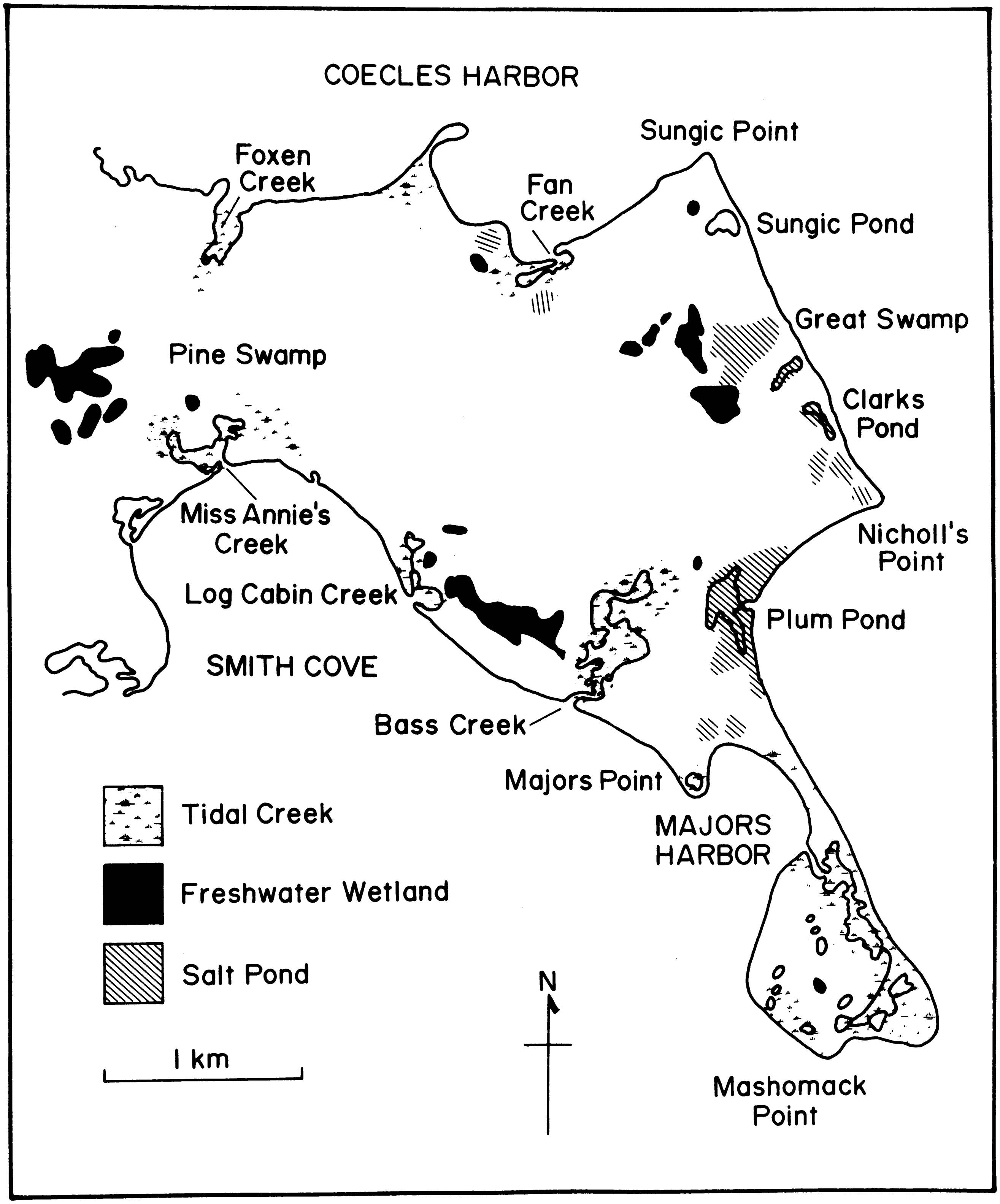

Figure 2. The Mashomack Habitats

salinity levels vary tremendously depending upon the magnitude and timing of freshwater discharges (Penny 1982a:8). Seven tidal creeks were identified and field tested by Penny (1982a) during the Mashomack Preserve's masterplan study. These included Foxon Creek and Fan Creek along the north shore and Miss Annies Creek, Log Cabin Creek, Bass Creek, Majors Harbor Creek,and Mashomack Creek along the south shore (see Figure 2).

The brackish tidal creeks support a diverse array of fauna and flora. Penny's (1982a:63,76-77) field sampling of these habitats recovered 41 invertebrate and fish species. The major species are listed below. Several shellfish species, including hard clam (Mercenaria mercenaria), soft clam (Mya arenaria),and razor clam (Ensis directus) thrive in the subtidal and inter-tidal substrata of unconsolidated sand, mud, and sand/mud. Other shellfish, such as oyster (Crassostrea virginica), bay scallop (Acquipecten irradians), mud snail (Ilyanassa obsoleta), common periwinkle (Littorina littorea), and the common slipper shell (Crepidula fornicata), occupy the tidal creek bottoms and shallow waters. Crustaceans also abound in and around the tidal creeks and these include grass shrimp (Palaemometes vulgaris), long-clawed hermit crab (Pagurns longicarpus), the spider crab (Libinia dubia), lady crab (Ovalipes ocellatus), blue crab (Callimectes sapidus), mud fiddler (U. pugnak), and the sand fiddler (U. pugilator). The fish seined in the tidal creeks by Penny include the sheepshead minnow (Cyprinodon variegatus), mummichog (Fundulus heteroclitus), striped killifish (Fundulus majalis), Atlantic silverside (Menidia menidia), and the northern pipefish (Syngrathus fuscus).

The tidal creeks are commonly lined by salt marsh (Spartina alterniflora) and salt-meadow cord-grass (Spartina patens). The more brackish marshes contain sea lettuce and widgen grass. Penny (1982a:30-32) notes that these grasses provide nesting areas for many birds. The tidal creeks also attract numerous terrestrial animals to their shores to hunt and browse. The primary species include muskrats (Ondatra zibethicus), raccoons (Procyon lotor), New England cottontails (Sylvilagus floridanus), white-tailed deer (Odocoileus virginianus), mink (Mustela vision) and the white-footed mouse (Peromyscus leucopus).

3) **Salt Ponds**. This coastal habitat includes brackish ponds that have no direct outlets to the Peconic Bay waters. There are at least 20 salt ponds documented at Mashomack, the majority of which are found along the eastern and southeastern sides of the Preserve (see Figure 2). The largest of these include Sungic Pond, the Great Swamp, Clarks Pond and Plum Creek, all located along the eastern coastal strip.

Some of Mashomack's salt ponds were once tidal creeks or tidal marshes whose outlets to the sea have been blocked by the formation of dune ridge barriers (Penny 1982a:2,38). Many of the ponds situated between Nichols and Sungic Points were probably once tidal creek habitats. Others, such as Plum Pond, were once freshwater ponds that have been infiltrated by salt water due to historic mosquito ditching activities. The salinity of all the ponds varies drastically, anywhere from 1 to 65 parts per 1000, depending upon the influx of fresh and salt water. The "intermittent" ponds are those flooded by seawater from major storms more than once a year. These ponds typically have salinity levels greater than 12 parts per 1000. "Non-intermittent" ponds are those flooded by major storms less than once a year. Here the salinity can be less than 1 part per 1000, as recorded at Sungic Pond (see Penny 1982a:38). In general, the highest salinity for all the ponds occurs during droughts and in the absence of storm inflows (Penny 1982a:3).

Penny (1982a:65) found that a considerable number and variety of minnows, such as the sheepshead minnow (Cyprinodon variegatus), rainwater killifish (Lucania parva), mummichog (Fundulus heteroclitus), and tidewater silverside (Menidia beryllina), are found in coastal ponds. However, the fauna varies somewhat depending upon the salinity. The more saline ponds, such as Majors Point pond and East Salt Pond, contain grass shrimp, while other less saline ponds, such as the Great Swamp, have tadpoles and no fish. Penny (1982a:40) found little evidence of shellfish or other marine invertebrates in the ponds, especially those defined as "non-intermittent".

The salt ponds are typically ringed by marsh plant communities that include reeds (Phragmites communis), water millet (Echinochloa walteri), marsh fleabane (Pluchea purpurascens), and spike rush (Eleocharis parvula) (Rozsa and Metzler 1982:152-153).

Upland Habitats

Mashomack is a haven for ecologists given its 364 taxa of known native plants and 139 species of nonnative flora (Daniel 1982b). In a detailed field study of Mashomack's flora, Rozsa and Metzler (1982) recognized a vast "mosaic of different habitats and plant communities". While acknowledging this plant diversity, for the purposes of this report we used only three major habitats (or plant communities) defined by Rozsa and Metzler. For a much more detailed and fined tuned classification of the flora, the reader should consult Rozsa and Metzler's (1982) original study.

The major components of the noncoastal or "upland" woodlands and forests of Mashomack are various oak species. The particular mix of oaks and other plants distributed across the landscape depends largely on the moisture content of the soils. The dry sandy soils support a mixed oak-heath woodland, while the more mesic soils tend to produce a mixed oak-sedge forest. A third interior habitat discussed below is the freshwater pond or wetlands.

1) **Oak-Heath Woodland**. This habitat is found on the edaphic outwash sands of Carver and Plymouth soils, usually on the slopes or summits of ridges and hills. The primary tree species include the chestnut oak (Quercus prinus), scarlet oak (Quercus coccinea), red/black oak (Quercus rubra/velutina), and white oak (Quercus alba). The ground layer consists of black huckleberry (Gaylussacia baccata), early sweet blueberry (Vaccinum vacillans), late sweet blueberry (Vaccinium angustifolium), hairgrass (Deschampsia flexuosa), frostweed (Helianthemum canadense), and cow-wheat (Melampyrum lineare)(see Rozsa and Metzler 1982:117-119).

2) **Oak-Sedge Forest**. Found primarily on Montauk soils, which provide good moisture and nutrient supply, this habitat typically covers well drained lower slopes and depressions. The dominant tree species are chestnut oak (Quercus prinus), white oak (Quercus alba), and black oak (Quercus velutina), followed by red maple (Acer rubrum), mockernut hickory (Carya tomentosa), pignut hickory (Carya glabra), and hop-hornbeam (Ostrya virginiana). The lower tree canopy is made up primarily of flowering dogwood (Cornus florida). The understory consists of three species of sedges (Carex artitecta, C. pensylvanica, C. swanii), catbrier (Smilax rotundifolia), wood panic-grass (Panicum dichotomum), nodding fescue (Fescuca obtusa), early sweet blueberry (Vaccinium vacillans), wood aster (Aster divaricatus), false Solomon's seal (Smilacina racemosa), and wild geranium (Geranium maculatum) (see Rozsa and Metzler 1982:122-124).

3) **Freshwater Ponds or Wetlands**. Most of these habitats are kettle holes which contain freshwater on a seasonal or year-round basis. There are more than 45 freshwater ponds on Mashomack; the largest include the Pine Swamp ponds near the western boundary of the Preserve, Sanctuary Pond near Bass Creek, and several ponds west and south of the Great Swamp (Figure 2). The soils in and around these ponds are primarily decomposing peat and other organic remains. These conditions sustain "ericaceous shrub thickets" of red maple (Acer rubrum), sweet pepperbush (Clethra alnifolia), swamp azalea (Rhododendron viscosum), highbush blueberry (Vaccinium atrococcum/corymbosm), maleberry (Lyonia ligustrina), red chokeberry (Pyrus arbutifolia), winterberry (Ilex verticillata), swamp loosestrife (Decodon verticillatus), and various species of mosses (Rozsa and Metzler 1982:145-147). In addition, the Pine Swamp ponds are associated with a much rarer plant community made up of a white pine and red maple thicket described by Rozsa and Metzler (1982:147-149). Finally, the freshwater section of the Great Swamp consists of a marsh community composed of water parsnip (Sium suave), marsh fern (Dryopteris thelypteris), beggar's tick

(Bidens sp.), and smartweed (Polygonum sp.) (Rozsa and Metzler 1982:149-152).

The terrestrial habitats also support a wide range of fauna. Fieldwork at Mashomack has documented an extensive list of amphibians and reptiles (22 species), birds (42 to 60 species breed on the Preserve), and mammals (36 species) (see Daniel 1982c; Scheibel 1982; Penny 1982b). The freshwater wetlands and woodlands are home to numerous frogs, salamanders, turtles and snakes. The avifauna consists of year-round species, warm weather species (flycatchers, swallows, warblers, etc.), and fall and winter water birds migrating south (Canada goose-Branta canadensis, mallard-Anas platyrhynchos, etc.) (Daniel 1982d). The contemporary native mammals include white-tailed deer (Odocoileus virginianus) with an estimated Mashomack population of 100, New England cottontails (Sylvilagus transitionalis), wood chucks (Marmota monax), eastern chipmunks (Tamias striatus), muskrats (Ondatra zibethicus), striped skunks (Mephitis mephitis), minks (Mustela vison), and river otters (Lutra canadensis), in addition to multiple species of moles, mice, weasels, squirrels, and foxes. At least six mammal species have been introduced in recent years by humans. These are house mice (Mus musculus), norway rats (Rattus norvegicus), black rats (Rattus rattus), opossums (Didelphis marsupialis), eastern Cottontails (Sylvilagus floridanus), and black-tailed deer (Odocoileus hemionus). Raccoons (Procyon lotor) may also have been introduced to the island in historic times. For a more detailed account of Mashomack mammals see Penny 1982b.

Environmental Conditions: A Diachronic Perspective

The glacial activity of the Late Wisconsin (24,000 to 18,000 years ago) had considerable ramifications for long term environmental change on Shelter Island. During the Late Wisconsin and early Holocene the island experienced environmental conditions very different than that of today. The study of long term human adaptations to Shelter Island must take these changing conditions into consideration. Most importantly, Late Wisconsin conditions affected changes in sea level and the composition of the island's flora and fauna over a 15,000 year period.

Sea Level Change

During the last glacial maximum, when vast quantities of water were locked up in the Laurentide ice mass, sea level was considerably lower than it is today. Edwards and Merrill (1977:2) suggest that between 20,000 to 10,000 years ago, sea level may have dropped as much as 130 meters, a change that would have exposed a vast tract of the shallow continental shelf to the south and east of Long Island. Long Island Sound was either dry or part of an extensive freshwater lake until about 8000 years ago when rising sea level flooded the center of the Sound (Gordon

1983:73). Gordon (1983) also notes that the central and lower edges of the Sound could have been inundated by salt water at an earlier date. These data suggest strongly that Shelter Island was not an island during its early years, but rather a highland moraine deposit situated on the exposed continental shelf.

With the withdrawl of the Laurentide ice sheet during the early Holocene, sea level began to rise as melt water flowed back to the ocean. Currently, there is no clear consensus about the rate at which sea level rose in coastal New York, although several models have been proposed for the region. Most models propose a rapid rate of increase from about 10,000 to 6,000 years ago (Gordon 1983:70). For example, Bloom and Stuiver (1963:334) suggest a rate of increase of 18 cm per century during most of this period. Other models propose an oscillating rate of change, with periods of slight rises and decreases over the the last 15,000 years (Fairbridge 1960). However, most studies agree that the modern coastline began to take shape approximately two to three thousand years ago when the rate of sea level rise decreased substantially. Sea level rise continues today, possibly at a rate of only 3mm per year (Gordon 1983:69, see also Fairbridge 1960).

Understanding the coastal dynamics of Shelter Island depends upon a clear definition of local sea level rise and the rate at which this area rebounded from the weight of the Laurentide ice sheet, neither of which are well documented at this time. However, a geological study of Mashomack's tidal creeks does provide some information on the changing coastal configuration. Several tidal creeks were cored by Walter Newman. These cores produced a thick stratigraphic profile of salt peat over freshwater peat. As reported by Englebright (1982:299-307), a 6.75 meter core of the northern end of Bass Creek yielded a 1.3 meter deep stratum of salt peat overlying a 5.5 meter deep deposit of freshwater peat containing fragments of Spagnum and tree roots. The base of the salt water peat yielded a carbon-14 date of 850 ± 145 years B.P. Below the freshwater peat was a 7.6 cm soil stratum typical of profiles from dry upland soils. A carbon-14 sample just above this upland soil profile produced a date of 3590 ± 130 B.P. Extensive deposits of salt and freshwater peat were found in other tested locales, such as Miss Annies Creek and the Great Swamp, where peat deposits up to 11.4 meters thick were recorded in core samples.

Englebright (1982: 301) suggests that the modern tidal creeks of Mashomack are a relatively recent phenomena. Prior to 3500 years ago these areas were upland basins surrounded by woodland and forest habitats. However, as sea level continued to rise it also raised the freshwater table of Shelter Island, eventually to the point that these basins were inundated by freshwater. From about 3500 to 1000 years ago these basins supported freshwater wetlands. Finally about 1000 years ago the freshwater marshes were flooded by salt water, and the present day tidal creeks were formed.

Fauna

Since the Laurentide ice sheet shifted northward, a variety of plant communities have colonized coastal New York. Several studies outline the succession of plant communities in some detail (see Sirkin 1977:213-15, Ogden 1977:23-30, Newman 1977: 564). The earliest communities (beginning about 17,000 to 15,000 B.P.) were cold adapted and included park-tundra or spruce dominated forests. These were followed by a pine dominated forest (about 10,000 B.P.) and climaxed with hardwood forests about 6000 to 7000 years ago. The composition of these hardwood forests on Long Island appears to have changed somewhat, from oak-hemlock to oak-hickory and finally to oak-chestnut woodlands (Newman 1977:564).

Flora

The animals species inhabiting Shelter Island have also undergone change over the years. Mastodon, mammoth, walrus, caribou and ground sloth remains have been recovered from the Middle Atlantic shelf directly south of Long Island. These animals appear to have roamed along the eastern seaboard about 10,000 to 12,000 years ago (Edwards and Merrill 1977:9). While these data suggest that Shelter Island may have been included in the mammals' ranges, Edwards and Merrill report no fossil remains yet recovered for this area.

Other animals that were once represented on Shelter Island include moose (Aleces alces), elk (Cervus elaphus), black bear (Ursus americanus), bobcat (Lynx rufus), gray wolf (Canis nubilus), eastern fox squirrel (Sciurus niger), and beaver (Castor canadensis). With the exception of elk and moose, these animals were present during the early colonial days of the island, until their extermination by hunters (Penny 1982b:452).

Native American Occupation

The potential for detecting prehistoric sites on Shelter Island appears to be very good. However, very little work has been undertaken by professionally trained archaeologists. The most significant investigation involved the excavation of the Smith site, a large shell midden outside the western boundary of the preserve (see Latham 1957). During the period from 1943 to 1953, field workers under the direction of Roy Latham of the Southold Indian Museum excavated a midden deposit composed of scallop, soft clam, hard clam and oyster shells. A diverse range of artifacts (axes, celts, pestles, mortars, projectile points, and pottery), mammals (bear, deer, beaver, racoon, etc.) and fish (sturgeon, bluefish, shark, blackfish, flounder, codfish, etc.)

were reported. The excavators also recorded architectural features including hearths and two house structures. Latham suggested that the site was occupied during both the warm and cold seasons of the year. The site appears to date to the Late Woodland period, although earlier components may also be present.

Another site was recently excavated in a tidal creek of Shelter Island's southwestern coastline by John Witek (1986). The site, which appears to date to the Terminal Archaic, is situated close to freshwater. Witek's careful excavation revealed a cache of Susquehanna blades, a considerable quantity of fire-cracked rock and charcoal flecks, and various chipped stone tools produced from local quartz materials. He suggests that the site served as a special purpose camp where various food processing activities probably took place.

Approximately 25 other sites have been reported by amateurs on Shelter Island (Dunhill 1982: 4), seven of which were reported on Mashomack by Norman Sanwald. Brush and Brush (1982) have summarized what is known about these seven sites, and have produced a site distribution map. Most of the sites appear to be shell middens on tidal creeks. Our investigation of Mr.Sanwald's collection revealed various pottery types and a diverse range of lithic tools. Diagnostic artifacts indicate dates from the Late Archaic to the Late Woodland.

Historic accounts indicate that Shelter Island continued to be occupied by Native Americans through the Contact period. Unfortunately, the historic Indians of Shelter Island -- referred to as the "Manhansets", "Menhansacks" , "Manhansetts", "Manhassets", or "Menhansicks" (see Duvall 1952, Mallmann 1899, Ales 1979:22, Stone 1980:161) -- are not well documented. The first known European landing on Shelter Island was by James Ferret in 1638 (Duvall 1952:19). At this time, Pogatticut (or Yoco) was purportedly the sachem or leader of Shelter Island, as well as the "grand sachem" of eastern Long Island, reportedly having 10 to 15 lesser sachems under his influence (Mallmann 1899:12). Prior to 1637 the Manhansets (the name used in this report) paid tribute to the Pequots, and, after the Pequots' extermination, paid tribute to the English (Mallmann 1899:11).

The Manhansets are reported to have practiced a mixed subsistence economy, relying extensively on fish, shellfish, deer, bear, rabbit, cranberries, mulberries, huckleberries and strawberries for food. They also grew crops, clearing woodland plots to raise corn, pumpkins, beans and squash (Dunhill 1982:9-10). Reliable estimates of the island's population, as well as the size and nature of the settlements are limited (Duvall 1952:9). Dunhill (1982:9) suggests "a few to 100 families" resided in semipermanent villages that were moved in relation to seasonally available resources.

The termination of the native occupation began as early as 1638 when, as some reports suggest, the island was sold to James Farret. However, the official acquisition from the Manhansets was recorded in 1652 with the arrival of Nathanial Sylvester, the first white settler. Shortly thereafter Pogatticut died and his brother Wyandanch, sachem of Montauk, assumed the role of grand sachem (Duvall 1952:10). The combination of these factors led to an exodus by 1654 of most of the Manhansets, who joined relatives and friends among the nearby Montauk, Shinnecock and Corchaug groups (Mallmann 1899:18). The remaining Manhansets were further reduced by the great plague of 1659 which wiped out two thirds of the eastern Long Island Native American population (Dunhill 1982:122). However, sufficient Manhansets remained on Shelter Island to prompt the English settlers to import guns in 1669 for possible Indian uprisings. The 1700s marked the end of the Manhansets presence on Shelter Island, although it is reported that as late as 1790 there were still a few Native American families living on Sachems Neck, the pennisula making up the present day Mashomack Preserve (Duvall 1952:24).

Historic Land Use Modifications

Since Shelter Island's settlement by white settlers in the 1600s, land use practices have modified the natural environment and potentially impacted the archaeological record of the Native Americans. Aside from the construction of roads, houses and commercial buildings, which are continuing elsewhere on Shelter Island at an accelerated rate, the two most critical land use practices at Mashomack have been agriculture and logging.

Agriculture has been sporadically undertaken on the lands of the present Preserve since about 1730, with the most intensive farming occurring during the mid-1800s, when about half of Mashomack was cleared for farm plots, pastures, and orchards (Daniel 1982a: 118). For example, in 1845 five thousand acres of Shelter Island were in food production; some being cultivated for barley, buckwheat, rye, oats, turnips, and potatoes, while the rest served as pasture land for cattle or sheep (Dunhill 1982:48-52). Daniel (1982a:118) describes the land use pattern at this time as a mosaic of pasture land, hay fields, orchards and forests. During the 1900s the role of agriculture steadily declined and today it is only a relatively minor activity.

Agricultural cultivation can seriously impact the spatial integrity of shallow archaeological sites. Plowing disturbs the spatial context of artifactual material down to a maximum of 30 cm, depending upon the nature of the crops cultivated and the type of plow used. Some agricultural practices can also move coastal artifactual material to new contexts. Ceci (1984:65) notes that 19th century farmers "mined" prehistoric shell middens on Long Island for use as liming and fertilizing agents. The prehistoric shell deposits, commonly containing lithic and ceramic artifacts, were sometimes spread across interior fields at the rate of 20 tons per acre. Ceci (1984: 69) cautions that artifacts found on interior fields may be simply a result of this fertilization practice. Clearly, given the extent of 19th Century farming at Mashomack, we must be cognizant of the potential impact that cultivation has played on the local archaeological record.

Agriculture has also disturbed the natural habitat. Partially overgrown field systems, remnants of farming during the 19th and 20th centuries, dot some areas of the Preserve today. Former field systems are commonly colonized by locust stands and/or impenetrable patches of catbrier (Smilex rotundifolia), a tough throny climber (Rozsa and Metzler 1982:132-133). Daniel (1982a:120) notes that catbrier patches may also be a result of intensive sheep grazing. Whatever the cause, the northern sections of the Preserve are covered by intimidating catbrier patches that make survey work very pricklish.

Logging has had an impact on the Preserve. The Preserve was logged commercially during the 1880s and 1890s and the wood sold to New York City as firewood or construction material (Dunhill 1982:56). Some areas may have even been clear-cut of all commercially useable trees. The single area in Mashomack to escape logging was north of Log Cabin and Bass Creeks (Daniel 1982a:126). Although logging probably did not impact the archaeological record as much as tillage, it can still create soil disturbances such as increased erosion. Logging also has implications for the Preserve's so called "pristine" forests -- since most of today's woodlands represent secondary or tertiary growth, most trees are less than 100 years old (Daniel 1982a: 127).

Summary

Mashomack supports a diverse range of marine and terrestrial resources. Within one kilometer of the coast one will encounter tidal creeks, salt ponds, freshwater ponds, oak-sedge forests and oak-heath woodlands. The implications for prehistoric subsistence-settlement patterns are clear -- humans could have exploited a wide array of resources within a short walk of strategically located settlements. Thus, Mashomack is an excellent case study for evaluating how diverse resources packed within a limited area may have influenced prehistoric subsistence and settlement strategies, such as those proposed by Ceci, Gwynne and Salwen.

Any study of prehistoric Mashomack must take into account environmental change over time. The contemporary coastal and terrestrial habitats were formed only in the last 1000 to 6000 years. The tidal creeks have gone through a transition from upland woodland habitats (3500 years ago), to freshwater ponds, before their formation by rising sea level only about about 1000 years ago. Rising sea level, and its effect on the local freshwater table, would have also contributed to the formation of some upland freshwater habitats within the last 3500 years or less. Most of the salt ponds have undergone recent transformations from freshwater wetlands and tidal creeks. Finally, the oak dominated woodlands of this area do not predate much beyond 6,000 to 7,000 years.

Human land use practices have continued to modify Mashomack's natural environment in more recent years. Previous research provides little information on Native American settlement patterns on Shelter Island. Historic documents indicate that white settlers impacted the natural habitats by exterminating some fauna, clearing woodlands for fields and pastures, and logging timber commercially.

CHAPTER THREE: SUBSURFACE SURVEY

Introduction

The first phase of our field research was an intensive subsurface testing program designed to detect archaeological remains of low visibility. Our goal was to systematically sample the different habitats of Mashomack to estimate the diversity, density and spatial distribution of buried archaeological remains across the Preserve. The survey program involved two components. The first was a transect survey that tested different habitats using a stratified random sampling strategy. The second was a block survey that tested selected areas of the Preserve using a stratified judgmental sampling strategy.

This chapter begins with a brief introduction to subsurface survey strategies used in the Northeastern United States. This is followed by a description of the specific field methods employed in our transect and block surveys and the laboratory techniques used to study survey material. The final section is a detailed discussion on the results of the transect and block surveys.

Subsurface Survey

The environmental conditions of the eastern United States greatly exacerbate the rapid or simple detection of prehistoric remains. Depending upon local ecological conditions, archaeological remains are often covered by dense vegetation, leaf litter and soil that make it very difficult to detect prehistoric materials using standard pedestrian surface surveys. Surface reconnaissances conducted under these conditions can locate highly visible sites, such as shell middens, if they exhibit some form of surface manifestation, but they are totally inadequate for discovering undisturbed buried cultural remains (See McManamon 1984b: 243-245). The continued use of such survey techniques on Long Island is perpetuating a biased representation of the density and diversity of known prehistoric sites, a matter taken up in some detail elsewhere (Lightfoot et al. 1985a:62-64, Lightfoot 1986).

Over the last decade, archaeologists working in the eastern United States have devoted considerable effort to developing subsurface sampling procedures designed specifically to detect cultural remains buried by soil and duff. The major detection procedures have included the removal of duff at set intervals (Raab 1977), the use of soil augers and cores (Dincauze 1978; McManamon 1984b), and the excavation of test units of varying sizes and shapes (McManamon 1984b, Nance 1983). A common technique employed in eastern North America is the excavation of shovel probes at systematic intervals across survey units.

The Mashomack Surveys

Recognizing the trials and tribulations of past field-workers, we sought to develop a subsurface survey program capable of detecting buried archaeological remains. We planned initially to survey the entire Preserve with very little thought of sampling. However, it became apparent quickly that the time and lab or involved in a complete survey was prohibitive, and our survey design was modified to a more realistic goal. This goal was to sample a small fraction of the Preserve's total area in a very intensive manner. A probabilistic survey was employed to estimate statistically the diversity, density, and spatial distribution of archaeological remains in the six Mashomack habitats (coastal strip, tidal creeks, salt ponds, oak-heath, oak-sedge and freshwater wetlands). Survey units from each of the habitats were field inspected in great detail by survey crews. Multiple shovel units were excavated at set intervals in an attempt to discover archaeological remains of both high and low visibility.

The survey method was designed to minimally impact the flora and fauna of the Preserve. Two areas of the Preserve, which are home to several endangered species of plants and animals, were not surveyed. These sensitive areas included the Pine Swamps near the western boundary, where rare freshwater wetland flora thrive, and the southeastern section of the Preserve from Bass Creek to the tip of Mashomack Point (see Figure 2). Here, the protected osprey of Mashomack nest and raise their young during the late spring and summer months.

Field Methods

The survey methodology involved a number of important decisions. These decisions involved the size and shape of survey units (transect/block), choosing an appropriate sampling stategy for selecting survey units (random, stratified, judgemental), the number of survey units (sample size), the percentage of the study area to be surveyed (sample fraction), and the intensity of survey coverage (interval between shovel probes). The survey methods employed in the subsurface survey are described below.

1. **The Grid System**. The first stage of our survey methodology was to establish a grid system consisting of units measuring 10 hectares each across Mashomack. All grid squares were provenienced in relation to a master datum point set up about 300 meters south of the Fan Creek estuary (see Figure 3). The southwest corner of each square was used to designate the north/south and east/west distance from the master datum. A total of 56 whole or partial grid squares were defined in the ecologically nonsensitive areas of the Preserve accessible to survey crews.

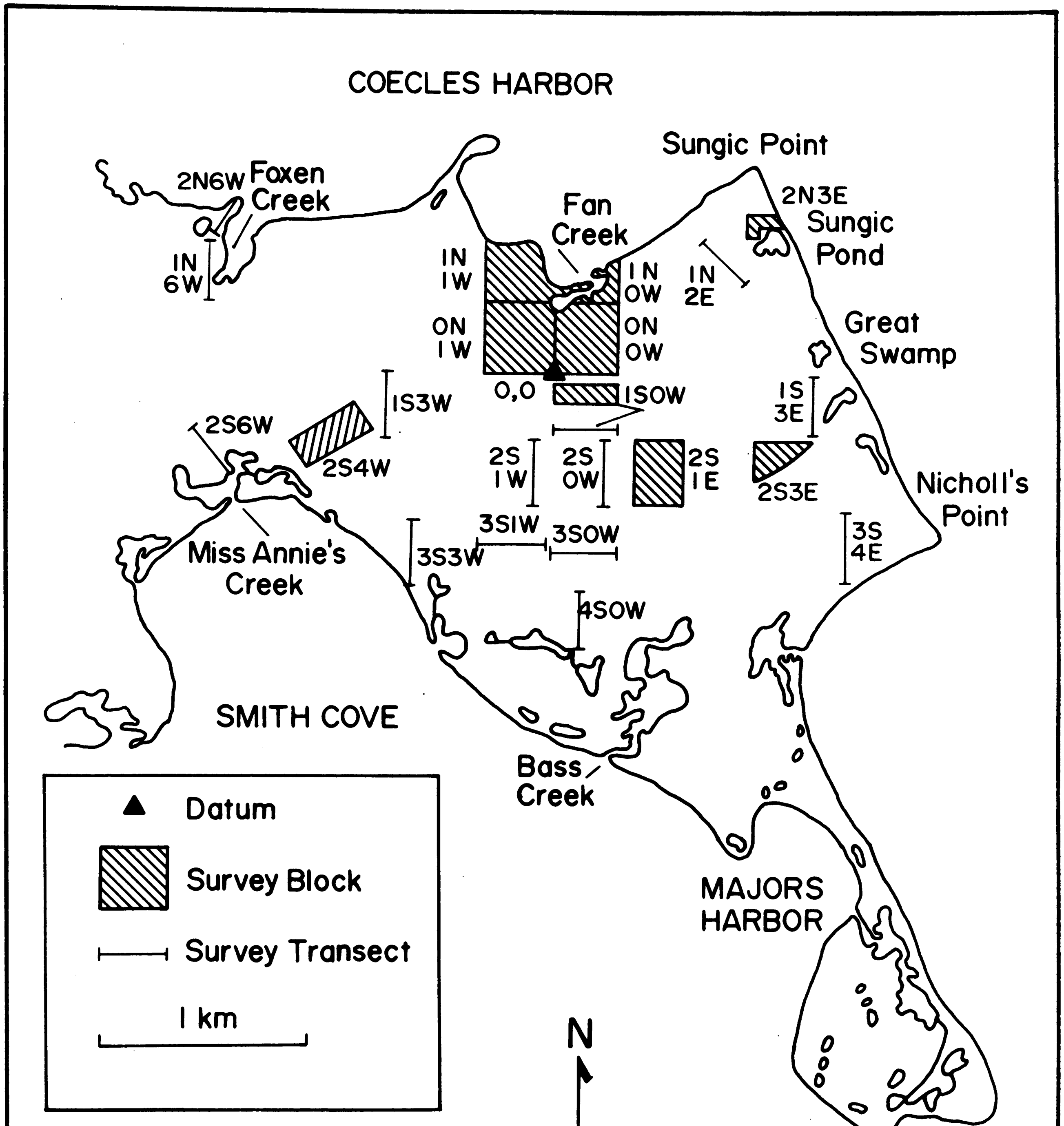

Figure 3. Mashomack Survey Units

2. **The Shape and Size of Survey Units**. The second stage involved making decisions about the shape and size of survey units. We decided to use two unit shapes consisting of linear transects and rectangular block units.

The transects were used to obtain information from different habitats without a tremendous investment of time and labor. The shortcoming of transects is the minimal spatial coverage represented by each unit. While one can get a sense of the density and diversity of archaeological remains found in each habitat, the spatial pattern of archaeological remains within a habitat is more elusive.

In contrast, while blocks are much more costly to survey than transects, they are especially useful for gathering detailed information on inter-site relationships and the spatial association of archaeological remains. This kind of detail can provide important insights into organizational parameters of prehistoric communities, a matter taken up in more detail later.

Most transects measured about 300 to 320 meters long (the length of a 10 hectare grid square) by 30 to 40 meters wide, although the length varied depending upon local geographical considerations, especially along the Mashomack shoreline. The blocks ranged in size from .5 to ten hectares.

3. **Sampling Strategies**. We decided to employ two different types of sampling strategies. Since transects can provide general information about the location of archaeological remains without major labor investments, we used a stratified random sampling design. We stratified the universe into habitat types according to the following criteria. Wetland habitats were defined as a 100 meter radius around the coastal strip, salt ponds, tidal creeks and freshwater ponds. Oak-heath and oak-sedge habitats were defined as the area beyond a 100 meter radius of freshwater or salt water wetlands, depending upon the soil and floral conditions. Of the 56 grid squares accessible to survey crews, we found that a little more than half contained salt and/or freshwater wetlands. Ten consisted of some fraction of tidal creeks, nine contained freshwater wetlands, five ringed the coastal strip and eight contained salt ponds. Another 24 grid squares were either oak-sedge or oak-heath habitats that contained no wetlands.

We employed a stratified judgmental sampling design to choose block survey units. The purpose was to obtain detailed spatial information on archaeological remains from both coastal wetland and upland oak habitats. In consultation with Michael Laspia, Preserve Director, we laid out large blocks across five habitats -- tidal creek, salt pond, freshwater wetland, oak-heath and oak-sedge.

4. **Sample Size and Sample Fraction**. The transects were chosen from each habitat stratum using a random numbers table. A 25% sample was selected. The sample included one from the coastal strip (3S3W), three from the tidal creek (2N6W, 1N6W, 2S6W), two from the salt pond (2N3E, 1S3E), four from the oak-heath (1S0W, 2S0W, 2S1W, 3S0W), three from the oak-sedge (1N2E, 1S3W, 4S0W), and two from the freshwater wetland (3S1W, 3S4E) (see Figure 3). The transects were oriented either in a north/south or east/west direction and ran the entire length of the grid. Fifteen transects were laid out and surveyed during the summer of 1984. The area surveyed was about 12 hectares, or a .014 sample fraction of the entire 825 hectare Preserve.

Seven survey blocks were surveyed during the 1983 and 1984 field seasons. These are as follows:

Two contiguous blocks, each consisting of two grid squares (0N1W/1N1W and 0N0W/1N0W), were placed along the tidal creek of the Fan Creek estuary. The former block covered the eastern half of the estuary and assorted salt ponds, while the other covered the western half. The purpose of this was to survey the entire extent of a Mashomack estuary.

Another block (2S3E) was placed adjacent to the Great Swamp which contained a salt pond to the north and a freshwater marsh along its southern periphery.

Two additional blocks were laid out in the upland oak-heath habitat (2S4W, 2S1E). The former encompassed an overgrown agricultural field that was once part of Miss Annies farm complex. The farm complex consisted of a large manor house, a barn and other out buildings, as well as the agricultural fields (see Dunhill 1982). The latter block contained a mature oak woodland dotted with an undercover of cat briar.

An additional interior block (1S0W) was set up in a large kettle hole composed of a mixture of oak-heath and oak-sedge vegetation.

The final block (2N3E) was an area already studied during the transect survey. Since the original transect along the north side of Sungic Pond proved very productive, as described below, an additional transect was surveyed to the north of the original that was only .5 hectare in size.

The entire block survey involved the intensive study of 32 hectares or about a .04 sample fraction of the entire 825 hectare Preserve.

5. **Survey Coverage**. The fifth stage involved the decision about the intensity of subsurface testing coverage. Field crews of four or five persons spaced ten meters apart surveyed each

transect and block. After some experimentation in the field, we chose to excavate shovel probes at 10 meter intervals. Each shovel probe, measuring 30 cm in diameter, was excavated to sterile Pleistocene deposits, which varied in depth from 25 to 80 cm. Most probes measured about 40 to 50 cm in depth. All soil was screened through .6 cm mesh to aid in the recovery of artifactual material.

Transect units were covered by one pass of a survey crew, while block units were covered by contiguous passes back and forth within the unit boundaries. Each pass of a survey unit resulted in shovel probes being excavated at the corners of a ten by ten meter grid system. We were fairly confident in our ability to detect most archaeological manifestations that had spatial distributions greater than a ten meter radius, and a sample of remains smaller than this. Using statistical estimates, described in Lightfoot (1986), we felt relatively secure in our ability to estimate the number of large and small archaeological manifestations in survey units.

Every shovel probe was assigned a specific provenience designation that included a) the survey unit number, b) transect number, d) the shovel probe station and d) the position number. The survey unit designation was that given the 10 hectare unit grid square within which the survey unit was placed. The transect number was defined by the number of passes across the unit (transect units always had one pass, while block units varied from 1 to 7). The shovel probe station was specified by the exact number of 10 meter intervals walked across the unit by survey crews. Position numbers were assigned to crew members based on their position across the survey unit. A probe excavated by a crew member at a specific shovel probe station was assigned that person's position number. For example, the shovel probe designation 2S6W 1-32-4 defines the fourth position of shovel probe interval 32 on the first pass of the survey unit in grid square 2S6W.

Shovel probes containing any cultural material were defined as "positive" probes. Material recovered from a positive probe was collected, its shovel probe provenience recorded, and a brief description of the find noted. When a positive probe was pinpointed in the field, all crew members converged and additional shovel probes were excavated from that point every two meters in the four cardinal directions until sterile probes were observed (cf. Chartkoff 1978, McManamon 1981:205). This procedure, defined as the "iron cross", was employed to distinguish isolated artifacts from larger scatters of cultural material. We were careful to record iron crosses separately from the shovel probes excavated systematically at 10 meter intervals. In this report, the systematic shovel probes are designated with a "S" for systematic survey, while the latter are defined by an "IC" for Iron Cross.

Archaeological Manifestations

Information from positive probes was employed to define three classes of archaeological manifestations -- a) isolated finds, b) low density scatters and c) high density scatters. These manifestations were defined by the following three criteria.

1. Spatial Dimensions. Positive S probes from each survey unit were plotted on graph paper. Isolated finds were defined as those manifestations where no or very few other positive S probes were found nearby and where IC probes excavated around that probe yielded no additional cultural materials. Scatters were defined as those manifestations containing multiple positive S and IC probes concentrated in a bounded unit of space.

The boundaries of limited scatters were defined by extending IC probes along the artifact bearing axes of the iron crosses as far as the distribution of artifacts continued. By excavating IC probes in the direction(s) of the artifact dispersal, we could roughly determine the size and depth of a manifestation and collect a sample of artifacts from across the scatter. The boundaries of more extensive scatters were defined by the overall spatial patterning of positive S probes, as well as additional information from IC probes. In most cases, the boundaries of scatters were outlined by surrounding buffer zones that contained few or no archaeological remains.

2. Percentage of Positive S Probes. This measure (P%) provided an estimate on the dispersal of artifactual material within scatters. The number of positive S probes was divided by the total number of S probes excavated within the area of the scatter. Scatters of less than a 10 meter radius may have only one S probe intersect them, while larger scatters had ten or more S probes fall within their boundaries. A low P% indicated a spotty distribution of material detected across the scatter, while a high P% noted a heavy dispersal of cultural material.

3. Artifact Density. We calculated the mean density (AD) and standard deviation (ASD) of artifacts per positive probe. Calcuations were undertaken on all positive S and IC probes found within the scatter.

Low density scatters had sparse quantities of material dispersed across the boundaries of the scatter. These manifestations exhibited relatively low percentages of positive S probes and low artifact densities per positive probes. After careful examination of the survey information, we found that low density scatters were usually characterized by P% of 1 to 35% and an AD value of less than 1.5. That is, less than 35% of the S probes proved positive and positive probes yielded less than 1.5 artifacts each on the average.

High density scatters were relatively discrete manifestations that contained a dense concentration of cultural material. These manifestations were characterized by a high percentage of positive S probes and a high density of artifact material per positive probe. Our survey information indicated that most high density scatters had P% values of between 50 to 100% and AD values of 2 or more. In a few cases we recorded scatters where all S probes proved positive and where the artifact density per probe was 10 or greater. Other high density scatters exhibited a fall-off pattern of cultural material, where the number of positive probes and artifact density per probe decreased from the core of the scatter to the periphery, eventually to the point where the detection of cultural remains ceased.

Archaeological Manifestations: A Consideration

Two considerations must be recognized when examining the survey data. First, it must be stressed that the survey methodology is sampling a very small fraction of the subsurface area within survey units (see Wobst 1983 for a discussion). This is also true for the archaeological manifestations tested in the field. The relatively few artifacts recovered from most scatters represent a very small fraction of the total cultural material inventory. A few flakes recovered from positive probes may represent only the tip of the manifestation.

One of the benefits of employing a probabilistic sampling design is that statistical estimates can be made for the total manifestation. In this report we occasionally present estimates on the total cultural material inventory from low and high density scatters. These estimates are based on the recognition that, theoretically, approximately 11 shovel probes can be excavated for every square meter of scatter. If one knows the areal extent of the manifestation, the percentage of positive probes and the artifact density per positive probe, then one can calculate roughly the range of materials found within a scatter. We used the following formula to make these estimates:

$$S \times P\% \times (AD \pm ASD) \times 11 = E$$

Where: S = Size of manifestation (m2)
P% = Percentage of Positive S Probes
AD = Mean Artifact Density Per Positive Probe
ASD = Artifact Standard Deviation
E = Estimate of Cultural Material Inventory

The second consideration is that the concepts of isolated finds, low density scatters and high density scatters are strictly archaeological definitions. These concepts simply define the distribution and density of cultural material found in shovel probes. How one interprets these phenomena is an entirely different matter. Depending upon the spatial distribution and context of isolated artifacts and low density scatters, they may represent the remains of historic farming activities that involved the relocation of artifacts by fertilizing fields with midden deposits (i.e. Ceci 1984). They may represent raw materials and tools lost or discarded by prehistoric people during various extractive activities. In this sense these manifestations may be viewed as part of larger non-site manifestations or low density procurement locations discussed in Chapter One.

High density scatters may also be interpreted in a variety of ways. Some may be simply concentrations of midden residue dumped as part of historic farming practices (Ceci 1984). Other manifestations may be traditionally defined sites that represent the remains of individual residential bases, field camps or bulk procurement locations. Still other scatters may be part of a much larger prehistoric settlement that was dispersed broadly across the landscape. For example, a dispersed community composed of individual house clusters surrounded by garden plots may be reflected in the archaeological record by multiple but discrete material cultural concentrations dispersed over a broad area. The point of this discussion is that the behavioral interpretation of the archaeological manifestations must be based on their depositional context and spatial distribution.

Analysis of Cultural Material

All cultural materials collected from positive S and IC probes were cleaned, labeled and analyzed in the Laboratory of Archaeology at SUNY at Stony Brook. Counts of all artifacts were tallied, and shellfish and bone remains were weighed.

The cultural material was divided initially into chipped stone material, ground stone material, fire-cracked rock, ceramic material, and shellfish remains.

1. **Chipped Stone Material**. These lithic remains, which make up the bulk of the Mashomack artifacts, were classified by both raw material and artifact type. The raw material types included several varieties of quartz (variegated, smokey, milky, rose, rock crystal, citrine), quartzite, chert, jasper, and granite, as well as a few others. The identification of artifact types began by separating utilized from nonutilized materials. All flakes were examined under a binocular microscope (60x - 150x) in an attempt to define edge damage resulting from utilization. Defining use-wear patterns on quartz or quartzite material proved difficult, however, since the hard surface does not result in edge damage as distinctive as flint, cherts or obsidian. Experimental work showed that quartz and quartzite tools would exhibit edge damage if they were used intensively in a cutting, scraping, or chopping activity, especially if the activity involved the modification of a relatively hard surface

such as bone, shell, or wood. The edge angles of all utilized surfaces were measured.

Utilized chipped stone materials were classified on the basis of morphological characteristics and edge angles defined by Most (1987). These included projectile points, hammerstones, perforators, knives, scrapers, and choppers. Most (based on Wilmsen 1972) employed edge angles to define tools suitable for cutting or slicing functions (knife; 1-29 degrees), skinning, hide scraping and shredding plant fiber (scraper; 30-59 degrees), and heavy duty chopping activities (choppers; 60 degrees or more).

Projectile points were further classified into traditional types based on their size and shape (see Ritchie 1961). We observed two common types at Mashomack -- a narrow stemmed point identified as the Wading River type (Ritchie 1959), and a triangular shaped point defined either as a Levanna or Madison type depending upon its size (Ritchie 1961:31-34). The Wading River points are the most common type of the Late Archaic period on Long Island (4000-1300 BC), while the Levanna and Madison points date primarily to the Late Woodland (AD 1000 - 1500).

The nonutilized chipped stone material appears to represent chipping debris resulting from different stages of lithic reduction. Six categories of lithic debris were defined -- primary decortication flakes, secondary decortication flakes, tertiary decortication flakes, micro flakes, shatter and cores. Primary flakes are those removed initially from the outside of a core. The dorsal side of the flake contains little or no evidence of flake scars and a high percentage of cortex material (90 to 100%). Secondary flakes are defined by dorsal surfaces exhibiting one or two flake scars and approximately 30 to 90 percent cortex material. Tertiary flakes consist of lithic pieces showing multiple dorsal flake scars and little or no (0 to 30%) cortex on their dorsal surface. Micro flakes are very small flakes measuring less than 1 cm along the longest axis. These may represent flakes from thinning bifaces, or tool retouch, or be small pieces of debitage (see Boudreau 1981:20). Shatter refers to workshop debris resulting from core reduction and/or tool production where no attributes characteristic of flakes are observed (i.e. bulb of percussion, striking platform). Cores are usually quartz or quartzite cobbles from which flakes were detached.

2. **Ground Stone Material.** Ground stone was defined as those lithic tools that were ground or pecked into shape. Few ground stone tools were found at Mashomack and these included pestles, grinding slabs, adzes, and axes.

3. **Fire-Cracked Rock**. This category included cobbles that had been fired at high temperatures and then cooled to produce highly fractured and fire-reddened rocks.

4. **Ceramic Material**. Ceramic materials included any fire hardened clay artifacts, the majority of which were sherds from ceramic vessels and pipes. Temper type, surface color and surface treatment were recorded for all ceramic materials.

5. **Shellfish Material**. Shellfish remains were sorted by species and weighed. The primary species represented in archaeological contexts included *Mercenaria mercenaria* (hard clam), *Mya arenaria* (soft clam), *Buccinidae* (whelk), *Crassostrea virginica* (oysters), *Pecten irradians* (bay scallops), and various snails.

The Transect Survey: Results

A total of 1642 systematically aligned shovel probes were excavated along the 15 transects. Seventy-three of these S probes, representing 4% of the sample, yielded prehistoric cultural material. 138 lithic, ceramic, and charcoal specimens were recovered, along with 3737 grams of shellfish remains. Most of the artifacts were buried 10 to 40 cm below the ground surface. There was little evidence of a plow zone in any of the transects.

The chipped stone material consisted of 90 pieces of lithic reduction debris (9 primary, 39 secondary, 22 tertiary, 11 micro, 2 shatter, 7 cores) and 5 tools (1 projectile point - type unidentified, 2 hammerstones, 1 scraper and 1 axe). The most common chipped stone material was quartzite (26), followed by variegated quartz (22), milky quartz (18), rock crystal quartz (6), citrine quartz (6), granite (5), smokey quartz (2) and basalt (1). No chert or jasper artifacts were recorded.

Other materials included three ceramic artifacts (1 sherd and 2 pieces of a pipe), 25 pieces of fire-cracked rock and fifteen chunks of charcoal. The species of shellfish represented include oyster (69 g.), whelk (49 g.), soft clam (2594 g.), hard clam (916 g.), scallop (92 g.), and snails (10 g.). Specific information on all cultural material is listed in Appendix One. This information includes the shovel probe designation (Unit#-Transect#-Shovel Probe Station-Position), shovel probe type (S or IC), depth below ground surface, habitat type (coastal strip, tidal creek, etc.), raw material type, cultural material type, and artifact counts or shellfish weights.

The results of the transect survey are discussed below in relation to individual transects, habitat types, and archaeological manifestations.

Transects

The detection of cultural material varied significantly among the transects. Table 1 summarizes information on each transect including the number of shovel probes excavated, the number of positive shovel probes, the percentage of positive shovel probes, and the cultural materials detected within positive shovel probes.

Tr.	Lgth	Wdth	Habitat	Shovel	Probes		Cultural	Materials				
Unit	m	m	%	T	P	P%	CSD	CT	Ch	Ce	FC	Sh
1N6W	340	30	B 100	140	10	7	8	0	0	0	4	72g
1N2E	290	20	E 80/D 20	90	0	0	0	0	0	0	0	0
1S0W	180	30	D 100	76	1	1	0	1	0	0	0	0
1S3E	350	30	C 50/F 50	144	13	9	15	0	10	0	4	0
1S3W	290	40	E 100	150	2	1	2	0	0	0	0	0
2N3E	160	30	C 100	68	10	15	33	0	0	0	7	3065g
2N6W	120	30	B 100	52	0	0	0	0	0	0	0	0
2S0W	290	40	D 100	150	2	1	1	1	0	0	0	0
2S1W	310	30	D 100	128	1	1	2	0	0	0	0	0
2S6W	320	30	B 100	132	26	20	24	2	2	1	10	586g
3S0W	290	30	D 100	120	2	2	0	1	2	0	0	0
3S1W	310	30	D 75/F 25	128	0	0	0	0	0	0	0	0
3S3W	190	30	D 70/A 30	80	6	7	5	0	1	2	0	14g
3S4E	140	30	A 10/F 30 E 60	60	0	0	0	0	0	0	0	0
4S0W	300	30	E 80/D20	124	0	0	0	0	0	0	0	0
	Totals			1642	73		90	5	15	3	25	3737g

KEY Habitat: A = Coastal Strip, B = Tidal Creek, C = Salt Pond
D = Oak-Heath, E = Oak-Sedge F = Fresh

Shovel Probes: T = Total S Probes Excavated
P = Number of Positive S Probes
P% = Percentage of Positive S Probes (P/T)

Cultural Materials: CSD = Chipped Stone Debris
CT = Chipped Stone Tools
Ch = Charcoal
Ce = Ceramics
FC = Fire-Cracked Rocks
Sh = Shellfish (grams)

Table 1. Transect Survey Information (By Transect).

One group of transects (1N2E, 1S0W, 1S3W, 2N6W, 2S0W, 2S1W, 3S0W, 3S1W, 3S4E, 4S0W) is characterized by few positive S probes, ranging from 0 to 2% of the total number excavated. In contrast, another group of transects (1N6W, 1S3E, 2N3E, 2S6W, and 3S3W) yielded the majority of the artifacts and shellfish remains detected during the survey. Between 7 to 20% of the S probes excavated along these transects proved positive.

This latter group of transects also produced a diverse range of cultural materials. That is, each transect contained chipped stone debris and at least two other categories of cultural material. Interestingly, the transects (1N6W, 2N3E, 2S6W) with largest quantities of shellfish remains also contained the greatest amount of fire-cracked rock and the majority of the chipped stone artifacts.

A final observation concerns the ecological association of the artifact bearing and nonartifact bearing transects, a matter taken up in more detail below. There is a tendency for the former to be coastal transects associated with tidal creeks, salt ponds, and the coastal strip. The nonartifact bearing transects tend to be found in upland zones of oak-sedge or oak-heath vegetation.

Habitat Types

Another way to examine the spatial pattern of positive S probes is to examine their distribution with respect to specific habitats. The total number of shovel probes excavated within each habitat was calculated, and the number of artifact bearing probes tallied. This information, along with the cultural material categories associated with each habitat, is presented in Table 2 (following page).

An examination of Table 2 demonstrates clearly that cultural materials are found primarily within coastal habitats. Survey along the coastal strip, tidal creeks and salt ponds produced a relatively high percentage of artifact bearing probes containing a diverse assortment of cultural materials. Our calculations suggest that for every 100 S probes excavated in these coastal habitats between 11 to 16 will yield cultural material.

In contrast, the upland interior habitats appear to contain little prehistoric cultural material. The excavation of more than a 1000 shovel probes in the oak-heath, oak-sedge and fresh-water habitats produced only 10 positive shovel probes. Our calculations suggest that for every 100 S probes excavated in the interior only one, on the average, will produce cultural material. The diversity of cultural material found in the uplands is also rather minimal, consisting primarily of chipped stone debris and tools.

Shovel Probes Habitat	T	T%	P	P%	Cultural Materials CSD	CT	Ch	Ce	FC	Sh
A	30	2	4	13	3	0	1	2	0	14g
B	324	20	37	11	32	2	2	1	14	658g
C	140	8	22	16	47	0	10	0	11	3065g
D	668	41	6	1	5	2	2	0	0	0
E	358	22	3	1	2	1	0	0	0	0
F	122	7	1	1	1	0	0	0	0	0
Totals	1642	100	73		90	5	15	3	25	3737g

KEY

Habitat: A = Coastal Strip B = Tidal Creek C = Salt Pond D = Oak-Heath E = Oak-Sedge F = Fresh-water

Shovel Probes: T = Number of S Probes Excavated
T% = Percentage of Total S Probes Excavated (T/Total T)
P = Number of Positive S Probes
P% = Percentage of Positive Shovel Probes By Habitat Type (P/T)

Cultural Materials: CSD = Chipped Stone Debris
CT = Chipped Stone Tools
Ch = Charcoal
Ce = Ceramics
FC = Fire-Cracked Rocks
Sh = Shellfish (grams)

Table 2. Transect Survey Information (By Habitat).

In evaluating the above relationship it must be recognized that a major portion of our survey effort focused on the uplands. About 70% of the 1642 S probes were excavated in upland habitats. Our results indicate strongly that there is a significant association between coastal habitats and cultural material. If cultural materials were randomly distributed with respect to habitat, then one would expect a greater number of positive shovel probes in the interior. Table 3 presents the number of shovel probes that would be expected in each habitat if cultural materials were randomly distributed, compared to the observed number of artifact bearing shovel probes. The coastal habitats contained two to four times more positive shovel probes than expected in a random distribution. In contrast, the upland habitats contained five times fewer artifact bearing shovel probes than expected (X^2 =47.8; df=5; p=.001).

Habitat	Percent Of Sample	Positive Shovel Probes Expected #	Observed #
A	2	1	4
B	20	15	37
C	8	6	22
D	41	30	6
E	22	16	3
F	7	5	1
Totals	100	73	73

KEY

Habitat: A = Coastal Strip B = Tidal Creek C = Salt Pond
D = Oak-Heath E = Oak-Sedge F = Fresh-water

Table 3. Expected Number of Positive Shovel Probes By Habitat.

Some differences can be observed in the density and kinds of cultural materials detected in the coastal habitats. For example, 2N6W, the northern most survey unit on Foxon Creek, did not produce any cultural material. However, there appear to be mitigating circumstances to consider in this case. The northern end of Foxon creek has been highly disturbed by recent dredging activites in Coecles Harbor, and extensive spoil piles have been deposited here. Interestingly, a prehistoric site (shell midden) has been reported by Norman Sanwald directly west of the transect in an undisturbed area (see Brush and Brush 1982). Furthermore, in the less disturbed southern section of Foxon Creek, transect 1N6W did yield a relatively high percentage of postitive S probes.

The most significant difference among the coastal habitats concerns the species of shellfish recovered from shovel probes. The tidal creek habitats sampled from the northern (Foxon Creek) and southern coasts (Miss Annies Creek) of Mashomack contained 658 grams of shellfish, of which hard clam (508 g.) dominated, followed by bay scallop (57 g.), oyster (37 g.), whelk (34 g.), snails (10 g.) and, finally, soft clam (5 g.). The coastal ponds sampled from the eastern boundary of the Preserve (Sungic Pond, the Great Swamp), produced 3065 g. of shellfish, of which soft clam (2575 g.) clearly dominated all the others (hard clam 408 g., bay scallop 35 g., oyster 32 g., and whelk 15 g.).

Archaeological Manifestations: The Transect Survey

The final observation concerns the kinds of archaeological manifestations found in the transect units. Tables 4 and 5 tally pertinent infomation on the isolated finds and the low and high density scatters recorded in the transect survey. Table 4 summarizes the provenience of each manifestation, the size of each scatter, the number of positive S probes, the total number

Provenience Unit	Tr-Sp	Type	Hab	Size M2	Shovel Probes PS	TS	P%	IC	AD	ASD
1N6W	1-2	LD	B	1400	7	20	35	0	1.3	.9
1N6W	1-27	HD	B	300	3	5	60	3	1.2	.4
1N6W	1-21	IF	B	-	1	-	-	0	3.0	0
1S0W	1-8	IF	E	-	1	-	-	0	1.0	0
1S3E	1-3	IF	C	-	1	-	-	0	1.0	0
1S3E	1-25	HD	C	1750	11	21	52	6	2.4	1.6
1S3E	1-36	IF	C	-	1	-	-	0	3.0	0
1S3W	1-3	IF	E	-	1	-	-	0	1.0	0
1S3W	1-8	IF	E	-	1	-	-	0	1.0	0
2N3E	1-0	HD	C	800	8	13	61	11	3.6	2.3
2N3E	1-7	LD	C	600	3	8	37	8	2.2	1.8
2S0W	1-7	IF	D	-	2	-	-	0	1.0	0
2S1W	1-26	IF	D	-	1	-	-	0	2.0	0
2S6W	1-19	HD	B	40	2	2	100	1	3.7	2.5
2S6W	1-22	HD	B	2400	24	33	72	10	1.7	1.7
3S0W	1-26	IF	D	-	1	-	-	0	1.0	0
3S0W	1-5	IF	D	-	1	-	-	0	1.0	0
3S3W	1-3	IF	D	-	2	-	-	0	1.0	0
3S3W	1-8	HD	A	240	2	5	40	7	2.2	1.4
3S3W	1-13	IF	A	-	1	-	-	0	1.0	0
3S3W	1-14	IF	A	-	1	-	-	0	1.0	0

KEY

Type: IF = Isolated Find LD = Low Density Scatter
HD = High Density Scatter

Habitat: A = Coastal Strip B = Tidal Creek C = Salt Pond
D = Oak-Heath E = Oak-Sedge F =Fresh

Shovel Probes: PS = # of Positive S Probes Within Scatter
TS = Total # of S Probes Within Scatter
P% = Percentage of Positive S Probes(PS/TS)
IC = # of Positive IC Probes Within Scatter
AS = Mean Artifact Density Per Positive Probe
ASD = Artifact Standard Deviation

Table 4. Transect Survey Archaeological Manifestations.

of S probes excavated within the area of the scatter, the percentage of positive S probes, the number of positive IC probes, and the mean density and standard deviation of artifacts from postive S and IC probes. Table 5 presents counts or weights of all cultural materials sampled from each manifestation.

Provenience Unit	Tr-Sp	P	S	T	Sa	Co	M	H	K	Pp	Sc	C	FC	Ce	Ch	Tsh	SC	HC	SA	O	W	SN	U
		Cultural Materials														Shellfish (Grams)							
1N6W	1-2	0	5	1	0	1	1	0	0	0	0	0	1	0	0	66	0	0	57	0	0	9	0
1N6W	1-27	2	1	0	0	0	0	0	0	0	1	0	4	0	0	6	0	0	0	0	0	0	6
1N6W	1-21	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
1S0W	1-8	0	0	0	0	0	0	0	0	0	0	0	0	0	0 1*	0	0	0	0	0	0	0	0
1S3E	1-3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1S3E	1-25	1	7	13	0	1	4	0	0	0	0	0	2	0	10	0	0	0	0	0	0	0	0
1S3E	1-36	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0
1S3W	1-3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1S3W	1-8	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2N3E	1-0	9	30	8	6	7	0	0	0	0	1	0	13	0	0	4404	3481	847	42	34	0	0	0
2N3E	1-7	1	10	7	0	0	2	0	0	0	0	0	0	3	0	109	0	68	0	1	31	8	0
2S0W	1-7	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
2S1W	1-26	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2S6W	1-19	2	3	2	0	0	1	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
2S6W	1-22	5	16	4	0	2	12	1	0	1	0	0	12	1	5	1074	38	899	0	51	84	1	1
3S0W	1-26	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
3S0W	1-5	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
3S3W	1-3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3S3W	1-8	2	1	0	0	0	8	0	0	0	0	0	0	2	6	53	13	27	0	0	0	0	13
3S3W	1-13	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3S3W	1-14	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

KEY Cultural Materials:

P = Primary
S = Secondary
T = Tertiary
Sa = Shatter
Co= Core
M = Micro Flake
H = Hammerstone
K = Knife
PP= Projectile Point
Sc= Scraper
C = Chopper
FC= Fire-Cracked Rock
Ce= Ceramic
Ch = Charcoal
Tsh= Total Shellfish
SC= Soft Clam
HC = Hard Clam
SA= Scallop
O = Oyster
W = Whelk
SN= Snail
U = Unidentified Shellfish
*= Axe

Table 5. Transect Survey Cultural Materials.

The nature of the isolated finds, low density and high density scatters are examined below in some detail.

1. <u>**Isolated Finds**</u>. Thirteen isolated finds were detected from almost every habitat of the Preserve (see Figure 4). These included two from the coastal strip, one from the tidal creek,

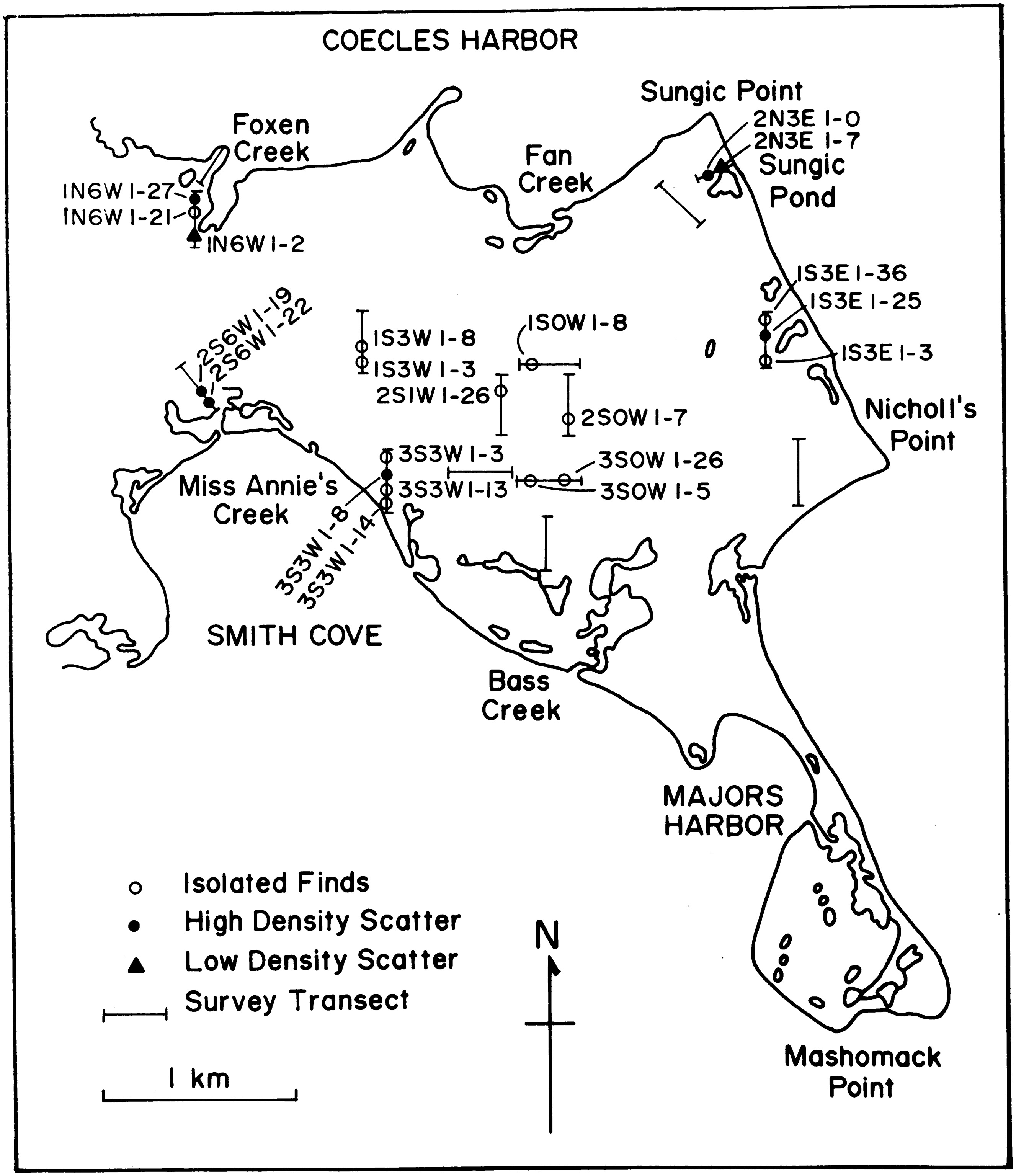

Figure 4. Transect Survey Archaeological Manifestations

two from the salt pond, five from the oak-heath and two from the oak-sedge habitats. Interestingly, the isolated finds of the coastal habitats consisted only of secondary and tertiary flakes and a fire-cracked rock, while those of the upland habitats included primary, secondary, tertiary and micro flakes, a chopper, an axe, a tip of a projectile point, and charcoal.

2. **Low Density Scatters**. We plotted two sparse scatters of artifacts in the tidal creek and salt pond habitats (see Figure 4).

1N6W 1-2. A relatively broad scatter of chipped stone debris, fire-cracked rock and a trace of shellfish was recorded along the southern half of Foxon Creek. Transect field notes indicate 66 grams of shellfish, consisting predominately of bay scallop, may have been dumped fairly recently in the area. The area has served as the camp site of several boy scout troops over the years.

2N3E 1-7. Survey crews recorded this thin scatter of cultural material on a low rise overlooking Sungic Pond. A moderate number (37%) of S probes proved positive across the scatter, from which chipped stone debris, a small quantity of shellfish (mostly hard clam and whelk) and three ceramic sherds were collected.

3. **High Density Scatters**. Six concentrations of artifacts and/or shellfish were defined exclusively in the coastal habitats (see Figure 4). They are as follows:

1N6W 1-27. A small linear shaped scatter adjacent to Foxon Creek, this manifestation is a relatively sparse concentration of chipped stone debris, fire-cracked rock, a scraper and a trace of shellfish refuse. The scatter falls on the lower boundary of our definition of a high density scatter -- while 60% of the S probes proved positive, the mean artifact density per probe was only 1.2.

1S3E 1-25. A large lithic scatter found adjacent to the Great Swamp, this manifestation is characterized by a moderate percentage of positive S probes and moderate artifact density. With the exception of two pieces of fire-cracked rock and charcoal, the material sampled from the site is entirely chipped stone debris. No shellfish remains were recovered. The concentration of workshop debris suggests that the production and/or maintenance of lithic artifacts took place here.

2N3E 1-0. This is a relatively large shell midden and associated lithic scatter detected directly north of Sungic Pond. A moderate number of S probes proved positive within the site area (61%), and those that did yielded high artifact counts ($\bar{x}$ = 3.6). The scatter, which extends from shovel probe intervals 1-0 to 1-4, was initially defined in the field as two separate sites based on the kinds and distributions of artifacts. The western-most shovel probe stations (1-0,1-1,1-2) sampled a lithic scatter on a slight hill, while the eastern shovel probe intervals (1-3 and 1-4) intersected the shell midden proper in a slight hollow. The shell midden is relatively large, about 14 x 20 meters in size, and contains a dense concentration of soft and hard clams, and scallop. Survey crews also recovered two unidentified animal bones. The average density of shellfish per probe was 232 grams (all probes) and 1468 grams (only probes from the midden proper). The size and density of the midden remains, as well as the diversity of shellfish refuse, suggests that this site may have functioned as a residential base, a point considered in detail next chapter. We estimate that the entire site contains somewhere between 7000 and 31,700 artifacts and roughly 2,758,000 grams of shellfish refuse.

<u>2S6W 1-19</u>. This small lithic scatter near Miss Annies Creek produced a high percentage of positive S probes (100%) and a high artifact density ($\overline{x}$ = 3.7 per probe). The sampled assemblage consisted of primary, secondary, tertiary and micro flakes, a hammerstone and two fire-cracked rocks. The site is situated on low hill overlooking the large shell midden of Miss Annies Creek (see following discussion). The heavy concentration of chipped stone debris suggests that the scatter may have served as a workshop area. We estimate that between 500 and 1500 pieces of chipped stone debris are dispersed across the 40 m2 area.

<u>2S6W 1-22.</u> This site consists of a combination lithic scatter and shell midden. The overall site produced a very high percentage of positive shovel probes (72%), but a very low density of artifacts per probe (1.7). The site extends over ten systematic shovel probe stations, from 1-22 to 1-32. Originally, we defined this manifestation as two separate sites in the field. The northern-most shovel probe intervals (1-22, 1-23, 1-24,1-25) yielded a diverse range of chipped stone material and a triangular projectile point, identified as a Late Woodland Madison point. The southern-most shovel probe intervals (1-26, 1-27,1-28,1-29,1-30,1-31,1-32) delineated the large shell midden (approximately 40 x 40 meters in size) adjacent to Miss Annies Creek. The shell midden probes contained micro flakes, a ceramic sherd, a hammerstone, multiple fire-cracked rocks and a mixture of shellfish remains primarily of hard clam, whelk and oyster. The average density of shellfish varied from 31 grams per probe (for all probes) to 47 grams per probe (for probes from the midden proper). Again, the relatively large size of the midden and the diversity of shellfish remains suggest the site functioned as more than a simple bulk procurement location or short-term field processing camp. The number of artifacts recovered from test probes varied substantially, as indicated by the high standard deviation (see Table 4), suggesting that the number of artifacts represented at the site may range

substantially from 380 to 64,600. We estimate tht more than 595,500 grams of shellfish may be found in the midden area.

3S3W 1-8. Situated along the coastal strip of Mashomack's south shore, this small scatter is characterized by a moderate percentage of positive S probes (40%) and a moderately high density of 2.2 artifacts per positive probe. The manifestation, which actually falls between our definition of a low and high density scatter, is significant because it contained chipped stone debris, charcoal, a small quantity of hard (27 g.) and soft (13 g.) clam, and two pieces of a kaolin pipe. While the temporal context of this scatter is questionable, it could be one of the few Contact period Native American sites identified at Mashomack.

The Block Survey: The Results

A total of 3881 systematically aligned shovel probes were excavated within the seven blocks. Only 101 (3% of the sample) of these S probes contained cultural material and these included 140 pieces of lithics, ceramics and charcoal fragments, as well as 1899 grams of shellfish. As in the transect survey, most of the cultural remains were buried 10 to 40 cm below ground surface. The block adjacent to Miss Annies farm complex (2S4W), exhibited a deep plow zone that impacted the upper 30 cm of soil. The other blocks were characterized by the natural soil horizon of the deciduous woodlands.

The chipped stone material consisted of 196 pieces of workshop debris (46 primary, 30 secondary, 39 tertiary, and 34 micro flakes, 42 shatter, and 6 cores) and 18 tools (7 projectile points, 3 scrapers, 6 hammerstones, 1 chopper, and 1 knife). Similar to the transect survey, the most common raw material was quartzite (107), followed by milky (58), variegated (32), rock crystal (6), rose (4), and citrine quartz (4). Four tools were produced from granite. Chert and jasper were each represented by one artifact.

Other cultural materials included 11 ceramic artifacts (10 sherds and 1 piece of a kaolin pipe), six fire-cracked rocks, and eight charcoal fragments. Soft clam (1293 g.) dominated the shellfish inventory, followed by hard clam (379 g.), whelk (85 g.), oyster (69 g.), scallop (68 g.) and snails (12 g.).

Specific information on all cultural material is listed in Appendix Two and includes the shovel probe provenience, shovel probe type, depth below ground surface, habitat type, cultural material type, and artifact counts or shellfish weights.

The results of the block survey are examined below with respect to individual blocks, habitat types and archaeological manifestations.

Blocks

Table 6 summarizes pertinent information obtained from each block. The table includes statistics on the size and habitat(s) of each block, the number of S probes excavated, the number of positive S probes, the percentage of positive S probes, and the cultural materials recovered from S probes.

Block	size (hectare)	Habitat %	Shovel T	P	Probes P%	Cultural Materials CSD	CT	Ch	Ce	FC	Sh
0N0W/1N0W	5.6	E 70/B 30	684	28	4	41	8	0	1	1	335g
0N1W/1N1W	9.7	B 50/E 40 D 10	1175	30	2	96	3	8	7	3	1482g
1S0W	2.2	D 50/E 50	264	7	3	12	2	0	3	0	6g
2N3E	.5	C 100	60	1	2	1	0	0	0	0	0
2S1E	7.2	D 100	867	2	.2	2	0	0	0	0	0
2S3E	4.0	E 50/F 50	486	7	1	21	0	0	0	2	0
2S4W	2.8	D 100	345	26	7	24	5	0	0	0	76g
TOTALS	32.0		3881	101	3	197	18	8	11	6	1899g

KEY Habitat: B = Tidal Creek C = Salt Pond D = Oak-Heath
E = Oak-Sedge F = Freshwater

Shovel Probes: T = Total S Probes Excavated
P = Number of Positive S Probes
P% = Percentage of Positive S Probes (P/T)

Cultural Materials: CSD = Chipped Stone Debris
CT = Chipped Stone Tools
Ch = Charcoal
Ce = Ceramics
FC = Fire-Cracked Rocks
Sh = Shellfish (grams)

Table 6. Block Survey Information (By Block).

Compared to the transect survey, the overall percentage of positive S probes from the blocks is slightly lower, ranging from only .2 to 7%. Although a large number of S probes were excavated as part of the block survey, only a relatively small number proved positive. Interestingly, the block with the highest percentage of positive probes (2S4W) is found in the oak-heath habitat. However, one must keep in mind that the coastal blocks (0N0W/1N0W and 0N1W/1N1W) are quite large and contain a significant area of upland oak habitats. In addition, it must be recognized that only a relatively few shovel probes (n=60) were excavated along the salt pond habitat, and these were laid out to the north of the initial, highly productive, transect surveyed along Sungic Pond.

Habitat Types

To examine the distribution of positive S probes by habitat type, we tallied the total number of probes excavated within each habitat and calculated the percentage of positive probes. This information, along with the cultural material categories associated with each habitat, is presented in Table 7. Given the limited number of probes from the salt pond habitat, it was not included in the following analysis.

	Shovel Probes				Cultural Materials					
Habitat	T	T%	P	P%	CSD	CT	Ch	Ce	FC	Sh
B	793	21	46	6	68	5	6	8	3	1816g
D	1461	38	28	2	26	5	0	0	0	76g
E	1324	35	19	1	81	8	2	3	1	7g
F	243	6	7	3	21	0	0	0	2	0
TOTALS	3821	100	100	3	196	18	8	11	6	1899g

KEY

Habitat: B = Tidal Creek D = Oak-Heath
E = Oak-Sedge F = Freshwater

Shovel Probes: T = Number of S Probes Excavated
T% = Percentage of Total S Probes Excavated (T/T Total)
P = Number of Positive S Probes
P% = Percentage of Positive S Probes By Habitat Type (P/T)

Cultural Materials: CSD = Chipped Stone Debris
CT = Chipped Stone Tools
Ch = Charcoal
Ce = Ceramics
FC = Fire-Cracked Rocks
Sh = Shellfish (grams)

Table 7. Block Survey Information (By Habitat).

The distribution of cultural material by habitat type corresponded fairly closely with that of the random transects. The coastal habitat exhibited the highest percentage of positive S probes in contrast to those excavated in the upland habitats. Yet the 6%

recovery rate (P%) from the tidal creek habitat was not nearly as high as the 11 to 16% rate from the coastal habitats sampled by the transects. The recovery rate (P%) from the oak and freshwater habitats, which ranged from 1 to 2%, was almost identical to that observed from the upland transects.

The diversity of cultural materials sampled from the coastal habitat was also similar to that of the transect survey. Shovel probes excavated along the Fan Creek estuary produced a diverse range of chipped stone debris, some chipped stone tools, charcoal fragments, ceramics, fire-cracked rocks and a mix of shellfish species. In contrast, the oak-sedge habitat produced some chipped stone artifacts and a small amount of shellfish debris. The probe samples from the freshwater habitat yielded only chipped stone debris and two fire-cracked rocks.

The major discrepancy between the transect and block surveys concerned the oak-sedge habitat. In the former, only chipped stone artifacts were recovered, while in the latter a full spectrum of chipped stone, ceramic and charcoal materials was observed, along with a trace of shellfish refuse.

The final observation refers to the kinds of chipped stone tools found in the coastal and upland habitats. The sample of tools recovered from the tidal creek included two hammerstones, two scrapers, and one knife. In contrast, the sample of tools defined from the oak-heath and oak-sedge habitats was four hammerstones, one scraper, one chopper, and seven projectile points (three Levannas, two Wading Rivers, and two fragments). Thus, the upland habitats yielded the only projectile points recovered from S probes.

Archaeological Manifestations: The Block Survey

Tables 8 and 9 outline the pertinent characteristics of the isolated finds, low density and high density scatters defined for the survey blocks. Table 8 tallies the provenience of each manifestation, the size of each scatter, number of positive S probes within the scatters, the percentage of positive S probes, the number of positive IC probes, and the mean and standard deviation of artifacts per positive S and IC probes. Table 9 summarizes the cultural materials recovered from each manifestation.

Below the characteristics of the isolated finds, low density and high density scatters are examined.

1. **Isolated Finds**. Sixteen manifestations, distributed across the major coastal and interior habitats, were defined as isolated finds (see Figures 5 and 6). While many of the finds were found along the Fan Creek estuary (6), they were also represented in the oak-heath (2), oak-sedge (4), and freshwater (3) habitats as well. The majority of these finds consisted of flakes, shatter and fire-cracked rocks. One kaolin pipe (from

Provenience				Size	Shovel Probes					
Unit	Tr-Sp	Type	H	M2	PS	TS	P%	IC	AD	ASD
0N0W	3- 3	LD	E	13500	7	128	5	1	1.6	1.1
0N0W	2- 1	HD	B	40	2	2	100	2	21.5	31.9
0N0W	2- 5	IF	B	-	1	-	-	0	1.0	0
0N0W	3-17	IF	B	-	1	-	-	0	2.0	0
0N0W	3-21	HD	B	100	3	4	75	5	6.4	14.4
0N0W	5-20	HD	B	64	1	2	50	6	1.0	1.5
0N0W	7-20	IF	B	-	1	-	-	0	1.0	0
0N0W	7-23	HD	B	40	1	1	100	9	2.0	1.6
1N0W	3-25	LD	B	400	4	9	44	1	1.2	.4
1N0W	5-26	IF	B	-	1	-	-	0	1.0	0
1N0W	3-30	HD	B	180	4	4	100	8	3.4	4.3
1N0W	4- 1	IF	B	-	1	-	-	0	1.0	0
0N1W	1-18	HD	E	24	1	1	100	0	4.0	0
0N1W	1-29	IF	B	-	1	-	-	0	1.0	0
0N1W	2- 3	IF	B	-	1	-	-	0	1.0	0
0N1W	4-24	HD	E	16	1	1	100	5	10.6	9.2
0N1W	5-32	HD	B	24	1	1	100	1	2.5	.7
0N1W	6-14	HD	E	4	1	1	100	0	30.0	0
0N1W	6 -4	HD	E	20	2	2	100	0	2.5	.7
1N1W	5A-1	HD	B	120	4	5	80	4	5.2	6.9
1N1W	5N-6	HD	B	16	1	1	100	4	6.4	2.6
1N1W	5N-9	HD	B	304	5	6	83	7	2.5	2.6
1N1W	5N-14	LD	B	240	2	10	20	0	2.5	.7
1N1W	6 -1	HD	B	1200	10	14	71	16	1.9	1.7
1S0W	1-11	IF	E	-	1	-	-	0	1.0	0
1S0W	1-17	IF	E	-	1	-	-	0	1.0	0
1S0W	2-17	IF	E	-	1	-	-	0	1.0	0
1S0W	2-4	HD	E	200	3	5	60	1	4.7	3.9
1S0W	3-1	IF	E	-	1	-	-	0	0	0
2S1E	2-1	IF	D	-	1	-	-	0	1.0	0
2S1E	2-11	IF	D	-	1	-	-	0	1.0	0
2S3E	3-15	IF	F	-	1	-	-	0	2.0	0
2S3E	4-12	IF	F	-	1	-	-	0	3.0	0
2S3E	4-3	HD	F	28	1	2	50	7	3.1	2.1
2S3E	7-1	HD	F	60	3	4	75	2	2.8	1.8
2S3E	7-12	IF	F	-	1	-	-	0	7.0	0
2S4W	2-3	LD	D	800	3	10	30	0	1.0	0
2S4W	1-4	LD	D	17400	22	172	13	0	1.2	.9

KEY Type: IF = Isolated Find LD = Low Density Scatter
HD = High Density Scatter
Shovel Probes:
PS = # of Positive S Probes Within Scatter
TS = Total # of S Probes Within Scatter
P% = Percentage of Positive S Probes Within Scatter(PS/TS)
IC = # of Positive IC Probes Within Scatter
AD = Mean Artifact Density Per Positive S and IC Probes
ASD = Artifact Density Standard Deviation

Table 8. Block Survey Archaeological Manifestations.

Fan Creek) and one projectile point (a Levanna point from the oak-sedge habitat) were also recovered.

Provenience		Cultural Material														Shellfish (Grams)							
Unit	Tr-Sp	P	S	T	Sa	Co	M	H	K	Pp	Sc	C	FC	Ce	Ch	Tsh	SC	HC	SA	O	W	S	U
0N0W	3-3	5	2	0	0	1	0	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
0N0W	2-1	7	6	1	55	5	0	1	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0
0N0W	2-5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0N0W	3-17	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0N0W	3-21	6	13	0	23	3	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0
0N0W	5-20	1	4	1	0	0	0	0	0	0	0	0	0	0	0	813	812	0	0	0	0	0	1
0N0W	7-20	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
0N0W	7-23	5	3	2	4	0	4	0	0	2	0	0	0	0	0	18	1	17	0	0	0	0	0
1N0W	3-25	3	1	7	0	0	0	0	0	0	1	0	0	0	0	2	0	1	0	0	0	0	1
1N0W	5-26	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1N0W	3-30	7	12	12	4	0	0	1	1	2	1	0	0	0	0	1681	1566	99	0	0	12	4	0
1N0W	4-1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0N1W	1-18	0	1	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0
0N1W	1-29	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0N1W	2-3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0N1W	4-24	5	9	8	51	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0N1W	5-32	0	2	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0
0N1W	6-14	0	0	9	0	0	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0N1W	6-4	0	0	0	1	0	2	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
1N1W	5A-1	10	13	2	14	0	1	0	0	1	0	0	0	0	0	159	148	11	0	0	0	0	0
1N1W	5N-6	3	5	6	12	0	4	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1N1W	5N-9	1	2	1	1	0	0	0	0	0	0	0	0	24	0	1344	971	237	24	1	88	0	0
1N1W	5N-14	2	0	0	1	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
1N1W	6-1	1	10	10	0	1	16	0	0	0	1	0	0	6	6	622	129	302	0	32	89	0	0
1S0W	1-11	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1S0W	1-17	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1S0W	2-17	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1S0W	2-4	6	2	2	2	0	0	1	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0
1S0W	3-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	6	0	0	0	0	0
2S1E	2-1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2S1E	2-11	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2S3E	3-15	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
2S3E	4-12	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
2S3E	4-3	1	7	12	4	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0
2S3E	7-1	2	3	5	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2S3E	7-12	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2S4W	2-3	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2S4W	1-4	8	4	5	5	0	0	0	0	4	0	1	0	0	0	93	13	9	0	58	0	0	13

KEY Cultural Material: P = Primary S = Secondary T = Tertiary
Sa = Shatter Co = Core M = Micro Flake H = Hammerstone
K = Knife PP = Projectile Point Sc = Scraper
C = Chopper FC = Fire-Cracked Rock Ce = Ceramic
Ch = Charcoal TSh = Total Shellfish SC = Soft Clam
HC = Hard Clam SA = Scallop O = Oyster
W = Whelk SN = Snail U = Unidentified Shell

Table. 9. Block Survey Cultural Materials.

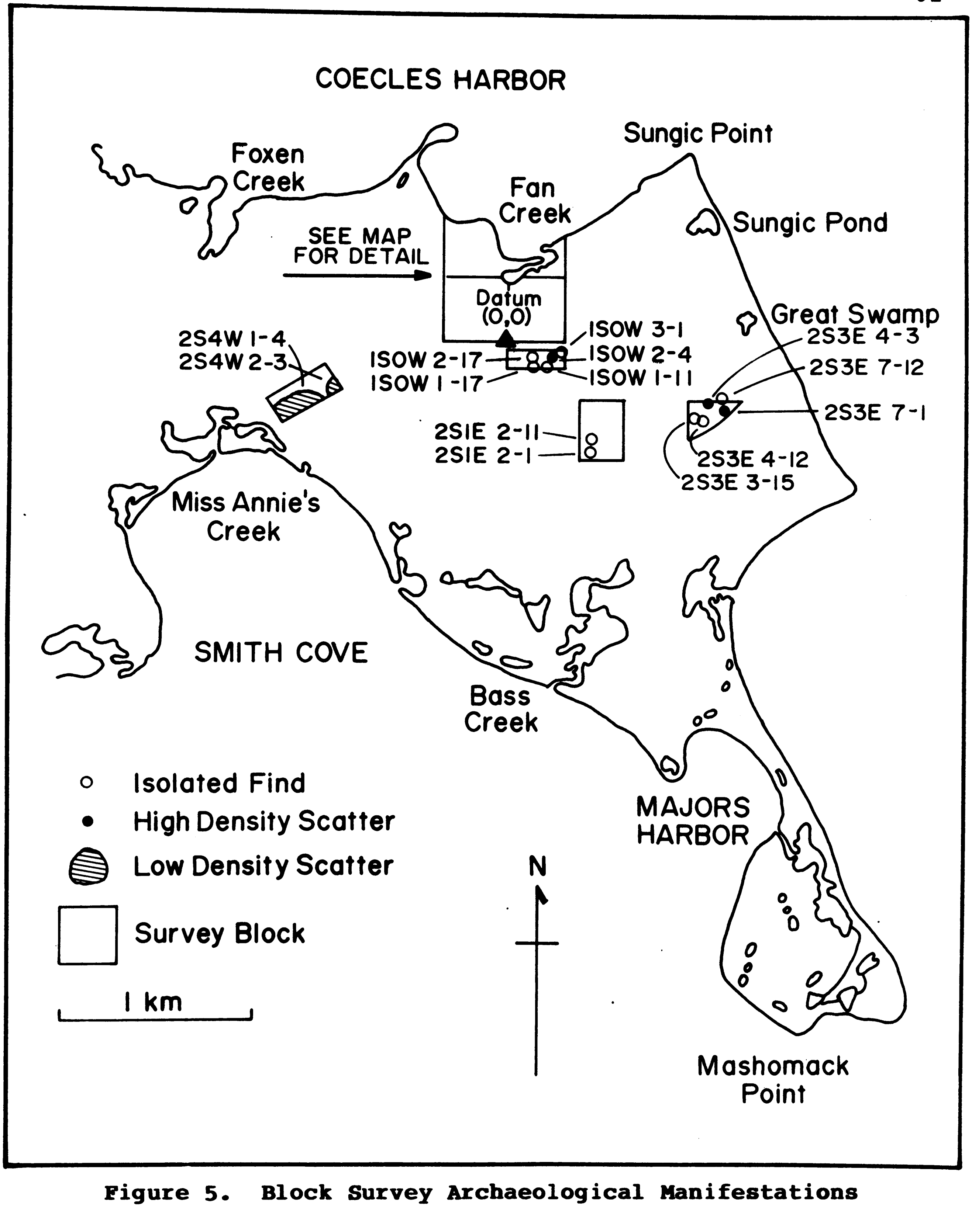

Figure 5. Block Survey Archaeological Manifestations

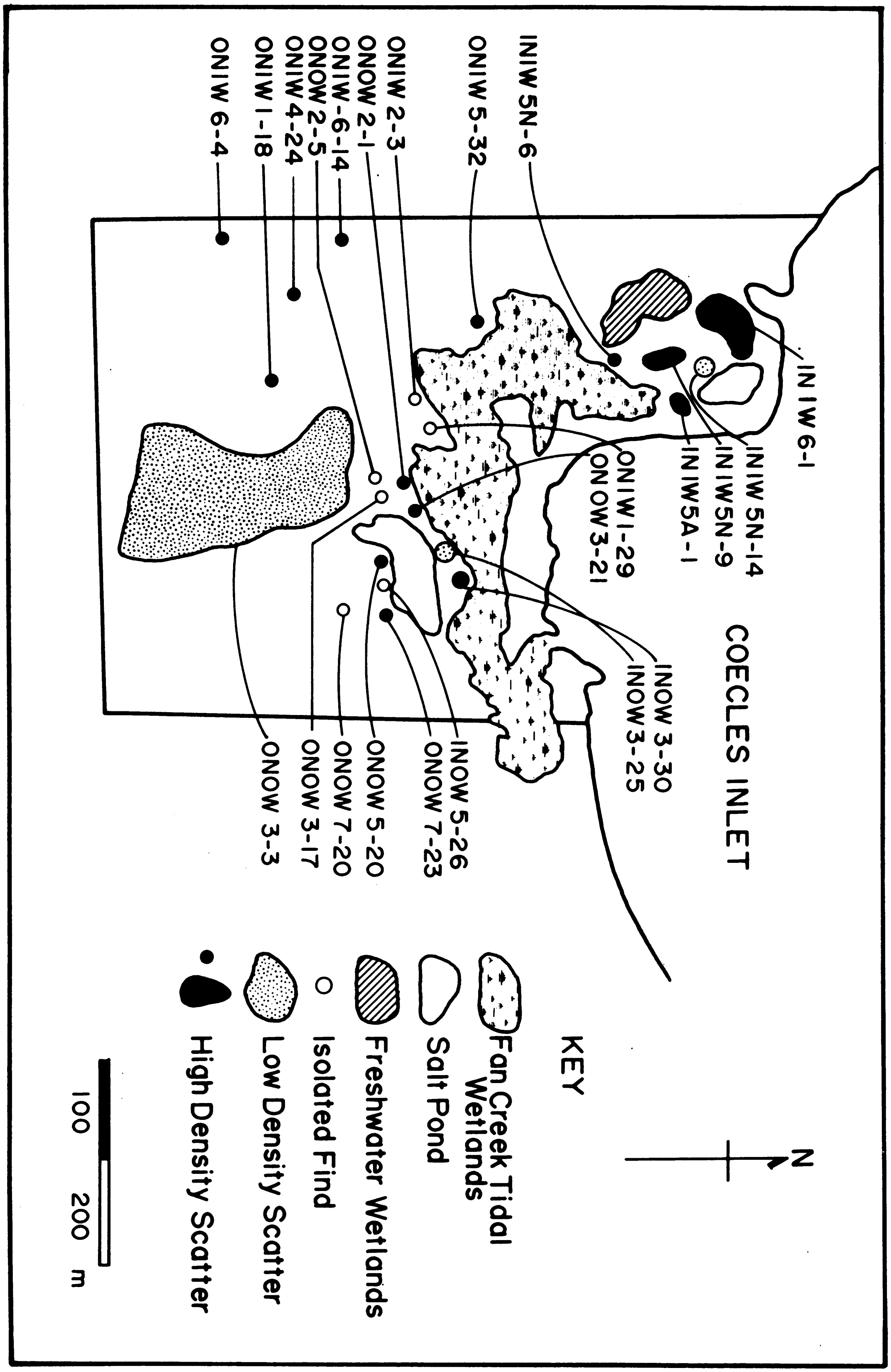

Figure 6. Archaeological Manifestations of Survey Blocks 0N0W/1N0W and 0N1W/1N1W

2. **Low Density Scatters**. Five scatters, ranging in size from 240 to 17,400 m2, were defined along the tidal creek (2), oak-heath (2) and oak-sedge (1) habitats (see figures 5 and 6). These include:

ONOW 3-3. This is a very light scatter of chipped stone debris and hammerstones that is dispersed broadly south of Fan Creek. One Levanna projectile point was recovered from this manifestation. We estimate that only about 5% of the area contains artifactual material.

1NOW 3-25. A small scatter located south of Fan Creek, this manifestation contained chipped stone debris, a trace of shellfish, and a scraper.

1N1W 5N-14. Another small scatter situated on the east side of Fan Creek from which we recovered a few pieces of chipped stone debris and fire-cracked rock. Only 20% of the shovel probes excavated in this scatter yielded artifacts.

2S4W 2-3 and 2S4W 1-4. Both of these scatters are located a short distance from one another in the abandoned agricultural field of Miss Annies farm complex. The historic activities of the farm have probably impacted this area extensively, and it is possible that some of the prehistoric materials could have resulted from fertilizing the fields with midden material. The scatters yielded an assortment of chipped stone debris and tools, as well as a trace of shellfish (mostly oyster) which may be associated with the farm complex. Four projectile points, representing both Wading River and Levanna points, and one chopper, were recovered. We estimate that roughly 4000 projectile points may be found within these broad scatters. If not deposited as part of historic farming activities, then it appears that this area was repeatedly used by prehistoric people for foraging and hunting purposes.

3. **High Density Scatters**. Seventeen concentrations of artifacts and/or shellfish, ranging from very small manifestations of 4 m2 to larger sites of 1200 m2, were defined in the tidal creek (10), oak-sedge (5) and freshwater (2) habitats (see Figures 5 and 6). No high density scatters were recorded for the oak-heath habitat.

ONOW 2-1. This small concentration of chipped stone debris and fire-cracked rock sits upon a low hill overlooking Fan Creek. The 40 m2 area produced a dense concentration of shatter, primary and secondary flakes, and some hammerstones. The positive shovel probes yielded an average density of 21.5 artifacts (sd = 31.9). Since the number of artifacts varied substantially among individual shovel probes, the total quantity found in the scatter could vary from a relatively few to a maximum of 23,500 pieces of chipping debris. The site appears to be a lithic workshop where quartzite cobbles were reduced into flakes.

ONOW 3-21. Another small concentration of chipped stone debris and fire-cracked rock, this site is situated about 40 meters east of ONOW 2-1 on a slight rise overlooking Fan Creek estuary. The site is very similar to its neighbor, containing a high density of shatter, primary and secondary flakes of quartzite material. An average of 6.4 artifacts (sd = 14.4) was recovered in each positive probe. We estimate that somewhere between a relatively few to a maximum of 17,000 pieces of chipping debris may be scattered across the 100 m2 area. The site is a lithic workshop where quartzite cobbles were reduced into flakes.

ONOW 5-20. A small site situated south of a former arm of the Fan Creek estuary, the manifestation is characterized by a shell midden and a small scatter of lithics on its east side. The site exhibited two interesting characteristics. First, it has a very low artifact density. An average of only 1.0 artifact (sd = 1.5) per positive probe was found, consisting exclusively of chipped stone debris. We estimate that a maximum of only 880 artifacts are dispersed across the 64 m2 area. Second, the midden appeared to be almost exclusively composed of soft shell clam remains. About 116 grams of shellfish, on the average, were recovered in positive midden probes. Our initial interpretation is that this site served as a procurement location or field processing camp for the bulk extraction of soft shell meat. This interpretation will be examined in more detail in the next chapter.

ONOW 7-23. Situated about 60 meters east of ONOW 5-20, this site is composed of a scatter of quartzite and variegated quartz flakes and projectile points. The sample of artifacts included micro flakes of the same raw material (variegated quartz) as that of the Wading River point and base of an unidentified point. These micro flakes may be thinning flakes from the production of projectile points, or alternatively, retouch flakes from the maintenance of the points. In either case, this lithic workshop differs significantly from ONOW 2-1 and ONOW 3-21, which exhibited large, crude looking, quartzite flakes and shatter and no formal tool types. We estimate that somewhere between 190 and 1600 artifacts may be dispersed across the 40 m2 area.

1NOW 3-30. This relatively large site, which straddles a narrow spit on the south side of Fan Creek estuary, is both a shell midden and associated lithic scatter. The lithic scatter, extending along shovel probe intervals 3-30, 3-31 on the west side of the midden, produced chipped stone debris and several tools, including a Levanna point, a knife, and a scraper. The shell midden proper, which is concentrated only in a 2 by 4 m area, is composed primarily of soft shell clam, and a small quantity of hard clam and snail shells. The quantity of shellfish varied from 140 grams per probe (the entire scatter) to 280 grams per probe (within the midden proper). Survey members recovered a Levanna point and some chipped stone debris from the midden proper. In many respects, the site is similar to 0N0S 5-20, given the small size of the midden and the predominance of soft clam refuse, and could represent a special purpose shellfish extraction site (either a bulk procurement location or field processing camp).

0N1W 1-18. Located south of Fan Creek estuary in the oak-sedge habitat, the artifact sample from this small scatter consisted of a few pieces of chipped stone debris and a bifacially worked scraper. Relatively few shovel probes were excavated within the scatter, as it was selected for more intensive excavation as outlined in the next chapter.

0N1W 4-24. Another lithic scatter situated south of Fan Creek in the oak-sedge habitat, this manifestation is very similar to the lithic workshops defined at 0N0W 2-1 and 0N0W 3-21. A dense concentration of quartzite primary, secondary and teritary flakes, as well as a considerable quantity of shatter, made up the sampled artifacts from the site. The average artifact density per positive test probe was 10.6 (sd =9.2), and we estimate that between 250 and 3500 pieces of chipping debris may be found here. What differentiates this site from the others is the presence of a very large quartzite boulder erratic from which the flakes and shatter were struck. A field examination of the boulder indicated extensive evidence of flake removal. We interpreted the site as a combination lithic extraction site and workshop, where large flakes were produced. It is possible, given the similarities of the raw material, that a few of the quartzite flakes found at 0N0W 2-1 and 0N0W 3-21 could have originated from the large boulder erratic.

0N1W 5-32. A small lithic scatter that sits upon a low rise overlooking the western end of the Fan Creek estuary, the sample of artifacts included a few pieces of chipped stone debris, a knife and a scraper.

0N1W 6-14. A very small concentration of tertiary flakes and micro flakes was delimited within a 2 by 2 meter area. The concentration is situated south of Fan Creek in the oak-sedge habitat. Within this small concentration, a very dense quantity of flakes was recovered, with one shovel probe yielding 30 artifacts.

0N1W 6-4. Another small lithic concentration located about 100 meters south of 0N1W 6-14 in the oak-sedge habitat, the light scatter of material sampled from the site included some charcoal fragments, a piece of shatter and two micro flakes.

<u>1N1W 5A -1</u>. Situated on a small spit in the northwest corner of the Fan Creek estuary, this manifestation is a combination lithic scatter and shell midden. The artifact sample from the lithic scatter (shovel probe intervals 5A-1,5A-2,5A-3) included chipped stone debris and one unidentified projectile point, as well as a trace of shellfish debris. The shell midden to the north of the scatter (shovel probe interval 5A-5), which may be no larger than a 3 by 2 meter area, yielded primarily soft shell clam and no artifacts. The density of shellfish refuse ranged from 18 grams per probe (the entire scatter) to 137 grams per probe (from the midden proper). This small midden, composed primarily of soft clam refuse, appears to be another possible candidate for a shellfish procurement location or field processing camp.

<u>1N1W 5N-6</u>. A small concentration of lithic material, covering no more than a 16 m2 area, this site produced a dense quantity of primary, secondary, tertiary and micro flakes, as well as shatter. The artifact sample from the site also included one knife. The average artifact density per positive probe was 6.4 (sd = 2.6), providing an estimate of between 670 and 1600 pieces of chipping debris for the 16 m2 area. While similar to the workshop sites (0N0W 2-1, 0N0W 3-21) described above, this site differs primarily in that the workshop debris consists mostly of variegated and milky quartz material.

<u>1N1W 5N-9</u>. Another combination artifact scatter and shell midden, this manifestation is situated on the east side of the Fan Creek Estuary. The artifact scatter, which extends along shovel probe intervals 5N-9,5N-10,5N-11, yielded a light dispersal of chipped stone debris and ceramic sherds. Although positive probes produced about 2.5 (sd = 2.6) artifacts, on the average, most of these were small ceramic sherds. Lithic artifacts averaged only .4 per probe, providing an estimate of only 1110 lithic artifacts across the entire 304 m2 scatter. The shell midden, which extends about 8 by 10 meters around shovel probe interval 5N-12, is made up primarily of soft clam, although hard clam, scallop, whelk, and oyster are also present. Testing of the midden area yielded ceramic sherds and a few pieces of chipped stone debris. The density of shellfish remains varied from 112 grams per probe (entire scatter) to 220 grams per probe (midden proper). While this manifestation contains ceramics and a more diverse range of shellfish remains, the very limited range of lithic materials sampled from across the site suggests it may also be a shellfish procurement location or field processing camp.

<u>1N1W 6-1</u>. Although located a short distance from the Fan Creek estuary, this combination artifact scatter and large shell midden extends along a small creek bed that faces Cedar Island Cove. Only a small portion of the 1200 m2 area is a discrete lithic scatter (shovel probe intervals 6-1,6-2) which contains

chipped stone debris and charcoal fragments. The remainder of the site (shovel probe intervals 6-3,6-4,6-5,6-6, 6-7) is an extensive shell midden, measuring at least 40 by 30 meters, composed of a mix of hard clam, soft clam, whelk and oyster shell debris. Shovel probes sampling the shell midden proper produced chipped stone debris, a scraper and ceramic sherds. The size of the midden, the diversity of shellfish remains, and the range of artifacts suggest a more diversified use for the site than other nearby midden deposits.

1S0W 2-4. Nestled along the sides of a large kettle depression in the oak-sedge habitat, this concentration contained chipped stone debris and ceramic sherds. Positive shovel probes yielded, on the average, 4.7 (sd = 3.9) artifacts. We estimate that the 200 m2 scatter may contain between 1000 to 11,400 artifacts.

2S3E 4-3. This concentration of lithics is situated close to the freshwater marsh that makes up the southern extension of the Great Swamp. The sample of artifacts included a full range of chipped stone flakes, suggesting that this site may be a small lithic workshop.

2S3E 7-1. Another small lithic scatter situated along the freshwater marsh of the Great Swamp, it also produced chipped stone debris. This concentration appears to be the remains of a lithic workshop.

A Consideration of the Transect and Block Surveys

The results of the transect and block surveys provide a good assessment on the density, diversity and spatial distribution of prehistoric materials at Mashomack. Below we outline five major observations for the survey data base.

1. **Upland Habitats**. Survey crews detected relatively few prehistoric materials in the upland oak and freshwater habitats. The probability of discovering prehistoric materials in shovel probes is very low here, ranging from only .2 to 2%.

We observed two different patterns of cultural material in the uplands. For transects and blocks surveyed some distance (200 or more meters) away from Mashomack's shoreline, the primary manifestations are isolated finds and broadly dispersed, low density scatters of chipped stone debris and tools, especially projectile points (i.e. 2S4W 1-4). These remains appear to be non-site manifestations (as defined in Chapter One), suggesting that upland areas were used sporadically for low bulk extraction activities involving hunting and some gathering.

In contrast, a diverse range of archaeological remains are found between 100 to 200 meters of the coastline. Here isolated finds, low density scatters, and most of the high density scatters defined for the upland habitats are located. These include the various scatters distributed south of Fan Creek estuary and the Great Swamp (see figures 5 and 6). Most of these manifestations also contain chipped stone debris and tools, and several appear to have served as lithic workshop areas.

2. **Coastal Habitats.** Survey crews detected the greatest number of cultural materials along Mashomack's coastlines. There is a comparatively high probability of detecting prehistoric material in coastal shovel probes, ranging anywhere from 6 to 16%. The survey demonstrated that a full range of archaeological manifestations, from isolated finds to high density scatters, are found in this zone. Overall, these remains produced a more varied assortment of cultural material than did those of the upland habitats.

3. **Scatters.** The various low and high density scatters defined during the surveys contain a wide assortment of cultural materials. It appears that prehistoric people performed a varied range of activites at these places. Some are lithic scatters, some are lithic and ceramic scatters, and still others are combination lithic scatters and shell middens.

At least ten of the scatters appear to be the remains of lithic workshops where considerable quantities of chipped stone debris are found. Some (0N0W 2-1, 0N1W 4-24, 2S3E 7-1) contain almost exclusively quartzite flakes and shatter, while others (1N1W 5N-6, 1S3E 1-25, 2S6W 1-19, 0N0W 3-21, and 2S3E 4-3) consist of a mix of quartzite, variegated and milky quartz debris. One site, 0N0W 7-23, appears to have served as a place for producing or modi-fying variegated quartz projectile points. Another dense scatter, 0N1W 4-24, found adjacent to a quartzite boulder erratic, probably served as a combination lithic procurement location and workshop.

Seven high density scatters are combination shell midden and lithic scatters. It is important to note that none of the shell middens are isolated components, but always appear to be associated with nonmidden activity areas. The size of the adjacent nonmidden areas vary from site to site, ranging from the small lithic component of 1N1W 6-1 to the more extensive use areas of 2N3E 1-0, 1N1W 5N-9, and 1N1W 5A-1.

We suggest that at least two types of shell middens can be defined. The first type, which includes 2N3E 1-0, 2S6W 1-22, and 1N1W 6-1, is characterized by large shell midden components, ranging in size from 280 to 1600 m2, that contain a diverse range of shellfish species, including soft clam, hard clam, oyster, whelk and scallops. The artifact assemblages sampled from these sites are relatively diverse, containing chipped stone debris and tools, fire-cracked rocks, and occasional charcoal fragments and ceramic sherds. These sites probably represent places of extended use where a variety of activities took place. It is possible that the middens and associated lithic scatters may represent the remains of residential bases, a point to be considered in the next chapter.

The other group (0N0W 5-20, 1N0W 3-30, 1N1W 5A-1) is characterized by small middens, ranging from only 4 to 16 m2, that contain predominately soft clam refuse. Samples from the midden areas suggest a very limited variety of artifacts, including chipped stone debris and an occasional tool. While the lithic component associated with one of the middens (1N0W 3-30) is characterized by a more varied range of chipped stone tools, the other two sites are composed almost exclusively of flakes and shatter. The small size of the middens, the limited diversity of shellfish remains, and the limited kinds of artifacts associated with these sites suggest that they served as bulk procurement locations or field processing camps where soft clams were gathered and processed in volume.

The function of one other midden site (1N1W 5N-9) is somewhat more ambiguous. The midden component of this scatter is about 80 m2. While soft clam is the most common shellfish, considerable quantities of hard clam, whelk and scallop are found here as well. The artifacts sampled from both the lithic and midden components are limited to chipped stone debris and multiple ceramic sherds. While the midden is somewhat larger than those of the second group, the limited diversity of artifacts suggests this location may also have served as a bulk procurement location or field processing camp.

4. **Chronology**. The sampling of ten scatters revealed diagnostic artifacts (projectile points or ceramics) that have chronological significance. The majority (70%) of these manifestations appear to date to the Late Woodland periods given the association of Levanna/Madison points and/or decorated ceramics. These include 2N3E 1-7, 2S6W 1-22 (large midden), 0N0W 3-3, 1N0W 3-30 (small midden), 1N1W 5N-9 (moderate sized midden), 1N1W 6-1 (large midden) and 1S0W 2-4. Another manifestation, 2S4W 1-4, a broad low density scatter, contains both Wading River and Levanna points. This upland area probably served as a foraging and hunting ground throughout the Late Archaic to Woodland periods. One scatter, 0N0W 7-23, a workshop, appears to date to the Late Archaic, while another scatter, 3S3W 1-8, containing kaolin pipe fragments may date to the Contact period.

5. **Spatial Distribution**. The survey results suggest that former (Sungic Pond) or active tidal creeks (Miss Annies Creek, Fan Creek) of Mashomack are characterized by a relatively consistent spatial patterning of scatters. Each of these areas contains at least one large shell midden associated with an adjacent lithic component. The sites, as described above, are

characterized by a diverse range of shellfish remains and cultural materials that probably resulted from multiple activities. These places may represent the remains of residential bases. Although the other tidal creek (Foxon Creek) sampled during the survey did not produce such a manifestation, it appears that a sizeable midden is located a short distance off the transect.

Interestingly, the large middens are invariably found close to other archaeological remains. The large middens of Miss Annies Creek (2S6W 1-22) and Sungic Pond (2N3E 1-0) are both associated with lithic scatters on nearby hilltops (see Figure 5). 2S6W 1-19 sits upon a small hill overlooking Miss Annies midden, while 2N3E 1-7 covers a slight rise situated directly above the Sungic midden.

The best area for examining the spatial distribution of the coastal remains is Fan Creek (see Figure 6). Here the large midden (1N1W 6-1) is also situated near a variety of other archaeological remains. It is interesting to note that the three small middens that may represent soft clam extraction sites are dispersed across different areas of Fan Creek. 0N0W 5-20 is located south of one of the former southern arms of Fan Creek, while 1N0W 3-30 sits upon a small spit on the eastern side of the active Fan Creek estuary. The other small midden, 1N1W 5A-1, is situated upon the western side of Fan Creek, in close association to the moderate sized midden of 1N1W 5N-9.

A variety of lithic scatters are dispersed between the large, moderate and small sized middens. At least one lithic workshop (1N1W 5N-6) is located on the eastern edge of Fan Creek, while two other workshops (0N0W 2-1 and 3-21) straddle low rises on the western and southern sections of Fan Creek. The lithic procurement location and workshop (0N1W 4-24) is situated south of the estuary not far from the varied scatters. Finally, low density scatters are found a short distance south of the estuary.

In summary, it appears many of the prehistoric activities conducted at Mashomack that left behind archaeological remains centered around tidal creeks. Most of the remains that can be chronologically assessed appear to date to the Late Woodland period. The tidal creeks exhibit a fairly similar pattern -- a large midden and adjacent lithic component surrounded by a variety of smaller midden and lithic scatters. Beyond 200 meters of the coastal zone sporadic remains consisting of isolated finds and broadly dispersed low density scatters are found. These upland areas appear to have been used sporadically for low bulk foraging and hunting activities.

CHAPTER FOUR: EXCAVATION

Introduction

The second phase of our research was the limited excavation of selected scatters detected during the transect and block surveys. Our goal was to obtain more precise information on the function, chronology and occupation histories of the different kinds of scatters found at Mashomack. Specifically, we were interested in elucidating the range of prehistoric activities that produced the diverse manifestations (lithic scatters, lithic and ceramic scatters, and combination lithic scatters and shell middens) of varying sizes and artifact densities.

Since the excavation of all manifestations detected by survey crews was precluded by time and budgetary considerations, we judgementally selected a sample of scatters for investigation. In consultation with the Preserve Director, we chose to investigate manifestations that were found near Fan Creek estuary and Sungic Pond. The reasons for focusing on these areas are threefold. First, as outlined in the previous chapter, these areas contain a diverse range of archaeological remains with high research potential. Second, these areas support few endangered plants or animals that might be adversely impacted by excavation. Finally, these areas are situated some distance from Mashomack's main gate, where most of the hiking trails begin, and few nature enthusiasts were apt to fall into open excavation units.

Seven scatters were chosen for excavation. These include:

a) 0N0W 2-1, 0N0W 3-21, two high density lithic scatters, overlooking Fan Creek estuary that were initially interpreted as lithic workshops;

b) 0N0W 5-20, the small lithic scatter/shell midden situated on a former arm of Fan Creek estuary that may have served as a shellfish procurement location or field processing camp;

c) 0N1W 1-18, the small high density lithic scatter located south of Fan Creek estuary;

d) 1S0W 2-4, the moderate sized high density lithic and ceramic scatter, found in a kettle depression south of Fan Creek estuary;

e) 2N3E 1-0, the large lithic scatter/shell midden north of Sungic Pond that has been tentatively interpreted as a residential base;

f) 2N3E 1-7, the low density scatter situated on the hill top overlooking Sungic Pond.

We begin this chapter with a discussion of the field methods employed to excavate the seven scatters. This is followed by separate sections describing each scatter. These sections include discussions on the stratigraphy, the kinds of artifacts collected, the floral and faunal remains recovered from soil samples, the kinds of architectural features recorded, and the chronology. In the final section we summarize our primary interpretations for each scatter.

Field Methods

The excavation strategy represents a compromise between our commitment to minimize adverse impacts to the natural environment of Mashoamck, and our desire to excavate large contiguous sections of the scatters. In an ideal situation, we advocate excavation techniques that carefully expose large contiguous sections of archaeological sites. The technique of "horizontal stripping" is ideally suited for detecting architectural features, such as house structures composed of multiple post-mold stains, and for undertaking intra-site spatial analyses of work areas and residences (see, for example, Moeller 1986:4, Dincauze 1976:137). Yet in the case of Mashomack, a horizontal stripping program was not acceptable to The Nature Conservancy because of its potentially negative impact on the natural environment. They decided that wholesale stripping of overlying vegetation was not in keeping with the goals and policies of the nature preserve.

Given these considerations we implemented a less destructive but less ambituous field strategy involving the excavation of randomly chosen one by one meter units. This excavation strategy is suited for providing information on stratigraphy, for augmenting the sample of cultural materials, and for recovering well provenienced soil and carbon-14 samples. However, we recognize that it is not a very effective method for delineating the spatial patterning of architectural features and artifacts across site areas.

A site datum was established for each of the seven scatters, from which a grid system of one by one meter squares was laid out. A random numbers generator was then used to select specific squares for excavation. In several cases we stratified the scatters into a core and a periphery based on the artifact density of survey probes. This stratified sampling strategy insured that squares would be excavated in areas of both high (the core) and low artifact densities (the periphery).

The field work began with mapping the topographic relief of each scatter using a transit and stadia rod. The units selected for excavation were staked out with string, and their southwest corners were designated as unit datums. The transit and stadia rod were then used to measure the elevational difference between the site datum and each unit datum. After each unit was tied into the master contour map of the scatter, the actual excavation work began.

We initially excavated in 5 cm arbitrary levels. Later, on some scatters, we excavated by natural levels. In cases of thick strata, the natural levels were divided into 5 cm arbitrary levels. All vertical and hortizontal measurements were made from the unit datums. Depending upon the context of each unit, either shovels or trowels were used in the excavation process. Soil from each level was screened through .6 cm wire mesh to aid in the recovery of cultural material.

While we did point-provenience artifacts in some contexts, most artifacts were provenienced from specific levels by lots. Charcoal suitable for carbon-14 analysis was point-provenienced and carefully removed from excavation units. A one to two liter sample of soil was taken from each level for flotation. Excavation crews recorded pertinent observations on the stratigraphy and cultural materials for each level excavated.

Architectural features, such as hearths and post-molds, were meticulously documented in the field. We cross-sectioned, mapped and photographed each feature, and collected carbon-14 and soil samples when pertinent.

The units were excavated to sterile soil. Once completed, the excavation crews profiled the stratigraphy of at least one wall, and photographed the unit.

The final step involved the careful backfilling of all units and the raking of humus and leaf litter over the areas of excavation. To assess the impact of the excavation on the natural environment, we made periodic observations of the backfilled areas over the course of two years. We found that within a few months time the areas of excavation transformed back to their former "natural" state. The ground cover quickly rejuvenated in the backfilled areas, and these areas became indistinguishable from the surrounding landscape.

Laboratory Methods

Archaeological samples collected from the excavations were sorted, cleaned and catalogued in the Laboratory of Archaeology at SUNY at Stony Brook. The artifact analysis followed that of the survey materials outlined in Chapter Three, and cultural materials were classified into various categories of chipped stone debris (primary, secondary, tertiary and micro flakes, cores, shatter), chipped stone tools (projectile points, knives, scrapers, choppers, hammerstones, perforators, etc.), groundstone tools (manos, pestles, grinding slabs, adzes, axes, mortars), ceramic materials (pipes, vessels), fire-cracked rocks, and shellfish refuse. In several cases bone tools, which exhibited evidence of being worked, were also identified. Most of these bone tools were classified as awls. Counts were recorded for all cultural materials except shellfish refuse, which was separated by species and weighed. For comparative purposes, the quantity of fire-cracked rocks was also weighed.

Diversity Indexes

To facilitate functional interpretations, we calculated diversity indexes based on the quantity of chipped stone, groundstone, ceramic and bone artifacts. An earlier study undertaken by the senior author defined the functional relationship of eight previously excavated Long Island sites using diversity indexes (Lightfoot 1985). All sites included in the original analysis were shell middens. The analysis differentiated the sites into two groups -- special purpose extraction sites (bulk procurement locations or field processing camps) and residential bases. Given the initial success of this study, we undertook a similar functional analysis of Shelter Island scatters.

A full discussion of the assumptions underlying the use of diversity indexes to interpret Long Island artifact assemblages is outlined elsewhere (Lightfoot 1985:300-303). Suffice it to say, these indexes are crude measures of the range of activities conducted at archaeological places, but are especially useful for undertaking comparative analyses of artifact assemblages. In calculating these indexes we assume that the frequency of artifact classes on a scatter represents, in some manner, the range of tasks performed at that place. A scatter containing only a few artifact classes is assumed to represent a place where a limited range of activities took place. In contrast, a scatter containing many artifact classes is assumed to represent a place where a diverse range of tasks occurred.

The diversity index is computed in the following manner (after Whittlesey and Reid 1982):

$$J = \frac{H}{H\ max} \qquad \text{Where: } H = \frac{n(\log n) - \sum^{k} fi(\log fi)}{n}$$

H max = log k
n = sample size
fi = number of observations in artifact class
k = number of artifact classes

The diversity index ranges from 0 to 1, with 0 representing the least diverse or most limited artifact assemblage and 1 representing the most diverse or varied artifact assemblage.

A major consideration in calculating the J index is determining the artifact classes to be included in the analysis. The range of prehistoric materials was based on a detailed examination of site reports from Long Island, for which the major artifact classes were identified (see Lightfoot 1985:301). The original study defined two groups of artifact classes -- chipped stone tools and ground stone, ceramic and bone tools. Since most site reports did not include counts of debitage, this material was not included in the initial analysis. However because we went to considerable lengths to classify and count chipped stone debris, a third group of artifact classes concerned with lithic production was added. This third group is defined below as chipped stone debitage and hammerstones.

1) **Chipped Stone Tools**. [7 artifact classes: projectile points, knives, scrapers, choppers, perforators, worked cobbles and net sinkers]. The J score calculated for this artifact group provides information on the diversity of activities pertaining to hunting and butchering (projectile points, knives, scrapers); vegetable or wood chopping (choppers, worked cobbles); and fishing (net sinkers). A high J score indicates that multiple activites relating to hunting, plant processing and fishing were performed at the place. A low score suggests a more limited tool assemblage associated with specialized hunting, plant processing or fishing tasks. (One artifact class of the original study, that of utilized flakes, was deleted since we defined utilized flakes into functional categories based on the measurement of edge angles, see Chapter Three).

2) **Ground Stone, Bone and Ceramic Tools**. [8 artifact classes: mano/grinding stone, slab/pestle/mortar, axe/celt/gouge/adze, paintstones, antler tines/spikes, awls, pendants/pipes, steatite/ ceramic vessels, and others (bannerstones/abraders/hoes)]. The J score computed for this group provides information on the diversity of tasks pertaining to food preparation (mano/grinding stone, slab/pestle/mortar); woodworking (axe/celt/gouge/adze); sewing or basketmaking (awls); cooking (steatitie/ceramic vessels); and recreational or possible ritual behavior (paintstones, pendants/pipes). A high J score suggests that a wide spectra of subsistence and domestic activities were performed. A low score indicates a more limited tool assemblage associated with a special purpose site.

3) **Chipped Stone Debitage and Hammerstones**. [7 artifact classes: primary flakes, secondary flakes, tertiary flakes, micro flakes, shatter, cores, and hammerstones]. The J score computed for this group provides information on the range of core reduction tasks that took place at a scatter. A high J score suggests

that a diverse range of chipped stone production activities occurred. A low score indicates a limited range of core reduction activites took place.

Diversity Indexes: Expectations

Diversity indexes calculated for artifact assemblages, when evaluated in combination with other archaeological data, can provide important insights on hunter-gatherer site types. Based on the discussion in Chapter One, we expect that residential bases should be characterized by high diversity indexes that indicate a variety of activities took place involving food processing, tool manufacture and maintenance, woodworking, cooking, recreation, and sewing. These sites should also contain a diverse range of architectural structures, and floral and faunal remains. In our original study (Lightfoot 1985:312-319) we found that residential bases appear to have diversity indexes for lithic, ceramic and bone tools ranging between .47 and .67.

We expect that field camps and bulk procurement locations should be characterized by a lower range of diversity indexes that indicate a limited range of activities. Of course, the diversity indexes may vary depending upon the occupation histories and the manner in which these places were reused (i.e. Binford 1982:10-18). These places should also be associated with a more limited range of architectural features and faunal and floral remains. We found that shellfish extraction sites appear to have diversity indexes for lithic, ceramic and bone tools ranging from .06 to .15. Distinguishing field camps from bulk procurement locations is a difficult undertaking, as outlined in Chapter One, but it is possible that the former may be characterized by nearby storage caches and slightly higher diversity indexes, reflecting the use of overnight equipment.

Flotation of Soil Samples

Soil collected from excavation units was processed in order to collect a sample of small artifacts that might have slipped through the .6 cm mesh, as well as to recover faunal and floral remains. The flotation process involved the following procedure. Unless otherwise indicated, a 500 ml sample of soil was weighed and then poured into a laboratory tank full of water. Sodium silicate was added to the water to facilitate the separation of organic and inorganic materials. The water was then agitated and a Fischer Scientific #20 mesh (1.5 x 1 mm) was used to recover the light fraction that floated to the surface. The remaining heavy fraction was then water screened through two fine meshes (4 x 4 mm; 1.5 x 1 mm). Both the light and heavy fractions were then dried and sorted into the following categories: sand and gravel, roots, charcoal, seeds and nuts, faunal remains (further separated into shellfish species, mammal and bird bones), micro artifacts (small lithic or ceramic materials), and insect remains. Finally, each of these categories was weighed.

The charcoal, seeds and nuts were identified by Dr. Margaret Conover, a plant anatomist of the Museum of Long Island Natural Sciences (SUNY at Stony Brook). The mammal, bird, reptile and fish bones were analyzed by Stephanie Rippel-Erikson of the Long Island Archaeological Project. The micro artifacts and shellfish remains were sorted, counted and weighed by members of the Archaeological Laboratory. Whole specimens of Mercenaria mercenaria were sent to Dr. Robert Cerrato's laboratory in the Marine Sciences Research Center (SUNY at Stony Brook) for sectioning.

Carbon-14 Samples

Carbon-14 samples recovered in the field were carefully sorted and stored at the Archaeology Laboratory at SUNY at Stony Brook. Given the costs of analyzing carbon-14 samples, we were unfortunately limited to relatively few chronometric dates. Six charcoal specimens were submitted to Dr. Murry Tamers of Beta Analytic, Inc., a radiocarbon laboratory in Coral Gables, Florida.

The Results of the Excavation

Below we outline the major findings for each of the seven scatters.

ONOW 2-1

This small (40 m2) lithic scatter, located on a three meter high hill overlooking Fan Creek, was initially interpreted as a lithic workshop. Today the hill top abounds with black oak, chestnut oak, and young dogwood trees, as well as a lush understory of blueberry and huckleberry bushes. Once the grid system was established, three one by one meter units were randomly selected for excavation. This included one unit (0N1W) from the core area of scatter, and two (1S1W, 2N1E) from the periphery (see Figure 7). Five arbritrary levels from each unit were excavated, the first levels measuring 0 to 5 cm below the unit datums, and the last levels extending 20 to 25 cm below surface. The unit datum of 0N1W was 17 cm below the site datum, while the other two unit datums measured 6 and 30 cm below the site datum, respectively.

1) **Stratigraphy**. The three units exhibited very similar profiles characteristic of deciduous woodland soils (see Figure 8). The upper stratum (S1), the Ao1 zone of humus, measured 0 to 3 cm below unit datum. This was followed by the A2 zone, a grey soil horizon (S2) of leached sand and humus materials, found

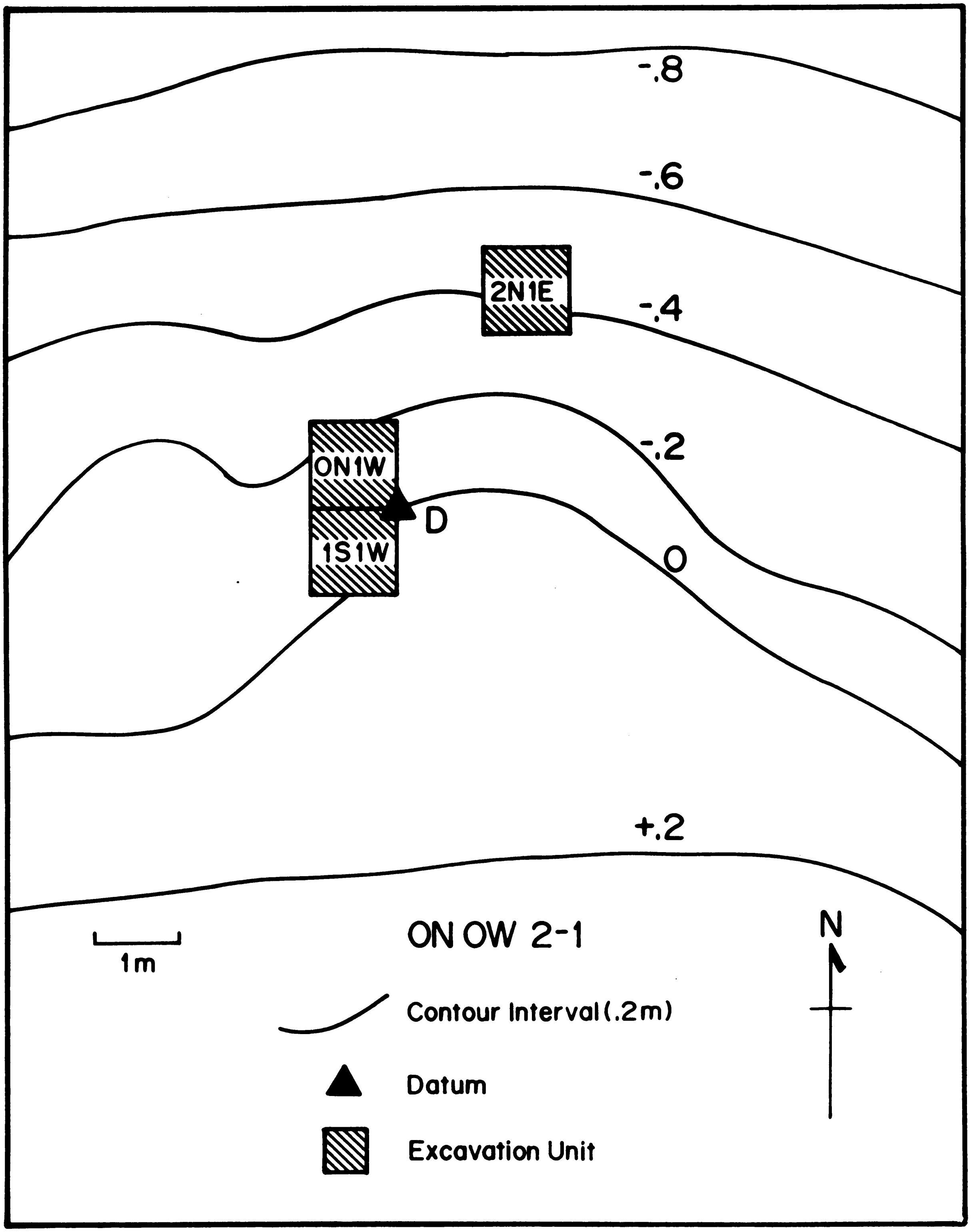

Figure 7. Excavation Units of ONOW 2-1

about 3 to 7 cm below unit datum. Finally, the B2 zone (S3), a yellow colored horizon containing sand, gravel and some cobbles, was defined at about 7 cm below the unit datum, and it continued to the bottom levels of the excavation.

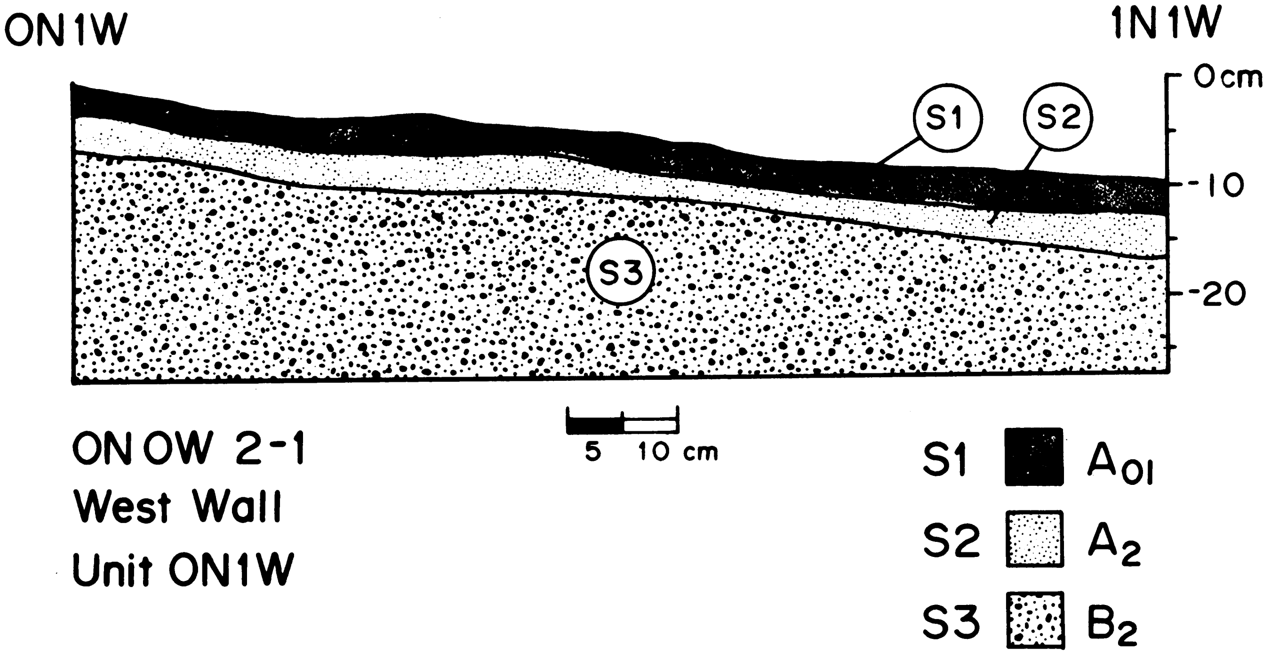

Figure 8. ONOW 2-1. West Wall Profile of Unit ON1W

2). __Lithic, Ceramic and Bone Artifacts__. A rather limited range of materials was recovered from ONOW 2-1. The specific artifact proveniences, by unit and level, and artifact raw material types are listed in Appendix Three. Table 10 summarizes the information on artifact types for each unit.

a) Chipped Stone Debitage and Hammerstones. The bulk of the site's artifact assemblage consisted of large chunky pieces of quartzite debitage. Quartzite shatter made up the majority of the chipped stone debris, followed by primary, secondary and tertiary flakes. One micro flake and two cores were also recovered. No hammerstones were reported.

Unit	P	S	T	Sa	Co	M	H	K	PP	Sc	Ch	FC	Ce
ON1W	2	0	0	2	0	0	0	0	0	0	0	5	0
1S1W	1	0	0	2	1	0	0	0	0	0	0	9	0
2N1E	8	5	2	33	1	1	0	0	0	0	0	12	0
Totals	11	5	2	37	2	1	0	0	0	0	0	26	0

KEY:

P = Primary	S = Secondary	T = Tertiary
Sa = Shatter	Co = Core	M = Micro Flake
H = Hammerston	K = Knife	PP = P. Point
Sc = Scraper	Ch = Chopper	FC = Fire Cracked Rock
Ce = Ceramic		

Table 10. Artifacts From ONOW 2-1.

b) Chipped Stone Tools. None recovered.

c) Groundstone, Ceramic and Bone Tools. None recovered.

d) Fire-Cracked Rock. Twenty-six rocks, weighing a total of 7170 grams, or an average of 276 grams per rock were inventoried from the site. All three units contained fire-cracked rocks.

3) **Charcoal**. No charcoal flecks or chunks were observed in any of the excavation units.

4) **Faunal and Floral Remains**. No faunal remains were recovered from the excavation units. The soil samples were not floated from this scatter.

5) **Architectural Features**. None reported.

6) **Artifact Density**. The excavation data fell into the lower range of density estimates predicted from the survey probes. The number of artifacts recovered from survey probes varied considerably, resulting in a very high standard deviation ($\bar{x}$ = 21.5, sd = 31.9). Thus, depending upon their location, the number of artifacts per excavation unit was expected to range anywhere from a relatively few to 587 artifacts per m2. The observed densities fell in the lower range of this estimate, varying from only 9 (1S1W) to 62 (2N1E) artifacts per m2.

7) **Artifact Diversity**. Diversity Indexes could be calculated for only one group of artifact classes--chipped stone debitage and hammerstones. It yielded a J value of .58. The

average diversity index for the other two groups (chipped stone tools and groundstone, ceramic and bone tools) was 0, and the average index for all classes of artifacts was only .19.

8) **Chronology**. No diagnostic materials recovered; date unkown.

9) **Interpretation**. The excavation data strongly supports the initial interpretation that this scatter served as a lithic workshop. The lack of lithic, bone or ceramic tools, and the resulting low mean diversity index, suggests that it was a special purpose location where a limited range of activities took place. The activities definable in the archaeological record appear to have involved the production of large quartzite flakes. The presence of considerable quantities of fire-cracked rock is somewhat puzzling. It may be a by-product of heat treating the quartzite cobbles before core reduction. Since a limited amount of charcoal was found in the three excavation units, we could not pinpoint the place where the rocks were heated.

ONOW 3-21

A close neighbor of ONOW 2-1, this scatter sits 4.6 meters above the Fan Creek estuary on a low hill top. The contemporary vegetation includes a tall canopy of black and chestnut oaks, and an understory of blueberry bushes and cat briar. Two excavation units, 1S3W and 1N0E, were randomly chosen for excavation (see Figure 9). The former was 8 cm above the site datum, from which point five arbitrary levels were excavated. The latter measured 31 cm below the site datum, and here six arbitrary levels were dug.

1) **Stratigraphy**. Four natural horizons were defined for the two units (Figure 10). The first horizon (S1), containing the humus and leaf litter (Ao1), was about four cm thick. The second horizon (S2), characterized by grey colored leached sand, measured about 4 to 8 cm in depth. The third horizon (S3), identified as the B1 zone, was characterized by a light brown sand lense. It measured about 8 to 14 cm below the unit datum. The final horizon (S4), a yellow colored B2 zone, contained sand, gravel and some rocks. It was found about 14 cm below the surface and continued to the bottom of the excavation units.

2) **Lithic, Ceramic and Bone Artifacts**. Similar to ONOW 2-1, this scatter produced a limited range of artifact types. The specific proviences and raw material types of all artifacts are listed in Appendix Three. Table 11 summarizes the pertinent infomation for each excavation unit.

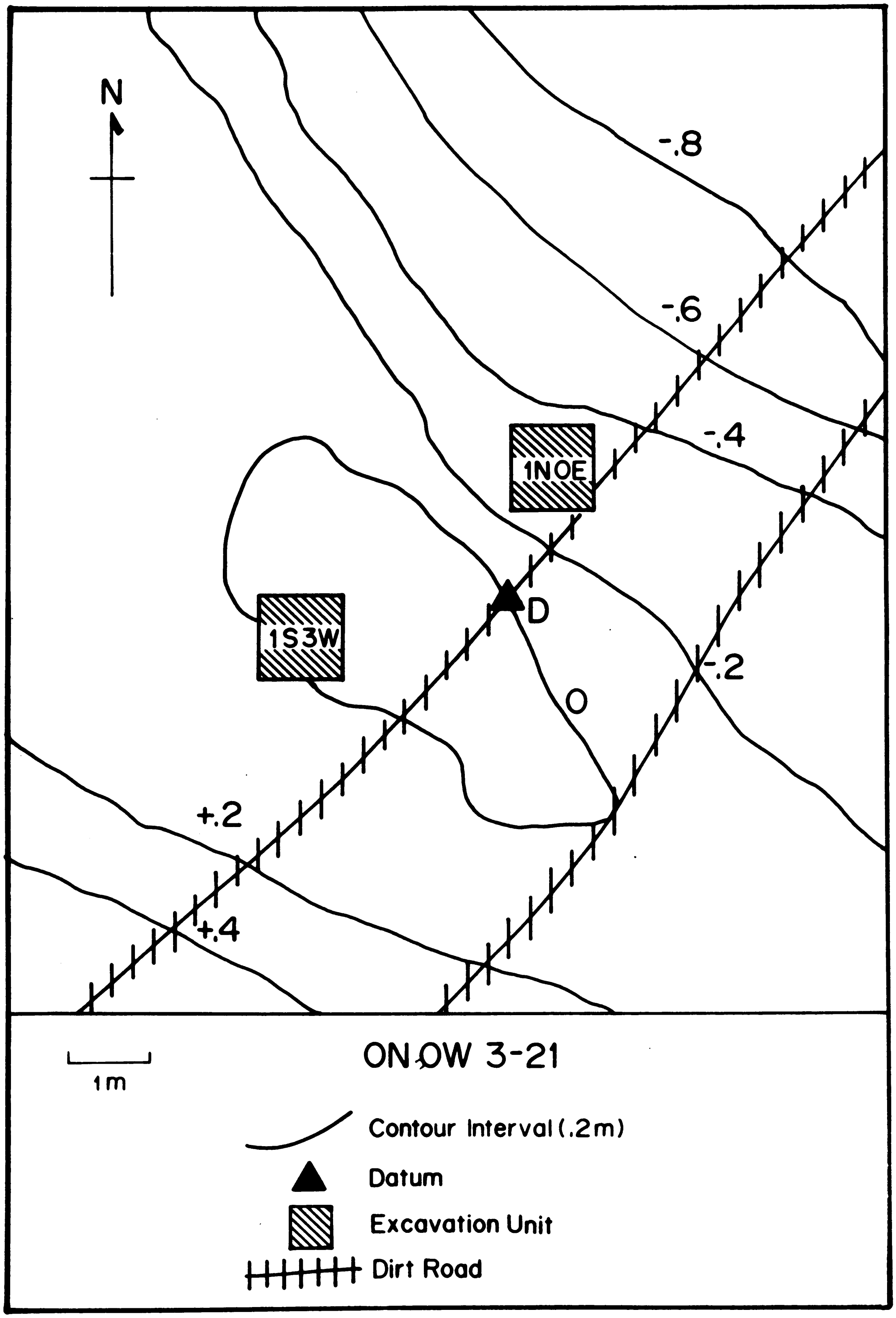

Figure 9. Excavation Units of ONOW 3-21

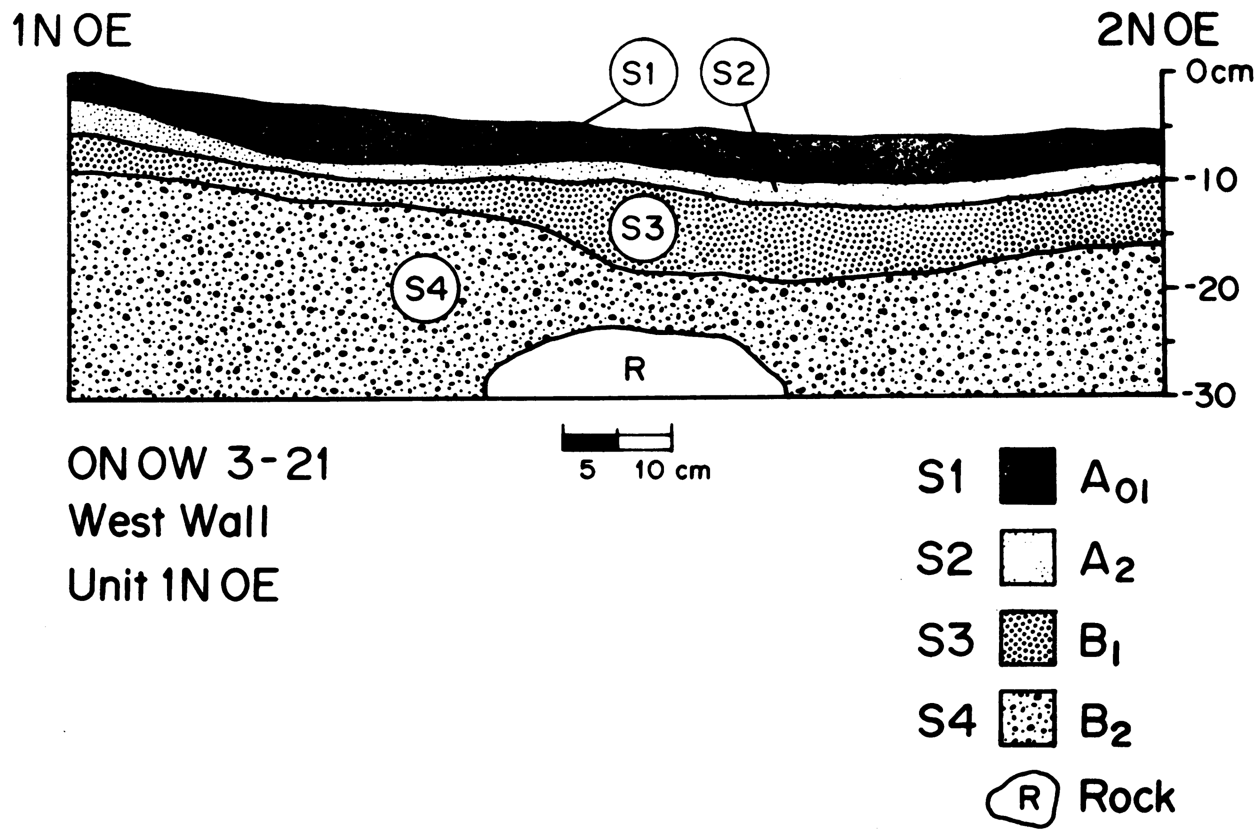

Figure 10. ONOW 2-1. West Wall of Profile of Unit 1N0E

Unit	P	S	T	Sa	Co	M	H	K	PP	Sc	C	FC	Ce
1N0E	3	4	5	10	0	0	0	0	0	1	0	0	1
1S3W	0	1	0	0	0	0	0	0	0	0	0	0	0
Totals	3	5	5	10	0	0	0	0	0	1	0	0	1

KEY:

P = Primary	S = Secondary	T = Tertiary
Sa = Shatter	Co = Core	M = Micro Flake
H = Hammerstone	K = Knife	PP = P. Point
Sc = Scraper	C = Chopper	FC = Fire Cracked Rock
Ce = Ceramic		

Table 11. Artifacts From ONOW 3-21.

a) Chipped Stone Debitage and Hammerstones. The majority of the cultural material, found in unit 1N0E, was chipped stone debris consisting of shatter, secondary, tertiary and primary flakes. Unlike ONOW 2-1, a wide range of raw materials was represented, including milky quartz, variegated quartz, smokey quartz, rock crystal quartz and quartzite. One piece of chert was also identified. The diversity of raw material types contradicts the initial findings of the survey, which suggested that the assemblage consisted primarily of quartzite materials.

b) Chipped Stone Tools. One variegated quartz scraper was recovered from unit 1N0E level 4.

c) Ground Stone, Ceramic and Bone Tools. A single sherd of a sand tempered vessel, the interior of which was decorated with scallop shell impressions, was collected from unit 1N0E level 5.

d) Fire-Cracked Rock. No fire-cracked rocks were observed in either excavation unit.

3) Charcoal. Excavation crews noted a few small flecks of charcoal in unit 1S3W (levels 3 and 4) and unit 1N0E (level 3).

4) Faunal and Floral Remains. Soil samples were floated from unit 1S3W (levels 2,3,4 and 5). The small quantity of soil collected in the field resulted in samples of only 150 ml (levels 2, 3), 350 ml (level 4) and 300 ml (level 5). No floral or faunal remains were recovered from the samples (see Appendix 4). In addition, the sifting of all excavated soil through .6 cm mesh did not yield any faunal specimens.

5) **Architectural Features**. No features were recorded.

6) **Artifact Density**. A varied number of artifacts were initially recovered from positive shovel probes in the survey. While most positive probes contained only one or two artifacts, one yielded 42 pieces. This produced a very high standard deviation (14.2) with respect to the overall mean (6.4) number of artifacts per positive probe. Thus, we expected that the number of artifacts per excavation unit could vary considerably, from very few artifacts to 227 per m2. If only 75% of the probes within an excavation unit were positive (see Table 8), then the upper limit may be reduced to 171 artifacts per m2. The observed artifact densities for the excavation units fell into the lower density range, varying from only 1 (1S3W) to 24 (1N0E) artifacts per m2.

7) **Artifact Diversity**. The diversity index for chipped stone debris and hammerstones was .66, while the indexes for the other artifact categories were 0. The average J index for lithic, ceramic and bone tools was 0, and for all artifact categories it was only .22.

8) **Chronology**. The presence of a scallop brushed sherd tentatively suggests a Middle or Late Woodland date for 0N0W 3-21.

chipped stone debris and charcoal fragments. The remainder of the site (shovel probe intervals 6-3,6-4,6-5,6-6, 6-7) is an extensive shell midden, measuring at least 40 by 30 meters, composed of a mix of hard clam, soft clam, whelk and oyster shell debris. Shovel probes sampling the shell midden proper produced chipped stone debris, a scraper and ceramic sherds. The size of the midden, the diversity of shellfish remains, and the range of artifacts suggest a more diversified use for the site than other nearby midden deposits.

1S0W 2-4. Nestled along the sides of a large kettle depression in the oak-sedge habitat, this concentration contained chipped stone debris and ceramic sherds. Positive shovel probes yielded, on the average, 4.7 (sd = 3.9) artifacts. We estimate that the 200 m2 scatter may contain between 1000 to 11,400 artifacts.

2S3E 4-3. This concentration of lithics is situated close to the freshwater marsh that makes up the southern extension of the Great Swamp. The sample of artifacts included a full range of chipped stone flakes, suggesting that this site may be a small lithic workshop.

2S3E 7-1. Another small lithic scatter situated along the freshwater marsh of the Great Swamp, it also produced chipped stone debris. This concentration appears to be the remains of a lithic workshop.

A Consideration of the Transect and Block Surveys

The results of the transect and block surveys provide a good assessment on the density, diversity and spatial distribution of prehistoric materials at Mashomack. Below we outline five major observations for the survey data base.

1. **Upland Habitats**. Survey crews detected relatively few prehistoric materials in the upland oak and freshwater habitats. The probability of discovering prehistoric materials in shovel probes is very low here, ranging from only .2 to 2%.

We observed two different patterns of cultural material in the uplands. For transects and blocks surveyed some distance (200 or more meters) away from Mashomack's shoreline, the primary manifestations are isolated finds and broadly dispersed, low density scatters of chipped stone debris and tools, especially projectile points (i.e. 2S4W 1-4). These remains appear to be non-site manifestations (as defined in Chapter One), suggesting that upland areas were used sporadically for low bulk extraction activities involving hunting and some gathering.

In contrast, a diverse range of archaeological remains are found between 100 to 200 meters of the coastline. Here isolated

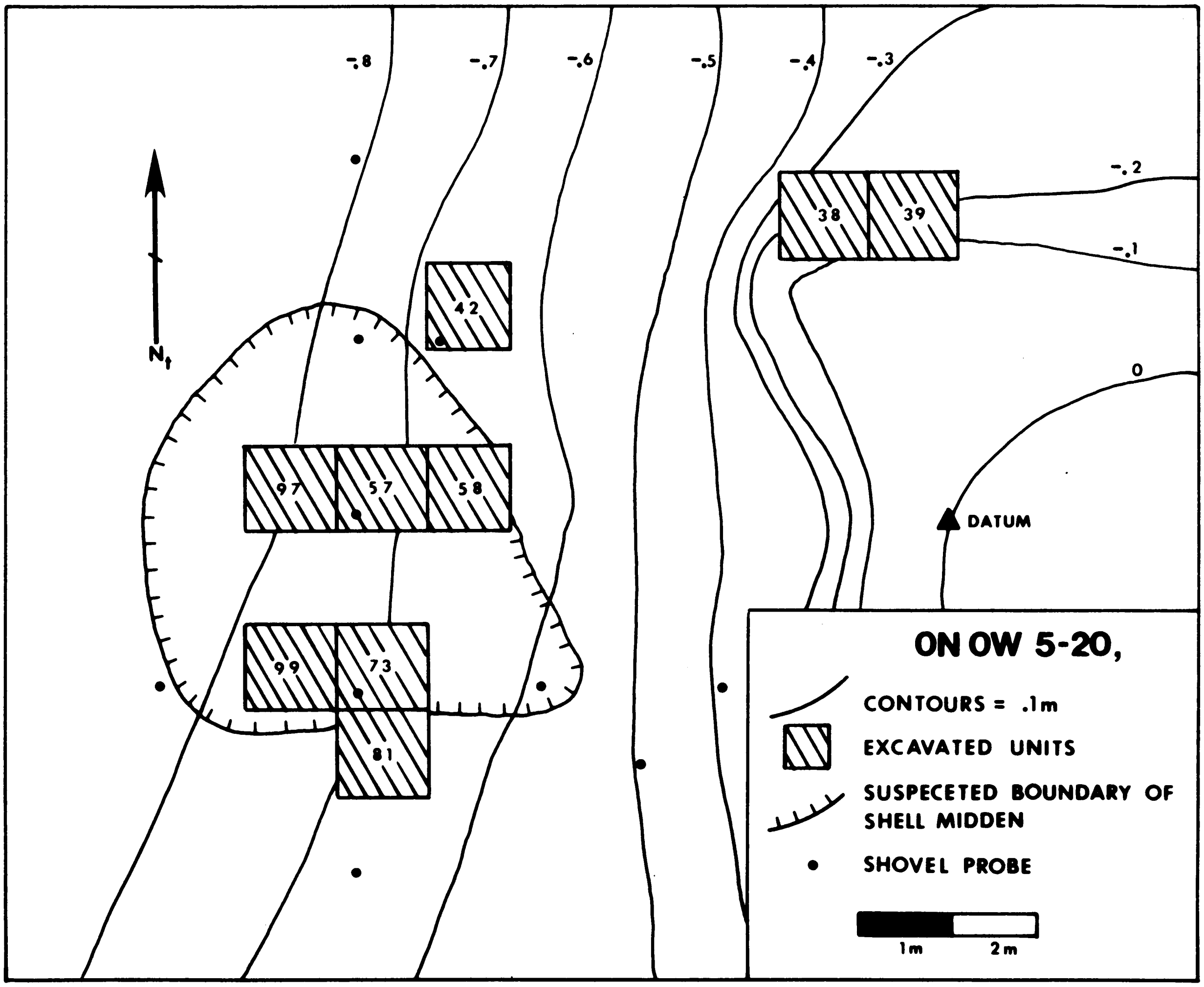

Figure 11. Excavation Units of ONOW 5-20

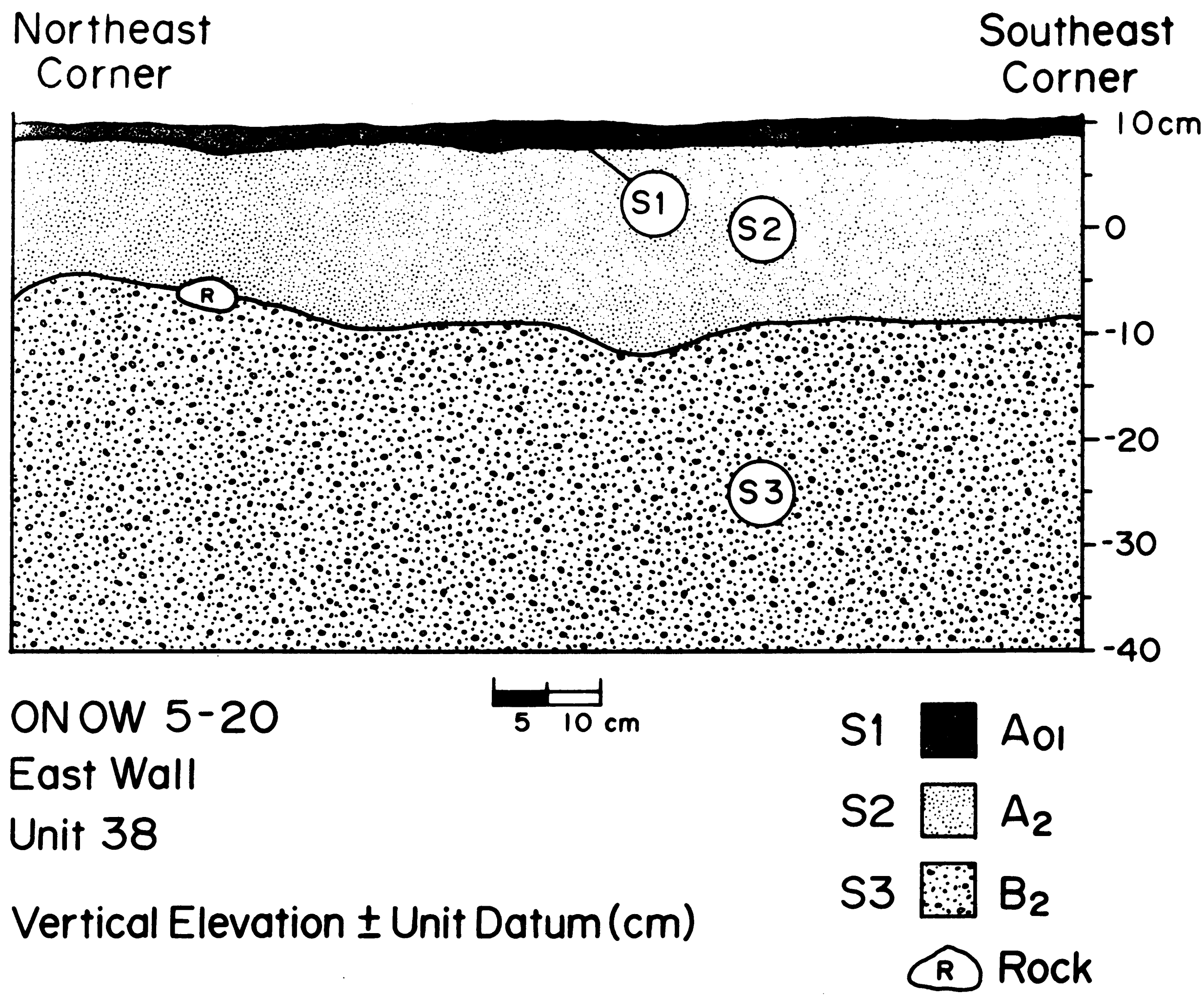

Figure 12. ONOW. East Wall Profile of Unit 38

cm below the surface, followed by the light brown B1 zone (S2) to about 10 cm below ground surface. The concentration of shellfish refuse (L1) extended anywhere from 10 to about 20 or 30 cm below the ground surface. The 10-20 cm thick shell lense overlay the B2 stratum (S3) that extended to the bottom of the units.

2) **Lithic, Ceramic and Bone Artifacts.** The excavation recovered 253 artifacts from the shell midden and lithic scatter. The specific proviences and raw material types of these remains are listed in Appendix Three. Table 12 summarizes the debitage and tool categories for the nine excavation units.

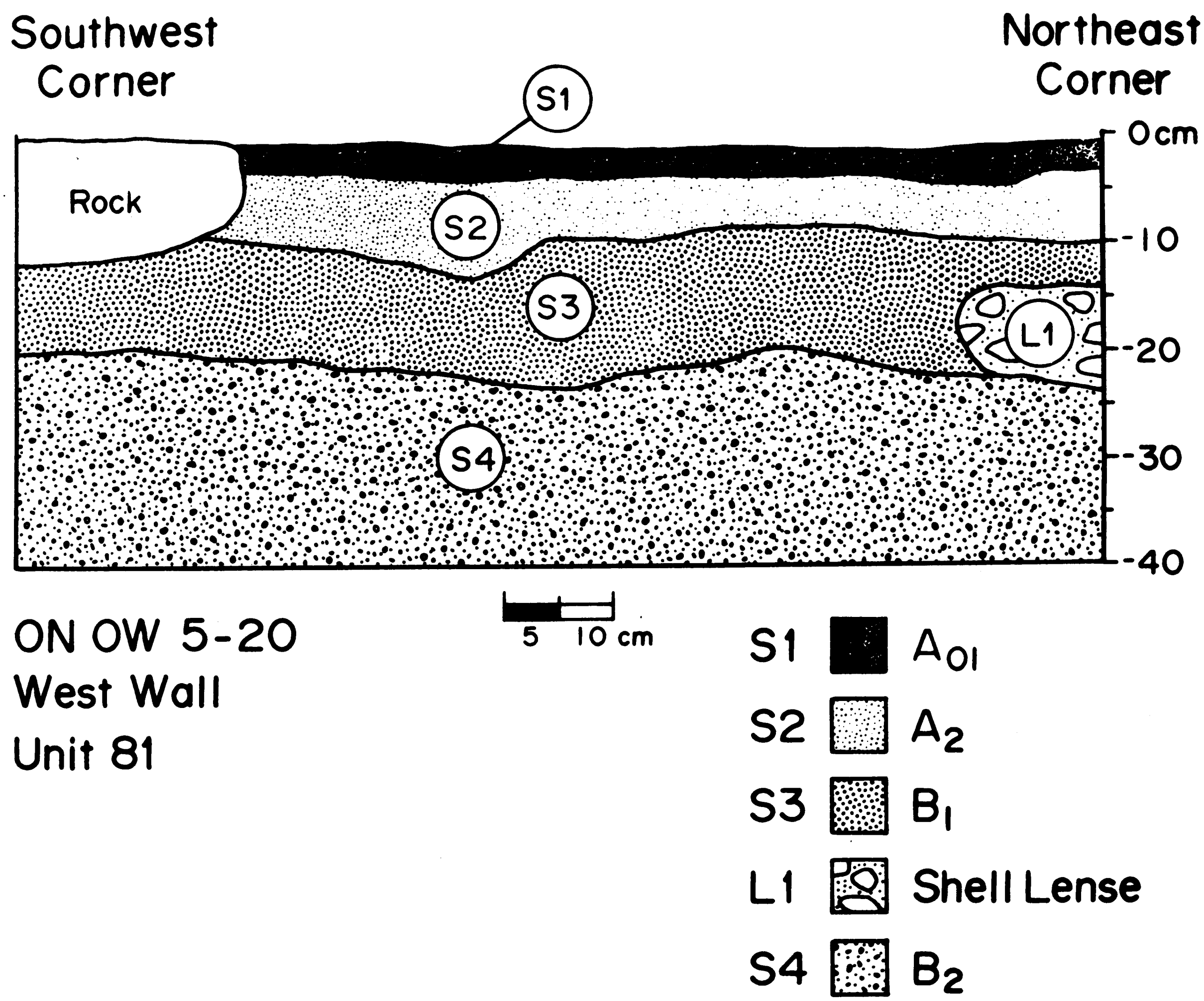

Figure 13. ONOW 5-20. West Wall Profile of Unit 81

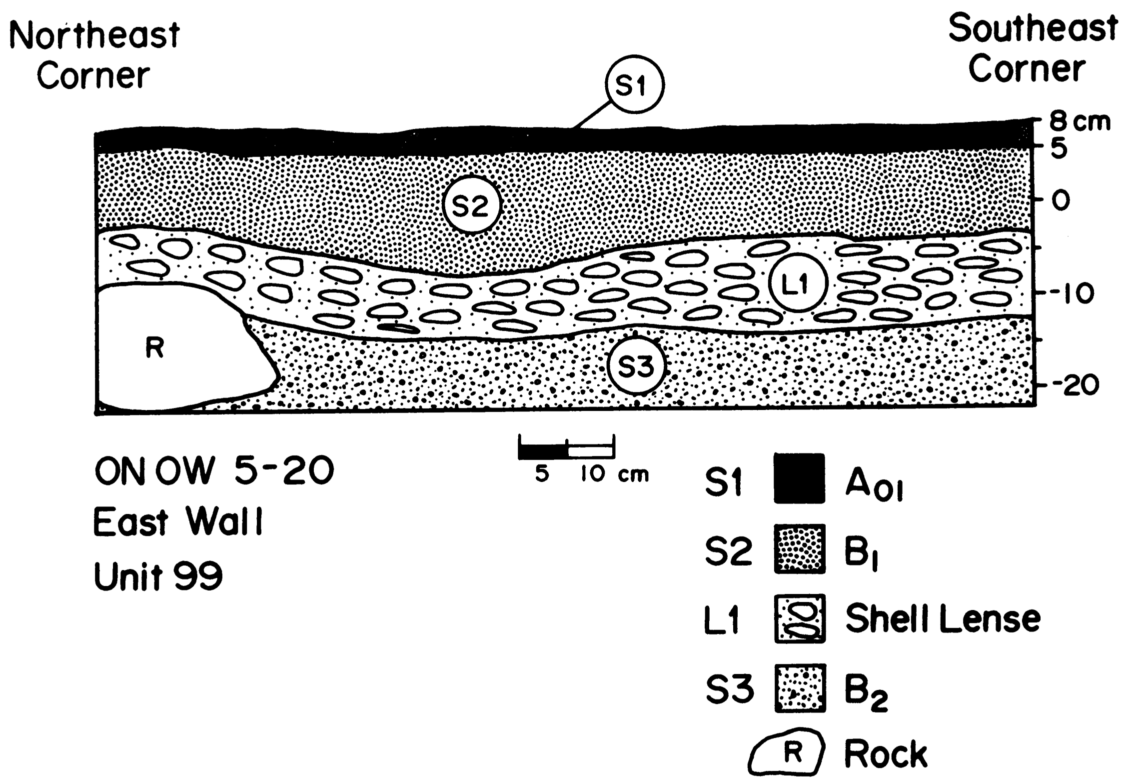

Figure 14. ONOW 5-20. East Wall Profile Unit 99

UNIT	P	S	T	Sa	Co	M	H	K	PP	Sc	C	FC	Ce
38	1	2	7	0	0	0	2	0	0	0	0	0	4
39	9	8	7	0	0	0	0	1	0	0	0	0	2
42	7	10	6	12	1	0	2	0	0	0	0	0	0
57	6	5	9	0	0	0	0	1	0	0	0	0	29
58	4	6	6	3	3	0	0	2	0	0	0	0	3
73	4	5	1	2	1	0	0	1	2	0	0	0	0
81	3	1	1	0	0	0	2	0	0	0	0	0	0
97	5	4	5	0	0	0	0	0	0	0	0	0	40
99	9	1	8	0	0	0	0	0	0	0	0	0	0
Totals	48	42	50	17	5	0	6	5	2	0	0	0	78

KEY:
P = Primary; S = Secondary; T = Tertiary
Sa = Shatter; Co = Core; M = Micro Flake
H = Hammerstone; K = Knife; PP = P. Point
Sc = Scraper; C = Chopper; FC = Fire Cracked Rock
Ce = Ceramic

Table 12. Artifacts from ONOW 5-20.

a) Chipped Stone Debitage and Hammerstones. The bulk of the sampled assemblage from ONOW 5-20 was chipped stone debris. The materials included a relatively large quantity of primary, secondary and tertiary flakes, some shatter, and a few cores and hammerstones. Interestingly, no micro flakes were recovered. A wide range of local raw materials were represented, including milky quartz, variegated quartz, rock crystal quartz, smokey quartz, rose quartz and quartzite.

b) Chipped Stone Tools. The meager number of tools in the lithic assemblage included five knives and two Levanna projectile points.

c) Groundstone, Ceramic and Bone Tools. Seventy-Eight sherds from six different vessels were identified, primarily from units 57 and 97. The six vessels are represented in Appendix Three using the symbols a1, a2, b1, b2, c, and d. These vessels were grouped into three basic types: a sand tempered, smoothed brownware (two vessels represented--a1 and a2); a sand tempered, scallop brushed interior type (two vessels represented--b1 and b2); and a shell tempered grey ware (c). Sherds of a historical glaze ware vessel (d) were also collected from the first level of unit 97.

No groundstone or bone tools were recovered.

d) Fire-Cracked Rock. None were identified.

3) **Charcoal**. A considerable quantity of charcoal flecks and chunks was noted by field crews. At least half the levels of each unit contained charcoal, and some, such as units 38 and 39, contained charcoal in each level. There is a high probability that the charcoal in the Ao1 and A2 strata resulted from natural fires. Yet the charcoal recovered from the shell lense in units 57, 58, 73, 97 and 99 was probably associated with the prehistoric use of the site.

4) **Floral and Faunal Remains**. Four soil samples from unit 57 (levels 1,2,4,5) were floated. Table 13 summarizes the materials recovered from these samples.

a) Shellfish. Only a relatively small proportion of the soil samples from unit 57 consisted of shellfish refuse. Of this, soft clam was the only species identified. Other shellfish remains recovered from the excavation units using .6 cm mesh were cleaned, identified by species, and weighed. Table 14 summarizes this information. It is clear that soft clam makes up the bulk of the shellfish assemblage (21,069 g., 98.9% of total), followed distantly by hard clam (214.6 g., 1%) and whelk (2.3 g., .01%).

b) Other Faunal Remains. Despite careful examination and screening of material from the midden and lithic scatter, no faunal specimens besides the shellfish were unearthed. In

Unit	Level	Sample Size (m)	Weight (In Grams) TS	G/S	Sh	R	Ch/S	F	A
57	1	500	485	1.9	.2	1.5	1.2	0	0
57	2	500	519	12.1	3.4	2.1	2.6	0	0
57	4	500	592	36.9	28.2	1.6	.4	0	1 Ce
57	5	500	634	39.1	1.9	1.0	.4	0	0

KEY: TS = Total Sample Weight G/S = Gravel/Sand
Sh = Shellfish R = Roots
Ch/S = Charcoal, seeds F = Fauna
A = Artifacts (Ce = ceramic)

Table 13. Materials Recovered from Soil Samples of ONOW 5-20.

addition no faunal remains were recovered from the floated soil samples.

Unit	Shellfish (grams) Soft Clam	Hard Clam	Whelk
38	13.2	0	0
39	0	21.3	0
42	0	0	0
57	11,272.3	134.2	.6
58	120.2	0	0
73	3,283.3	42.7	1.7
81	112.8	1.6	0
97	3,135.9	0	0
99	3,131.6	14.8	0
Totals	21,069.3	214.6	2.3

Table 14. Shellfish Remains Recovered From Excavation Units of ONOW 5-20.

c) Floral Remains. Two hickory nuts were identified and collected during the excavation of units 73 and 99 (see Appendix Three). The soil flotation yielded charred and uncharred grape seeds (Vitis sp.), and uncharred specimens of raspberry seeds (Rubus sp.), sumac (Rhus sp.), sedge-polygonum, bayberry (Myrica sp.), and dogwood seeds (Cornus sp.) (see Appendix 4).

5) **Architectural Features.** None reported.

6) **Artifact Density.** The intial survey produced an average of 1 artifact per positive probe (sd = 1.5). We expected that the density of artifacts would range from very few to 27 per m2. The upper limit would be less if only 50% of the probes yielded artifacts. The artifact densities of six of the excavation units (38, 39, 58, 73, 81, 99) fell within the expected range (7 to 27 artifacts/m2), while three units (42,57,97) exceeded the upper limit (38 to 50 artifacts/m2).

7) **Artifact Diversity.** The J values for the chipped stone debitage and hammerstones, the chipped stone tools, and groundstone, ceramic and bone tools were .78, .29, and 0, respectively. The average diversity index for the lithic, ceramic and bone tools was very low (.14), and the average index for all artifact classes was .36.

8) **Chronology.** A Late Woodland occupation is suggested by the Levanna projectile points and the plain and scallop brushed ceramics. A charcoal specimen (Beta-19913) recovered from the shell lense of Unit 57 (level 2) yielded a carbon-14 date of 460 ± 80 B.P. The site appears to have been used about a century or so before Shelter Island was settled by whites, sometime between AD 1410 to 1570.

9) **Interpretation.** The original interpretation that the Laspia site served as a shellfish bulk procurement location (or possibly as a field processing camp) was supported by the excavation. Soft shell clam clearly comprised the vast majority of the shellfish collected and processed at the site. The diversity indexes suggest a very limited range of activities took place. The chipped stone material probably resulted from the expedient production of sharp edge flakes (knives) that would have facilitated the extraction of meat from soft shell clams. Given the presence of charcoal and ceramic vessels, it is possible that the meat was then cooked or processed on site. Despite the presence of a midden deposit that would ordinarily preserve organic materials, there is little evidence that other faunal remains were processed at the site.

The uncharred plant remains recovered in the soil samples may be flora deposited through natural agencies in the midden deposit. On the other hand, the raspberry, wild grape, and sumac remains may have resulted from the nearby foraging of these resources during the time of the shellfish processing. The seeds may have been excreted into the midden by the prehistoric shellfish gatherers. The implications of this latter interpretration is that the shellfish gathering took place in August or September when raspberry, grape and sumac were available. This idea is supported by the presence of dogwood seeds which also ripen between August and September (Margaret Conover, personal communication).

ONlW 1-18 (The Sanwald Site)

This small scatter south of Fan Creek estuary, dubbed the Sanwald site, is found in a mixed woodland of oak and hickory trees and blueberry bushes. The site generated interest because of its location in the oak-sedge habitat and because of a circular arrangement of surface rocks that resembled a hearth. A citrine scraper, listed in Appendix Two (ONlW 1-18 S probe), was found close to this possible feature.

Five units were laid out and excavated at the Sanwald site; three from the core area (1S2E, 2S0E, 3S0E) and two from the periphery (4S0E, 2S3E)(see Figure 15). The southern half of 2S0E and the northern half of 3S0E contained the possible feature. Only the south half of 2S0E was excavated. The depth below site datum and number of levels excavated for each unit varied as follows: unit 1S2E (-22 cm, 10 levels), unit 2S0E (-24 cm, 12 levels), unit 2S3E (-30 cm, 14 levels), unit 3S0E (-23 cm, 11 levels) and 4S0E (-37 cm, 13 levels). This site represented one of the deepest excavated at Mashomack with cultural material extending from the first level to more than 70 cm below ground surface in unit 2S3E.

1) **Stratigraphy**. Four soil natural levels were defined (see Figure 16). The humus level (S1) made up the first level (0-2 cm), followed by a brown B1 stratum (S2) of leached sand and gravel (2-14 cm), then the yellow B2 horizon (S3) of sand, gravel and cobbles (14-50 cm). The final level (S4), beginning around 50 cm below surface and contining to the bottom of the units, was the B3 zone of orange/red colored sand, gravel and dense cobbles.

2) **Lithic, Ceramic and Bone Artifacts**. The excavation yielded 356 pieces of chipped stone debris, tools and fire-cracked rocks. The specific proveniences and raw material types of the artifacts are presented in Appendix Three. Table 15 summarizes the artifact types for each excavation unit.

a) Chipped Stone Debitage and Hammerstones. A wide variety of raw materials, comprising milky quartz, citrine quartz, variegated quartz, rose quartz and quartzite, were worked on the site. Shatter outnumbered all other artifact categories, followed by secondary, tertiary, micro and primary flakes. Six cores and eight hammerstones rounded out the inventory.

b) Chipped Stone Tools. Four tool categories were defined on the site. These included scrapers (8), knives (2), choppers (2) and one projectile point. The point, identified as Brewerton side notched, may date to the Late Archaic period (Ritchie 1961:19).

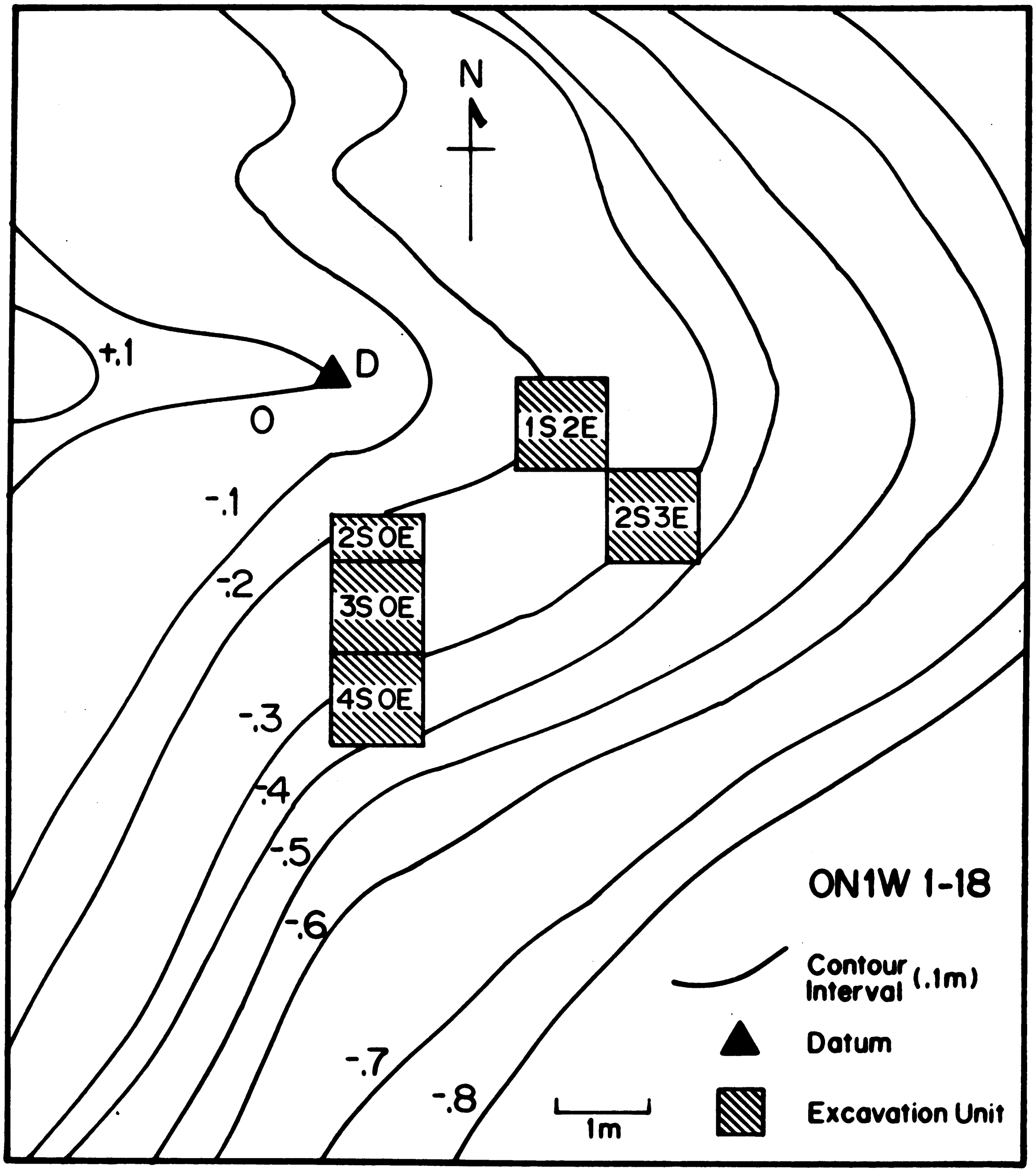

Figure 15. Excavation Units of ON1W 1-18

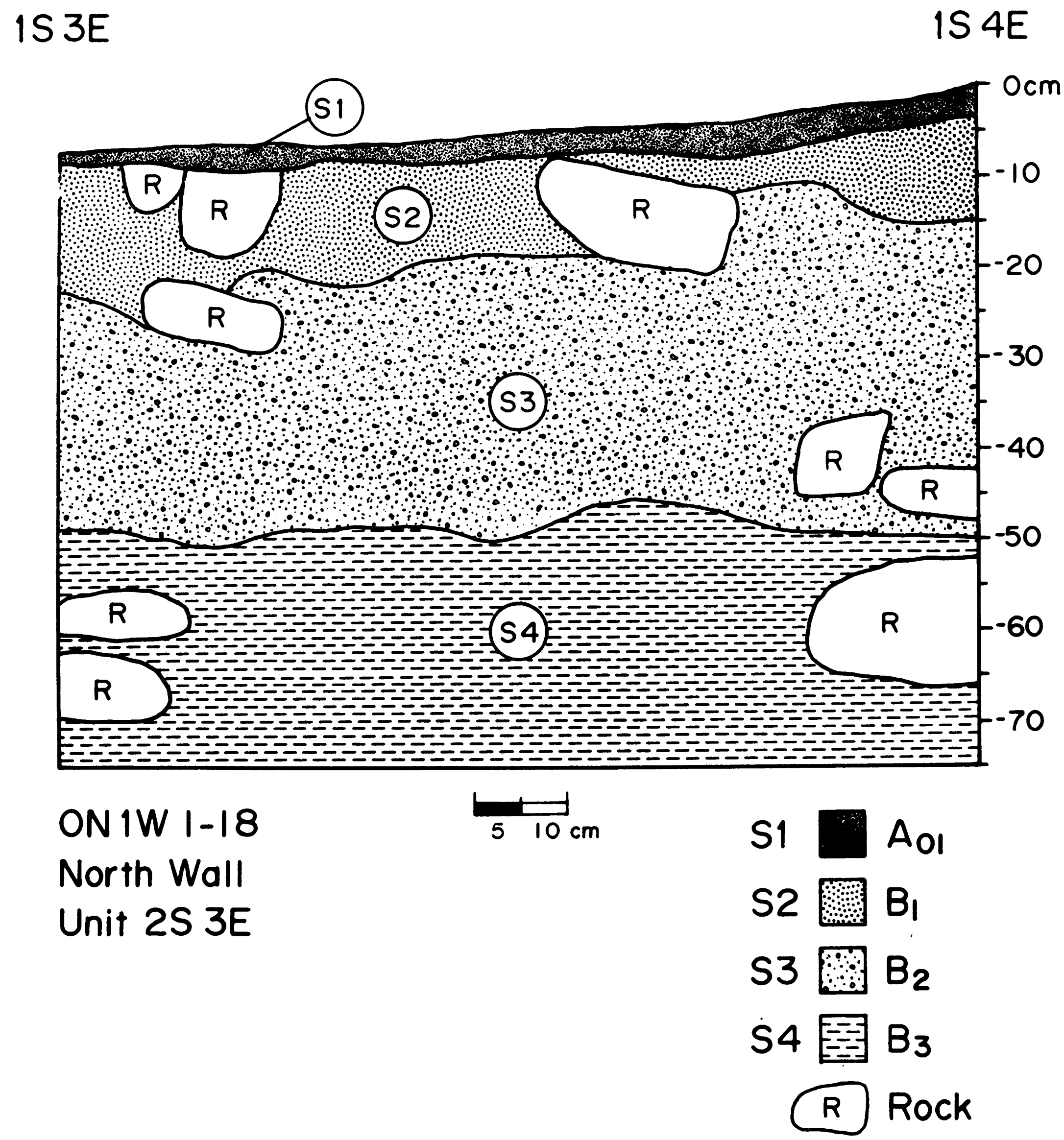

Figure 16. ON1W 1-18. North Wall Profile of Unit 2S3E

Unit	P	S	T	Sa	Co	M	H	K	PP	Sc	C	FC		Ce
1S2E	4	15	12	6	1	5	0	0	0	0	0	9	(141 g.)	0
2S0E	2	20	15	5	0	4	0	2	0	1	0	10	(581 g.)	0
2S3E	5	8	10	25	1	16	0	0	0	1	0	7	(106 g.)	0
3S0E	8	15	6	12	0	2	2	0	0	4	0	8	(947 g.)	0
4S0E	9	11	12	27	4	10	6	0	1	2	2	31	(1309 g.)	0
Totals	28	69	55	75	6	37	8	2	1	8	2	65	(3084 g.)	0

KEY: P = Primary S = Secondary T = Tertiary

Sa = Shatter Co = Core M = Micro Flake
H = Hammerstone K = Knife PP = P. Point
Sc = Scraper C = Chopper FC = Fire-Cracked Rock
Ce = Ceramic

Table 15. Artifacts From 0N1W 1-18.

c) Groundstone, Ceramic and Bone Tools. None recovered.

d) Fire-Cracked Rock. Sixty-five pieces of fire-cracked rock, weighing a total of 3084 grams, were recovered.

3) **Charcoal**. Charcoal flecks and chunks were reported from only two units -- 2S0E (levels 1,3,7) and 3S0E (levels 4,5,6).

4) **Faunal and Floral Remains**. Ten soil samples from unit 2S0E (levels 1,2,3,4,5,8,9,10,11,12) were selected for flotation. The materials recovered from the analysis are listed in Table 16.

a) Shellfish. A trace amount of shellfish was observed in several of the soil samples.

b) Other Faunal Remains. No faunal remains were recovered from the soil samples or from sifting soil through .6 cm mesh during the excavation.

c) Floral Remains. A relatively diverse range of plant specimens was recovered from the soil samples (Appendix 4). The charred remains included cherry seeds (*Prunus sp.*), sedge-polygonum, and nut fragments (either *Carya sp.* or *Juglans sp.*). The uncharred flora consisted of raspberry seeds (*Rubus sp.*), grape seeds (*Vitis sp.*), sedge-polygonum, Chenopodiaceae, and mustard (*Brassicaceae*).

5) **Architectural Features**. The circular arrangement of surface rocks measured about 25 cm in diameter. However, the excavation of 2S0E and 3S0E did not reveal a well defined hearth,

Unit	Level	Sample Size (ml)	Weight (in grams) TS	G/S	Sh	R	Ch/S	F	A
2S0E	1	500	356	59.1	.1	13.9	2.0	0	Ball B.
2S0E	2	500	440	43.6	.2	12.0	1.0	0	5 micro
2S0E	3	500	-	46.4	0	22.0	.1	0	0
2S0E	4	250	308	-	0	-	.1	0	0
2S0E	5	250	454	-	0	-	.1	0	0
2S0E	8	500	590	96.3	0	4.1	0	0	0
2S0E	9	500	319	117.2	0	2.7	.1	0	0
2S0E	10	500	616	131.1	.1	2.3	.1	0	1 micro
2S0E	11	250	399	194.1	0	.8	0	0	0
2S0E	12	350	503	199.5	.1	.1	0	0	1 micro

KEY: TS = Total Sample Weight G/S = Gravel and Sand
Sh = Shellfish R = Roots
Ch/S = Charcoal, Seeds F = Fauna
A = Artifacts (Ball Bearing, Micro Flakes)

Table 16. Materials Recovered From Soil Samples of 0N1W 1-18.

but a rather amorphous concentration of rocks. The surface context and ambiguous relationship of the rocks led us to discount this as a prehistoric feature. Yet it is interesting that these two units contained the only evidence of charcoal from the site, some of which was found five to 25 cm below the ground surface.

6) **Artifact Density**. The initial density estimate was based on the results of a single shovel probe which contained four artifacts. Extrapolating from this limited data, we estimated that a m2 unit may contain about 44 artifacts. This estimate is lower than that observed during the excavation. The observed densities ranged from 52 (1S2E) to 115 (4S0E) artifacts per m2.

7) **Artifact Diversity**. The J score for the chipped stone debitage and hammerstones was .88; for the chipped stone tools it was .56, and for ground stone, ceramic and bone tools it was 0. The mean diversity index for lithic, ceramic and bone tools was .29; for all artifact categories it was .48.

8) **Chronology**. The Brewerton side notched point recovered from unit 4S0E, level 9 (20-25 cm below unit datum) initially suggested a Late Archaic date. However, a charcoal specimen (Beta-19914) recovered from unit 3S0E, level 4 (5-10 cm below unit datum) yielded a carbon-14 date of 170 ± 60 BP. This date

indicates that the rock feature visible on the surface may be a relatively recent phenomonon, dating sometime between AD 1720 to 1840. Our tenative interpretation is that the Sanwald site witnessed two occupation episodes. The original occupation, at the time lithic scatter was produced, dates to the Late Archaic. Then during the 18th or 19th century a campfire was constructed on the site's surface.

9) **Interpretation.** It appears that a relatively diverse spectrum of activities took place at 0N1W 1-18. Lithic production included not only the reduction of quartz and quartzite cobbles, but also tasks that produced many micro flakes. The latter may have resulted from the maintenance (retouch) or manufacture (thinning) of bifacial tools. If formal bifaces were produced on the site, it appears that they were curated to other locations.

In addition to lithic production, the relatively high J index for chipped stone tools, the large quantity of fire-cracked rocks, and the presence of charred and uncharred flora remains indicate other tasks were performed revolving around food processing and cooking. The presence of knives, scrapers, and a projectile point suggest that the butchering of game may have taken place, although the absence of faunal remains (which tend to preserve poorly in nonmidden sites) makes this interpretation difficult to evaluate. The presence of charred nuts, cherry seeds and sedge tentatively indicate that plant resources may have been roasted or cooked on site. The uncharred flora -- raspberry, grapes, chenopodiaceae, and mustard -- may have been deposited by fortuitous natural circumstances, or they may represent resources foraged from the nearby area which were consumed and excreted on the site.

In sum, the Sanwald site appears to have been a small camp from which foraging and hunting activites may have been conducted. The mean diversity index for the lithic, ceramic and bone tools (.29) falls between the limited activity sites and residential bases defined in the original study (Lightfoot 1985). The site probably represents either a short-term field camp situated some distance from a Late Archaic residential base or a small foraging residential camp. If the floral remains were associated with the occupation of the site, and if the site was occupied during their time of harvest, then it appears the place was occupied sometime during the late summer or early fall.

1S0W 2-4 (The Kettle Hole Site)

This ceramic and lithic scatter wraps around the northeast side of a large kettle hole about 380 meters south of Fan Creek. The kettle is impressive in size, measuring 230 by 130 meters along its east/west and north/south axes, respectively. It exhibits a vertical drop of 12 meters from the rim to the bottom of the depression. A dense woodland of pignut hickory, dogwood, black oak, chestnut oak with an understory of raspberry and some catbriar covers the rim and sides of the kettle.

Five units were excavated across the gentle slope of the kettle where survey crews had delimited the boundaries of the scatter (Figure 17). These include: 7N0E (60 cm above site datum, 3 arbitrary levels), 7N6E (102 cm above site datum, 7 arbitrary levels), 3N2W (15 cm above site datum, 8 arbritary levels), 2N7E (60 cm above site datum, 7 arbritrary levels), and 0N2E (18 cm above site datum, 7 arbitrary levels).

1) **Stratigraphy**. The four soil horizons typify an undisturbed woodland habitat (Figure 18). A humus level (S1) comprised the first 2 cm of the vertical profile, followed by the grey leached zone (S2) of A2 material about 2 to 10 cm below ground surface. The third stratum (S3) was a light brown B1 horizon consisting of sand and gravel. This level extended about 10 to 24 cm below unit datum. The fourth stratum (S4) was the B2 zone of yellow sand, gravel and cobbles that began about 24 cm below surface and extended to the bottom of the units.

2) **Lithic, Ceramic and Bone Artifacts**. A very sparse quantity of cultural remains was unearthed at 1S0W 2-4. The northern two units (7N0E, 7N6E) and the southern most unit (0N2E) yielded no cultural material. (An ambiguous wooden object was recovered from 7N6E). The only clearly definable cultural materials included a secondary flake from 3N2W (level 3), and 15 ceramic sherds from 2N7E (levels 1-3) and 3N2W (levels 3,4) (see Appendix Three).

a) Chipped Stone Debitage and Hammerstones. No materials were recovered except the secondary quartzite flake from 3N2W.

b) Chipped Stone Tools. None recovered.

c) Groundstone, Ceramic and Bone Tools. The 15 ceramic sherds represented one sand tempered, orange plainware vessel that was smoothed on both the interior and exterior surfaces.

d) Fire-Cracked Rock. None recovered.

3) **Charcoal**. Excavation crews reported a few flecks of charcoal in units 7N6E (levels 1,2), 3N2W (levels 1,3,4,7), 2N7E (levels 1,2), and 0N2E (levels 1,3).

4) **Faunal and Floral Remains**. Seven soil samples were selected from unit 3N2W for flotation. These included level 2 (1000 ml, 1059.9 g.), level 3 (500 ml, 645.8 g.), level 4 (500 ml, 780.5 g.), level 5 (500 ml, 695.5 g.), level 6 (500 ml, 652.0 g.), level 7 (500 ml, 687.5 g.), and level 8 (500 ml, 707.1 g.).

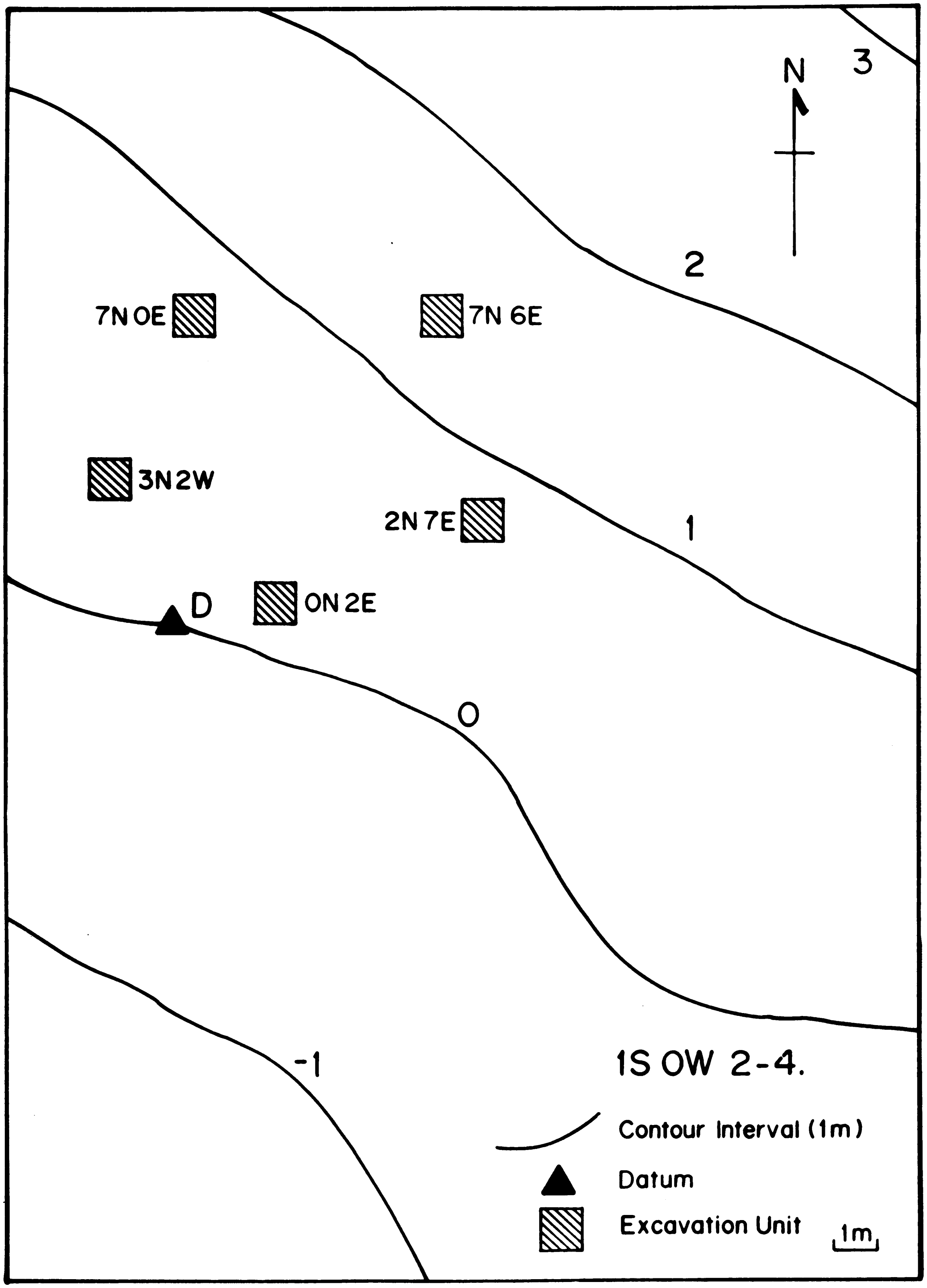

Figure 17. Excavation Units of 1SOW 2-4

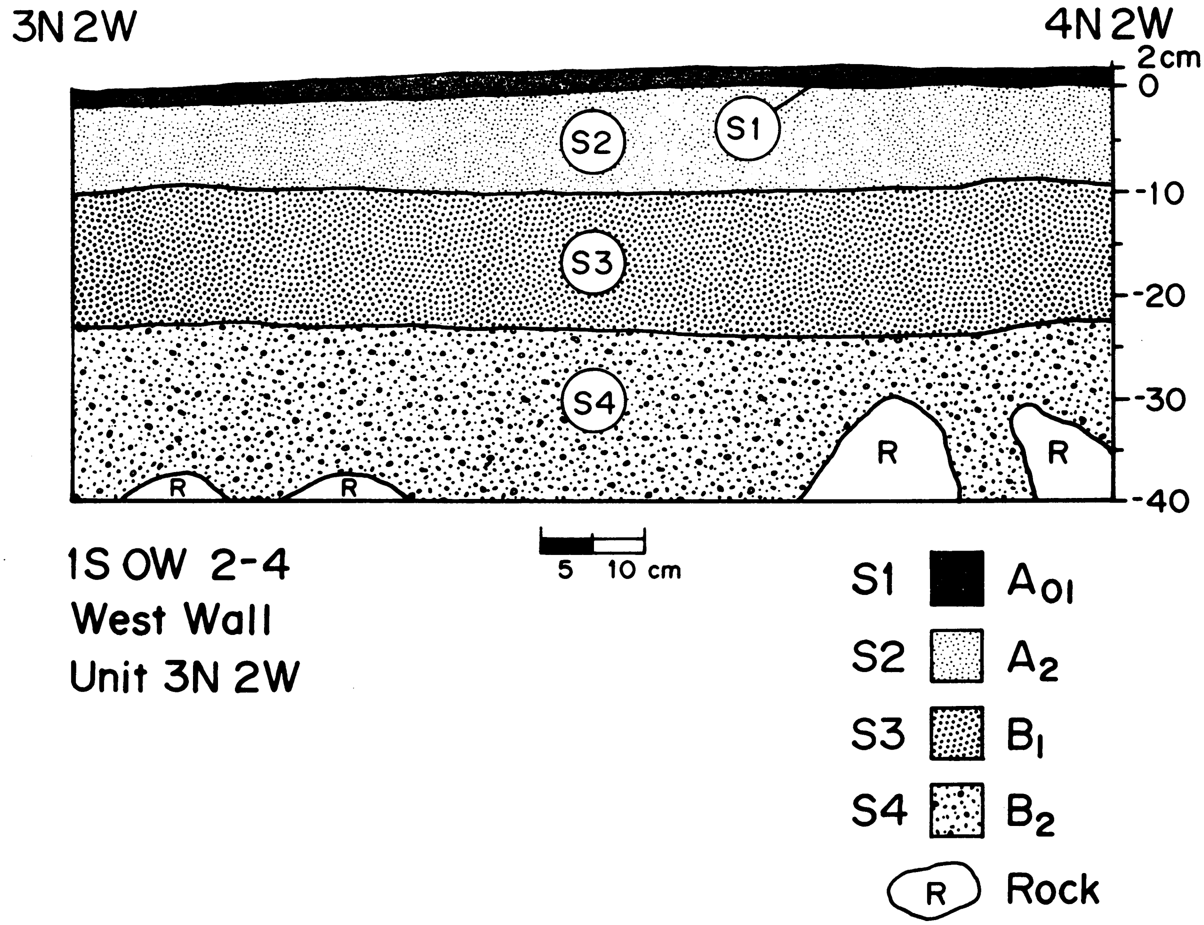

Figure 18. 1SOW 2-4. West Wall Profile of Unit 3N2W

a) Shellfish. None recovered.

b) Other Fauna. No animal bones were recovered.

c) Flora Remains. Several different kinds of plant remains were recovered from the soil samples (see Appendix 4). The identified charred remains included acorns (Quercus sp.) and sedge-polygonum. The identified uncharred remains consisted of raspberry (Rubus sp.), sumac (Rhus sp.), grape (Vitis sp.), and sedge-polygonum.

5) **Architectural Features**. None reported.

6) **Artifact Density**. The subsurface survey yielded between 1 and 10 artifacts per positive probe ($\overline{x}$ = 4.7, sd = 3.86), sug-

gesting an expected range of 9 to 94 artifacts per m2. If only 60% of the shovel probes yielded cultural material, then this would reduce the range from 5 to 56 artifacts per m2. The observed density of excavated material was on the lower end of this range, varying from 0 (7N6E, 7N0E, 0N2E), 5 (3N2W) and 11 (2N7E) artifacts per m2.

7) **Artifact Diversity**. The J scores for all artifact categories was 0.

8) **Chronology**. The presence of plainware pottery suggests a Woodland period age for the Kettle Hole site.

9) **Interpretation**. 1S0W 2-4 appears to have been a procurement location where a very limited range of activities (at least those which produce definable archaeological remains) took place. These activities probably revolved around gathering and processing plant foods. If the plant remains were associated with the occupation of the site, and if they were harvested during the site's occupation, then it appears that the location was used in August or September.

2N3E 1-0 (The Sungic Midden Site)

The excavation of this large scatter focused primarily on the shell midden component situated directly north of Sungic Pond. This site was tentatively identified as a residential base. A second excavation was conducted at the nearby lithic scatter, 2N3E 1-7, and will be discussed in the following section. The shell midden extends about 17 meters north and 25 meters west from the phragmites-lined edge of the pond (see Figure 19). The elevation difference from the lower pond edge to the upper end of the midden is about 1 to 1.30 meters, and this upper area contains oak trees, catbriar and a lone apple tree.

The site datum was established to the north of the midden, and seven units were laid out for excavation. The units were distributed in the following fashion: two (13S1E, 14S0E) were placed in the center of the midden; one (5S0E) was laid out near the northern edge of the midden; two (4S1W, 4S0W) others straddled the northern boundary; another (13S9W) straddled the western midden boundary; while the last (14S12W) was situated outside the midden proper. Table 17 lists the vertical elevation below the site datum, the number of arbitrary levels excavated, and the maximum depth below ground surface for each unit.

1) **Stratigraphy**.

a) Nonmidden. Unit 14S12W exhibited three natural levels: a dark loam that extended from the surface to about 11cm below surface; a reddish brown B1 horizon that measured about 11 to 30 cm below surface; and finally the yellow B2 horizon.

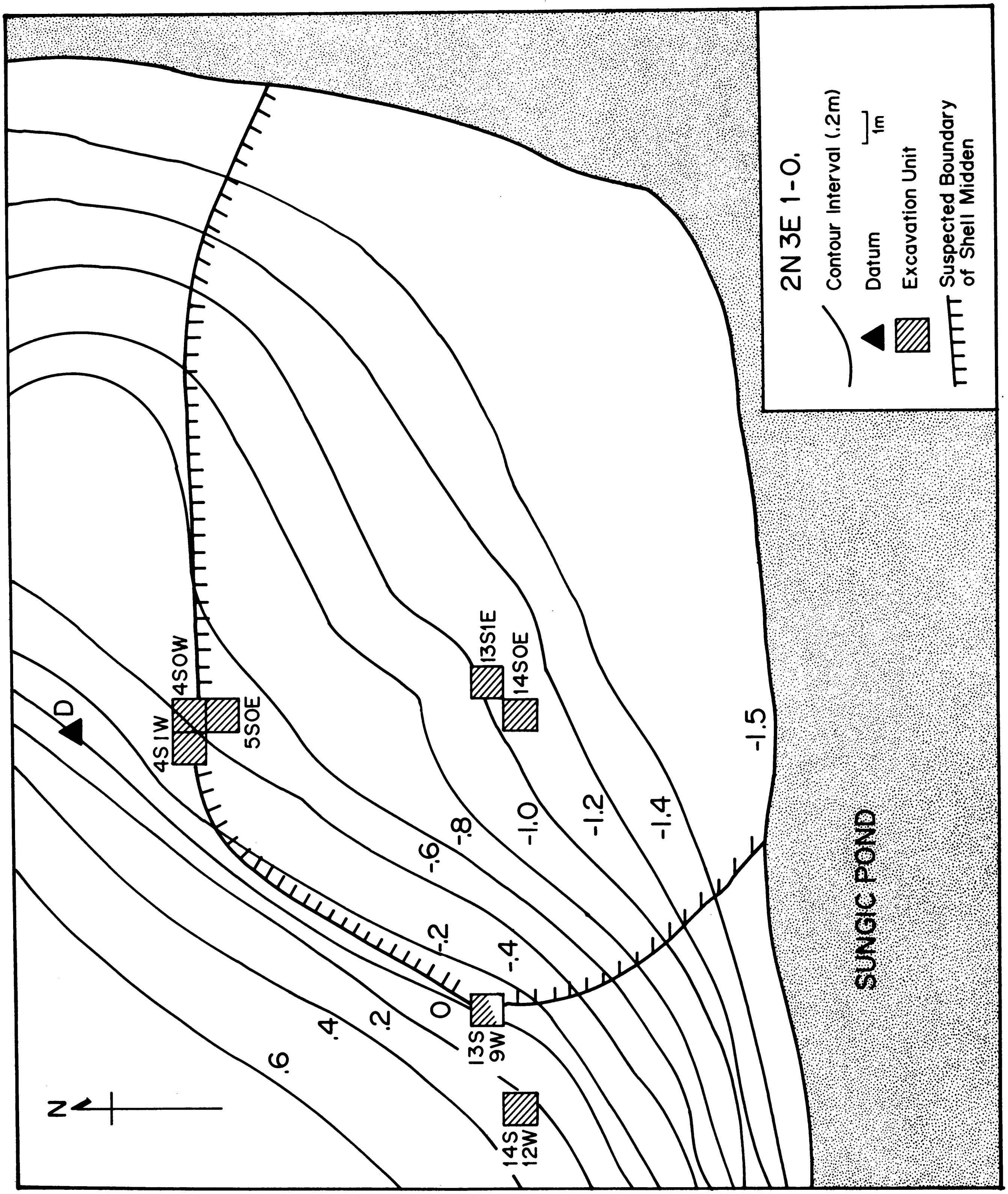

Figure 19. Excavation Units of 2N3E 1-0

Unit	Vertical Distance +/- Site Datum m	Number of Levels	Arbitrary (A) Natural (N) Levels	Maximum Depth Below Unit Datum m
4S0W	- .43	7	A	.40
4S1W	- .31	6	A	.30
5S0E	- .47	6	N	.40
13S9W	- .05	4	A	.20
14S12W	+ .30	6	A	.30
13S1E	-1.00	11	A	.85
14S0E	-1.12	10	A	.60

Table 17. Excavation Units Of 2N3E 1-0.

b) Midden Edge. Units 13S9W, 4S0W, 4S1W, and 5S0E shared a relatively similar stratigraphy of two soil strata and two lenses of shellfish (see Figure 20, for example). The first level (S1) was a black loam with few or no shell remains that extended from surface to about 10 to 15 cm below unit datum. This was followed by a discrete shell lense (L1) that ranged in thickness from about 10 to 25 cm. Below the shell lense was the yellow B2 stratum (S2).

c) Central Midden. A very complex stratigraphic profile was observed in units 13S1E and 14S0E. In both units it appeared at at least three different dumping episodes took place. Each of these dumping episodes probably represented a discrete occupation, suggesting that this part of the midden was reoccupied on several different occasions.

13S1E. The north wall (Figure 21) exhibited four major strata: a black loam (S1) containing few or no shellfish remains (0-5cm); a thick lense (L1) of crushed shellfish refuse in a black matrix (5-25 cm); followed by a lense (L2) of whole shellfish remains (25-33cm); and finally the yellow B2 horizon (S2). The south wall (Figure 22) profile contained three soil strata, three discrete shell lenses, and two features: 1) black loam (S1) (0-10cm), 2) a very thick lense (L1) of crushed shell remains in a black matrix which ranged in depth from 20 to 55 cm, 3) a hearth (F1) of fire-cracked rocks embedded in the crushed shell at a depth of 45cm, 4) a lense (L2) of crushed shell in a grey matrix below L1 (55-65cm), 5) a large bell shaped pit (F2) full of whole shells that underlay L2 (65-85cm), 6) a discrete shell lense (L3) on the west side of the unit about 38 to 55 cm below surface, 7) yellow B2 (S2) that was probably backfill from the pit, and 8) the yellow B2 horizon (S3) that surrounded the lower levels of the midden.

The south wall profile of 13S1E suggests that a large bell shaped pit (F2) was first dug into the B2 soil. This pit was filled with whole hard and soft clam, along with some charcoal flecks and chunks. It appears that the pit may have been used to bake shellfish and other foods. We were unable to define the bottom of the pit since we struck salt water at 80 cm below surface (see Figure 22). On top of the pit's refuse another lense of shellfish (L2) was laid down. The crushed nature of the shell suggests it was repeatedly trampled by the midden's occupants. Still another occupation level appears to have been laid down on top of the L2 lense. This thick lense of crushed shellfish (L1) contained a small hearth (F1) of fire-cracked rocks.

14S0E. The north profile produced 3 soil strata and 3 discrete shell lenses (see Figure 23): 1) black loam (S1) from surface to 7cm), 2) a thick lense (L1) of crushed shell in a black matrix (7-20cm), 3) a small deposit (L2) of whole shell in 45 degree angle, 4) a lense of whole shell (L3) that underlay

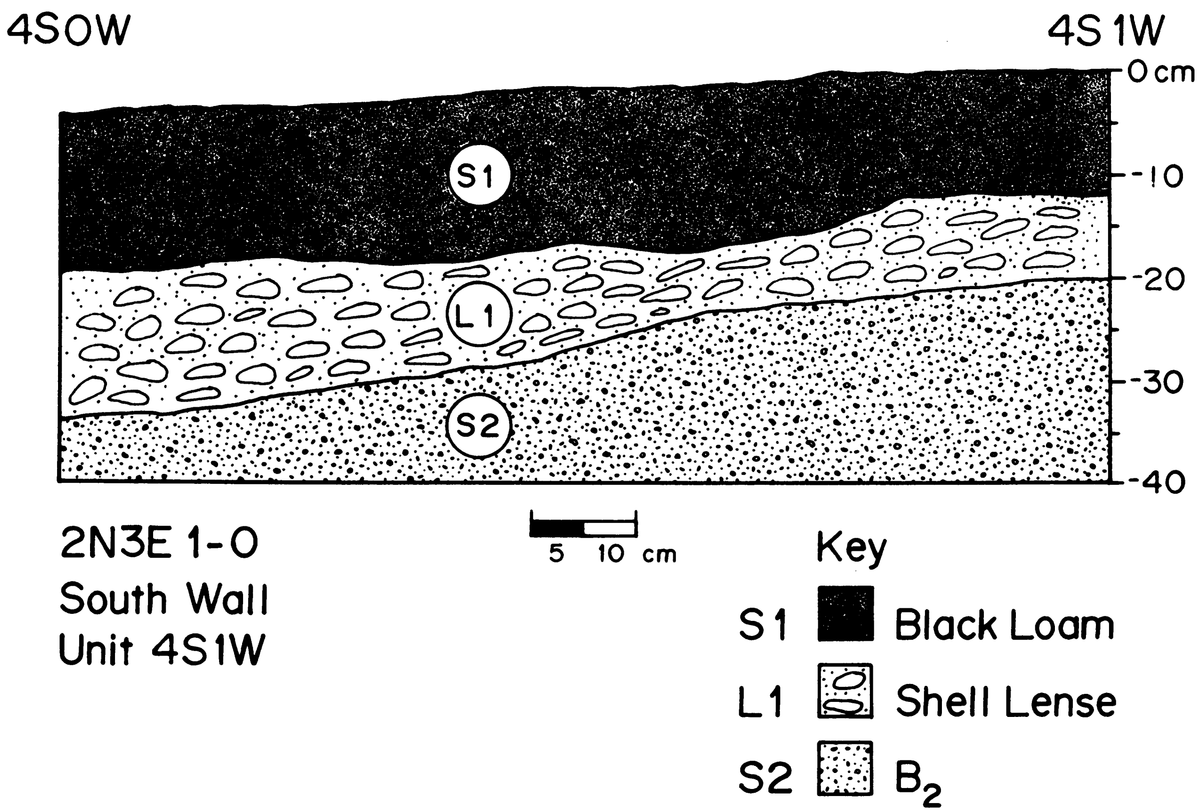

Figure 20. 2N3E 1-0. South Wall Profile of Unit 4S1W

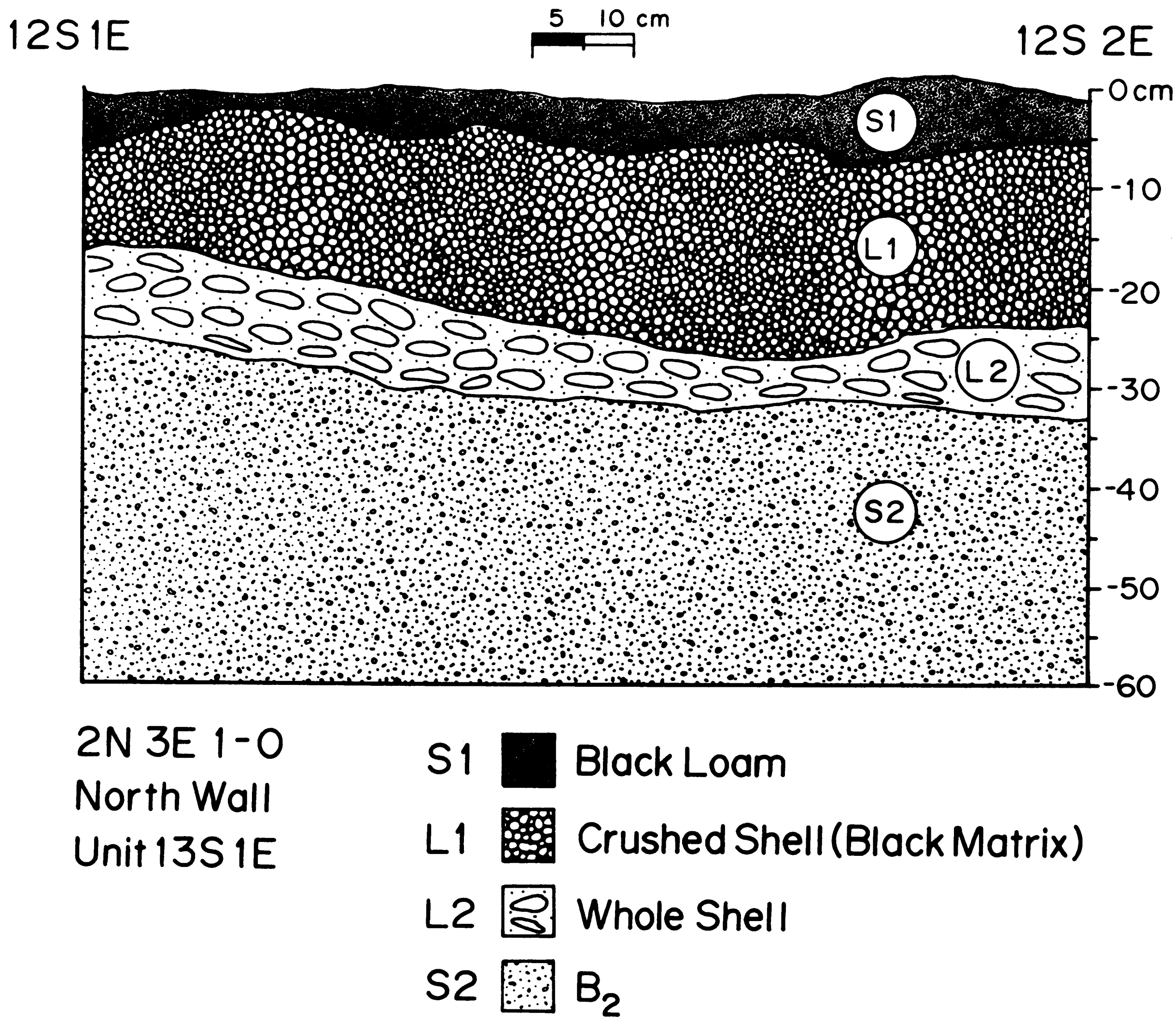

Figure 21. 2N3E 1-0. North Wall Profile of Unit 13S1E

strata L1 and L2 in the east half of the unit, 5) a thick stratum (S2) of black loam with gravel inclusions that underlay stratum L1 in the west half, and 6) the yellow B2 stratum(S3) that began about 35 cm below the surface.

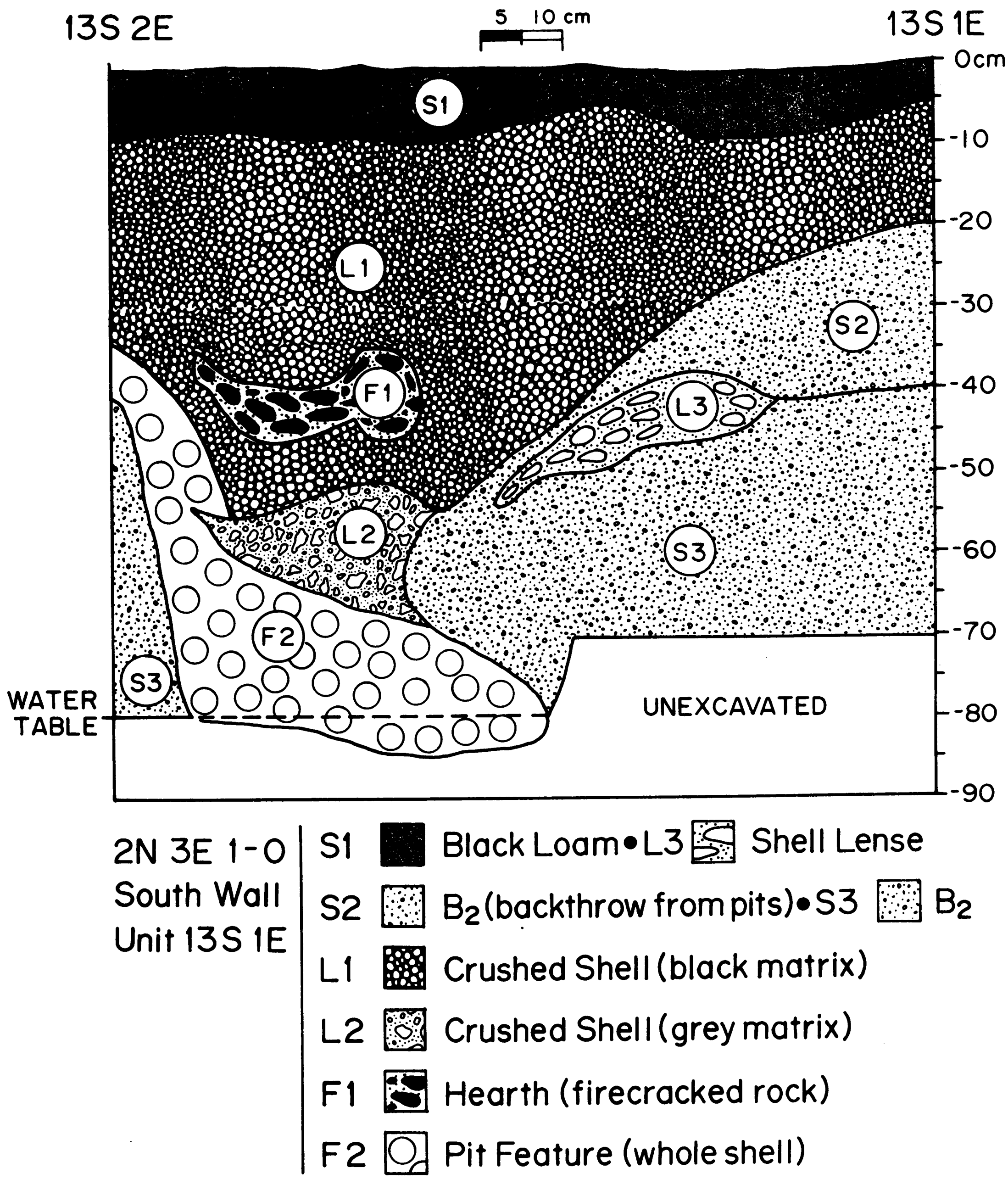

Figure 22. 2N3E 1-0. South Wall Profile of Unit 13S1E

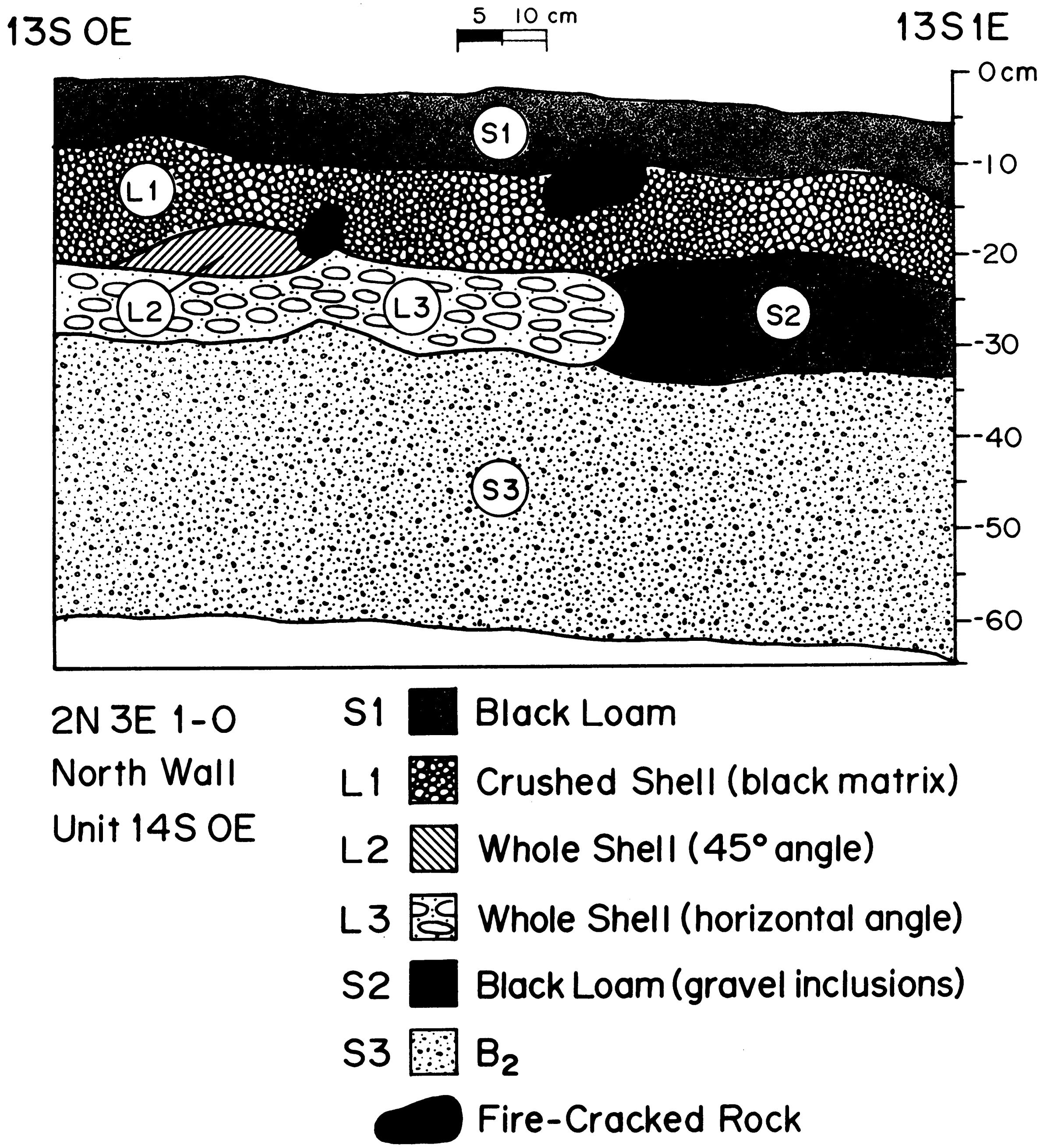

Figure 23. 2N3E 1-0. North Wall Profile of Unit 14S0E

The south profile of 14S0E contained four soil strata, three distinct shell lenses, and two features (Figure 24). These included: 1) black loam (S1) from surface to 10cm; 2) a lense (L1) of crushed and whole shell deposited in a horizontal angle;

3) a stratum (S2) of black loam below L1 in the east half of the unit; 4) a hearth (F1) in the west half of the unit that connected with L1; 5) a small deposit (L2) of crushed shell laid down in a 20 to 30 degree angle adjacent to the hearth; 6) another lense (L3) of crushed shell below the hearth and S2 and L2 that extended 30cm below surface; 7) a dark loam stratum (S3) that contained few shell remains; 8) a pit (F2) containing whole shellfish that measured 50 cm below surface, and 9) the yellow B2 strata (S4) that underlay the midden deposits.

An examination of the south wall of 14S0E (Figure 24) also supports a multi-occupational interpretation for the midden. The earliest occupation episode involved digging a pit (F2) that probably served as a shellfish bake. After cooking and extracting the clam meat, it appears that the remaining shell detritus was then dumped back into the hole, which was eventually capped with dark loam (S3). This was followed by another dumping episode in which shellfish refuse (L3) was laid down over the loam. This lense of crushed shell appears to have been intensively trampled by the midden's occupants. Part of this lense may have been capped by dark loam (S2). The next occupation episode involved the construction of a hearth (F1) and the deposition of whole and crushed shellfish refuse (L1) across the unit. It appears the hearth was dug into the crushed shell lense (L3) so that the fire-cracked rocks were anchored into the top of the lower loam lense (S3). The excavated material was then dumped as a back pile along the bottom edge of the hearth (L2). Finally, the hearth and shellfish lense (L1) were capped with dark loam (S1).

2) **Lithic, Ceramic and Bone Artifacts.** All but one of the units (14S12W) yielded cultural materials. The specific proveniences and raw material types of the artifacts are listed in Appendix Three. Table 18 summarizes the information on artifact types from each excavation unit.

a) Chipped Stone Debitage and Hammerstones. Of the 28 pieces recovered from excavation units, secondary flakes predominated, followed by primary and tertiary flakes, cores and hammerstones. In addition to these materials five micro flakes were recovered from soil samples, a point taken up below. The chipped stone debris is represented by a relatively diverse range of raw materials, including quartzite, granite, variegated quartz, citrine quartz, rose quartz, milky quartz, and rock crystal quartz (see Appendix Three). All units except 4S0W and 14S12W contained chipped stone debris.

b) Chipped Stone Tools. The 13 tools were evenly split among knives (3), projectile points (2), scrapers (3), choppers (2), and a perforator (1). One projectile point (13S1E level 4) was identified as a Levanna, while the other point (13S9W level

2) was unclassified. The majority of the chipped stone tools were recovered in units 13S1E, 13S9W, 14S0E and 5S0E.

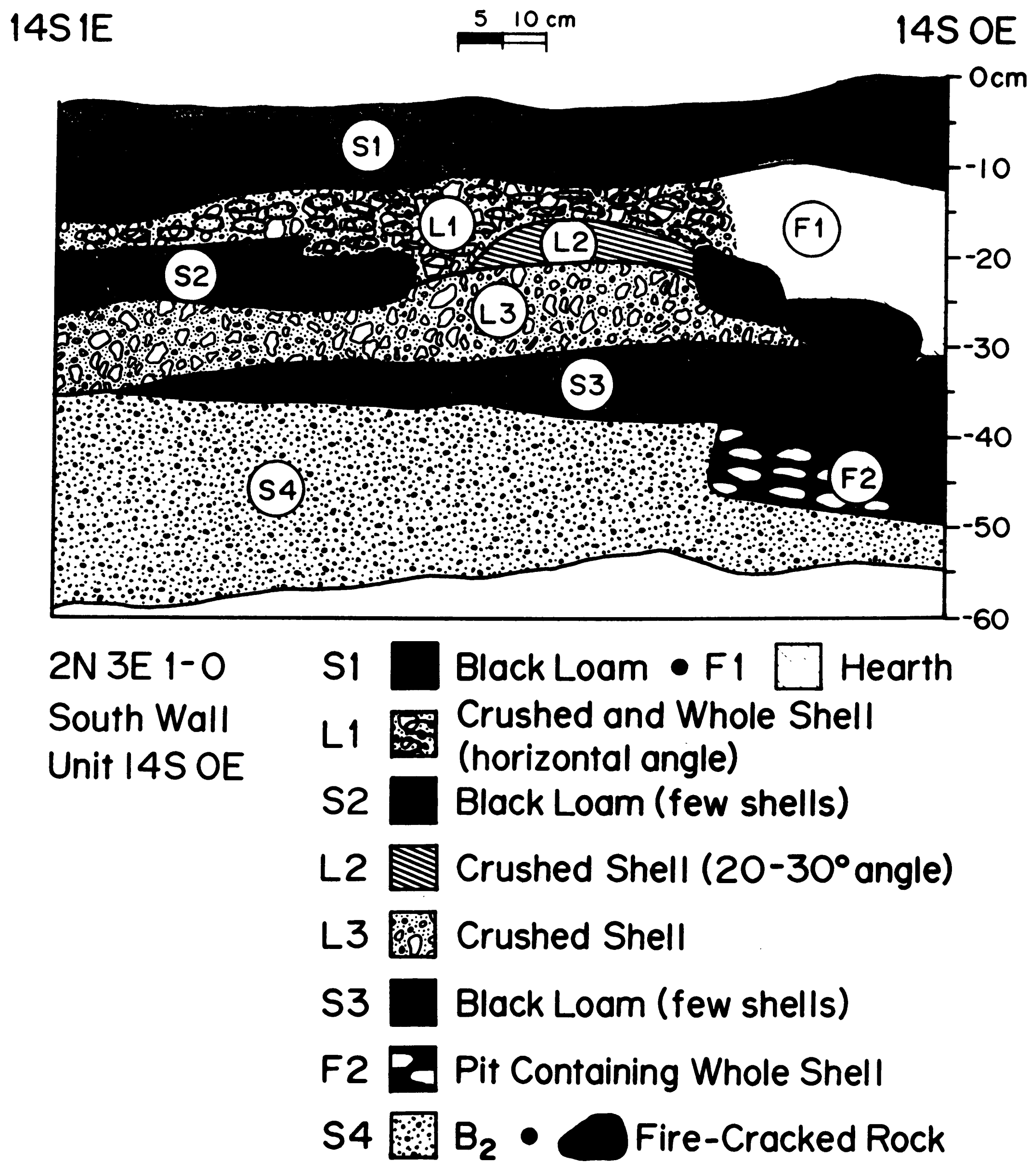

Figure 24. 2N3E 1-0. South Wall Profile of Unit 14S0E

UNIT	P	S	T	Sa	Co	M	H	K	PP	Sc	C	FC	Ce	Ma	A	Ad	Pa	Aw	GS	P	OG
4S0W	0	0	0	0	0	0	0	0	0	0	0	0	14	1	1	0	0	0	0	0	0
4S1W	1	3	1	0	0	0	0	0	0	0	0	0	4	0	0	0	1	0	0	0	0
5S0E	1	4	2	0	2	0	1	1	0	0	1	9	13	0	0	1	0	0	1	0	0
13S1E	1	1	0	0	0	0	0	1	1	2	0	22	1	2	0	0	0	2	0	0	0
13S9W	3	2	0	0	0	0	0	0	1	1	0	14	2	0	0	0	0	0	0	0	0
14S0E	3	2	0	0	0	0	1	1	0	0	1	134	12	1	0	0	0	0	0	1	1
Totals	9	12	3	0	2	0	2	3	2	3	2	179	46	4	1	1	1	2	1	1	1

KEY:
P = Primary; S = Secondary; T = Tertiary
Sa = Shatter; Co = Core; M = Micro Flake
H = Hammerstone; K = Knife; PP = P. Point
Sc = Scraper; C = Chopper; FC = Fire-Cracked Rock
Ce = Ceramic; Ma = Mano; A = Axe
Ad = Adze; Pa = Paintstone; Aw = Bone Awl
GS = G. Slab; P = Perforator; OG = Other Groundstone

Table 18. Artifacts from 2N3E 1-0.

c) Ground Stone, Ceramic and Bone Tools. The ground stone materials included tools for processing vegetable matter (4 basalt and granite manos, 1 basalt grinding slab), tools for working wood (a basalt adze, a granite axe), materials for producing pigment (1 paintstone), and a basalt groundstone piece of unkown function.

The ceramic inventory consisted of two ceramic wasters and 44 sherds. The ceramic wasters (13S1E, level 1 and 13S9W, level 2) are clay pieces that were fired so hot that they vitrified. The presence of these pieces suggest that ceramic production activities may have taken place at the Sungic Midden site. The 44 sherds represent at least seven vessels that were grouped into the following five types:

1) Sand tempered brownware (a) - interior scallop brushed, exterior smoothed (1 sherd, 13S9W);

2) Shell tempered plainware (b) - smoothed exterior and interior surfaces (1 sherd, 14S0E; 3 sherds 4S1W);

3) Shell tempered cordmarked brownware (c) - interior scallop brushed, exterior scallop brushed and cordmarked (3 sherds 14S0E);

4) Shell tempered interior scallop brushed brownware (d) - interior scallop brushed, exterior smoothed; three vessels

represented -- d1 (8 sherds,14S0E; 1 sherd 5S0E), d2 (14 sherds 4S0W),and d3 (1 sherd,4S1W);

5) Shell tempered scallop brushed brownware (e) - interior and exterior scallop brushed (12 sherds, 5S0E).

The bone artifacts consisted of two awls from 13S1E (levels 5,7).

d) Fire-Cracked Rock. A significant quantity of fire-cracked rock was unearthed from units 13S1E (22 pieces, 1604 g.), 13S9W (14 pieces, 1031 g.), 14S0E (134 pieces, 2799 g.), and 5S0E (9 pieces, 577 g.). Some of these rocks appear to have been dumped in close proximity to where they were heated and cooled. In these cases conjoinable fragments of the same rock were found in direct association with one another.

3) **Charcoal**. Charcoal flecks were recovered from every excavation unit. 5S0E, 4S0W, 13S1E, and 14S0E contained a large quantity of charcoal flecks and chunks.

4) **Faunal and Floral Remains**. Soil samples were floated from multiple levels of 13S1E and 5S0E, and from the hearth (F1, south wall) of 14S0E. More than one sample from a level was floated in some cases to provide comparative data for evaluating the flotation technique. The weights of the different materials recovered from the float (light and heavy fraction) samples are presented in Table 19.

a) Shellfish Remains. The quantity of shellfish refuse is substantial for the midden deposit, comprising (in some cases) 60 to more than 70% of the soil samples by weight (see Table 19). In unit 13S1E shellfish comprised 62% to 76% of the soil samples in levels 2 through 6, from which point it decreased to about 50% of the samples in levels 7 through 10. In unit 5S0E shellfish comprised 18 to 88% of the soil samples, with level 5 containing the greatest concentration.

Soft clam was the predominate shellfish identified, followed by varying quantites of hard clam, oyster, scallop, whelk and snails. The weights and precentages of each shellfish species recovered from the soil samples are presented in Table 20.

While soft clam is the most common shellfish represented at the Sungic Midden site, it is important to note that the frequency of different shellfish species varies from the lower to the upper deposits of the midden. We observed three patterns in unit 13S1E:

1) Levels 2-6. In the upper shell lense (L1 - Figure 22), soft clam made up the bulk of the shell refuse (67- 94%). Hard clam was present, but it never comprised more than 21% of the

shellfish for any level. Oyster (0-6%) decreased slightly from the upper to lower levels, while scallop (1-5%) and snails (in trace amounts) remained relatively constant throughout the upper levels. Whelk appeared to be completely absent from these levels. Interestingly, relatively large quantities of the shell remains were crushed and fragmented beyond identification (Table 20), a finding that supports the idea that prehistoric people repeatedly walked across the midden deposit.

Unit	Level	Sample Size (ml.)	Weights (in grams) TS	G/S	Sh	Sh%	R	Ch/S	B	A
13S1E	2	500	569	14.2	367.4	(64)	0	3.8	.2	0
13S1E	2	500	554	5.5	346.1	(62)	.5	.5	.4	10 (FC)
13S1E	3	500	525	9.7	334.8	(64)	1.4	.5	.1	7 (FC)
13S1E	3	500	517	13.9	353.0	(68)	.2	.3	.1	0
13S1E	4	500	492	5.7	305.1	(62)	.4	.9	.1	.5 (1 SB,1M)
13S1E	5	500	440	5.0	312.1	(71)	.2	.6	.4	0
13S1E	5	500	398	2.5	302.2	(76)	.1	1.4	0	0
13S1E	6	500	453	9.4	317.9	(70)	0	.3	0	.6 (3 M)
13S1E	7	500	580	46.1	273.3	(47)	.2	1.2	.1	0
13S1E	10	500	513	17.9	262.3	(51)	0	.1	0	0
5S0E	2	500	495	.6	2.5	(.5)	.5	.3	.1	0
5S0E	3	500	567	14.0	103.7	(18)	0	.1	0	.3 (Ce)
5S0E	3	500	529	16.7	309.1	(58)	0	.5	0	0
5S0E	4	500	556	26.2	195.8	(35)	.4	1.5	.1	.3 (Ce)
5S0E	5	500	535	8.4	474.4	(88)	2.1	2.3	0	0
14S0E	7	500	481	2.7	165.9	(34)	.1	2.7	.1	10 (FC)

Key: TS = Total Sample Weight G/S = Gravel and Sand
Sh = Shell Sh% = Shell % by Weight (SH/TS)
R = Roots Ch/S = Charcoal and Seeds
F = Fauna
A = Artifacts (M = Micro Flake, SB = Shell Bead, C = Ceramics, FC = Fire-Cracked Rocks)

Table 19. Materials Recovered From Soil Samples oF 2N3E 1-0.

2) Level 7. The sample collected from the lower level of L1 (Figure 22) represented the most diverse spectrum of shellfish remains. While soft clam still dominated (72%) and hard clam was hardly present, scallop (4%), oyster (9%), and whelk (6) were present in some quantity.

Unit	L	Total Shell (g)	SC g	SC %	HC g	HC %	Sc g	Sc %	O g	O %	W g	W %	Sn g	Sn %	U g	U %
13S1E	2	367.4	288	(78)	5.3	(1)	6.2	(2)	22.1	(6)	0	(0)	.2	(0)	45.6	(13)
13S1E	2	346.1	232	(67)	8.8	(2)	8.6	(2)	17.0	(5)	0	(0)	.1	(0)	79.6	(24)
13S1E	3	334.8	255	(76)	20.4	(6)	9.6	(3)	3.0	(1)	0	(0)	.1	(0)	46.7	(14)
13S1E	3	353.0	272	(77)	16.2	(5)	14.1	(4)	3.0	(1)	0	(0)	.1	(0)	47.6	(13)
13S1E	4	305.1	241	(79)	10.5	(3)	4.5	(1)	7.4	(3)	0	(0)	.1	(0)	41.6	(14)
13S1E	5	312.1	255	(82)	18.9	(6)	1.0	(0)	1.0	(0)	0	(0)	.1	(0)	36.1	(12)
13S1E	5	302.2	266	(88)	0	(0)	16.5	(5)	2.8	(1)	0	(0)	.1	(0)	16.8	(5)
13S1E	6	317.9	298	(94)	6.9	(2)	4.1	(1)	.1	(0)	0	(0)	.1	(0)	8.6	(3)
13S1E	7	273.3	197	(72)	.1	(0)	9.8	(4)	25.1	(9)	15.7	(6)	.1	(0)	25.5	(9)
13S1E	10	262.3	77	(29)	182	(69)	1.4	(1)	.4	(0)	0	(0)	0	(0)	1.5	(1)
5S0E	2	2.5	1.2	(48)	1.3	(52)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)
5S0E	3	103.7	84	(82)	10.9	(10)	0	(0)	0	(0)	0	(0)	0	(0)	8.8	(8)
5S0E	3	309.1	203	(66)	67.4	(22)	18.6	(6)	4.0	(1)	0	(0)	0	(0)	16.1	(5)
5S0E	4	195.8	138	(70)	25.4	(13)	5.3	(3)	0	(0)	0	(0)	.1	(0)	27.0	(14
5S0E	5	474.4	388	(82)	70.0	(15)	6.7	(1)	1.3	(0)	0	(0)	3	(1)	5.4	(1)

KEY: SC = Soft Clam HC = Hard Clam Sc = Scallop 0 = Oyster
W = Whelk Sn = Snail U = Unidentified Shell

Table 20. Shellfish Species Recovered From Soil Samples Of 2N3E 1-0.

3) Level 10. The sample from the earliest occupation epsiode, collected from the bell shaped pit (F2 - Figure 22), indicated that hard clams dominated (69%), followed by soft clam (29%), and a trace of scallop and oyster.

The samples from 5S0E indicated that soft clam remained the most popular shellfish in all levels, comprising 66 to 82% of the total shell in weight. In general, this unit contained a greater percentage of hard clam (10 to 13% of the total) than the upper levels of 13S0E. Other than scallop (0-6%), additional shellfish species were either not present or present in trace amounts.

A sample of the Mercenaria mercenaria shells was cross sectioned by Professor Robert Cerrato to provide information on the age, growth rates and season of death of individuals. A full discussion of his results is presented in Appendix Five. The study suggests that most of the clams were harvested at the time of peak productivity, when they were about four to seven years old. Some age variation is noted, however, with some young (two and three year olds) and elderly (15 year olds) clams represented in the sample. Interestingly, the growth rates (height vs. age) of the Sungic Midden clams are very similar to modern clam populations analyzed for the Great South Bay of Long Island. While this may suggest, on the surface, that environmental conditions have not changed drastically in Long Island waters over the last 1000 years or so, the relationship is complicated by a number of other factors. As Cerrato cautions, one can not demonstrate that habitat conditions were on the average similar without a more detailed investigation of daily and seasonal growth patterns.

The season of death analysis indicates that clams were harvested throughout most of the year. However, it appears that harvesting intensity peaked in fall and early winter. Of the 42 clams that could be interpreted, the most common season of death was fall (19), followed by winter (10), summer (8) and spring (5). Few clams were harvested in the late winter.

While variation in the season of death exists in the different levels of Sungic Midden units (see Appendix Five, Figure 30), it must be cautioned that these are arbitrary levels that do not correspond neatly with distinct occupation episodes. When the arbitrary levels are combined into definable shell or cultural lenses, it appears that each lense or cultural unit contains evidence of harvesting during most of the year. For example, the samples from unit 5S0E, levels 3 and 4, are part of the same shell lense; the samples from unit 13S1E -- levels 4,5,6 and 7-- are from the heavily trampled L1 shell lense (Figure 22); the samples from unit 13S1E, levels 8 and 9, are primarily from the L2 lense (Figure 22); and the samples from unit 14S0E, levels 5 and 7, are from the F1 feature in Figure 24. Unfortunately, we can not offer a more refined interpretation on the occupation duration or reuse patterns of each of the shell lenses and cultural features.

Cerrato (Appendix Five) also notes that the age distribution of the Sungic Midden clams is similar to modern clam populations that have been intensively harvested. That is, the Sungic Midden sample differs from the age structure predicted for a natural, unharvested population. However, he also cautions that other factors could account for the observed age distribution. These include collection biases of the natives, differential preservation and differential processing of large and small sized clams.

b) Other Faunal Remains. Animal bones were recovered using two sampling methods. The first method was the screening of midden material through .6 cm wire mesh, a technique that recovered relatively large faunal specimens. The other method was through the flotation of soil samples which facilitated the recovery of small faunal specimens. This latter technique produced multiple small unidentifiable mammal, bird and fish bones.

The faunal remains identified by Stephanie Rippel-Erikson are described in Appendix Six. These included the osteological remains of white tailed deer (Odocoileus virginianus), domesticated dog (Canis familiaris), box turtle (Terrapene sp), mallard (Anas platyrhynchos), and sturgeon (Acipenser sp) plates. Unidentifiable fragments were also recorded for medium sized mammals, duck and song-sized birds, and fish.

The majority of the faunal remains identified from units 5S0E, 13S1E, and 14S0E were mammals. However, about 35% of the bones recovered from unit 13S1E were fish, and about 13% of the faunal remains in unit 14S0E were bird.

The mandible of the dog recovered from unit 13S1E, level 5 contained deciduous premolars (P2, P3), which had just erupted, and a permanent molar (M1) not yet erupted. The age of death appears to have been about 5 months old. The deer mandibles (left and right) from unit 13S1E, levels 5 and 7, contained molars (m1 and m2) that indicate a specimen of about three and one-half years old. About 5% of the total faunal assemblage was burned, possibly the result of cooking activities. The majority of the carbonized sample, including deer and mallard remains, was recovered in and below the hearth (F1) and the pit feature (F2) of unit 14S0E (Figure 24). In addition, the bell shaped pit excavated in unit 13S1E (F2 in Figure 22) contained the remains of deer and deer-sized mammals, as well as the shellfish described above.

c) Floral Remains. The floral specimens recovered and identified from the soil samples are listed in Appendix Four. Charred plant remains included acorn (Quercus sp.), Chenopodium, a cherry seed (Prunus sp.), sedge-polygonum and charred nut meats. The uncharred remains included multiple raspberry seeds (Rubus sp.), sumac (Rhus sp.), grape seeds (Vitis sp.), sedge-polygonum, Chenopodiaceae, mustard (Brassicaceae sp.), bayberry (Myrica sp.), and elderberry seeds (Sambucus sp.).

5) **Architectural Features**. Several features were identified at the Sungic Midden site. These included the hearth (F1) and bell shaped pit (F2) of unit 13S1E (Figure 22), and the hearth (F1) and pit (F2) of unit 14S0E (Figure 24). In addition, five small post-molds (c. 3 cm diameter, and 5 to 7 cm deep) were defined north of the hearth in unit 14S0E (levels 7 and 8). These postmolds may be associated with the hearth feature.

6) **Artifact Density**. Extrapolating from the survey data ($\bar{x}$ = 3.56 artifacts/probe, sd = 2.3), we expected that the density of artifacts per m2 would range between 14 and 64. If only 61%

of the shovel probes yielded cultural material, then the range may be reduced to between 8 and 39 artifacts/m2. The density of material recovered from most of the excavation units fell within this expected range, ranging from 10 (4S1W), 16 (4S0W), 23 (13S9W), 33 (13S1E), and 36 (5S0E). The two exceptions were unit 14S12W (0 artifacts/ m2) and 14S0E (157 artifacts/ m2).

7. **Diversity Indexes**. The diversity indexes calculated for chipped stone artifacts, chipped stone tools, and groundstone, ceramic and bone tools were .80, .89 and .74, respectively. The average diversity index for lithic, ceramic and bone tools, as well as all artifact categories was .81.

8. **Chronology**. The Levanna point and scallop brushed and cordmarked pottery indicate a Late Woodland date. Four charcoal samples were submitted for radiocarbon dates. The specimen (Beta-19911) from unit 14S0E, level 5 (20-25 cm) -- which was recovered from the hearth feature (F1 - Figure 24) -- yielded a date of 1200 ± 120 BP. Another specimen (Beta-19912) from unit 14S0E, level 9 (40-50 cm) -- recovered from below the hearth -- produced a modern carbon-14 date. This sample appears to have been contaminated. The sample (Beta-19909) from the shell lense (L1-Figure 22) unit 13S1E, level 5 (15-20 cm) yielded a date of 1240 ± 100 BP. The final sample, recovered from the large bellshaped pit (F2 - Figure 22) of unit 13S1E, level 10, was too small to date.

In sum, the available evidence suggests an occupation history that spans sometime during the Middle and Late Woodland periods.

9. **Interpretation**. The Sungic Midden site appears to have been a residential base that was occupied repeatedly during the Middle and Late Woodland periods. The midden stratigraphy indicates that the site experienced at least three separate occupation episodes. A diverse range of activities are evident by the high diversity indexes. These indicate that some lithic and ceramic production, butchering, plant processing, cooking, woodworking and possibly sewing or basketmaking activities took place on or near the site. The food resources apparently used by the prehistoric inhabitants include shellfish (soft clam, hard clam, oyster, scallop), deer, waterfowl, fish, acorns, sedge, Chenopodium, and mustard seeds. Other food resources that may have been used include uncharred berry seeds (raspberry, elderberry), sumac, and wild grape.

It is possible that the site was occupied throughout most of the year. The hard clam specimens analyzed by Dr. Cerrato indicate that shellfish gathering was taking place during the spring, summer, fall and early winter. The varied lenses and cultural deposits from which the hard clam samples were recovered appear to represent different occupation episodes of the site.

Thus, there is tentative support for a relatively year-round use of the Sungic Midden site during its different occupation episodes.

The interpretation of at least a spring to early winter occupation is corroborated by other faunal and floral remains recovered from Sungic Midden. This corroboration, of course, assumes that the floral and faunal remains were harvested at the time of the Sungic Midden's occupation. The charred floral remains (acorns, Chenopodium) were harvestable in September to October, while the uncharred seeds (which could have been consumed and excreted on the site) were exploitable in June through August (raspberry) and August through September (sumac, grape, and elderberry). The presence of mallard suggests that waterfowl may have been hunted in the fall/early winter or spring when these birds traveled along their migration routes (see Appendix Six). Finally, the presence of sturgeon may indicate a spring or early summer harvest in nearby tidal creeks (see Appendix Six).

While a spring to early winter occupation is suggested by the data, one can not rule out late winter use of the Sungic Midden. Shellfish gathering may have been largely curtailed during the late winter and early spring due to the weather. Shellfish collecting possibly peaked during the fall and early winter in order to produce a surplus for the cold winter months. Late winter is also the period of the year when few floral resources are available for exploitation. Thus, one can not expect to find evidence of a late winter occupation based on floral remains. Since other faunal remains that could be used to evaluate a late winter occupation were not found, it remains unclear whether the site was used year-round.

2N3E 1-7

This low density scatter on a hill slope overlooking 2N3E 1-0 is situated in a grove of atlantias trees. Two units (10N10E and 10N8E) were laid out and excavated to sterile soil. The former extends 47 cm below ground surface (8 arbitrary levels), and the latter 70 cm (7 arbitrary levels).

1. **Stratigraphy**. Three major soil strata were defined (see Figure 25): the A01 stratum (S1) of humus (0-15cm), the brown B1 stratum (S2) (15-25cm), and the yellow B2 stratum (S3) which started at 25 cm below surface.

2. **Lithic, Ceramic and Bone Artifacts**. The specific proviences of the cultural materials are listed in Appendix Three. Table 22 summarizes information on artifact types for each unit.

Unit	P	S	T	Sa	Co	M	H	K	PP	Sc	C	FC	Ce
10N10E	2	5	12	1	0	9	0	0	0	0	1	10	2
10N8E	1	6	19	0	1	10	0	0	1	0	0	4	1
Totals	3	11	31	1	1	19	0	0	1	0	1	14	3

KEY: P = Primary; S = Secondary; T = Tertiary; Sa = Shatter; Co = Core; M = Micro Flake; H = Hammerstone; K = Knife; PP = P. Point; Sc = Scraper; C = Chopper; FC = Fire-Cracked Rock; Ce = Ceramic

Table 21. Artifacts From 2N3E 1-7.

a) Chipped Stone Debitage and Hammerstones. Tertiary (31) micro (19), and secondary (11) flakes made up the bulk of the chipped stone debris, followed by primary (3), shatter (1), and cores (1). No hammerstones were recovered. The raw material represented in the sample included milky quartz, variegated quartz, smokey quartz, rock crystal quartz, and quartzite.

b) Chipped Stone Tools. Only two tools, an unidentified projectile point and a chopper, were identified.

c) Groundstone, Ceramic and Bone Tools. Three sherds of probably the same brownware vessel were recovered in the two excavation units. The shell tempered vessel was decorated on both the interior and exterior by thin scallop brushed lines.

d) Fire-Cracked Rock. A total of 14 pieces of fire-cracked rock was unearthed in both units. Ten pieces, weighing 1519 g., came from 10N10E, while the remaining 4 pieces, weighing 544 g., were found in 10N8E.

3) **Charcoal**. Charcoal flecks were noted only in unit 10N10E at levels 5,6, and 7.

4) **Faunal and Floral Remains**. Two soil samples from a possible hearth in unit 10N10E were floated. The materials recovered from these samples are listed in Table 23.

a) Shellfish. Small quantities of shellfish remains, some so badly eroded that they were unidentifiable by species, were recovered in both units (see Appendix 3). These included hard and soft clams (173 g.), oyster (22 g.), whelk (22 g.), and snails (5 g.). In addition, trace amounts of shell were recovered from the soil samples.

b) Other Faunal Remains. None recovered.

c) Floral Remains. No floral remains were identified during the excavation or recovered from the soil samples (see Appendix 4).

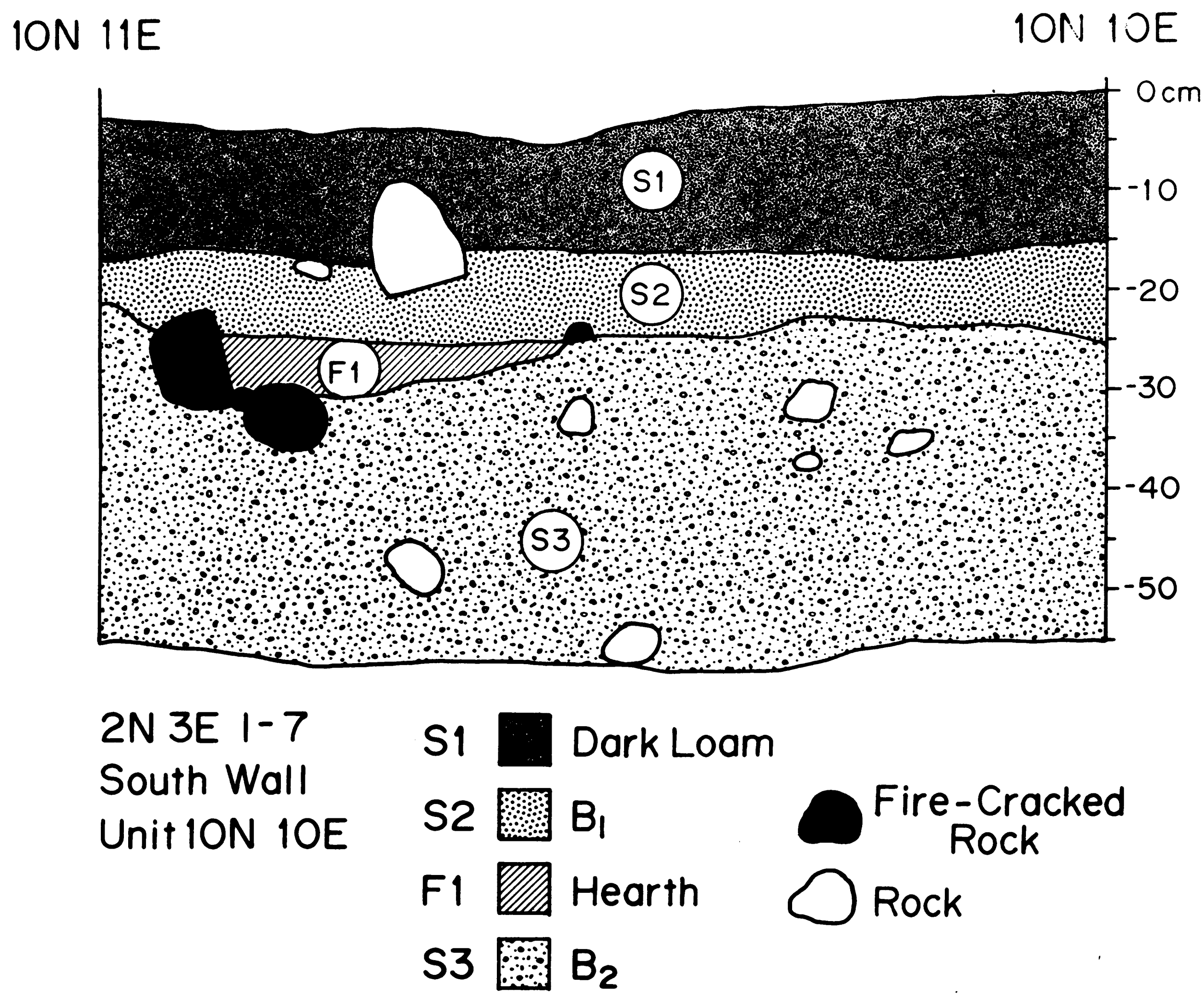

Figure 25. 2N3E 1-7. South Wall Profile of Unit 10N10E

Unit	Level	Sample Size (ml)	TS	Weight (in grams) G/S	Sh	R	Ch/S	F	A
10N10E	6	500	505	85.1	.2	1.0	.3	0	0
10N10E	6	500	503	78.9	.3	1.1	.7	0	0

KEY: TS = Total Sample Weight; G/S = Gravel and Sand; Sh = Shellfish; R = Roots; Ch/S = Charcoal, Seeds; F = Other Fauna; A = Artifacts

Table 22. Materials Recovered From Soil Samples Of 2N3E 1-7.

5) **Architectural Features.** A concentration of fire-cracked rock, charcoal flecks, and stained soil was defined in unit 10N10E, levels 6 and 7 (22 - 44 cm below surface). The feature (F1), defined as a hearth, measured 38 and 32 cm along its east/ west and north/south diameters, respectively (see Figure 25). A possible post-mold stain, 7 cm in diameter, was found 5 cm west of the hearth.

6) **Artifact Density.** The survey yielded an average of 2.18 artifacts per probe (sd = 1.84). We estimated that the density of artifacts per m2 should range from 3 to 47 artifacts. If only 37% of the shovel probes were positive, then this estimate would be reduced to between 1 and 17 artifacts/m2. The observed densities of 10N10E and 10N8E (42 and 43 artifacts/m2, respectively) fell into the upper range of the survey estimates.

7) **Artifact Diversity.** The diversity indexes calculated for the chipped stone debitage and hammerstones, the chipped stone tools, and the groundstone, ceramic and bone tools were .66, .36 and 0, respectively. The mean tool diversity index was only .18, while the average for all artifacts was .34.

8) **Chronology.** The presence of a scallop brushed ceramic vessel suggests a Late Woodland date.

9) **Interpretation.** The artifact diversity indexes indicate that a relatively limited range of activities took place on 2N3E 1-7. The archaeological evidence suggests that the major activity revolved around lithic production. Given the large number of tertiary and micro flakes, it appears that some kind of trimming or tool maintenance related tasks was involved. The

presence of the hearth, the ceramic vessel, and the trace of shellfish suggests that cooking activities may have also taken place. In either case, the low density scatter appears to represent a place of limited use.

Conclusion

The excavation and analysis of materials from the seven scatters supported and refined some of the interpretations based on the transect and block surveys. The prehistoric natives of Mashomack, especially during the Middle/Late Woodland period, participated in a wide range of activites that produced archaeological manifestations concentrated near the coastal habitats. It appears, based on the small sample of manifestations investigated, that many of the subsistence related activites took place in the summer, fall and early winter months. Our study also indicates that the various lithic scatters, lithic and ceramic scatters, and combination lithic scatters/shell middens detected during the survey may represent a diverse range of low density procurement locations, bulk procurement locations, field camps, and residential bases.

Specifically our study identified lithic workshops, a plant procurement location, a possible field camp, a shellfish procurement location (or field processing camp), and a residential base. These findings are summarized briefly below.

1) **Lithic Workshops**. Three manifestations (0N0W 2-1, 0N0W 3-21, 2N3E 7-1) represent places where primarily lithic production activities took place. These manifestations are characterized by considerable chipped stone debris, few tools, and few or no plant and animal remains. The excavations yielded patterns similar to those suggested by the survey data, a finding that lends support to our initial interpretation of ten scatters that were defined as lithic procurement locations and/or workshops in Chapter Three.

However, there are differences between the excavated manifestations. 0N0W 2-1 contains mostly quartzite lithics and fire-cracked rocks, while 0N0W 3-21 contains a much greater range of lithic raw materials and no evidence for fire-cracked rocks. This suggests that heat treating quartzite cobbles did not take place at 0N0W 3-21. 2N3E 7-1 contains a hearth and some shellfish remains, which tentatively indicates that food processing may have also been carried out here.

2) **Field Camp**. 0N1W 1-18, the Sanwald Site, may have functioned either as a small field camp or as a short duration residential base from which hunting and plant foraging activities took place. The site has the second highest artifact diversity indexes, as well as a wide variety of charred and uncharred plant remains.

3) **Plant Procurement Location**. 1S0W 2-4, the Kettle Hole Site, appears to have functioned as a place where plant resources were harvested and possibly processed. The site exhibits the lowest artifact diversity indexes of any of the excavated sites, and yet contains a broad range of charred and uncharred plant remains. Other than a few flakes (found mostly in survey probes), the majority of the cultural remains consist of ceramic sherds. This finding suggests that lithic tools may have played a minor role in the extraction and processing of some of Mashomack's plant resources. As Thomas (1983:84) points out, the exploitation of plant resources, especially by foraging parties, may produce few tangible shreds of evidence in the archaeological record. It is possible that this manifestation represents a low density procurement location where foraging parties encountered nuts, berries, and other plant resources.

4) **Shellfish Procurement Location**. 0N0W 5-20, the Laspia Site, is a small midden produced from the bulk harvesting and processing of soft shell clam. This manifestation exhibits very low artifact diversity indexes and no other faunal remains. Most of the plant remains are uncharred seeds that may have been picked during the time of the shellfish harvest. If this is the case, then the harvest probably took place in late summer or early fall months.

The excavation of 0N0W 5-20 lends support to the interpretation, based on survey data, that the three other shell middens (see Chapter Three) containing primarily soft clam, few tools, and a limited range of other cultural materials served as special purpose extraction sites. At this time we are not able to determine whether these sites functioned as bulk procurement locations within the near hinterland of proximate Mashomack residential bases or, alternatively, as field processing camps established in the far hinterland of distant residential bases. No storage caches, which might be associated with field camps, were observed. In addition, no architectural features or cultural materials indicating an overnight stay were recovered. However, since only a limited area of 0N0W5-20 was excavated, this finding is tentative to say the least.

5) **Residential Base**. 2N3E 1-0, the Sungic Midden Site, appears to be the remains of a relatively small residential base that was used repeatedly during the spring, summer, fall and early winter months, although we do not rule out a year-round occupation. From this place it appears that hunters set forth to bring back deer and waterfowl; shellfish collectors and fisher-people exploited the nearby coastal zone to harvest soft clam, hard clam, oyster, scallop, whelk, snails and fish; and that gathering parties were dispatched to bring home deciduous nuts, seeds and berries. The site is characterized by the greatest diversity indexes of any of the excavated sites, indicating that

butchering, woodworking, lithic and ceramic production, sewing, plant processing, and cooking tasks were performed here.

The results support our initial interpretation that the large midden/lithic scatters found adjacent to Miss Annies Creek (2S6W 1-22), Fan Creek (1N1W 6-1) and Sungic Pond (2N3E 1-0) served as residential bases.

CHAPTER FIVE: MASHOMACK HUNTER - GATHERERS

In this chapter we synthesize the major findings of the archaeological research undertaken on the Mashomack Preserve. Specifically, we reconstruct some aspects of the prehistoric subsistence and settlement system employed on Shelter Island during the Woodland period, and outline several implications concerning diachronic adaptations to the coastal environment. We suggest that the Woodland settlement system differs, in some ways, from typical forager and collector strategies described in Chapter One. These differences concern the bulk exploitation of coastal resources within a short distance of residential bases, and the use of linear logistical ranges that follow the coastline for many kilometers.

Woodland Subsistence and Settlement

The Local System

Most of the archaeological manifestations on Mashomack appear to date to the Middle/Late Woodland period. Our research suggests that many kinds of functions are represented by these manifestations. Some served as residential bases, others as low density procurement locations, bulk procurement locations or field processing camps. The majority of the residential bases and special purpose extraction sites are situated along the coastal habitats, while the low bulk extraction locations are found in both the coastal and upland habitats.

Below we outline how these manifestations were integrated in the local settlement system.

1) **Residential Bases**. The hub of the Woodland settlement system was the residential base. It appears that residential bases were established on many of the extant or former tidal creeks of Mashomack. Our field work suggests residential bases were set up on Miss Annies Creek (2S6W 1-22), Fan Creek (1N1W 6-1), and Sungic Pond (2N3E 1-0). Another potential residential base may be found on Foxon Creek, based on information from Mr. Sanwald, although this manifestation has yet to be fully documented.[1]

The residential bases were situated in optimal places for exploiting a variety of coastal and terrestrial resources. Similar to many other coastal hunter-gatherers described in Chapter One, Mashomack people maintained their residential bases in ecotones that intersected the major habitats of the island. Here they could minimize transportation costs while exploiting a diverse array of nearby plant and animal foods.

These bases appear to have been the focus of a variety of tasks, which included lithic and ceramic production, processing plant foods, preparing fish, bird and deer meats, undertaking shellfish bakes, cooking other plant and animal resources, woodworking, and possibly sewing or basketmaking. Some features, such as hearths and baking pits, were constructed at residential bases. The question of whether house structures were erected on these sites remains debatable. Our excavation strategy did not delimit broad contiguous areas necessary to define the spatial patterning of individual residential structures. However, several post-molds were recorded at the Sungic Midden site.

Some of the residential bases may have had relatively complex occupation histories. The excavation of the Sungic Midden documented multiple occupation episodes that spanned the spring, summer, fall, and early winter months. It is possible that the site was used on a year-round basis, although the evidence for late winter occupation is equivocal.

Only a few families probably occupied the site at any one time. The actual site area was probably divided into residential space and midden space, the latter making up a significant component of the site. Furthermore, it is uncertain, given the complex reuse pattern of the place, whether the entire site was occupied simultaneously.

As a very crude maximum figure, we employed Hassan's (1981: 72) formula devised for estimating the population of hunter-gatherer residential bases. The use of his formula ($A = .71015 P^{1.76}$, where A = Area of site, P = Population) suggests a maximum range of roughly 50 to about 100 people for the Mashomack bases. These estimates are probably inflated given that they assume the entire site area consists of residential space that was occupied simultaneously. One must also be careful about relying too heavily on these estimates since they assume that the Mashomack people occupied space in the same manner as the hunter-gatherer groups used to compute Hassan's formula.

2) **The Hinterland of Residential Bases.** There is considerable evidence that many prehistoric activities took place in the near and far hinterland of residential bases. These extraction activities appear to have incorporated both foraging and logistically organized strategies depending upon the density, availability, and spatial distance of resources from residential bases. Below the hinterland landscape of residential bases is divided into three spatial zones -- the near hinterland, the upland hinterland, and the coastal or logistical hinterland. We suggest that each hinterland zone is characterized by different combinations of exploitation tactics.

The Near Hinterland. The zone found within a 200 meter radius of residential bases on tidal creeks is defined as the near hinterland. Here both foraging and logistically organized strategies appear to have taken place. Figure 26 illustrates a residential base and its near hinterland. Of course, the archaeological distribution is complicated by the fact that some remains found along tidal creeks may have been produced by groups operating out of more distant bases, a point taken up below. At the very least it appears that people had the option of establishing low density and bulk procurement locations very close to home to exploit the following resources:

a) Lithic Raw Materials. Task groups extracted lithic material from boulder erratics and from nearby morainal deposits containing quartz and quartzite cobbles. In several cases, it appears that preliminary core reduction took place at these locations, an activity that produced considerable amounts of debitage of primary and secondary flakes, some cores and hammerstones. Examples of ten such manifestations are described in Chapters Three and Four. Most of these manifestations are found within 200 meters of tidal creeks near residential bases. While lithic raw materials are distributed widely across the coastal and upland habitats, it appears that some procurement and most lithic production activities took place close to residential bases.

b) Coastal Resources. Some coastal resources, such as shellfish and anadromous fish, may have represented productive resource patches that could have been exploited on a seasonal basis. Excavations yielded little evidence for the bulk exploitation of anadromous fish at Mashomack, with the exception of a few sturgeon plates from Sungic Midden. However, there is ample evidence to suggest that shellfish procurement locations were established near coastal residential bases (see Figure 26). Our study suggests that specialized task groups may have been dispatched from nearby residential bases to exploit soft clams in bulk. The soft clam was harvested, the meat separated from the shell, and the shell discarded at these locations. It is possible that the meat was prepared here and then either consumed and/or brought back to the main residence for consumption or storage.

Other plant (e.g. seeds, nuts, berries) and fish resources could have been exploited close to the residential base as well. The numerous isolated finds and low density scatters found in the near hinterland (see Chapter Three) probably resulted from the low bulk extraction of such resources. Foraging parties working close to home evidently lost or discarded tools on an occasional basis that produced the non-site manifestations (see Figure 26).

The floral remains recovered from procurement locations indicate that harvesting activities were probably taking place

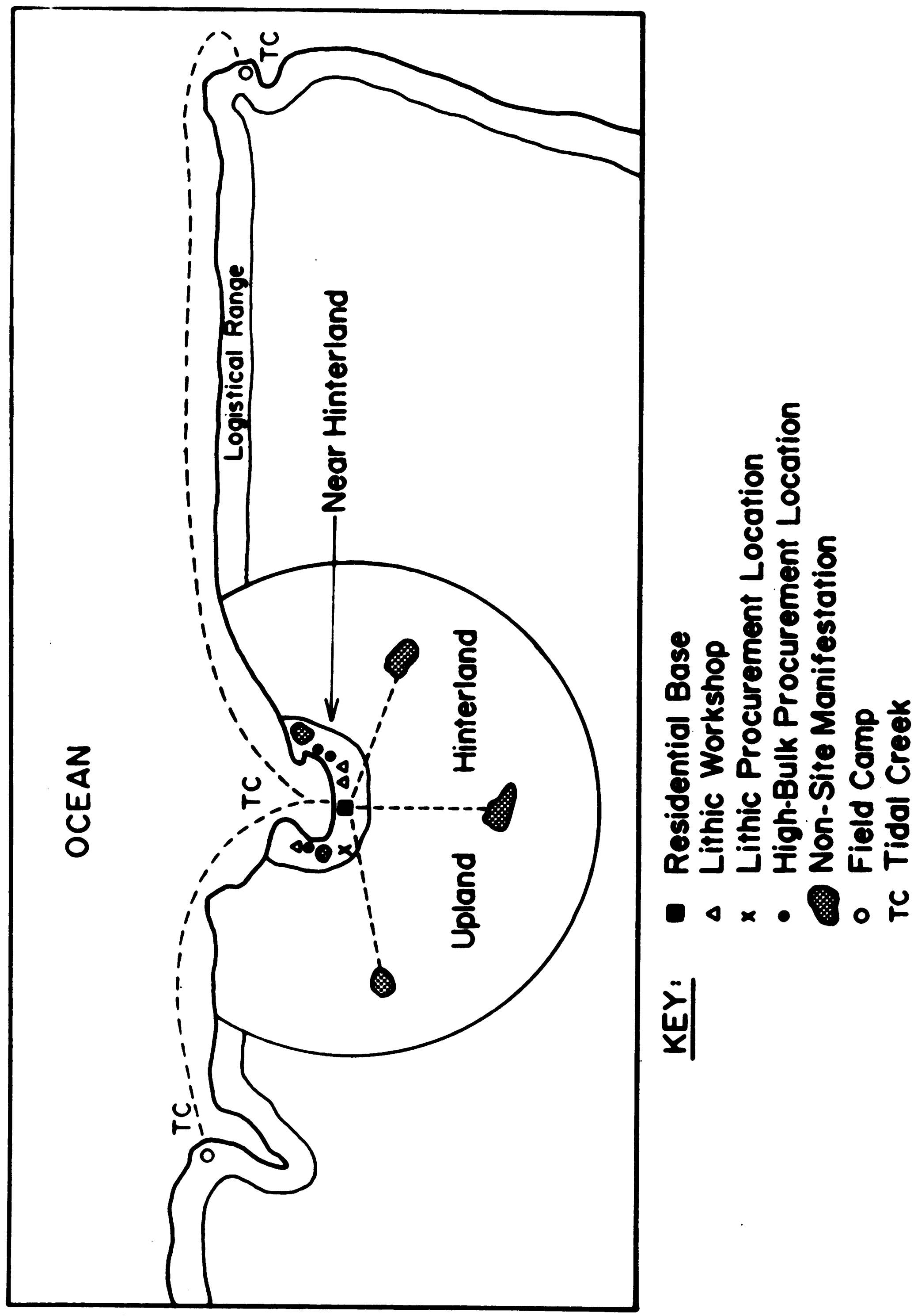

Figure 26. Coastal Hunter-Gatherers: A Middle/Late Woodland Settlement Model for Shelter Island

during the summer and fall. Of course, one must be careful about interpreting the seasonal use of sites based on floral remains alone. It is possible that some plant remains (especially the uncharred remains) recovered from soil samples were not associated with the site's occupation. Other problems to consider are the implications of storing or trading plant remains, which may affect seasonality interpretations based on floral remains (see Monks 1981).

The Upland Hinterland. This zone is found beyond a 200 meter radius of residential bases and today consists primarily of oak-sedge and oak-heath habitats. This area appears to have been largely the domain of foraging activities. Many of the upland resources, which include game, wood and some plant foods, were probably exploited on an encounter basis. Hunting parties searching for deer in the interior may have produced, over many years of use, extensive non-site manifestations of flakes and projectile points like those described in Chapter Three. Foraging parties collecting firewood and gathering plant foods, such as berries and seeds, may have produced occasional isolated finds, such as the axe and multiple flakes, that are distributed across the preserve (see Chapters Three and Four). These foraging activities may also have produced low density scatters (e.g. 1SOW 2-4) that have been identified as plant procurement locations.

There is little evidence for bulk procurement locations in the upland hinterland. This finding suggests that logistically organized task groups did not commonly operate in the uplands. It is possible, of course, that logistically organized task groups may have exploited some plant resources that produced few remains in the archaeological record. The harvesting of deciduous nuts may be a case in point. While it is possible that logistically organized food procurement parties may have been dispatched to productive groves to exploit these resources in bulk, there is little evidence at this time to evaluate this possibility.

Finally, there is little evidence that secondary residential bases or field camps were established in the upland hinterland. This makes intuitive sense, since most of the upland habitats of Shelter Island were well within a one to two hour walk from the tidal creeks of Woodland residential bases. In fact, a 5 to 10 km catchment range from these bases would have encompassed a good portion of island. The small size of Shelter Island may explain why no residential bases and few field camps were identified beyond a 200 meter radius of tidal creeks; there would have been little need to establish separate interior bases or field camps when most upland resources were well within the foraging range of coastal bases.

The Coastal or Logistical Hinterland. Coastal resources were almost certainly exploited beyond the near hinterland of residential bases. Using canoes, the Mashomack people could have easily exploited tidal creeks and shorelines around Shelter Island and across the Peconic Bay on the north and south forks of Long Island. Logistically organized task groups may have established bulk procurement locations in these more distant locales where soft shell clam, and other estuarine resouces were harvested in mass, processed and brought back home. In cases where groups bivouacked overnight, field processing camps may have been established. This implies that some special purpose extraction sites found along the north and south forks may have been produced by collectors from Mashomack residential bases. Conversely, some special purpose extraction sites found along Mashomack's coast may have been generated by task groups from distant residential bases (the eastern forks or mainland of Long Island).

A significant problem identified in this study is the potentially complex depositional histories of special purpose extraction sites at Mashomack. Some of these sites may be bulk procurement locations established in the near hinterland of Mashomack residential bases where task groups could have walked a short distance to exploit local shellfish beds. Others may be bulk procurement locations found in the more distant hinterland of other Shelter Island or Long Island residential bases. In this case task groups could have used canoes to visit more distant tidal creeks within a day's ride of their residential base. Still other sites may represent field processing camps found in the logistical range of distant Long Island or even New England coastal people. Here, coastal resources could have been exploited beyond a day's canoe ride of the residential base which would have necessitated the establishment of overnight camps. In any event, it remains a very difficult archaeological challenge to clearly distinguish these different kinds of special purpose extraction sites.

In summary, our interpretation of the local settlement system differs somewhat from that typically described for foragers and collectors (see Chapter One). Most models suggest that foraging activities are conducted primarily within a 5 to 10 km radius of residential bases, and that logistically organized activities normally take place beyond this distance (the logistical range). Yet temperate coastal environments, like Shelter Island, are characterized by densely packed resource zones that are linearly distributed along the coastline. This resource distribution may allow coastal people to operationalize a greater range of subsistence strategies than that normally documented for hunter-gatherers of the Arctic or the equator.

The linear distribution of coastal resources has three significant implications.

First, both foraging and logistically organized procurement strategies may be practiced within the near hinterland of residential bases. While Binford (1980:10) notes that logistically organized groups do sometimes operate close to home, his models, drawn from the Nunamiut, do not emphasize this strategy. Among coastal hunter-gatherers this strategy may take on added significance, and we may expect to find bulk procurement locations near residential bases.

Second, the logistical range of coastal groups may take on a linear distribution that follows the coastline for many kilometers (see figure 26). Canoes not only provide an efficient means of traveling beyond the normal 5-10 km catchment range, but they provide an economical means of transporting bulk goods back home. Using canoes, task groups can extend the distance over which coastal resources can be exploited within a day's trip of the residential base. In addition, the use of overnight field camps can extend the logistical range of coastal people considerably further.

Third, a plethora of archaeological remains may be produced along productive coasts by procurement parties operating from near and distant residential bases. The overlapping logistical ranges of coastal residential bases may result in a variety of bulk procurement locations and field processing camps being established along tidal creeks.

The Regional Settlement System

The settlement information suggests that people did not aggregate into large communities at Mashomack, but rather practiced a dispersed homestead settlement system. It appears that the Woodland population was dispersed across the different tidal creeks in relatively sedentary homesteads containing a few family units. These residential homesteads, if the Sungic Midden is any indication, may have been occupied during the spring, summer, fall and early winter months, or even throughout the entire year. Of course, future work may delineate even greater variation in the seasonal occupation of other Shelter Island residential bases.[2]

It is not clear at this time how many residential bases were occupied simultaneously on Mashomack. If the various tidal creeks of Mashomack all supported small homesteads, then a rather sizeable population may have been dispersed across Shelter Island's landscape during the Middle and Late Woodland periods. Presently, it is not clear whether Mashomack could have supported the simultaneous occupation of more than one or two homesteads at any one time. Given the rather crude level of chronological control, these questions can not be resolved at this time. However, since at least one residential base exhibited multiple occupation episodes, it is not beyond comprehension that more than one residential base was occupied at any one time.

Diachronic Perspective

Both geological and archaeological data suggest that Mashomack's coastline is dynamic, and has only recently taken on its present configuration. The cores from Bass Creek indicate that this estuary began forming only about 1000 years ago. Significantly, our excavation of the Sungic Midden site suggests that its major period of occupation probably took place around 1200 BP and that earlier occupations have now been inundated by rising sea level (see our discussion of unit 13S0E, Chapter 4). Limited testing along the southern edge of the midden indicates that a portion of the site lies underneath the extant Sungic Pond.

The recent formation of Mashomack's tidal creeks probably explains why most of the archaeological manifestations date to the Middle/Late Woodland. Archaeological remains that predate this period, and which were distributed along former tidal creeks, are now inundated. We propose that as sea level rose in recent years, coastal residential bases and special purpose extraction sites were shifted upslope as earlier sites were abandoned and eventually inundated. This suggests that the coastal archaeological record consists of numerous overlapping occupation episodes that span from the area's earliest use, now probably located in Peconic Bay, to the Middle/Late Woodland manifestations described in this volume.

It is possible that the earliest settlement systems, especially those dating back to the Archaic, may have differed from those of the Middle/Late Woodland. The Archaic manifestations found in contemporary upland and coastal habitas would have been located some distance from the Archaic residential bases that may now be inundated in Peconic Bay. The distance between the Archaic coastal residential bases and upland habitats may have been far enough to warrant the development of overnight field camps like 0N1W 1-18. In any event, the lower sea level would have exposed a greater land mass during the Archaic that would have had potentially significant implications for hunter-gatherer adaptations.

NOTES

1. Whether all the tidal creeks of Mashomack supported residential bases is, of course, unknown. An initial test of this proposition in the fall of 1984 yielded little evidence of prehistoric occupation along the Bass Creek estuary. Here, along the north side of the estuary, limited subsurface testing produced a few flakes, but no significant manifestations.

2. The proposition that some late prehistoric Northeastern populations were widely dispersed across the landscape in small, relatively sedentary homesteads is not new. Discussions with Frank McManamon, who worked at Cape Cod for many years, and Pierre Morenon, who has worked extensively in coastal Rhode Island, first suggested this settlement pattern to the senior author. We would like to acknowledge their stimulating insights in our interpretation of Shelter Island.

CHAPTER SIX: CONCLUDING REMARKS

In this final chapter we address the six questions that were initially raised in Chapter One concerning the archaeology of Shelter Island.

1) Do shell middens represent the remains of residential bases or special purpose extraction sites (either field processing camps or bulk procurement locations)? Our study suggests that shell middens may represent a varied range of activities. Some shell middens served as special purpose extraction sites where soft clams were harvested in bulk. These manifestations are characterized by a limited diversity of artifact types, of faunal and floral remains, and of architectural features. Many of these sites appear to have been bulk procurement locations established near residential bases, although we do not rule out the possibility that some may have served as field processing camps for groups traveling beyond a day's canoe trip from distant residential bases.

Other combination shell middens and lithic scatters appear to represent the remains of residential bases. These manifestations are characterized by a high diversity of artifact types, and floral and faunal remains. They also contain architectural features. The internal spatial pattern of these sites suggests that residential space may have been segregated from midden deposits where shellfish were processed, cooked, and their remains discarded.

2) What other types of archaeological remains are found at Mashomack? We detected various lithic scatters, lithic and ceramic scatters and isolated finds that appear to represent the remains of lithic procurement sites, lithic workshops, plant procurement sites, and generalized foraging areas.

3) What was the season of use and size of local residential bases -- do they represent warm and/or cold weather occupations? The excavation of one residential base, the Sungic Midden site, indicates a seasonal occupation spanning the spring, summer, fall and early winter, although we do not rule out a year-round occupation. The size of the residential bases range from 800 to 2400 m2. Granting complex occupation histories for these locations, and the possible segregation of midden and residential space, it appears that the size of the residential groups during any one occupation episode was small -- probably a few family units. Floral remains from nearby extraction sites tentatively suggest that many of the subsistence related activities in the hinterland took place in the summer and fall months.

4) What was the subsistence base of prehistoric groups and is there any evidence for agriculture? The archaeologcial record suggests that Late Woodland people subsisted on deer, waterfowl,

fish, various kinds of shellfish (soft clam, hard clam, scallop, oyster), and plant resources such as acorns, hickory nuts, wild cherries, sedge-polygonum, wild grapes, raspberries, sumac, chenopodiaceae, elderberries, and mustard. There is no evidence of agriculture being practiced by the prehistoric Mashomack people.

5) What seasons were shellfish harvested? The sectioning study of Mercenaria mercenaria indicates that hard shell clams were harvested at Sungic Midden primarily during the spring, summer, fall and early winter months. The harvesting intensity peaked in the fall and early winter, and minimal collecting was done in the late winter. The floral remains from the Laspia site tentatively indicate that soft clam were being harvested during the late summer or early fall.

These findings suggest that shellfish may have provided 1) a supplementary source of fresh meat during the spring, summer, fall and early winter months, and/or 2) a source that was harvested in bulk, prepared, and stored for use during the least productive months of the year -- the late winter and early spring months. In either case, it does not appear that Mashomack groups were intensively exploiting hard clams during the leanest months of the year, a finding that is contrary to that reported from other areas of New England.

6) Does it appear the prehistoric groups practiced nomadic forager or sedentary collector strategies? The Mashomack natives, at least during the Middle/Late Woodland period, practiced a dispersed homestead settlement system that combined aspects of both forager and collector strategies. Coastal residential bases served as focal points from which people foraged for upland resources and from which specialized food procurement parties were dispatched to exploit specific coastal resources in bulk. Both strategies appear to have been implemented within a one or two hour walk or short canoe trip from the coastal bases. Specialized task groups probably also operated along a linear logistical range that followed the shorelines of Shelter Island and the north and south forks of Long Island for many kilometers.

7) Did the subsistence and settlement patterns change over time? We detected relatively few prehistoric manifestations that predate the Middle/Late Woodland period. The geological and archaeological evidence indicates that Mashomack's coastline did not take on its present configuration until about 1000-1200 years ago. Thus, earlier coastal sites, if they were once situated along tidal creeks, would now be submerged. We propose that the gradual inundation of Mashomack's coastline has produced an overlapping distribution of archaeological remains that extend from the Middle/Late Woodland manifestations to earlier coastal sites now under tidal creeks and salt ponds.

The dynamic coastline may have influenced past subsistence and settlement systems. The exposure of the shallow shelf surrounding Shelter Island would have produced a much larger land mass. Under such conditions, the distance separating coastal residential bases from upland habitats may have been sufficient enough to establish overnight field camps, such as 0N1W 1-18.

In summary, the dispersed homestead settlement system of Mashomack appears to fall somewhere between the two settlement models proposed by Ceci (1982) and Salwen (1983). Our evidence suggests that the Middle/Late Woodland Mashomack people did not aggregate into large villages, although we can not rule out the presence of villages in other, unexplored, areas of Shelter Island. It also appears that horticulture did not make up an important component of the Woodland period subsistence practices. On the other hand, the Mashomack people were not simple, nomadic foragers who established very short duration residential bases. Our findings suggest that they established coastal residential bases of relatively extended seasonal use from which both foraging and logistically organized strategies were employed.

Perlman's (1980) prediction concerning the relationship between sedentary life and productive coastal environments is only partly supported by our findings. An association does exist between the stabilization of Mashomack's coastline about 1000 years ago and the presence of relatively sedentary coastal homesteads. However, we do not know if the homesteads developed in response to changing coastal conditions or to some other factor(s) not controlled in our study. It is possible that the homestead pattern predates the period of coastal stabilization. To fully evaluate this possibility, residential bases predating the Middle/Late Woodland and now inundated on the coastal shelf will need to be excavated. Furthermore, the evidence is equivocal about the year-round occupation of Middle/Late Woodland residential bases. These residential bases are also smaller than the "nonband" coastal communities predicted by Perlman (1980:293-294). It is possible that the small size of Shelter Island may have mitigated against the development of very large sedentary communities as proposed by Perlman.

While the dispersed homestead settlement system appears to characterize the late prehistoric occupation of Mashomack, it remains to be seen whether similar settlement distributions are found in other areas of Long Island. We can not assume that coastal adaptations on a small woodland island, like Shelter Island, would be necessarily similar to those that occurred on the mainland of Long Island proper. Further field research will be undertaken to evaluate this proposition.

APPENDIX ONE: TRANSECT SURVEY CULTURAL MATERIALS

KEY:

UNIT = Survey Unit
TR = Survey Transect #
SPS = Shovel Probe Station
POS = Position
SPT = Shovel Probe Type
- S = Systematic
- IC= Iron Cross

DEP = Depth
- 1 = Surface
- 2 = 1-10 cm
- 3 = 11-20 cm
- 4 = 21-30 cm
- 5 = 31-40cm
- 6 = 41-50 cm
- 7 = 51-60 cm

HAB = Habitat
- A = Coastal Strip
- B = Tidal Creek
- C = Salt Pond
- D = Oak-Heath
- E = Oak-Sedge
- F = Freshwater

MAT = Raw Material Types
- 1 = Quartzite
- 2 = Variegated Quartz
- 3 = Smokey Quartz
- 4 = Milky Quartz
- 5 = Rose Quartz
- 6 = Rock Crystal Quartz
- 7 = Chert
- 8 = Jasper
- 9 = Granite
- 10 = Volcanic
- 11 = Wood
- 12 = Bone
- 13 = Shell
- 14 = Nut Shell
- 15 = Clay
- 16 = Coal
- 17 = Citrine Quartz
- 18 = Other

TYPE = Artifact Types
- 1 = Primary Flake
- 2 = Secondary Flake
- 3 = Tertiary Flake
- 4 = Shatter
- 5 = Core
- 6 = Projectile Point
- 7 = Scraper
- 8 = Prehistoric Ceramic
- 9 = Ground Stone
- 10 = Fire-Cracked Rock
- 11 = Oyster
- 12 = Whelk
- 13 = Soft Clam
- 14 = Hard Clam
- 15 = Scallop
- 16 = Micro Flake
- 17 = Historic Cer.
- 18 = Charcoal
- 19 = Hammerstone
- 20 = Snail
- 21 = Chopper
- 22 = Kaolin Pipe
- 23 = Brick
- 24 = Knife

OTHER = Comments
- G = Grams
- * = Edge Angle
- SC = Split Core
- ST = Sand Temper
- SHT= Shell Temper
- SM = Smoothed
- ISB= Interior Scallop Brushed
- INC = Incised
- ESB= Exterior Scallop Brushed
- IB = Int. Brushed
- (a,b,c,or d) = Ceramic Vessels Described In The Text

APPENDIX ONE

Archaeological Manifestations Defined as Low and High Densit Scatters Provenienced by Shovel Probe Intervals:

MANIFESTATION	SHOVEL PROBE INTERVALS (TR-SPS)
1N6W 1-2	1-2, 1-3, 1-4, 1-5, 1-6, 1-8, 1-9
1N6W 1-27	1-27, 1-28
1S3E 1-25	1-25, 1-27, 1-28, 1-29, 1-31, 1-32, 1-33
2N3E 1-0	1-0, 1-1, 1-2, 1-3, 1-4
2N3E 1-7	1-7, (also 2-9 listed in Appendix Two)
2S6W 1-19	1-19
2S6W 1-22	1-22, 1-23, 1-25, 1-26, 1-27, 1-28, 1-29 1-30, 1-31, 1-32
3S3W 1-8	1-8, 1-9

Archaeological Manifestations Defined as Isolated Finds:

- 1N6W 1-21, 1S0W 1-8 , 1S3E 1-3 , 1S3E 1-36, 1S3W 1-3, 1S3W 1-8 , 2S0W 1-7 , 2S1W 1-26, 3S0W 1-26, 3S0W 1-5, 3S3W 1-3 , 3S3W 1-13, 3S3W 1-14

APPENDIX ONE

UNIT	TR	SPS	POS	SPT	DEP	HAB	MAT	TYPE	COUNT	OTHER
1N6W	1	2	2	S		B		10	1	
1N6W	1	2	3	S		B	2	2	2	
1N6W	1	21	2	IC		B	3	1	1	2N
1N6W	1	21	2	IC		B	1	2	3	
1N6W	1	27	1	S	4	B		10	1	
1N6W	1	27	1	S		B	13		6	G
1N6W	1	27	1	IC		B			1	2S,TOOL
1N6W	1	27	1	IC	3	B		10	1	2N
1N6W	1	27	1	IC	3	B	4	1	1	2N
1N6W	1	27	1	IC		B		10	1	2W
1N6W	1	28	3	S	3	B		10	1	
1N6W	1	28	4	S	4	B		10	1	
1N6W	1	3		S	2	B	18		1	GLASS
1N6W	1	4	2	S		B	17	2	1	
1N6W	1	4	2	S		B	1	2	1	
1N6W	1	4	2	S		B	1	16	1	
1N6W	1	5	2	S		B	1	3	1	
1N6W	1	6	3	S		B		5	1	F.C.
1N6W	1	8	4	S	3	B	2	2	1	
1N6W	1	9	3	S		B	13	15	57	G
1N6W	1	9	3	S		B	13	20	9	G
1S0W	1	8	4	S	3	E	9		1	AXE?
1S3E	1	25	1	S		C	1	2	2	
1S3E	1	25	1	S		C	1	3	1	
1S3E	1	25	1	IC		C	1	3	1	
1S3E	1	25	1	IC		C	4	16	1	
1S3E	1	25	1	IC		C	2	3	1	
1S3E	1	25	1	IC		C	2	16	1	
1S3E	1	25	2	IC	4	C		16	1	RETOUCH
1S3E	1	25	2	IC		C	17	2	1	
1S3E	1	25	2	S		C	11	18	1	
1S3E	1	25	2	S		C	5	1	1	
1S3E	1	25	2	S		C	6	3	2	
1S3E	1	25	2	S		C	17	3	2	
1S3E	1	25	2	S		C	2	3	1	
1S3E	1	27	1	IC		C	2	3	1	
1S3E	1	28	2	S	2	C	2	2	1	
1S3E	1	28	2	IC		C	2	3	2	
1S3E	1	29	3	S		C	11	18	1	
1S3E	1	29	3	IC	3	C	11	18	1	
1S3E	1	29	3	IC	3	C	11	18	1	
1S3E	1	29	3	IC	3	C	11	18	1	
1S3E	1	3	2	S		F	4	2	1	
1S3E	1	31	2	S		C	2	2	1	
1S3E	1	31	2	IC	3	C	11	18	1	
1S3E	1	31	2	IC	3	C	2	1	1	
1S3E	1	31	2	IC		C	4	3	1	
1S3E	1	31	2	IC		C	4	3	1	

UNIT	TR	SPS	POS	SPT	DEP	HAB	MAT	TYPE	COUNT	OTHER
1S3E	1	31	3	S		C		10	2	
1S3E	1	31	4	S		C	11	18	2	
1S3E	1	32	2	S		C	2	2	1	
1S3E	1	32	2	S		C	2	16	1	
1S3E	1	32	3	S		C	11	18	4	
1S3E	1	33	1	S		C		10	1	
1S3E	1	33	2	S		C	1	2	1	
1S3E	1	36	4	S	4	C	11	18	2	
1S3E	1	36	4	S	4	C		10	1	
1S3W	1	3	5	S		E	2	2	1	
1S3W	1	8	4	S		E	2	1	1	
2N3E	1	0	4	IC		C	6	5	1	2N2E
2N3E	1	0	4	IC		C	1	5	1	2N2E
2N3E	1	0	4	IC		C	2	5	1	2N2E
2N3E	1	0	4	IC		C	6	3	1	4N
2N3E	1	0	4	IC		C	4	2	1	4N
2N3E	1	0	4	IC	3	C	4	2	1	2E
2N3E	1	0	4	IC	3	C	4	1	1	2E
2N3E	1	0	4	IC	3	C	3	1	1	2E
2N3E	1	0	4	IC		C	3	1	2	2N2E
2N3E	1	0	4	S	4	C	4	1	1	
2N3E	1	0	4	S	4	C	4	2	1	
2N3E	1	0	4	S	4	C	4	3	1	
2N3E	1	0	4	IC	5	C	6	2	2	2S
2N3E	1	0	4	IC	5	C	4	4	4	2S
2N3E	1	0	4	IC	5	C	4	2	2	4N
2N3E	1	0	4	IC	5	C	4	1	1	4N
2N3E	1	0	4	IC	5	C	2	1	1	4N
2N3E	1	0	4	IC	5	C	1	7	1	4N,55*
2N3E	1	0	4	IC	5	C	2	2	1	6N
2N3E	1	0	4	IC	4	C	6	2	1	2W
2N3E	1	0	4	IC	4	C	4	2	1	2W
2N3E	1	0	4	IC	5	C	4	2	2	4N2W
2N3E	1	0	4	IC		C	4	2	2	
2N3E	1	1	2	S	2	C	4	2	3	
2N3E	1	1	2	S	2	C	2	1	1	
2N3E	1	1	2	S	2	C	2	2	1	
2N3E	1	1	4	S	5	C	6	3	1	
2N3E	1	2	2	S	6	C	4	5	1	
2N3E	1	2	2	S	6	C	4	3	1	
2N3E	1	2	2	S	6	C	4	2	1	
2N3E	1	2	2	S	6	C	1	3	1	
2N3E	1	2	2	S	6	C	1	4	2	
2N3E	1	2	2	S	6	C	17	2	1	
2N3E	1	2	4	S	4	C	1	2	2	
2N3E	1	2	4	S	4	C	9	2	3	
2N3E	1	2	4	S	4	C		2	2	
2N3E	1	2	4	S	4	C	9	5	1	
2N3E	1	3	2	S	5	C	4	5	1	

UNIT	TR	SPS	POS	SPT	DEP	HAB	MAT	TYPE	COUNT	OTHER
2N3E	1	3	2	S	5	C	17	5	1	
2N3E	1	3	2	S	5	C	6	2	1	
2N3E	1	3	2	S	5	C	4	1	1	
2N3E	1	3	2	S	5	C	4	2	1	
2N3E	1	3	4	IC		C	13	14	439	8N,G
2N3E	1	3	4	IC		C	13	15	7	8N,G
2N3E	1	3	4	IC		C	13	13	906	8N,G
2N3E	1	3	4	IC		C	13	11	2	8N,G
2N3E	1	3	4	IC		C		10	6	8N
2N3E	1	3	4	IC		C	12		2	8N
2N3E	1	3	4	S		C	13	13	2575	G
2N3E	1	3	4	S		C	13	14	408	G
2N3E	1	3	4	S		C	13	15	35	G
2N3E	1	3	4	S		C	13	11	32	G
2N3E	1	3	4	S	4	C	6	3	1	
2N3E	1	3	4	S	4	C	4	3	1	
2N3E	1	3	4	S	4	C	18	3	1	BASALT
2N3E	1	3	4	IC		C	4	2	1	10N
2N3E	1	4	4	S		C		10	7	
2N3E	1	7		IC		C	3	3	1	
2N3E	1	7	1	S	2	C	1	3	1	
2N3E	1	7	1	IC		C	1	2	3	
2N3E	1	7	5	IC		C	2	3	2	
2N3E	1	7	5	IC		C	13	20	8	G
2N3E	1	7	5	IC	4	C	4	1	1	
2N3E	1	7	5	IC	4	C	6	16	1	
2N3E	1	7	5	IC	4	C	4	16	1	
2N3E	1	7	5	IC	4	C	13	12	13	G
2N3E	1	7	5	IC	4	C	13	11	1	G
2N3E	1	7	5	IC	4	C	13	14	64	G
2N3E	1	7	5	IC		C	2	3	1	
2N3E	1	7	5	IC		C	1	3	1	
2N3E	1	7	5	IC	2	C	15	8	3	
2N3E	1	7	5	IC	2	C	6	2	2	
2N3E	1	7	5	IC	2	C	4	2	1	
2N3E	1	7	5	IC		C	13	12	4	G
2N3E	1	7	5	IC		C	13	14	4	G
2N3E	1	7	5	S		C	13	12	15	G
2N3E	1	7	5	IC		C	6	2	1	
2N3E	1	7	5	IC		C	2	2	2	
2N3E	1	7	5	IC		C	4	2	1	UTILIZED
2S0W	1	28	2	S	3	D	15	17	7	
2S0W	1	4	4	IC		D	17	2	1	
2S0W	1	7	3	S	3	D	1	16	1	
2S0W	1	7	5	S	4	D	2	6	1	TIP
2S1W	1	26	4	S	5	D	1	3	1	
2S1W	1	26	4	S		D	1	3	1	
2S6W	1	19		S	3	B	1	3	1	
2S6W	1	19	3	S	3	B	2	3	1	

UNIT	TR	SPS	POS	SPT	DEP	HAB	MAT	TYPE	COUNT	OTHER
2S6W	1	19	3	IC		B	1	1	2	
2S6W	1	19	3	IC	3	B	1	2	1	
2S6W	1	19	3	IC	3	B	2	2	2	
2S6W	1	19	3	IC	4	B	17	16	1	
2S6W	1	19	3	S	4	B		10	1	
2S6W	1	19	3	S		B		10	1	
2S6W	1	19	3	S		B		19	1	
2S6W	1	21	4	IC		B	2	2	1	2S
2S6W	1	22	4	S	3	B	1	2	2	
2S6W	1	22	4	IC		B		10	1	2W
2S6W	1	22	4	IC	4	B	4	2	1	2W
2S6W	1	22	4	IC	3	B		10	2	2N2W
2S6W	1	23	1	S	5	B	17	2	1	
2S6W	1	23	1	S	5	B	3	2	1	
2S6W	1	23	4	S	3	B	3	2	1	
2S6W	1	23	4	IC	4	B	1	2	1	2SE
2S6W	1	23	4	IC	4	B		10	1	2SE
2S6W	1	23	4	IC	3	B	1	2	1	2E
2S6W	1	25	4	S	5	B	1	2	1	
2S6W	1	25	4	S	6	B		10	1	
2S6W	1	25	4	IC	4	B	2	2	1	1SW
2S6W	1	25	4	IC	4	B	4	2	1	1SW
2S6W	1	25	4	IC	7	B	6	3	1	1SW
2S6W	1	25	4	IC	5	B	1	1	2	2W
2S6W	1	25	4	IC	5	B	2	6	1	2S,MADISON
2S6W	1	26	1	S	6	B	13	14	16	G
2S6W	1	26	1	S	6	B	6	2	1	
2S6W	1	26	1	IC	2	B	13	14	7	G
2S6W	1	26	2	S	4	B	13	14	30	G
2S6W	1	26	2	S	4	B	1	16	1	
2S6W	1	26	2	S	4	B	2	16	1	
2S6W	1	26	3	S	4	B	13		1	G
2S6W	1	27	1	S	4	B	13	14	101	G
2S6W	1	27	1	S	4	B	13	11	18	G
2S6W	1	27	1	S	4	B	13	12	12	G
2S6W	1	27	1	S	5	B	4	16	1	
2S6W	1	27	1	S	5	B	2	16	1	
2S6W	1	27	2	S	4	B	13	14	109	G
2S6W	1	27	2	S	4	B	13	11	11	G
2S6W	1	27	2	IC	3	B	2	16	1	
2S6W	1	27	2	IC	3	B	6	16	1	
2S6W	1	27	2	IC	2	B	13	14	37	G
2S6W	1	27	2	IC	2	B	13	13	7	G
2S6W	1	27	2	IC	2	B	11	18	3	
2S6W	1	27	2	IC	3	B	13	14	151	G
2S6W	1	27	2	IC	3	B	13	13	12	G
2S6W	1	27	2	IC	3	B	13	12	38	G
2S6W	1	27	2	IC	3	B	13	11	12	G
2S6W	1	27	2	IC	3	B	17	2	1	
2S6W	1	27	2	IC	2	B	17	16	1	

UNIT	TR	SPS	POS	SPT	DEP	HAB	MAT	TYPE	COUNT	OTHER
2S6W	1	27	2	IC	2	B	3	16	2	
2S6W	1	27	2	IC	3	B	16		2	
2S6W	1	27	2	IC	3	B	13	12	8	G
2S6W	1	27	2	IC	3	B	13	14	35	G
2S6W	1	27	2	IC	3	B	13	13	14	G
2S6W	1	27	2	IC		B	13	12	4	G
2S6W	1	27	2	IC		B	13	11	2	G
2S6W	1	27	2	IC		B	13	14	147	G
2S6W	1	27	3	S	4	B	13	14	77	G
2S6W	1	27	3	S	4	B	13	12	18	G
2S6W	1	27	3	S	4	B	2	5	1	
2S6W	1	27	3	S	4	B		3	1	
2S6W	1	27	3	S	4	B		19	1	
2S6W	1	28	1	S	4	B	13	14	9	G
2S6W	1	28	1	S	4	B	2	16	1	
2S6W	1	28	2	S	3	B	13	14	20	G
2S6W	1	28	2	S	3	B	13	11	8	G
2S6W	1	28	2	S	3	B		10	4	
2S6W	1	28	2	S	3	B	1	5	1	
2S6W	1	28	3	S	4	B	13	14	6	G
2S6W	1	28	4	S	5	B		10	1	
2S6W	1	29	1	S	5	B	13	14	58	G
2S6W	1	29	1	S	5	B	4	16	1	
2S6W	1	29	2	S		B	13	14	62	G
2S6W	1	29	2	S		B	13	13	5	G
2S6W	1	29	2	S		B	13	12	4	G
2S6W	1	29	2	S		B	11	18	2	
2S6W	1	29	3	S		B		10	1	
2S6W	1	29	3	S		B	13	14	3	G
2S6W	1	29	4	S	4	B	16		1	
2S6W	1	30	1	S	4	B	15	17	1	
2S6W	1	30	1	5	5	B	13	14	14	G
2S6W	1	30	1	S	5	B		10	1	
2S6W	1	30	1	S	5	B	5	2	1	
2S6W	1	30	2	S		B	2	1	1	
2S6W	1	30	3	S	4	B	13	14	5	G
2S6W	1	30	4	S	4	B	13	14	6	G
2S6W	1	30	5	S	6	B	2	1	1	
2S6W	1	31	5	S		B	4	16	1	
2S6W	1	32	4	S	4	B	13	14	6	G
2S6W	1	32	4	S	4	B	18		1	GLASS
2S6W	1	32	4	S	4	B	1	2	1	
2S6W	1	32	4	S	3	B	13	20	1	G
2S6W	1	32	4	S	3	B	15	8	1	
2S6W	1	32	4	S	2	B	2	3	1	
2S6W	1	32	4	IC	2	B	2	3	1	
2S6W	1	32	4	IC	4	B	1	1	1	
2S6W	1	33	5	IC	2	B	18		3	PLASTIC
3S0W	1	26	4	S	5	D	1	21	1	
3S0W	1	5	4	S	3	D	11	18	2	

UNIT	TR	SPS	POS	SPT	DEP	HAB	MAT	TYPE	COUNT	OTHER
3S3W	1	13	3	S		A	2	2	1	
3S3W	1	14	3	S		A	6	3	1	
3S3W	1	3	1	S		D	1	1	1	
3S3W	1	3	4	S		D	1	1	1	
3S3W	1	8	2	1C	4	A	13	14	15	2N,G
3S3W	1	8	2	IC	4	A	15	17	1	2N
3S3W	1	8	2	IC	4	A	5	16	1	
3S3W	1	8	2	IC	4	A	1	16	1	
3S3W	1	8	2	IC	4	A	4	16	2	
3S3W	1	8	2	IC	4	A	6	16	1	
3S3W	1	8	2	IC	4	A	13		6	G
3S3W	1	8	4	S		A	13	13	14	G
3S3W	1	8	4	IC		A	17	2	1	4N
3S3W	1	8	4	IC		A	13	14	12	4N,G
3S3W	1	8	4	IC		A	5	1	1	4N
3S3W	1	8	4	IC	3	A	13		7	6E,G
3S3W	1	8	4	IC	4	A	4	1	1	6E
3S3W	1	8	4	IC	3	A	6	16	1	16E
3S3W	1	8	4	IC	3	A	3	16	1	6E
3S3W	1	8	4	IC	2	A	11	18	1	
3S3W	1	8	4	S		A	15	22	2	
3S3W	1	8	4	IC	4	A	11	18	4	
3S3W	1	9	1	S	3	A	4	16	1	
3S3W	1	9	1	S	3	A	11	18	1	

APPENDIX TWO: BLOCK SURVEY CULTURAL MATERIALS

KEY:

UNIT = Survey Unit
TR = Survey Transect #
SPS = Shovel Probe Station
POS = Position
SPT = Shovel Probe Type
- S = Systematic
- IC= Iron Cross

DEP = Depth
- 1 = Surface
- 2 = 1-10 cm
- 3 = 11-20 cm
- 4 = 21-30 cm
- 5 = 31-40 cm
- 6 = 41-50 cm
- 7 = 51-60 cm

HAB = Habitat
- A = Coastal Strip
- B = Tidal Creek
- C = Salt Pond
- D = Oak-Heath
- E = Oak-Sedge
- F = Freshwater

MAT = Raw Material Types
- 1 = Quartzite
- 2 = Variegated Quartz
- 3 = Smokey Quartz
- 4 = Milky Quartz
- 5 = Rose Quartz
- 6 = Rock Crystal Quartz
- 7 = Chert
- 8 = Jasper
- 9 = Granite
- 10 = Volcanic
- 11 = Wood
- 12 = Bone
- 13 = Shell
- 14 = Nut Shell
- 15 = Clay
- 16 = Coal
- 17 = Citrine Quartz
- 18 = Other

TYPE = Artifact Types
- 1 = Primary Flake
- 2 = Secondary Flake
- 3 = Tertiary Flake
- 4 = Shatter
- 5 = Core
- 6 = Projectile Point
- 7 = Scraper
- 8 = Prehistoric Ceramic
- 9 = Ground Stone
- 10 = Fire-Cracked Rock
- 11 = Oyster
- 12 = Whelk
- 13 = Soft Clam
- 14 = Hard Clam
- 15 = Scallop
- 16 = Micro Flake
- 17 = Historic Cer.
- 18 = Charcoal
- 19 = Hammerstone
- 20 = Snail
- 21 = Chopper
- 22 = Kaolin Pipe
- 23 = Brick
- 24 = Knife

OTHER = Comments
- G = Grams
- * = Edge Angle
- SC = Spit Core
- ST = Sand Temper
- SHT= Shell Temper
- SM = Smoothed
- ISB = Interior Scallop Brushed
- INC = Incised
- ESB = Exterior Scallop Brushed
- IB = Int. Brushed
- (a,b,c, or d) = Ceramic Vessels Described In The Text

APPENDIX TWO

Archaeological Manifestations Defined as Low and High Density Scatters Provenienced by Shovel Probe Intervals:

MANIFESTATION	SHOVEL PROBE INTERVAL (TR-SPS)
0N0W 3-3	3-3, 3-8, 3-11, 1-6, 1-7, 5-4, 7-10
0N0W 2-1	2-1, 2-2
0N0W 3-21	3-21, 3-22
0N0W 5-20	5-20
0N0W 7-23	7-23
1N0W 3-25	3-25, 3-26, 3-27
1N0W 3-30	3-30, 3-31, 3-32, 3-33
0N1W 1-18	1-18
0N1W 4-24	4-24
0N1W 5-32	5-32
0N1W 6-14	6-14
0N1W 6-4	6-4, 6-5
1N1W 5A-1	5A-1, 5A-2, 5A-3, 5A-5
1N1W 5N-6	5N-6
1N1W 5N-9	5N-9, 5N-10, 5N-11, 5N-12
1N1W 5N-14	5N-14
1N1W 6-1	6-1, 6-2, 6-3, 6-4, 6-5, 6-6, 6-7
1S0W 2-4	2-4, 3-2, 3-3
2S3E 4-3	4-3
2S3E 7-1	7-1, 7-2, 7-4
2S4W 2-3	2-3, 2-4, 2-7
2S4W 1-4	1-4, 1-5, 1-6, 1-11, 1-14, 1-17, 1-20, 1-21 2-14, 2-18, 2-21, 2-25, 2-29, 2-31, 2-34, 2-35, 2-36, 2-37, 2-38, 2-40, 2-43

Archaeological Manifestations Defined As Isolated Finds:

0N0W 2-5, 0N0W 3-17, 0N0W 7-20, 1N0W 5-26, 1N0W 4-1, 0N1W 1-29, 0N1W 2-3, 1S0W 1-11, 1S0W 1-17, 1S0W 2-17, 1S0W 3-1, 2S1E 2-1, 2S1E 2-11, 2S3E 3-15, 2S3E 4-12, 2S3E 7-12

APPENDIX TWO

UNIT	TR	SPS	POS	SPT	DEP	HAB	MAT	TYPE	COUNT	OTHER
ONOW	1	12		S	2	E	13	15	1	G
ONOW	1	6		S	3	E	4	2	1	
ONOW	1	7		S	2	E	1	1	1	
ONOW	2	1		S	7	B	4	5	1	
ONOW	2	1		S	7	B	1	2	1	
ONOW	2	1		S	7	B	1	1	2	
ONOW	2	2		S	2	B	1	10	1	
ONOW	2	2		S	2	B	9	19	1	
ONOW	2	2		S	2	B	1	5	2	
ONOW	2	2		S	2	B	1	2	1	
ONOW	2	2		S	2	B	1	1	2	
ONOW	2	2		S	2	B	1	4	4	
ONOW	2	2		IC		B	1	10	7	2E
ONOW	2	2		IC		B	1	1	4	2E
ONOW	2	2		IC		B	1	2	4	2E
ONOW	2	2		IC		B	1	3	1	2E
ONOW	2	2		IC		B	1	4	51	2E
ONOW	2	2		IC		B	1	5	2	2E,FC
ONOW	2	2		IC		B	1	10	2	2S,CORE
ONOW	2	3		S	2	B	15	17	7	
ONOW	2	5		S	3	B	1	1	1	
ONOW	3	11		S		E	1	5	1	
ONOW	3	11		S		E	1	19	1	
ONOW	3	11		IC		E	1	1	1	2S
ONOW	3	17		S	3	B	2	16	1	
ONOW	3	17		S	3	B	4	1	1	
ONOW	3	21		S	3	B	1	1	1	
ONOW	3	21		S	3	B	1	5	1	SPENT
ONOW	3	21		IC	3	B	1	1	1	2E
ONOW	3	21		IC	3	B	1	2	9	2E
ONOW	3	21		IC	3	B	1	10	6	2E
ONOW	3	21		IC	3	B	3	2	4	2E
ONOW	3	21		IC	3	B	1	5	1	2E
ONOW	3	21		IC	3	B	1	4	21	2E
ONOW	3	21		IC		B	1	5	1	2N,FC
ONOW	3	21		IC		B	1	4	2	2S2E
ONOW	3	21		IC		B	1	1	1	4E
ONOW	3	21		IC		B	1	1	1	2S2E
ONOW	3	22	1	S	2	B	2	1	1	
ONOW	3	22	2	S	2	B	4	1	1	
ONOW	3	3		S		E	1	19	1	NET SINK?
ONOW	3	3		S		E	2	1	1	
ONOW	3	3		S		E	1	2	1	
ONOW	3	3		S		E	1	1	1	
ONOW	3	8		S		E	1	1	1	
ONOW	3	8		S		E	9	19	1	
ONOW	5	20		IC		B	1	1	1	4N2E
ONOW	5	20		IC		B	4	2	2	4N2E

UNIT	TR	SPS	POS	SPT	DEP	HAB	MAT	TYPE	COUNT	OTHER
0N0W	5	20		IC		B	2	3	1	4N2E
0N0W	5	20		IC		B	4	2	2	14
0N0W	5	20		IC		B	13	13	1	4E,G
0N0W	5	20		IC		B	13	13	1	60,G
0N0W	5	20		IC		B	13	13	470	2E,G
0N0W	5	20		IC		B	13	14	1	2E,G
0N0W	5	20		S	2	B	13	13	162	G
0N0W	5	20		S	2	B	13		1	G
0N0W	5	20		IC		B	13	13	118	4N,G
0N0W	5	4		S	3	E	5	6	1	W.RIVER?
0N0W	7	10		S	3	E	4	6	1	LEVANNA
0N0W	7	20		S	3	B	15	22	1	
0N0W	7	23		S		B	2	1	1	
0N0W	7	23		IC		B	2	6	1	4N6E,W.RIVER
0N0W	7	23		IC		B	1	1	1	4N6E
0N0W	7	23		IC		B	2	2	1	4N6E
0N0W	7	23		IC		B	4	1	1	4N6E
0N0W	7	23		IC	2	B	1	2	1	2N6E
0N0W	7	23		IC	2	B	1	4	3	2N6E
0N0W	7	23		IC	2	B	2	6	1	2N6E,BASE
0N0W	7	23		IC	4	B	1	1	2	2N4E
0N0W	7	23		IC	3	B	2	3	1	2N8E
0N0W	7	23		IC		B	2	16	2	2W
0N0W	7	23		IC		B	4	4	1	8N6E
0N0W	7	23		IC		B	2	3	1	8N6E
0N0W	7	23		IC		B	4	2	1	8N6E
0N0W	7	23		IC		B	2	16	1	2N2E
0N0W	7	23		IC		B	2	16	1	2N4W
0N0W	7	23		IC		B	13	13	1	2N6E,G
0N0W	7	23		IC	4	B	13	14	17	2N4E
0N0W	7	3		S		E	15	17	5	
0N1W	1	18		S		E		10	1	
0N1W	1	18		S		E	17	2	1	
0N1W	1	18		S		E	17	3	1	
0N1W	1	18		S		E	17	7	1	55-60*
0N1W	1	29	1	S	3	B	2	1	1	
0N1W	2	3	1	S	2	B	5	1	1	
0N1W	4	24	3	S		E	5	1	1	
0N1W	4	24	3	S		E	5	2	1	
0N1W	4	24	3	S		E	1	1	2	
0N1W	4	24	3	S		E	1	3	3	
0N1W	4	24	3	S		E	1	2	3	
0N1W	4	24	3	S		E	1	4	17	
0N1W	4	24	3	IC		E	1	3	5	4E
0N1W	4	24	3	IC		E	1	4	7	4E
0N1W	4	24	3	IC		E	1	4	7	2N
0N1W	4	24	3	IC		E	1	2	1	2W
0N1W	4	24	3	IC		E	1	4	10	2E
0N1W	4	24	3	IC		E	1	1	2	2E
0N1W	4	24	3	IC		E	1	2	1	2E

UNIT	TR	SPS	POS	SPT	DEP	HAB	MAT	TYPE	COUNT	OTHER
0N1W	4	24	3	IC		E	1	2	3	2S
0N1W	4	24	3	IC		E	1	5	1	2S
0N1W	5	32		S	2	B	4	7	1	30-35*
0N1W	5	32		IC		B	2	24	1	2N,20-30*
0N1W	5	32		IC	4	B	1	2	1	2N
0N1W	5	32		IC		B		10	1	2N
0N1W	5	32		S	2	B	1	2	1	
0N1W	6	14	4	S	3	E	1	3	9	
0N1W	6	14	4	S	3	E	1	16	21	
0N1W	6	4	4	S	4	E	2	16	1	
0N1W	6	4	4	S	4	E	4	16	1	
0N1W	6	5	4	S	4	E	11	18	1	
0N1W	6	5	4	S	4	E	1	4	1	
0N1W	6	5	4	S	4	E	11	18	1	
1N0W	3	25		S		B	13	14	1	G
1N0W	3	25		S		B	13		1	G
1N0W	3	25	2	S	3	B	2	1	1	
1N0W	3	25	4	S	2	B	1	1	1	
1N0W	3	25	4	IC	4	B	6	2	1	2W
1N0W	3	25	4	IC	4	B	4	3	1	2W
1N0W	3	26		S	2	B	9	7	1	40*
1N0W	3	27		S	5	B	4	1	1	
1N0W	3	30	3	IC		B	4	1	2	2S
1N0W	3	30	3	IC		B	4	2	4	2S
1N0W	3	30	3	IC		B	2	3	4	2S
1N0W	3	30	3	IC		B	2	2	1	2S
1N0W	3	30	3	IC		B	2	7	1	2S,32*
1N0W	3	30	3	IC		B	4	1	1	4E
1N0W	3	30	3	IC		B	1	1	1	4E
1N0W	3	30	3	IC		B	4	1	2	2N
1N0W	3	30	3	IC		B	4	2	2	2N
1N0W	3	30	3	IC		B	4	3	1	2N
1N0W	3	30	3	IC		B	2	24	1	2N,25*
1N0W	3	30	3	IC		B	2	2	1	2N
1N0W	3	30	3	IC		B	2	6	1	2E,LEVANNA
1N0W	3	31		S		B	6	3	1	
1N0W	3	32		S	3	B	13	13	1	G
1N0W	3	32		IC	3	B	13	13	4	2N,G
1N0W	3	32		S	3	B	13	20	1	G
1N0W	3	33		S	3	B	18		1	PLASTIC
1N0W	3	33		S	3	B	4	3	3	
1N0W	3	33		S	3	B	2	2	3	
1N0W	3	33		S	3	B	2	1	1	
1N0W	3	33		S	3	B	9	19	1	
1N0W	3	33		IC	2	B	4	3	1	2E
1N0W	3	33		IC	5	B	18		1	4W,PLASTIC
1N0W	3	33		IC	4	B	18		1	2W,PLASTIC
1N0W	3	33		IC	3	B	2	3	2	2W
1N0W	3	33		IC	3	B	2	2	2	2W
1N0W	3	33		IC	3	B	1	4	5	2W

UNIT	TR	SPS	POS	SPT	DEP	HAB	MAT	TYPE	COUNT	OTHER
1N0W	3	33		IC	3	B	2	6	1	2W,LEVANNA
1N0W	3	33		IC	2	B	13	13	1428	2W,G
1N0W	3	33		S	3	B	13	13	133	G
1N0W	3	33		S		B	13	14	33	G
1N0W	3	33		IC		B	13	14	64	G
1N0W	3	33		IC	3	B	13	14	2	2W,G
1N0W	3	33		IC		B	13	20	3	2E,G
1N0W	3	33		S		B	13	12	1	G
1N0W	3	33		IC		B	13	12	8	G
1N0W	3	33		IC		B	13	12	3	G
1N0W	4	1		S	3	B	6	3	1	
1N0W	5	26		S		B	4	2	1	
1N1W	5A	1		S	2	B	1	1	1	
1N1W	5A	2		S		B	4	3	2	
1N1W	5A	2		S		B	13	13	1	G
1N1W	5A	2		S	3	B	13	13	16	G
1N1W	5A	3		IC		B	1	1	2	2E
1N1W	5A	3		IC		B	1	2	3	2E
1N1W	5A	3		IC	4	B	5	4	13	2W
1N1W	5A	3		IC	4	B		6	1	2W
1N1W	5A	3		IC	6	B	1	2	10	260W
1N1W	5A	3		IC	6	B	1	1	7	260W
1N1W	5A	3		IC	6	B	6	16	1	260W
1N1W	5A	3		IC	2	B	1	4	1	260 3W
1N1W	5A	3		IC	4	B	13	14	5	2W,G
1N1W	5A	5		S		B	13	14	6	G
1N1W	5A	5	2	S	5	B	13	13	131	G
1N1W	5N	10		S		B	13	13	1	
1N1W	5N	10		IC		B	15	8	3	2E,ST,SM
1N1W	5N	10		IC		B	15	8	6	2NW,ST,ISB
1N1W	5N	10		IC		B	4	1	1	2NW
1N1W	5N	10		IC		B	3	4	1	2S
1N1W	5N	10	2	S		B	13	14	5	G
1N1W	5N	10	2	IC		B	13	13	18	2S,G
1N1W	5N	11	3	S	3	B	15	8	2	ST
1N1W	5N	12	4	S	4	B	13	15	7	G
1N1W	5N	12	4	S	4	B	13	11	1	G
1N1W	5N	12	4	S	4	B	13	14	80	G
1N1W	5N	12	4	S	4	B	13	13	34	G
1N1W	5N	12	4	IC	4	B	15	8	8	1E,SHT,SM
1N1W	5N	12	4	IC	2	B	15	8	1	2N,SHT,INC
1N1W	5N	12	4	IC	3	B	15	8	4	1N,SHT,SM
1N1W	5N	12	4	IC	2	B	4	2	1	3N
1N1W	5N	12	4	IC	2	B	6	3	1	3N
1N1W	5N	12	4	IC		B	13	15	2	G
1N1W	5N	12	4	IC		B	13	14	24	3N,G
1N1W	5N	12	4	IC		B	13	13	67	3N,G
1N1W	5N	12	4	IC	3	B	13	13	103	1E,G
1N1W	5N	12	4	IC	3	B	13	12	59	1E,G
1N1W	5N	12	4	IC	3	B	13	14	117	1E,G

UNIT	TR	SPS	POS	SPT	DEP	HAB	MAT	TYPE	COUNT	OTHER
1N1W	5N	12	4	IC	3	B	13	15	1	1E,G
1N1W	5N	12	5	S		B	13	14	16	G
1N1W	5N	12	5	S		B	13	13	767	G
1N1W	5N	12	5	S		B	13	15	14	G
1N1W	5N	12	5	S		B	13	12	29	G
1N1W	5N	14	2	S		B	1	1	1	
1N1W	5N	14	2	S		B	1	4	1	
1N1W	5N	14	6	S		B	1	1	1	
1N1W	5N	14	6	S		B	1	10	2	
1N1W	5N	6	4	S		B	4	1	1	
1N1W	5N	6	4	S		B	2	24	1	20*
1N1W	5N	6	4	S		B	2	3	1	
1N1W	5N	6	4	S		B	2	2	1	
1N1W	5N	6	4	S		B	2	4	3	
1N1W	5N	6	4	S		B	6	16	1	
1N1W	5N	6	4	S		B	2	16	2	
1N1W	5N	6	4	IC		B	4	3	2	2N
1N1W	5N	6	4	IC		B	4	4	5	2N
1N1W	5N	6	4	IC		B	4	2	2	2NW
1N1W	5N	6	4	IC		B	1	2	1	2NW
1N1W	5N	6	4	IC		B	4	1	1	1N
1N1W	5N	6	4	IC		B	4	24	1	1N,25*
1N1W	5N	6	4	IC		B	4	4	3	1N
1N1W	5N	6	4	IC		B	1	1	1	1W
1N1W	5N	6	4	IC		B	4	3	3	1W
1N1W	5N	6	4	IC		B	4	2	1	1W
1N1W	5N	6	4	IC		B	4	4	1	1W
1N1W	5N	6	4	IC		B	4	16	1	1W
1N1W	5N	9	2	S	3	B	1	2	1	
1N1W	6			S		B		5	1	
1N1W	6	1	2	S		B	11	18	1	
1N1W	6	1	4	S	3	B	11	18	5	
1N1W	6	1	4	S	3	B	6	16	1	
1N1W	6	1	4	S	3	B	13	15	43	G
1N1W	6	1	4	S	3	B	13	20	11	G
1N1W	6	2	2	S		B	4	3	3	
1N1W	6	2	4	S		B	13	14	17	G
1N1W	6	3	5	IC	3	B	1	2	2	20W
1N1W	6	3	5	IC	3	B	13	13	4	20W,G
1N1W	6	3	5	IC	3	B	1	3	1	16S20W
1N1W	6	3	5	IC		B	13	14	10	30W,G
1N1W	6	3	5	IC		B	2	2	1	4S
1N1W	6	3	5	IC		B	4	16	2	4S
1N1W	6	3	5	S	4	B	13	14	12	G
1N1W	6	3	5	IC	4	B	2	16	2	
1N1W	6	3	5	IC	5	B	13	13	19	G
1N1W	6	3	5	S	5	B	17	16	1	
1N1W	6	3	5	S	5	B	4	16	2	
1N1W	6	3	5	S	5	B	2	16	1	
1N1W	6	3	5	IC	3	B	13	14	10	G

UNIT	TR	SPS	POS	SPT	DEP	HAB	MAT	TYPE	COUNT	OTHER
1N1W	6	3	5	IC	3	B	2	16	3	
1N1W	6	3	5	IC	5	B	17	2	1	
1N1W	6	3	5	IC		B	2	2	1	8W
1N1W	6	3	5	IC		B	6	16	1	8W
1N1W	6	3	5	IC		B	13	14	12	8W,G
1N1W	6	3	5	IC	3	B	15	8	3	8W
1N1W	6	3	5	S	3	B	13	13	8	G
1N1W	6	3	5	S	3	B	1	16	1	
1N1W	6	3	5	S	3	B	4	16	1	
1N1W	6	3	5	IC		B	2	7	1	6S,RETOUCH
1N1W	6	3	5	IC		B	2	3	1	6S
1N1W	6	3	5	S		B	13	14	7	G
1N1W	6	3	5	IC	5	B	4	16	1	
1N1W	6	3	5	S	4	B	13	14	23	G
1N1W	6	3	5	IC		B	2	2	1	12S
1N1W	6	3	5	IC		B	13	12	29	12S,G
1N1W	6	3	5	IC		B	13	11	22	12S,G
1N1W	6	3	5	IC		B	13	14	17	12S,G
1N1W	6	3	5	IC		B	13	13	60	G
1N1W	6	4	5	IC	3	B	13	14	5	4W,G
1N1W	6	4	5	IC	3	B	1	3	1	4W
1N1W	6	5	4	S	3	B	1	2	1	UTILIZED
1N1W	6	5	4	S	3	B	7	2	1	
1N1W	6	5	4	S	3	B	13	14	11	G
1N1W	6	5	5	S	3	B	13	11	10	G
1N1W	6	5	5	S	3	B	13	12	19	G
1N1W	6	5	5	S	3	B	13	13	33	G
1N1W	6	5	5	S	3	B	13	14	103	G
1N1W	6	5	5	IC		B	13	12	9	16S8W,G
1N1W	6	5	5	IC	4	B	1	1	1	4W
1N1W	6	5	5	IC	4	B	1	3	1	4W
1N1W	6	5	5	IC		B	13	14	45	4W,G
1N1W	6	5	5	IC	3	B	1	3	1	16S16W
1N1W	6	5	7	IC		B	15	8	1	42W
1N1W	6	6	4	S	4	B	13	13	5	G
1N1W	6	6	4	S	4	B	13	14	20	G
1N1W	6	6	4	S	4	B	15	8	2	
1N1W	6	7	5	S		B	13	12	32	G
1N1W	6	7	5	S		B	13	14	23	G
1N1W	6	7	5	S		B	2	3	2	
1N1W	6	7	5	S		B	13	14	4	G
1SOW	1	11	5	S		E	4	1	1	
1SOW	1	17	4	S	4	E	2	2	1	
1SOW	2	17		S	3	E	4	6	1	LEVANNA?
1SOW	2	4	5	S	2	E	15	8	3	ST,SM
1SOW	2	4	5	IC	3	E	15	8	3	ST,SM
1SOW	2	4	5	IC	3	E	4	1	1	
1SOW	2	4	5	IC	3	E	4	3	1	
1SOW	3	1	6	S	4	E	13	14	6	G
1SOW	3	2		S	3	E	4	2	1	

UNIT	TR	SPS	POS	SPT	DEP	HAB	MAT	TYPE	COUNT	OTHER
1S0W	3	3		S		E	4	1	5	
1S0W	3	3		S		E	4	2	1	
1S0W	3	3		S		E	4	3	1	
1S0W	3	3		S		E	4	4	2	
1S0W	3	3		S		E	1	19	1	FC
2N3E	2	9	1	S	5	C	4	3	1	
2S1E	1	1		S	2	D	15	17	1	
2S1E	2	1		S	1	D	2	3	1	
2S1E	2	11		S	3	D	1	1	1	
2S3E	3	15		S	4	F	4	4	1	
2S3E	3	15		S	4	F	1	10	1	
2S3E	4	12		S	4	F	1	1	1	
2S3E	4	12		S	4	F		10	1	
2S3E	4	12		S	4	F	4	2	1	
2S3E	4	3		S	3	F	4	1	1	
2S3E	4	3		S	3	F	4	2	2	
2S3E	4	3		S	3	F	4	3	2	
2S3E	4	3		IC	3	F	4	3	1	4W
2S3E	4	3		IC	3	F	4	2	3	4W
2S3E	4	3		IC	3	F	1	3	4	2W
2S3E	4	3		IC	3	F	1	4	3	2W
2S3E	4	3		IC	4	F	1	3	2	6W
2S3E	4	3		IC	4	F	1	4	1	6W
2S3E	4	3		IC	3	F	2	2	1	8W
2S3E	4	3		IC	3	F	4	3	1	8W
2S3E	4	3		IC	3	F	2	3	1	10W
2S3E	4	3		IC	4	F	4	2	1	2E
2S3E	4	3		IC	4	F	2	16	1	2E
2S3E	4	3		IC		F	4	3	1	2S
2S3E	4	3	3	IC	7	F	13	14	1	2E,G
2S3E	7	1		S		F	1	3	1	
2S3E	7	12		S	4	F	1	4	7	
2S3E	7	2		S		F	5	2	1	
2S3E	7	2		IC	3	F	1	3	3	2S
2S3E	7	2		IC	3	F	1	2	1	2S
2S3E	7	2		IC		F	1	4	3	2E
2S3E	7	4		S	3	F	1	1	2	
2S3E	7	4		S	3	F	1	2	1	
2S3E	7	4		S	3	F	1	3	1	
2S4W	1	10		S	1	D	15	17	1	
2S4W	1	10		S	2	D	13	12	4	G
2S4W	1	11		S	2	D	2	1	1	
2S4W	1	11		S	2	D	4	4	1	
2S4W	1	11		S	2	D	15	17	2	
2S4W	1	12		S		D	15	17	1	
2S4W	1	14		S		D	1	1	1	
2S4W	1	15		S	5	D	15	17	2	
2S4W	1	16		S	3	D	15	17	1	
2S4W	1	17		S		D	13		1	G
2S4W	1	20		S	4	D	14	4	1	

UNIT	TR	SPS	POS	SPT	DEP	HAB	MAT	TYPE	COUNT	OTHER
2S4W	1	21		S		D	13	13	1	G
2S4W	1	23		5		D	15	17	1	
2S4W	1	24		S	3	D	15	17	1	
2S4W	1	3		S	3	D	15	17	1	
2S4W	1	4		S	4	D	4	3	1	
2S4W	1	4		S	4	D	4	6	1	BASE
2S4W	1	4		S	4	D	15	17	2	
2S4W	1	4		S	4	D	13	14	1	G
2S4W	1	5		S	4	D	4	2	2	
2S4W	1	5		S	4	D	13	14	8	G
2S4W	1	6		S		D	15	17	1	
2S4W	1	6	4	S		D	13	11	30	G
2S4W	1	9		S		D	15	17	2	
2S4W	2	11		S	2	D	13	14	3	G
2S4W	2	11	3	S	5	D	15	17	1	
2S4W	2	14		S		D		23	1	
2S4W	2	14	3	S	3	D	4	1	1	
2S4W	2	14	3	S	3	D	15	17	1	
2S4W	2	14	3	S	4	D	15	17	1	
2S4W	2	16		S		D	15	17	1	
2S4W	2	17		S	3	D	15	17	2	
2S4W	2	18		S		D	4	4	1	
2S4W	2	2	1	S	3	D	15	17	2	
2S4W	2	2	3	S	6	D	15	17	1	
2S4W	2	20	1	S	4	D	15	17	1	
2S4W	2	20	2	S	3	D	15	17	1	
2S4W	2	20	3	S	4	D	15	17	1	
2S4W	2	21	1	S	4	D	4	4	1	
2S4W	2	23	2	S	3	D	15	17	1	
2S4W	2	25	1	S	3	D	15	17	1	
2S4W	2	25	1	S	3	D	8	21	1	CORE,60*
2S4W	2	28		S	2	D	15	17	1	
2S4W	2	29		S		D	4	2	1	
2S4W	2	29	2	S	4	D	15	17	2	
2S4W	2	3	2	S	5	D	15	17	1	
2S4W	2	3	2	S	4	D	4	4	1	
2S4W	2	31		S		D	2	1	2	
2S4W	2	31		S		D	2	3	1	
2S4W	2	32		S		D	15	17	1	
2S4W	2	33		S	4	D	15	17	1	
2S4W	2	34		S		D	15	17	1	
2S4W	2	34	3	S	6	D	4	1	1	
2S4W	2	35		S		D	4	3	1	
2S4W	2	36	4	S	3	D	4	3	1	
2S4W	2	37		S	3	D	2	2	1	
2S4W	2	37	2	S	4	D	15	17	1	
2S4W	2	38		S		D	13	11	28	G
2S4W	2	4		S	3	D	15	17	1	
2S4W	2	4	1	S	4	D	4	1	1	
2S4W	2	40		S	3	D	2	6	1	LEVANNA

UNIT	TR	SPS	POS	SPT	DEP	HAB	MAT	TYPE	COUNT	OTHER
2S4W	2	42		S	3	D	15	17	1	
2S4W	2	43		S		D	4	1	1	
2S4W	2	43		S		D	4	6	1	
2S4W	2	43	3	S	4	D	6	3	1	
2S4W	2	43	3	S	4	D	2	1	1	
2S4W	2	43	3	S	2	D	2	4	1	
2S4W	2	43	4	S	4	D	4	6	1	W.RIVER
2S4W	2	7	1	S	4	D	15	17	1	
2S4W	2	7	2	S	2	D	6	3	1	
2S4W	2	8		S		D	15	17	2	

APPENDIX THREE: CULTURAL MATERIALS FROM EXCAVATED SCATTERS

KEY:

SCATTER = Scatter Designation
EUNIT = Excavation Unit
LEVEL = Level #
DEPTH = Depth Below Unit Datum
MAT = Raw Material Types

1 = Quartzite	2 = Variegated Quartz
3 = Smokey Quartz	4 = Milky Quartz
5 = Rose Quartz	6 = Rock Crystal Quartz
7 = Chert	8 = Jasper
9 = Granite	10 = Volcanic
11 = Wood	12 = Bone
13 = Shell	14 = Nut Shell
15 = Clay	16 = Coal
17 = Citrine Quartz	18 = Other

TYPE = Artifact Types

1 = Primary Flake	2 = Secondary Flake
3 = Tertiary Flake	4 = Shatter
5 = Core	6 = Projectile Point
7 = Scraper	8 = Prehistoric Ceramic
9 = Ground Stone	10 = Fire-Cracked Rock
11 = Oyster	12 = Whelk
13 = Soft Clam	14 = Hard Clam
15 = Scallop	16 = Micro Flake
17 = Historic Ceramic	18 = Charcoal
19 = Hammerstone	20 = Snail
21 = Chopper	22 = Kaolin Pipe
23 = Brick	24 = Knife

OTHER = Comments

G = Grams * = Edge Angle SC = Split Core
ST = Sand Temper SHT= Shell Temper SM = Smoothed
ISB= Interior Scallop Brushed INC = Incised
ESB= Exterior Scallop Brushed IB = Int. Brushed
(a,b,c, or d) = Ceramic Vessels Described In The Text

APPENDIX THREE

SCATTER	EUNIT	LEVEL	DEPTH	MAT	TYPE	COUNT	OTHER
ONOW 2-1	ON1W	3	10-15	1	1	1	
ONOW 2-1	ON1W	3	10-15	1	10	1	415 G
ONOW 2-1	ON1W	4	15-20	1	1	1	
ONOW 2-1	ON1W	4	15-20	1	4	2	
ONOW 2-1	ON1W	4	15-20	1	10	4	1039 G
ONOW 2-1	1S1W	4	15-20	1	10	4	1749 G
ONOW 2-1	1S1W	4	15-20	1	1	1	
ONOW 2-1	1S1W	4	15-20	1	4	2	
ONOW 2-1	1S1W	5	20-25	1	10	5	2168 G
ONOW 2-1	1S1W	5	20-25	1	5	1	
ONOW 2-1	2N1E	3	10-15	1	1	4	
ONOW 2-1	2N1E	3	10-15	1	2	3	
ONOW 2-1	2N1E	3	10-15	1	4	12	
ONOW 2-1	2N1E	3	10-15	5	16	1	
ONOW 2-1	2N1E	4	15-20	1	10	1	135 G
ONOW 2-1	2N1E	4	15-20	1	1	1	
ONOW 2-1	2N1E	4	15-20	1	4	5	
ONOW 2-1	2N1E	5	20-25	1	10	11	1664 G
ONOW 2-1	2N1E	5	20-25	1	3	2	
ONOW 2-1	2N1E	5	20-25	1	4	15	
ONOW 2-1	2N1E	5	20-25	1	2	2	
ONOW 2-1	2N1E	5	20-25	1	1	2	
ONOW 2-1	2N1E	6	25-30	4	5	1	
ONOW 2-1	2N1E	7	30-35	1	1	1	
ONOW 2-1	2N1E	7	30-35	1	4	1	
ONOW 3-21	1N0E	3	10-15	4	3	1	
ONOW 3-21	1N0E	4	15-20	4	1	1	
ONOW 3-21	1N0E	4	15-20	3	7	1	35*
ONOW 3-21	1N0E	4	15-20	1	2	1	
ONOW 3-21	1N0E	4	15-20	4	4	4	
ONOW 3-21	1N0E	4	15-20	2	3	1	
ONOW 3-21	1N0E	4	15-20	2	4	2	
ONOW 3-21	1N0E	4	15-20	1	1	1	
ONOW 3-21	1N0E	4	15-20	1	4	2	
ONOW 3-21	1N0E	4	15-20	7	2	1	
ONOW 3-21	1N0E	5	20-25	15	8	1	ST,ISB
ONOW 3-21	1N0E	5	20-25	6	2	1	
ONOW 3-21	1N0E	5	20-25	6	4	1	
ONOW 3-21	1N0E	5	20-25	6	3	1	
ONOW 3-21	1N0E	5	20-25	4	2	1	
ONOW 3-21	1N0E	5	20-25	4	3	1	
ONOW 3-21	1N0E	5	20-25	1	4	1	
ONOW 3-21	1N0E	5	20-25	1	3	1	
ONOW 3-21	1N0E	5	20-25	1	1	1	
ONOW 3-21	1S3W	4	15-20	2	1	1	
ONOW 5-20	38	4	15-20	4	3	1	
ONOW 5-20	38	4	15-20	2	2	1	
ONOW 5-20	38	4	15-20	15	8	2	ST,ISB,(b2)

SCATTER	EUNIT	LEVEL	DEPTH	MAT	TYPE	COUNT	OTHER
ONOW 5-20	38	4	15-20	15	8	2	ST,SM,(a2)
ONOW 5-20	38	4	15-20	1	19	2	
ONOW 5-20	38	5	20-25	3	3	1	
ONOW 5-20	38	7	30-35	5	1	1	
ONOW 5-20	38	7	30-35	9	3	1	
ONOW 5-20	38	7	30-35	4	3	1	
ONOW 5-20	38	7	30-35	2	3	1	
ONOW 5-20	38	8	35-40	9	3	1	
ONOW 5-20	38	8	35-40	4	2	1	
ONOW 5-20	38	8	35-40	4	3	1	
ONOW 5-20	39	2	1-6	2	3	1	
ONOW 5-20	39	2	1-6	3	1	1	
ONOW 5-20	39	2	1-6	4	3	1	
ONOW 5-20	39	2	1-6	2	1	1	
ONOW 5-20	39	3	6-10	4	2	1	
ONOW 5-20	39	3	6-10	2	1	1	
ONOW 5-20	39	3	6-10	2	2	1	
ONOW 5-20	39	3	6-10	2	3	1	
ONOW 5-20	39	3	6-10	3	1	1	
ONOW 5-20	39	3	6-10	6	24	1	25*
ONOW 5-20	39	4	10-17	4	2	1	
ONOW 5-20	39	4	10-17	2	2	2	
ONOW 5-20	39	4	10-17	2	3	1	
ONOW 5-20	39	4	10-17	3	1	1	
ONOW 5-20	39	4	10-17	3	2	1	
ONOW 5-20	39	4	10-17	1	3	1	
ONOW 5-20	39	5	17-22	4	1	3	
ONOW 5-20	39	5	17-22	4	3	1	
ONOW 5-20	39	5	17-22	2	2	2	
ONOW 5-20	39	5	17-22	6	3	1	
ONOW 5-20	39	5	17-22	3	1	1	
ONOW 5-20	39	5	17-22	15	8	2	ST,SM,(a1)
ONOW 5-20	42	1	0-5	4	1	1	
ONOW 5-20	42	1	0-5	4	3	1	
ONOW 5-20	42	1	0-5	4	4	5	
ONOW 5-20	42	2	5-10	4	1	2	
ONOW 5-20	42	2	5-20	4	2	7	
ONOW 5-20	42	2	5-10	3	2	1	
ONOW 5-20	42	2	5-10	1	2	1	
ONOW 5-20	42	2	5-10	4	4	7	
ONOW 5-20	42	3	10-15	4	1	1	
ONOW 5-20	42	3	10-15	4	2	1	
ONOW 5-20	42	3	10-15	4	3	3	
ONOW 5-20	42	3	10-15	2	1	1	
ONOW 5-20	42	3	10-15	1	3	2	
ONOW 5-20	42	3	10-15	4	19	1	
ONOW 5-20	42	5	20-30	4	1	1	
ONOW 5-20	42	5	20-30	4	19	1	
ONOW 5-20	42	6	30-40	4	1	1	
ONOW 5-20	42	6	30-40	4	5	1	

SCATTER	EUNIT	LEVEL	DEPTH	MAT	TYPE	COUNT	OTHER
ONOW 5-20	57	1	0-5	3	1	1	
ONOW 5-20	57	1	0-5	1	1	1	
ONOW 5-20	57	1	0-5	1	24	1	20*
ONOW 5-20	57	2	5-10	2	1	1	
ONOW 5-20	57	2	5-10	2	3	3	
ONOW 5-20	57	2	5-10	1	2	4	
ONOW 5-20	57	2	5-10	1	3	5	
ONOW 5-20	57	3	10-15	2	1	1	
ONOW 5-20	57	3	10-15	2	2	1	
ONOW 5-20	57	3	10-15	2	3	1	
ONOW 5-20	57	3	10-15	15	8	7	ST,SM,(a1)
ONOW 5-20	57	4	15-20	4	1	1	
ONOW 5-20	57	4	15-20	1	1	1	
ONOW 5-20	57	4	15-20	15	8	22	ST,SM,(a1)
ONOW 5-20	58	2	5-10	4	5	1	
ONOW 5-20	58	3	10-15	4	1	1	
ONOW 5-20	58	3	10-15	4	3	1	
ONOW 5-20	58	3	10-15	2	1	1	
ONOW 5-20	58	3	10-15	2	3	2	
ONOW 5-20	58	3	10-15	6	3	1	
ONOW 5-20	58	3	10-15	1	1	1	
ONOW 5-20	58	3	10-15	15	8	1	ST,ISB,(b1)
ONOW 5-20	58	3	10-15	1	24	1	29*
ONOW 5-20	58	3	10-15	1	5	2	CONJOINS U 38, L 7
ONOW 5-20	58	4	15-20	4	2	3	
ONOW 5-20	58	4	15-20	4	3	1	
ONOW 5-20	58	4	15-20	3	1	1	
ONOW 5-20	58	4	15-20	1	2	2	
ONOW 5-20	58	4	15-20	15	8	2	ST,ISB,(b2)
ONOW 5-20	58	4	15-20	4	24	1	*20
ONOW 5-20	58	4	15-20	4	4	3	
ONOW 5-20	58	5	20-25	4	3	1	
ONOW 5-20	58	5	20-25	1	2	1	
ONOW 5-20	73	4	15-20	4	2	1	
ONOW 5-20	73	4	15-20	4	4	2	
ONOW 5-20	73	4	15-20	4	6	1	LEVANNA BASE
ONOW 5-20	73	5	20-25	4	1	1	
ONOW 5-20	73	5	20-25	4	2	2	
ONOW 5-20	73	5	20-25	3	1	1	
ONOW 5-20	73	5	20-25	3	2	1	
ONOW 5-20	73	5	20-25	17	2	1	
ONOW 5-20	73	5	20-25	4	5	1	
ONOW 5-20	73	5	20-25	14		1	HICKORY NUT
ONOW 5-20	73	6	25-30	4	1	1	
ONOW 5-20	73	6	25-30	4	3	1	
ONOW 5-20	73	6	25-30	3	1	1	
ONOW 5-20	73	6	25-30	4	6	1	LEVANNA,BROKEN
ONOW 5-20	73	7	30-35	4	24	1	20*
ONOW 5-20	81	3	10-15	5	1	1	

SCATTER	EUNIT	LEVEL	DEPTH	MAT	TYPE	COUNT	OTHER
0N0W 5-20	81	4	15-20	4	1	1	
0N0W 5-20	81	4	15-20	4	2	1	
0N0W 5-20	81	4	15-20	9	19	1	
0N0W 5-20	81	5	20-25	4	1	1	
0N0W 5-20	81	5	20-25	4	3	1	
0N0W 5-20	81	5	20-25	9	19	1	
0N0W 5-20	97	1	0-5	4	3	3	
0N0W 5-20	97	1	0-5	1	2	1	
0N0W 5-20	97	1	0-5	15	8	2	ST,SM,(al)
0N0W 5-20	97	1	0-5	15	7	8	HISTORIC,(d)
0N0W 5-20	97	2	5-10	4	1	1	
0N0W 5-20	97	2	5-10	4	2	1	
0N0W 5-20	97	2	5-10	6	3	2	
0N0W 5-20	97	2	5-10	1	1	1	
0N0W 5-20	97	2	5-10	15	8	5	ST,SM,(al)
0N0W 5-20	97	2	5-10	15	8	1	SHT,SM,(c)
0N0W 5-20	97	3	10-15	5	1	1	
0N0W 5-20	97	3	10-15	4	1	1	
0N0W 5-20	97	3	10-15	15	8	20	ST,SM,(al)
0N0W 5-20	97	4	15-20	5	2	2	
0N0W 5-20	97	4	15-20	1	1	1	
0N0W 5-20	97	4	15-20	15	8	3	ST,ISB,(bl)
0N0W 5-20	97	5	20-30	15	8	1	ST,SM,(al)
0N0W 5-20	99	1	0-8	2	1	1	
0N0W 5-20	99	2	8-10	4	1	1	
0N0W 5-20	99	2	8-10	2	3	3	
0N0W 5-20	99	2	8-10	3	1	3	
0N0W 5-20	99	2	8-10	3	2	1	
0N0W 5-20	99	2	8-10	3	3	1	
0N0W 5-20	99	2	8-10	1	1	1	
0N0W 5-20	99	3	10-15	4	3	2	
0N0W 5-20	99	3	10-15	2	3	1	
0N0W 5-20	99	3	10-15	3	1	1	
0N0W 5-20	99	3	10-15	3	3	1	
0N0W 5-20	99	3	10-15	1	1	2	
0N0W 5-20	99	3	10-15	14		1	HICKORY NUT
0N1W 1-18	1S2E	1	0-5	4	16	1	
0N1W 1-18	1S2E	1	0-5	4	4	1	
0N1W 1-18	1S2E	1	0-5	17	2	1	
0N1W 1-18	1S2E	1	0-5	2	3	1	
0N1W 1-18	1S2E	1	0-5	17	3	2	
0N1W 1-18	1S2E	1	0-5	2	4	1	
0N1W 1-18	1S2E	2	5-10	4	1	1	
0N1W 1-18	1S2E	2	5-10	4	2	1	
0N1W 1-18	1S2E	2	5-10	2	3	1	
0N1W 1-18	1S2E	2	5-10	1	10	9	141 G
0N1W 1-18	1S2E	3	10-15	1	1	1	
0N1W 1-18	1S2E	3	10-15	2	2	2	
0N1W 1-18	1S2E	3	10-15	1	2	1	
0N1W 1-18	1S2E	3	10-15	1	4	3	

SCATTER	EUNIT	LEVEL	DEPTH	MAT	TYPE	COUNT	OTHER
0N1W 1-18	1S2E	3	10-15	1	5	1	
0N1W 1-18	1S2E	4	15-20	2	1	2	
0N1W 1-18	1S2E	4	15-20	2	16	1	
0N1W 1-18	1S2E	4	15-20	2	2	1	
0N1W 1-18	1S2E	4	15-20	5	2	1	
0N1W 1-18	1S2E	4	15-20	1	2	1	
0N1W 1-18	1S2E	4	15-20	1	3	1	
0N1W 1-18	1S2E	5	20-25	4	2	1	
0N1W 1-18	1S2E	5	20-25	2	2	1	
0N1W 1-18	1S2E	5	20-25	4	16	2	
0N1W 1-18	1S2E	5	20-25	2	3	1	
0N1W 1-18	1S2E	5	20-25	1	3	1	
0N1W 1-18	1S2E	5	20-25	2	4	1	
0N1W 1-18	1S2E	5	20-25	2	16	1	
0N1W 1-18	1S2E	6	25-30	2	2	5	
0N1W 1-18	1S2E	6	25-30	2	3	5	
0N1W 1-18	2S0E	2	5-0	2	2	4	
0N1W 1-18	2S0E	2	5-0	2	3	3	
0N1W 1-18	2S0E	2	5-0	2	16	1	
0N1W 1-18	2S0E	2	5-0	2	10	5	429 G
0N1W 1-18	2S0E	3	0-5	2	24	1	29*
0N1W 1-18	2S0E	3	0-5	2	2	3	
0N1W 1-18	2S0E	3	0-5	2	3	2	
0N1W 1-18	2S0E	3	0-5	4	10	1	73 G
0N1W 1-18	2S0E	4	5-10	4	16	1	
0N1W 1-18	2S0E	4	5-10	4	10	2	67 G
0N1W 1-18	2S0E	4	5-10	2	10	1	3 G
0N1W 1-18	2S0E	5	10-15	1	1	1	
0N1W 1-18	2S0E	5	10-15	6	2	1	
0N1W 1-18	2S0E	5	10-15	2	2	6	
0N1W 1-18	2S0E	5	10-15	2	3	6	
0N1W 1-18	2S0E	5	10-15	2	4	2	
0N1W 1-18	2S0E	5	10-15	2	24	1	29*
0N1W 1-18	2S0E	5	10-15	17	10	1	9 G
0N1W 1-18	2S0E	7	20-25	2	2	1	
0N1W 1-18	2S0E	7	20-25	2	3	1	
0N1W 1-18	2S0E	7	20-25	4	3	1	
0N1W 1-18	2S0E	7	20-25	4	4	1	
0N1W 1-18	2S0E	8	25-30	4	2	1	
0N1W 1-18	2S0E	8	25-30	3	2	1	
0N1W 1-18	2S0E	8	25-30	4	4	1	
0N1W 1-18	2S0E	8	25-30	2	4	1	
0N1W 1-18	2S0E	9	30-35	2	1	1	
0N1W 1-18	2S0E	9	30-35	2	2	2	
0N1W 1-18	2S0E	9	30-35	2	3	1	
0N1W 1-18	2S0E	10	35-40	2	16	1	
0N1W 1-18	2S0E	10	35-40	2	2	1	
0N1W 1-18	2S0E	10	35-40	4	3	1	
0N1W 1-18	2S0E	10	35-40	2	3	1	
0N1W 1-18	2S0E	10	35-40	4	16	1	

SCATTER	EUNIT	LEVEL	DEPTH	MAT	TYPE	COUNT	OTHER
ON1W 1-18	2S0E	11	40-45	2	7	1	35*
ON1W 1-18	2S3E	1	0-5	2	16	1	
ON1W 1-18	2S3E	1	0-5	2	3	1	
ON1W 1-18	2S3E	1	0-5	4	3	1	
ON1W 1-18	2S3E	2	5-10	4	1	2	
ON1W 1-18	2S3E	2	5-10	4	16	1	
ON1W 1-18	2S3E	2	5-10	17	2	1	
ON1W 1-18	2S3E	2	5-10	1	2	1	
ON1W 1-18	2S3E	2	5-10	2	3	2	
ON1W 1-18	2S3E	2	5-10	17	3	1	
ON1W 1-18	2S3E	2	5-10		5	1	
ON1W 1-18	2S3E	3	10-15	4	16	1	
ON1W 1-18	2S3E	3	10-15	17	16	1	
ON1W 1-18	2S3E	3	10-15	17	7	1	55*
ON1W 1-18	2S3E	4	15-20	17	2	1	
ON1W 1-18	2S3E	5	20-25	4	4	4	
ON1W 1-18	2S3E	5	20-25	2	16	1	
ON1W 1-18	2S3E	5	20-25	2	4	2	
ON1W 1-18	2S3E	5	20-25	5	4	1	
ON1W 1-18	2S3E	5	20-25	2	10	1	1 G
ON1W 1-18	2S3E	5	20-25	17	10	2	17 G
ON1W 1-18	2S3E	6	25-30	4	16	3	
ON1W 1-18	2S3E	6	25-30	4	10	1	2 G
ON1W 1-18	2S3E	7	30-35	2	2	1	
ON1W 1-18	2S3E	7	30-35	5	16	1	
ON1W 1-18	2S3E	7	30-35	2	16	1	
ON1W 1-18	2S3E	7	30-35	4	4	1	
ON1W 1-18	2S3E	7	30-35	2	4	1	
ON1W 1-18	2S3E	8	35-40	4	4	3	
ON1W 1-18	2S3E	9	40-45	4	1	1	
ON1W 1-18	2S3E	9	40-45	2	1	1	
ON1W 1-18	2S3E	9	40-45	2	16	2	
ON1W 1-18	2S3E	9	40-45	2	4	1	
ON1W 1-18	2S3E	9	40-45	4	10	2	6 G
ON1W 1-18	2S3E	10	45-50	4	1	1	
ON1W 1-18	2S3E	10	45-50	2	2	1	
ON1W 1-18	2S3E	10	45-50	4	16	2	
ON1W 1-18	2S3E	10	45-50	4	4	2	
ON1W 1-18	2S3E	10	45-50	2	16	5	
ON1W 1-18	2S3E	10	45-50	2	4	5	
ON1W 1-18	2S3E	11	50-55	2	16	1	
ON1W 1-18	2S3E	11	50-55	2	2	2	
ON1W 1-18	2S3E	11	50-55	4	3	1	
ON1W 1-18	2S3E	11	50-55	2	3	1	
ON1W 1-18	2S3E	11	50-55	2	4	1	
ON1W 1-18	2S3E	12	55-60	4	3	1	
ON1W 1-18	2S3E	12	55-60	2	3	1	
ON1W 1-18	2S3E	13	60-65	2	2	1	
ON1W 1-18	2S3E	13	60-65	4	3	1	
ON1W 1-18	2S3E	14	65-70	2	10	1	80 G

SCATTER	EUNIT	LEVEL	DEPTH	MAT	TYPE	COUNT	OTHER
0N1W 1-18	3S0E	1	10-5	5	2	2	
0N1W 1-18	3S0E	1	10-5	4	10	2	98 G
0N1W 1-18	3S0E	1	10-5	1	19	1	
0N1W 1-18	3S0E	2	5-0	2	2	2	
0N1W 1-18	3S0E	2	5-0	2	3	1	
0N1W 1-18	3S0E	2	5-0	2	4	1	
0N1W 1-18	3S0E	2	5-0	1	10	5	50 G
0N1W 1-18	3S0E	3	0-5	2	2	1	
0N1W 1-18	3S0E	3	0-5	1	19	1	
0N1W 1-18	3S0E	3	0-5	1	10	1	799 G
0N1W 1-18	3S0E	4	5-10	2	2	4	
0N1W 1-18	3S0E	4	5-10	2	3	2	
0N1W 1-18	3S0E	4	5-10	17	3	1	
0N1W 1-18	3S0E	4	5-10	5	4	1	
0N1W 1-18	3S0E	5	10-15	2	7	2	35*,2 SC
0N1W 1-18	3S0E	5	10-15	1	2	1	
0N1W 1-18	3S0E	5	10-15	2	4	3	
0N1W 1-18	3S0E	6	15-20	2	1	1	
0N1W 1-18	3S0E	6	15-20	2	2	2	1 SC
0N1W 1-18	3S0E	6	15-20	2	3	1	
0N1W 1-18	3S0E	6	15-20	2	4	1	
0N1W 1-18	3S0E	7	20-25	2	7	1	50*
0N1W 1-18	3S0E	7	20-25	3	1	2	2SC
0N1W 1-18	3S0E	7	20-25	1	1	1	
0N1W 1-18	3S0E	7	20-25	1	7	1	40*
0N1W 1-18	3S0E	7	20-25	1	3	1	
0N1W 1-18	3S0E	9	30-35	2	1	3	2SC
0N1W 1-18	3S0E	9	30-35	1	1	1	
0N1W 1-18	3S0E	9	30-35	2	2	1	
0N1W 1-18	3S0E	9	30-35	3	2	1	
0N1W 1-18	3S0E	9	30-35	2	4	8	
0N1W 1-18	3S0E	10	35-40	1	2	1	
0N1W 1-18	3S0E	10	35-40	1	3	1	
0N1W 1-18	3S0E	10	35-40	2	16	1	
0N1W 1-18	3S0E	10	35-40	4	16	1	
0N1W 1-18	4S0E	1	20-15	2	1	2	
0N1W 1-18	4S0E	1	20-15	2	16	3	
0N1W 1-18	4S0E	1	20-15	4	1	1	
0N1W 1-18	4S0E	1	20-15	4	2	2	
0N1W 1-18	4S0E	1	20-15	2	2	1	
0N1W 1-18	4S0E	1	20-15	4	16	1	
0N1W 1-18	4S0E	1	20-15	2	3	1	
0N1W 1-18	4S0E	1	20-15	2	4	6	
0N1W 1-18	4S0E	1	20-15	3	4	1	
0N1W 1-18	4S0E	1	20-15	4	4	4	
0N1W 1-18	4S0E	1	20-15	17	4	1	
0N1W 1-18	4S0E	1	20-15	1	4	2	
0N1W 1-18	4S0E	1	20-15	3	5	1	
0N1W 1-18	4S0E	1	20-15	2	10	2	82 G
0N1W 1-18	4S0E	1	20-15	1	10	1	8 G

SCATTER	EUNIT	LEVEL	DEPTH	MAT	TYPE	COUNT	OTHER
0N1W 1-18	4S0E	1	20-15	2	19	1	
0N1W 1-18	4S0E	1	20-15	17	19	1	
0N1W 1-18	4S0E	2	15-10	3	4	1	
0N1W 1-18	4S0E	3	10-5	5	16	1	
0N1W 1-18	4S0E	3	10-5	4	16	1	
0N1W 1-18	4S0E	3	10-5	1	2	1	
0N1W 1-18	4S0E	3	10-5	5	3	2	
0N1W 1-18	4S0E	3	10-5	4	3	1	
0N1W 1-18	4S0E	3	10-5	2	3	2	
0N1W 1-18	4S0E	3	10-5	17	3	1	
0N1W 1-18	4S0E	3	10-5	2	4	1	
0N1W 1-18	4S0E	3	10-5	5	4	1	
0N1W 1-18	4S0E	3	10-5	4	5	1	
0N1W 1-18	4S0E	3	10-5	4	10	2	22 G
0N1W 1-18	4S0E	3	10-5	2	10	1	7 G
0N1W 1-18	4S0E	3	10-5	5	10	2	246 G
0N1W 1-18	4S0E	3	10-5	2	19	1	
0N1W 1-18	4S0E	4	5-0	4	16	1	
0N1W 1-18	4S0E	4	5-0	2	4	1	
0N1W 1-18	4S0E	4	5-0	3	19	1	
0N1W 1-18	4S0E	4	5-0	5	7	1	35*
0N1W 1-18	4S0E	4	5-0	5	21	1	60*
0N1W 1-18	4S0E	5	0-5	2	4	2	
0N1W 1-18	4S0E	5	0-5	5	4	1	
0N1W 1-18	4S0E	5	0-5	5	5	1	
0N1W 1-18	4S0E	5	0-5	4	10	1	1 G
0N1W 1-18	4S0E	6	5-10	17	2	2	
0N1W 1-18	4S0E	6	5-10	1	2	1	
0N1W 1-18	4S0E	6	5-10	3	3	1	
0N1W 1-18	4S0E	6	5-10	5	16	1	
0N1W 1-18	4S0E	6	5-10	2	4	2	
0N1W 1-18	4S0E	6	5-10	3	4	1	
0N1W 1-18	4S0E	6	5-10	17	3	2	
0N1W 1-18	4S0E	6	5-10	1	5	1	SPENT
0N1W 1-18	4S0E	6	5-10	4	10	1	62 G
0N1W 1-18	4S0E	6	5-10	2	19	1	
0N1W 1-18	4S0E	6	5-10	5	10	1	19 G
0N1W 1-18	4S0E	6	5-10	17	10	1	30 G
0N1W 1-18	4S0E	6	5-10	1	10	1	39 G
0N1W 1-18	4S0E	7	10-15	1	1	2	
0N1W 1-18	4S0E	7	10-15	1	2	1	
0N1W 1-18	4S0E	7	10-15	2	4	2	
0N1W 1-18	4S0E	7	10-15	3	4	1	
0N1W 1-18	4S0E	7	10-15	2	10	1	8 G
0N1W 1-18	4S0E	8	15-20	2	16	1	
0N1W 1-18	4S0E	8	15-20	1	1	4	
0N1W 1-18	4S0E	8	15-20	2	2	1	
0N1W 1-18	4S0E	8	15-20	17	2	1	
0N1W 1-18	4S0E	8	15-20	1	21	1	65*
0N1W 1-18	4S0E	8	15-20	2	10	1	194 G

SCATTER	EUNIT	LEVEL	DEPTH	MAT	TYPE	COUNT	OTHER
0N1W 1-18	4S0E	8	15-20	5	10	1	51 G
0N1W 1-18	4S0E	8	15-20	17	10	4	328 G
0N1W 1-18	4S0E	8	15-20	1	10	2	147 G
0N1W 1-18	4S0E	8	15-20	17	19	1	
0N1W 1-18	4S0E	9	20-25	2	6	1	BREWERTON
0N1W 1-18	4S0E	10	25-30	1	7	1	40*
0N1W 1-18	4S0E	10	25-30	2	10	1	11 G
0N1W 1-18	4S0E	12	35-40	4	10	1	1 G
0N1W 1-18	4S0E	12	35-40	2	10	3	13 G
0N1W 1-18	4S0E	13	40-50	2	2	1	
0N1W 1-18	4S0E	13	40-50	1	16	1	
0N1W 1-18	4S0E	13	40-50	17	10	2	21 G
0N1W 1-18	4S0E	14	50-60	2	3	2	
0N1W 1-18	4S0E	14	50-60	1	10	2	19 G
1S0W 2-4	2N7E	1	0-5	15	8	6	ST,SM,1VES
1S0W 2-4	2N7E	2	5-10	15	8	3	ST,SM,1VES
1S0W 2-4	2N7E	3	10-15	15	8	2	ST,SM,1VES
1S0W 2-4	3N2W	3	10-15	1	2	1	
1S0W 2-4	3N2W	3	10-15	15	8	2	
1S0W 2-4	3N2W	4	15-20	15	8	2	ST,SM,1VES
1S0W 2-4	7N6E	5	25-30	11		1	WOODEN ARTIFACT?
2N3E 1-0	13S1E	2	5-10	1	1	1	
2N3E 1-0	13S1E	2	5-10	9	2	1	
2N3E 1-0	13S1E	2	5-10	1	10	6	427 G
2N3E 1-0	13S1E	2	5-10	9	10	3	571 G
2N3E 1-0	13S1E	2	5-10	10	10	1	10 G, BASALT
2N3E 1-0	13S1E	2	5-10	10	9	1	MANO, BASALT
2N3E 1-0	13S1E	2	5-10	18	10	1	238 G
2N3E 1-0	13S1E	2	5-10	15	8	1	CERAMIC WASTER
2N3E 1-0	13S1E	3	10-15	10	10	2	41 G, BASALT
2N3E 1-0	13S1E	4	15-20	4	6	1	LEVANNA
2N3E 1-0	13S1E	4	15-20	9	9	1	MANO
2N3E 1-0	13S1E	4	15-20	1	10	3	52 G
2N3E 1-0	13S1E	4	15-20	9	10	3	128 G
2N3E 1-0	13S1E	4	15-20	18	10	2	25 G
2N3E 1-0	13S1E	5	20-25	18	7	1	56*
2N3E 1-0	13S1E	5	20-25	9	10	1	112 G
2N3E 1-0	13S1E	5	20-25	12		1	AWL
2N3E 1-0	13S1E	6	25-30	4	7	1	50*
2N3E 1-0	13S1E	7	30-40	12		1	AWL?
2N3E 1-0	13S1E	7	30-40	4	24	1	
2N3E 1-0	13S9W	1	5-10	9	1	1	
2N3E 1-0	13S9W	1	5-10	5	1	1	
2N3E 1-0	13S9W	1	5-10	2	2	1	
2N3E 1-0	13S9W	1	5-10	4	7	1	35*
2N3E 1-0	13S9W	1	5-10	1	10	2	68 G
2N3E 1-0	13S9W	2	10-15		6	1	
2N3E 1-0	13S9W	2	10-15	4	1	1	

SCATTER	EUNIT	LEVEL	DEPTH	MAT	TYPE	COUNT	OTHER
2N3E 1-0	13S9W	2	10-15	5	2	1	
2N3E 1-0	13S9W	2	10-15	1	10	9	873 G
2N3E 1-0	13S9W	2	10-15	9	10	2	54 G
2N3E 1-0	13S9W	2	10-15	18	10	1	36 G
2N3E 1-0	13S9W	2	10-15	15	8	1	CERAMIC WASTER
2N3E 1-0	13S9W	2	10-15	15	8	1	ST,ISB,(a)
2N3E 1-0	14S0E	2	5-10	4	1	1	
2N3E 1-0	14S0E	2	5-10	1	24	1	29*
2N3E 1-0	14S0E	2	5-10	10	19	1	BASALT
2N3E 1-0	14S0E	2	5-10	10	9	1	MANO,BASALT
2N3E 1-0	14S0E	2	5-10	1	10	6	203 G
2N3E 1-0	14S0E	2	5-10	4	10	2	76 G
2N3E 1-0	14S0E	2	5-10	5	10	1	5 G
2N3E 1-0	14S0E	2	5-10	9	10	21	253 G
2N3E 1-0	14S0E	3	10-15	9	10	2	328 G
2N3E 1-0	14S0E	3	10-15	6	10	1	5 G
2N3E 1-0	14S0E	3	10-15	5	10	1	3 G
2N3E 1-0	14S0E	4	15-20	15	8	1	CERAMIC WASTER
2N3E 1-0	14S0E	4	15-20	1	10	6	86 G
2N3E 1-0	14S0E	4	15-20	10	10	1	78 G, BASALT
2N3E 1-0	14S0E	4	15-20	5	10	5	13 G
2N3E 1-0	14S0E	4	15-20	9	10	7	190 G, FRAG SAME RK
2N3E 1-0	14S0E	4	15-20	2	1	1	
2N3E 1-0	14S0E	4	15-20	2		1	PERFORATOR
2N3E 1-0	14S0E	4	15-20	10	9	1	GROUND STONE
2N3E 1-0	14S0E	4	15-20	9	10	30	885 G
2N3E 1-0	14S0E	5	20-25	4	2	1	
2N3E 1-0	14S0E	5	20-25	4	21	1	79*
2N3E 1-0	14S0E	5	20-25	18	10	1	3 G
2N3E 1-0	14S0E	5	20-25	1	10	9	176 G
2N3E 1-0	14S0E	5	20-25	5	10	1	3 G
2N3E 1-0	14S0E	5	20-25	18	10	5	18 G
2N3E 1-0	14S0E	5	20-25	9	10	21	278 G
2N3E 1-0	14S0E	6	25-30	1	10	2	22 G
2N3E 1-0	14S0E	6	25-30	17	10	2	31 G
2N3E 1-0	14S0E	6	25-30	9	10	7	117 G, FRAG SAME RK
2N3E 1-0	14S0E	7	30-35	15	8	1	SHT,SM,(b)
2N3E 1-0	14S0E	7	30-35	15	8	2	SHT,ISB, ESB,(c)
2N3E 1-0	14S0E	7	30-35	1	10	1	15 G
2N3E 1-0	14S0E	7	30-35	5	10	1	5 G
2N3E 1-0	14S0E	7	30-35	18	10	1	6 G
2N3E 1-0	14S0E	9	40-50	4	1	1	
2N3E 1-0	14S0E	9	40-50	15	8	5	SHT,ISB,(dl)
2N3E 1-0	14S0E	9	40-50	15	8	2	SHT,ISB,(dl)

SCATTER	EUNIT	LEVEL	DEPTH	MAT	TYPE	COUNT	OTHER
2N3E 1-0	14S0E	9	40-50	15	8	1	SHT,ISB, ESB,(c)
2N3E 1-0	14S0E	9	40-50	15	8	1	SHT,ISB,(d1)
2N3E 1-0	4S0W	1	0-5	15	8	1	ST,ISB,(d2)
2N3E 1-0	4S0W	3	10-15	15	8	2	ST,ISB,(d2)
2N3E 1-0	4S0W	3	10-15	15	8	1	ST,ISB,(d2)
2N3E 1-0	4S0W	3	10-15	15	8	4	ST,ISB,(d2)
2N3E 1-0	4S0W	3	10-15	15	8	4	ST,ISB,(d2)
2N3E 1-0	4S0W	3	10-15	15	8	2	ST,ISB,(d2)
2N3E 1-0	4S0W	6	25-30	18	9	1	MANO
2N3E 1-0	4S0W	7	30-40	9		1	AXE
2N3E 1-0	4S1W	1	0-5	4	2	1	
2N3E 1-0	4S1W	3	10-15	15	8	1	ST,ISB,(d3)
2N3E 1-0	4S1W	4	15-20	1	1	1	
2N3E 1-0	4S1W	4	15-20	1	2	2	
2N3E 1-0	4S1W	4	15-20	10	3	1	BASALT
2N3E 1-0	4S1W	4	15-20	18		1	PAINTSTONE
2N3E 1-0	4S1W	4	15-20	15	8	3	SHT,SM,(b)
2N3E 1-0	5S0E	2	5-11	2	5	1	
2N3E 1-0	5S0E	2	5-11	10	9	1	ADZE, BASALT
2N3E 1-0	5S0E	3	11-16	10	9	1	GRINDING STONE, BAS.
2N3E 1-0	5S0E	3	11-16	17	1	1	
2N3E 1-0	5S0E	3	11-16	4	2	1	
2N3E 1-0	5S0E	3	11-16	2	2	1	
2N3E 1-0	5S0E	3	11-16	17	2	1	
2N3E 1-0	5S0E	3	11-16	4	3	1	
2N3E 1-0	5S0E	3	11-16	6	3	1	
2N3E 1-0	5S0E	3	11-16	6	24	1	25*
2N3E 1-0	5S0E	3	11-16	2	5	1	
2N3E 1-0	5S0E	3	11-16	1	10	1	81 G
2N3E 1-0	5S0E	3	11-16	15	8	4	SHT,ISB, ESB,(e)
2N3E 1-0	5S0E	3	11-16	15	8	2	SHT,ISB, ESB,(e)
2N3E 1-0	5S0E	3	11-16	15	8	4	SHT,ISB, ESB,(e)
2N3E 1-0	5S0E	4	16-21	18	19	1	
2N3E 1-0	5S0E	4	16-21	1	10	7	384 G
2N3E 1-0	5S0E	4	16-21	15	8	2	SHT,ISB, ESB,(e)
2N3E 1-0	5S0E	5	21-27	15	8	1	SHT,ISB,(d1)
2N3E 1-0	5S0E	6	27-37	2	2	1	
2N3E 1-0	5S0E	6	27-37	18	7	1	56*
2N3E 1-0	5S0E	6	27-37	9	10	1	112 G
2N3E 1-7	10N10E	1	0-5	13	20	4	G
2N3E 1-7	10N10E	2	5-10	6	3	1	
2N3E 1-7	10N10E	2	5-10	4	3	1	
2N3E 1-7	10N10E	2	5-10	4	4	1	
2N3E 1-7	10N10E	2	5-10	4	16	5	

SCATTER	EUNIT	LEVEL	DEPTH	MAT	TYPE	COUNT	OTHER
2N3E 1-7	10N10E	2	5-10	13		13	G, ERODED CLAMS
2N3E 1-7	10N10E	2	5-10	13	20	1	G
2N3E 1-7	10N10E	2	5-10	13	12	2	G
2N3E 1-7	10N10E	3	10-15	4	1	2	
2N3E 1-7	10N10E	3	10-15	4	2	2	
2N3E 1-7	10N10E	3	10-15	4	3	8	
2N3E 1-7	10N10E	3	10-15	4	16	4	
2N3E 1-7	10N10E	3	10-15		10	2	31 G
2N3E 1-7	10N10E	3	10-15	13		45	G, ERODED CLAMS
2N3E 1-7	10N10E	3	10-15	13	12	11	G
2N3E 1-7	10N10E	4	15-20	4	10	1	30 G
2N3E 1-7	10N10E	4	15-20	2	2	1	
2N3E 1-7	10N10E	4	15-20	13		72	G, ERODED CLAMS
2N3E 1-7	10N10E	4	15-20	13	12	11	G
2N3E 1-7	10N10E	5	20-22	6	2	1	
2N3E 1-7	10N10E	5	20-22	13		15	G, ERODED CLAMS
2N3E 1-7	10N10E	5	20-22	13	12	1	G
2N3E 1-7	10N10E	6	22-32	1	3	1	
2N3E 1-7	10N10E	6	22-32	4	10	2	86
2N3E 1-7	10N10E	6	22-32		10	5	1372 G
2N3E 1-7	10N10E	6	22-32	13		18	G, ERODED CLAMS
2N3E 1-7	10N10E	6	22-32	13	12	1	G
2N3E 1-7	10N10E	6	22-32	6	3	1	
2N3E 1-7	10N10E	6	22-32	15	8	2	ST,IB
2N3E 1-7	10N10E	6	22-32	1	21	1	93*
2N3E 1-7	10N10E	7	32-42	4	2	1	
2N3E 1-7	10N10E	7	32-42	11	18	1	
2N3E 1-7	10N8E	1	0-10	2	2	2	
2N3E 1-7	10N8E	1	0-10	13	12	17	G
2N3E 1-7	10N8E	2	10-15	2	5	1	
2N3E 1-7	10N8E	2	10-15	2	3	13	
2N3E 1-7	10N8E	2	10-15	2	16	4	
2N3E 1-7	10N8E	2	10-15		10	2	355 G
2N3E 1-7	10N8E	2	10-15	13		1	G,ERODED CLAM
2N3E 1-7	10N8E	2	10-15	13	12	1	G
2N3E 1-7	10N8E	3	15-20	6	2	1	
2N3E 1-7	10N8E	3	15-20	6	3	1	
2N3E 1-7	10N8E	3	15-20	4	3	3	
2N3E 1-7	10N8E	3	15-20	4	2	2	
2N3E 1-7	10N8E	3	15-20	4	16	3	
2N3E 1-7	10N8E	3	15-20	2	2	3	
2N3E 1-7	10N8E	3	15-20	2	16	3	
2N3E 1-7	10N8E	3	15-20	4	6	1	TIP
2N3E 1-7	10N8E	3	15-20		10	2	189 G
2N3E 1-7	10N8E	3	15-20	13		9	G,ERODED CLAM

SCATTER	EUNIT	LEVEL	DEPTH	MAT	TYPE	COUNT	OTHER
2N3E 1-7	10N8E	3	15-20	15	8	1	SHT,ISB, ESB,BURNED
2N3E 1-7	10N8E	4	20-30	2	3	1	
2N3E 1-7	10N8E	4	20-30	1	1	1	
2N3E 1-7	10N8E	5	30-40	2	3	1	

APPENDIX FOUR: FLORAL REMAINS FROM MASHOMACK SITES

Compiled by Margaret Conover
Museum of Long Island Natural Sciences
SUNY at Stony Brook

KEY:
- A = Acorn (Quercus sp)
- C = Cherry (Prunus sp)
- S-P = Sedge-Polygonum
- G = Grape (Vitis sp)
- N = Nuts (Carya,Juglans sp)
- R = Raspberry (Rubus sp)
- S = Sumac (Rhus sp)
- CH = Chenopodiaceae
- M = Mustard (Brassicaceae)
- D = Dogwood (Cornus)
- B = Bayberry (Myrica sp)
- E = Elderberry (Sambucus sp)
- 0 = Unknown/Other

SITE PROVENIENCE	CHARRED						UNCHARRED									
	A	C	S-P	G	N	0	R	S	G	S-P	CH	M	D	B	E	0
ONOW 3-21 UNIT 1S3W																
LEVELS 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0N0W 5-20 UNIT 57																
LEVELS 1	0	0	0	2	0	0	3	0	0	13	0	0	19	+	0	0
2	0	0	0	0	0	0	5	1	6	3	0	0	18	+	0	5
4	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
5	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	2
0N1W 1-18 UNIT 2S0E																
LEVELS 1	0	0	0	0	2	0	3	0	0	0	2	0	0	0	0	0
2	0	1	0	0	0	0	2	0	0	1	2	0	0	0	0	0
3	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	4	1	1	0	0	0	1
5	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
8	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0
9	0	0	0	0	0	0	2	0	0	0	0	1	0	0	0	0
10	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0
11	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0

SITE PROVENIENCE	CHARRED						UNCHARRED									
	A	C	S-P	G	N	O	R	S	G	S-P	CH	M	D	B	E	O
1S0W 2-4																
UNIT 3N2W																
LEVELS 2	2	0	0	0	0	1	2	2	2	17	0	0	0	0	0	7
3	0	0	3	0	0	4	0	0	0	3	0	0	0	0	0	0
4	0	0	0	0	0	0	4	0	0	2	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1
7	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2N3E 1-0																
UNIT 5S0E																
LEVELS 2	0	0	0	0	0	0	6	2	4	1	0	0	0	4	100	0
3	0	0	0	0	0	0	10	1	1	1	7	0	0	1	150	0
3	3	0	0	0	+	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	+	0	0	0	0	0	1	0	0	0	100	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2N3E 1-0																
UNIT 13S1E																
LEVELS 2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
2	0	0	0	0	0	0	2	2	1	0	1	0	0	0	7	0
3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2N3E 1-0																
UNIT 14S0E																
LEVEL 7	0	0	3	0	0	0	1	0	0	0	0	0	0	1	0	0

APPENDIX FIVE: MICROGROWTH LINE ANALYSIS OF HARD CLAMS

The Sungic Midden Site (2N3E 1-0), Shelter Island, New York

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Introduction

Shell growth in bivalves is not continuous but occurs episodically, depending on both the internal rhythms of the animal and environmental conditions. Many bivalves, for example, have concentric annual rings or bands on the external surface of their shells. An annual ring generally corresponds in time to the winter months when growth slows and may even stop. These rings may be used to determine age in many species in a manner analogous to analyzing growth rings in trees. However, external growth rings have limited application in bivalve research. Often other disturbances such as storms or spawning stress also cause the formation of external bands making interpretation difficult. In addition, there is usually considerable abrasion and dissolution of the external surface of the shell which can obscure the rings further.

About 20 years ago, it was discovered that if the shell is cross-sectioned along an axis running from the hinge (umbo) to the growing edge, microscopic internal growth lines can be observed (Barker 1964). In some species, such as Mercenaria mercenaria, these internal growth lines are far more detailed than discernible external patterns. Research on Mercenaria has shown that growth on a daily basis can be measured using these internal features (see review in Kennish 1980). In other species, such as Mya arenaria, internal patterns are not as detailed (MacDonald and Thomas 1980), and interpretation of those growth lines which are found has not been completely resolved.

As a result of excavations at the Mashomack Preserve, Shelter Island, samples of the hard clam Mercenaria mercenaria and the soft shell clam Mya arenaria have been recovered. The overall goal of this project has been to analyze internal micro-growth patterns in specimens of these two species in an attempt to reconstruct information on age structure, growth, and season of harvest. Because the interpretation of growth patterns in Mya has not been resolved, work on this species is still under way. Through the analysis of modern samples, progress has been made in developing a usable technique. Once a method has been verified, it will be applied to soft shell clams recovered from the Mashomack Preserve. Research on the second species of interest, the hard clam Mercenaria mercenaria, has been completed, and results will be presented in this report.

Methods

Eleven samples of whole, intact hard clam valves were taken from various levels of the Sungic Midden site (2N3E 1-0). These samples consisted of from one to ten valves. Shell height, the straight line distance from the umbo to the growing edge along the axis of maximum growth, was measured with vernier calipers to the nearest 0.1 mm.

Valves were prepared for microgrowth pattern analysis by first embedding them in an epoxy resin to prevent fracturing during sectioning. The embedding media was a mixture of 1 part DTA curing agent and 10 parts Epon 815 (Miller Stephenson Co., Danbury, CT). After the epoxy had thoroughly cured, embedded shells were removed from the molds and sectioned along the axis of maximum growth using a Raytech 10" diamond saw with a 1/16" thick blade. The cross-sectional surface was ground on a lapidary wheel with 320 and 600 grit wet-dry sanding disks, and polished with a levigated aluminum compound. Finally, the polished sections were etched for 5 minutes using a 5% solution of ethylenediaminetetraacetate (EDTA) adjusted to pH 7.5 (Haake et al. 1982).

The most prominent microstructural features in cross-sectioned shells are winter growth breaks. These are characterized by a V-shaped notch in the outer shell layer and thin daily growth increments. To analyze age and annual growth in each sectioned valve, the points of contact of these annual growth breaks with the external shell surface were identified and marked under a dissecting microscope. Shell height at each age was taken to be the distance from the umbo to a point of contact and was measured to the nearest 0.1 mm with vernier calipers.

Obtaining a cross-section which passes exactly through the axis of maximum growth is fairly difficult to do. Precise alignment of the shell prior to sectioning is necessary. In addition, kerf loss during sectioning (i.e., the sawing process removes a band of material which is somewhat greater than the thickness of the blade) and the amount of material removed during grinding must be taken into account. As a result of any small variation from the axis of maximum growth, the total height of the sectioned valve will be slightly less than the measured unembedded height. To correct for this, the measured height at each annual growth break was multiplied by the ratio of the unembedded to total sectioned shell height. While this ratio varied for each specimen, the correction factor was generally small and on the average resulted in a 3.4% increase in height.

The procedure for estimating the season of harvest (i.e., season of death) required a detailed examination of the microscopic growth lines from the last winter growth break to the margin of the shell. Estimates were obtained by counting the total number of daily lines in this region. In some specimens, daily increments were conspicuously grouped into clusters of fortnightly or lunar monthly patterns. When this occurred, these patterns rather than daily increments were counted. The winter growth break was assumed to correspond to January 1.

Results

A total of 52 specimens were examined. A tabulation of the measurements made for each specimen is presented at the end of this report. It should be noted that a complete set of measurements could not be obtained from every specimen because of variations in the clarity of the microgrowth lines and the presence of abraded or damaged areas on the shell.

a. Age Distributions

Age distributions for each sample are shown in Figure 27. Individuals ranged from 2 to 15 years old. Most of the youngest (2-3 years old) and oldest (9-15 years old) individuals were found in four samples (13S1E Levels 4-7). In most of the remaining samples, age distributions were restricted to individuals between 4 and 8 years old. The age distribution for all samples combined is presented in Figure 28. From this figure, it is clear that the majority (76%) of individuals examined were from 4 to 7 years old.

b. Growth

Plots of average height vs. age for each sample are shown in Figure 29. Age-specific average height varied considerably between samples. While these differences (up to 15 mm) appear to be large, it should be remembered that sample sizes are very small in many cases. In particular, the growth curves with the highest (i.e., 5 and 10) and lowest (i.e., 2) age-specific average heights were based on only 1 to 3 specimens. Thus, the apparently large variations seen in this figure may be due in part to imprecise estimates of average height.

c. Season of Harvest

Season of harvest estimates for each sample are presented in Figure 30. In terms of frequency of occurrence, less than half (4 of 11) of the samples contained individuals harvested in the spring. The result for summer was similar with 5 of 11 samples containing individuals harvested during the season. In addition, half of the specimens harvested in the summer were found in only one sample (13S1E Level 10). The occurrence of fall and winter harvesting was more common, with 8 of 11 samples containing specimens collected in the fall and 6 of 11 samples with winter harvested individuals. Counts of the microgrowth increments in the winter specimens suggest that harvesting took place early in

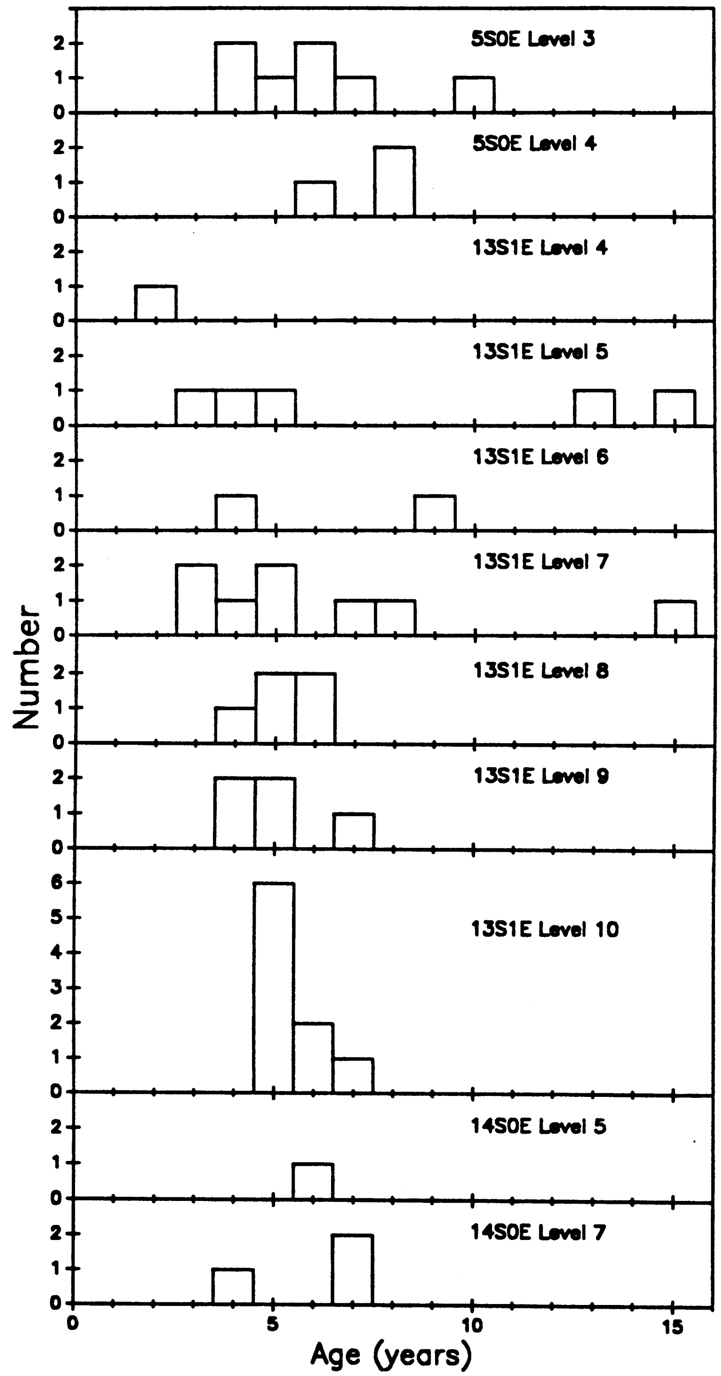

Figure 27. Age-frequency results for each hard clam sample

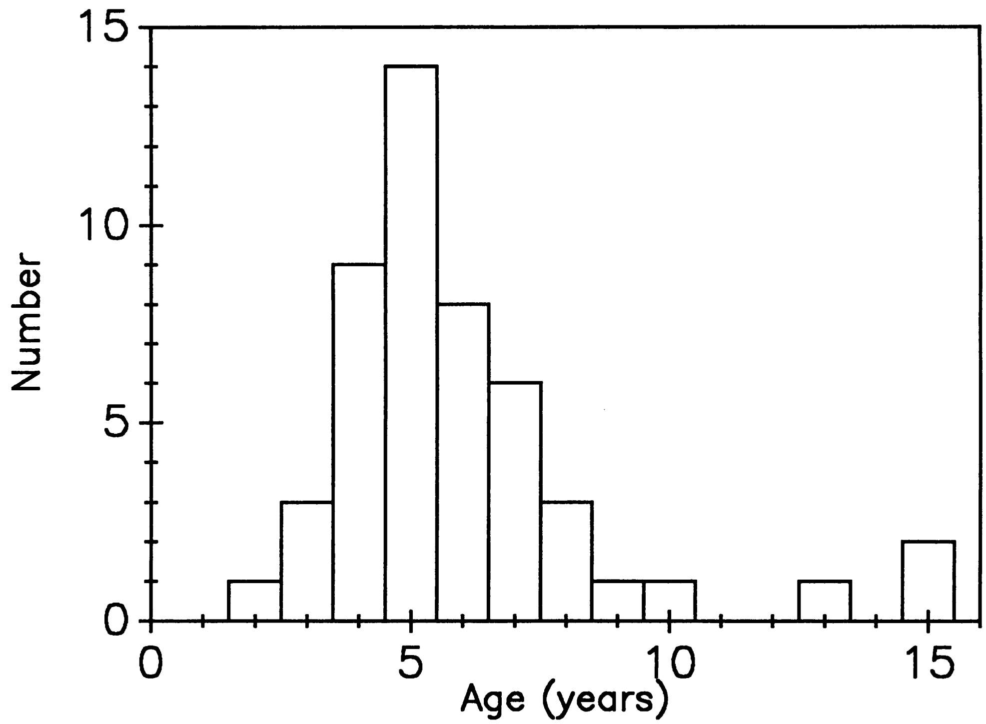

Figure 28. Age-frequency results for all hard clam samples combined

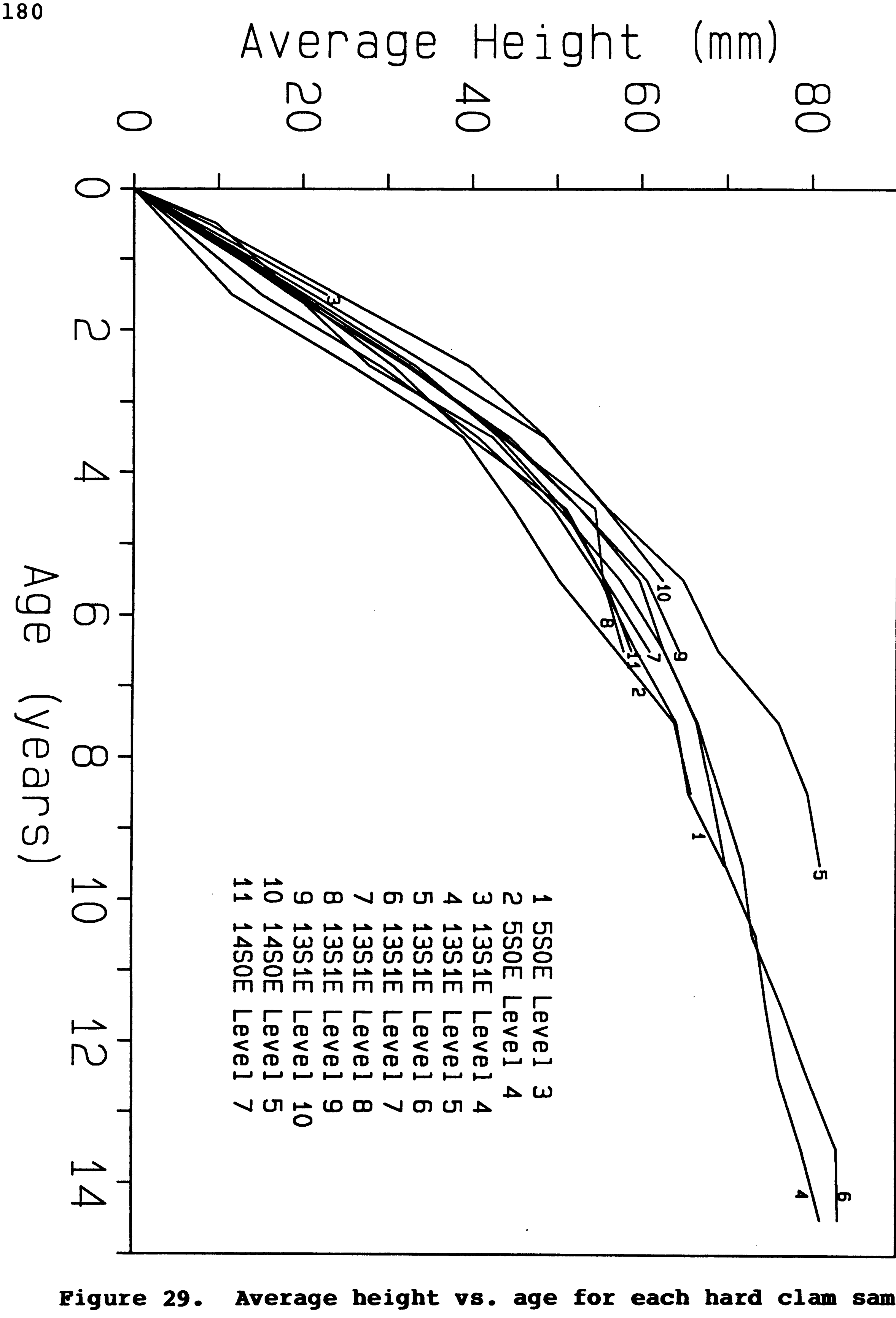

Figure 29. Average height vs. age for each hard clam sample

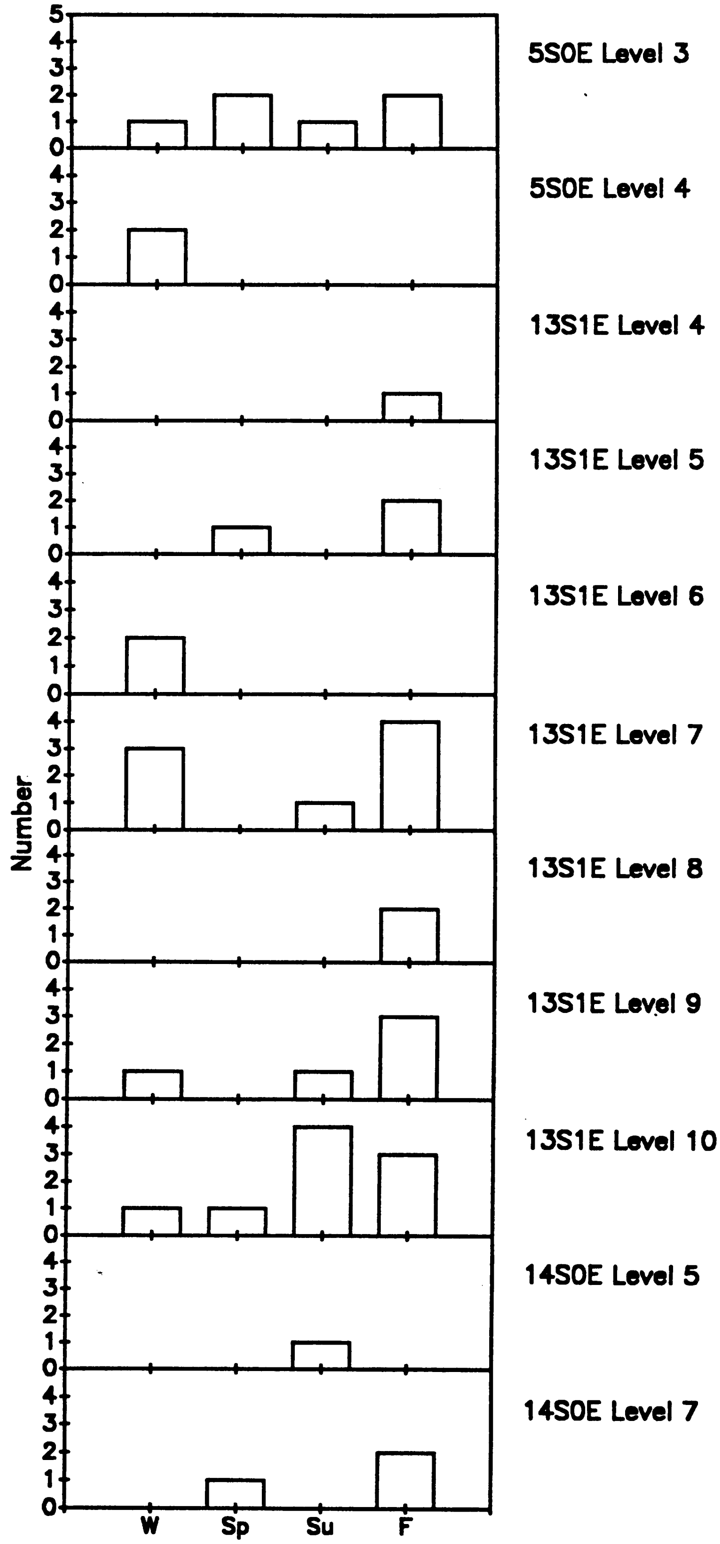

Figure 30. **Season of harvest distribution for each hard clam sample**

this season. In these specimens, the winter growth break occurred right at the margin of the shell with few daily increments following it. Overall (Figure 31), harvesting took place during all seasons but seems to have been more frequent in the fall and, given the indications from the microgrowth increment analysis, early winter.

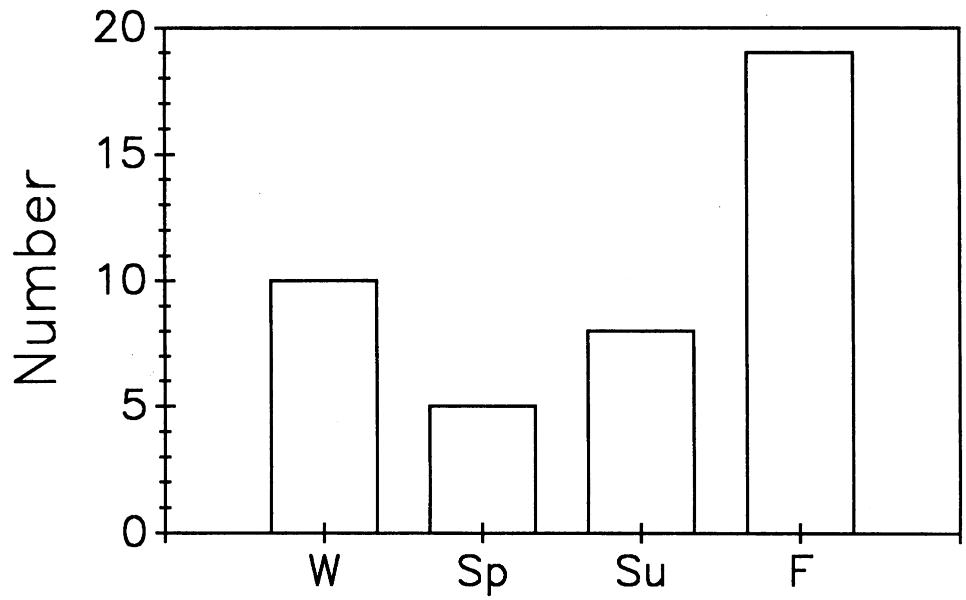

Figure 31. Season of harvest distribution for all hard clam samples combined

Discussion

Through an examination of microstructural growth patterns, it has been possible to obtain data on age, growth, and season of harvest. In this section, I would like to analyze these data and attempt to interpret the results in both an ecological and an archaeological context. Of course, any attempt to do this must consider a large number of factors which could have affected the results. These factors include those which influenced the living clams, such as habitat conditions (i.e., temperature, salinity, sediment type, food supply, etc.) and population parameters (i.e., population density, recruitment rates, and rates of mortality), as well as, harvesting methods, harvesting intensity, and differential preservation (since only intact valves were used). All of these factors could potentially vary among samples and most could have varied considerably during the time period represented by each excavation level. No individual factor affects the results in a unique, discernible way, and different combinations of them can produce identical results. Because of this, an unambiguous interpretation of cause would require a considerable amount of independent corroborating evidence which is not available. Hence, any statements about specific causal factors should be regarded with caution.

Comparable data from modern populations and the present day fishery exist. With the exception of differential preservation, all of the factors mentioned above also affect these data sets. However, unlike the archaeological data, there is independent information on how these factors interact to produce specific results. Rather than attempt to interpret our data with no independent information, we have instead chosen to compare our results to modern data sets, restricting our attention to obvious similarities or differences.

Because of the small sample sizes, this comparison will be carried out on the pooled or averaged results for all samples. In doing so, we risk combining unlike results. There is, however, no a priori reason to assume that the causal factors influencing the results varied any less within an excavation level than they varied between levels.

a. Distribution

Buckner (1984) carried out an extensive study of hard clam resources in Great South Bay, an important hard clam producing region on Long Island. Figure 32a shows an age distribution obtained during his 1979 survey in which he collected 2 replicate 1 square m bottom samples at 273 stations distributed throughout a 4800 hectare area. This area comprised all of the certified (i.e., public) shellfishing grounds in the Town of Islip and included a wide variety of different habitats.

The shape of this distribution has been influenced by several different factors. First, the relatively low numbers of 1 and 2 year old clams are an artifact of the sampling methods used. The sieving procedure used by Buckner to separate the animals from the sediments did not retain the smaller clams with 100% efficiency. Thus, the relative abundances of these two age classes have been underestimated and should be higher.

Population parameters influencing the shape of this distribution include annual variations in hard clam recruitment and both annual and age-specific variations in mortality. Annual variations in recruitment and mortality were not specifically analyzed in Buckner's study. However, age-specific mortality was examined in detail, and Buckner obtained estimates of both natural and harvesting mortality. The effect of these two sources of mortality on the shape of an age-frequency distribution is illustrated in Figure 32b and c. Both of these plots were constructed using only estimates of age-specific mortality from Buckner (1984). The distributions represent a hypothetical steady state population since they were calculated assuming constant recruitment from year to year and no annual variations in age-specific mortality. In addition, this method is insensitive to sampling bias. So unlike the survey data results (i.e., Figure 32a), the relative abundances of age classes 1 and 2 are not underestimated and represent a greater fraction of the population.

Buckner (1984) found that estimates of natural mortality varied with age but averaged about 10% per age class per year. Therefore, in a hard clam population not subjected to harvesting, relative abundances decline gradually with age (Figure 32b). As a result, older clams are fairly common. The potential life span for hard clams is 20 years or more (Buckner 1984). Assuming that the average natural mortality rate estimated by Buckner is reasonable for clams up to age 20, then over 50% of the hard clams in an unharvested population would be greater than or equal to 6 years old.

When substantial fishing mortality is added to natural levels, the shape of the age distribution can change dramatically. This is illustrated in Figure 32c. This plot has been constructed using Buckner's estimates of total (i.e., natural and harvesting) mortality. The minimum legally harvestable size of hard clams in New York waters is one inch in thickness. Most hard clams in Great South Bay reach this size somewhere between the age of 3 and 4 years (Buckner 1984). As was the case for natural mortality, Buckner found that harvesting mortality varied with age, and harvesting rates averaged about 43% of the legal size clams per year. Up to and including age 3, the decline in percent frequency with age shown in Figure 32c is due only to natural mortality. Beginning at about age 4, both natural and harvesting mortality is occurring. This substantial increase in mortality gives rise to a sharp decline in relative abundance with age. Thus, the principal difference in age structure in a heavily harvested population is the distinctly low proportion of older individuals (about 6% are greater than or equal to 6 years old). This difference is clearly evident in comparing the shapes of the age distributions in Figure 32b and 32c. The effects of substantial harvesting is also apparent in the age distribution from Buckner's 1979 survey (Figure 32a). Even though 1 and 2 year old clams were underrepresented because of sampling bias, only 26% of the clams obtained in the survey were greater than or equal to 6 years old.

While this analysis of a modern population was somewhat involved, it does provide several interpretative criteria which can be applied to the results of the present study. The age distribution from the present study is reproduced in Figure 32d. Although the location of the mode is displaced by two years, the shape of this distribution is quite similar to Buckner's 1979 survey. Both distributions are characterized by low relative

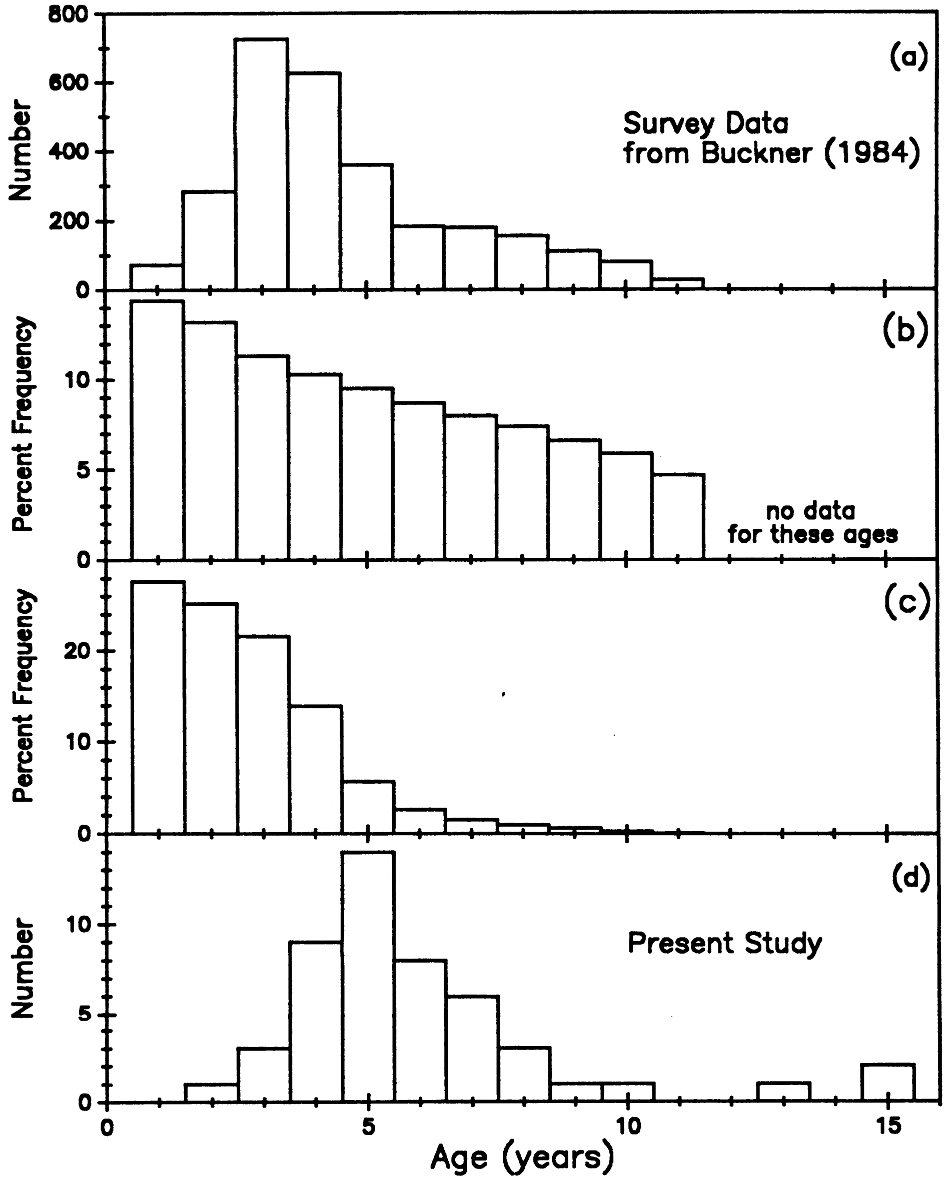

Figure 32. A comparison of age-frequency results in the present study to that of a modern hard clam population. (a) Age-frequency distribution from a 1979 survey of hard clams in Great South Bay by Buckner (1984). (b) Hypothetical age distribution of a steady state hard clam population subjected only to natural mortality. Results based on natural mortality estimated from Buckner (1984). (c) Hypothetical age distribution of a steady state hard clam population subjected to both natural mortality and substantial harvesting mortality. Results based on total mortality estimated from Buckner (1984). (d) Age-frequency results obtained in the present study.

abundances of young and old clams. For the present study, this may be the result of differential preservation, i.e., both the smallest and the largest clams did not preserve as whole valves. In addition to this possibility, several alternative interpretations are also plausible. The relative absence of 1-3 year old individuals could be due to collection bias. Smaller individuals, in this case less than about 30 mm in height, have little food value and may have been passed over by harvesters. The absence of older, larger individuals may also be due to a collection bias. For some reason, larger clams may have not been a desirable food item even though they would represent greater food value per individual than smaller clams. Or, it is possible that they were transported from the area without being processed. Another alternative is that the absence of older individuals is indicative of an intensely harvested resource.

b. Growth

In Figure 33, the relationship between average height vs. age in the present study is compared to the growth curve obtained by Buckner (1984) for certified waters in Great South Bay. These two growth curves are remarkably similar at the younger ages, and average shell heights differ by less than 5 mm up to age 8. Beyond this age, the growth curves seem to diverge. However, the number of older specimens examined in both studies was very limited; only 3 specimens in Buckner (1984) and 5 in the present study were greater than 8 years old.

Given this result, it is tempting to infer that environmental conditions (and especially those of archaeological interest like climate) were on the average rather similar to present day conditions in Great South Bay. Such an interpretation is, however, not possible. Growth is influenced in a complex way by a variety of factors including temperature, salinity, sediment type, food supply, and population density. Because of this, similarities in growth curves do not necessarily imply similarities in environmental conditions.

In addition, the effect on annual growth due to any one factor (or set of factors) is difficult to assess even when this factor is known to vary considerably. For example, Ansell (1968) used published data on hard clams to examine trends in annual rates of shell growth with respect to temperature and latitude. His analysis showed that a general relationship between growth and temperature existed. However, each geographic locality examined was found to be characterized by large variations in annual growth due to differences in local habitat conditions. As a result of this local variability, latitudinal differences in annual growth were not readily apparent. Neither the range of variation in annual growth nor the maximum annual growth rate measured were found to differ among localities from Florida to

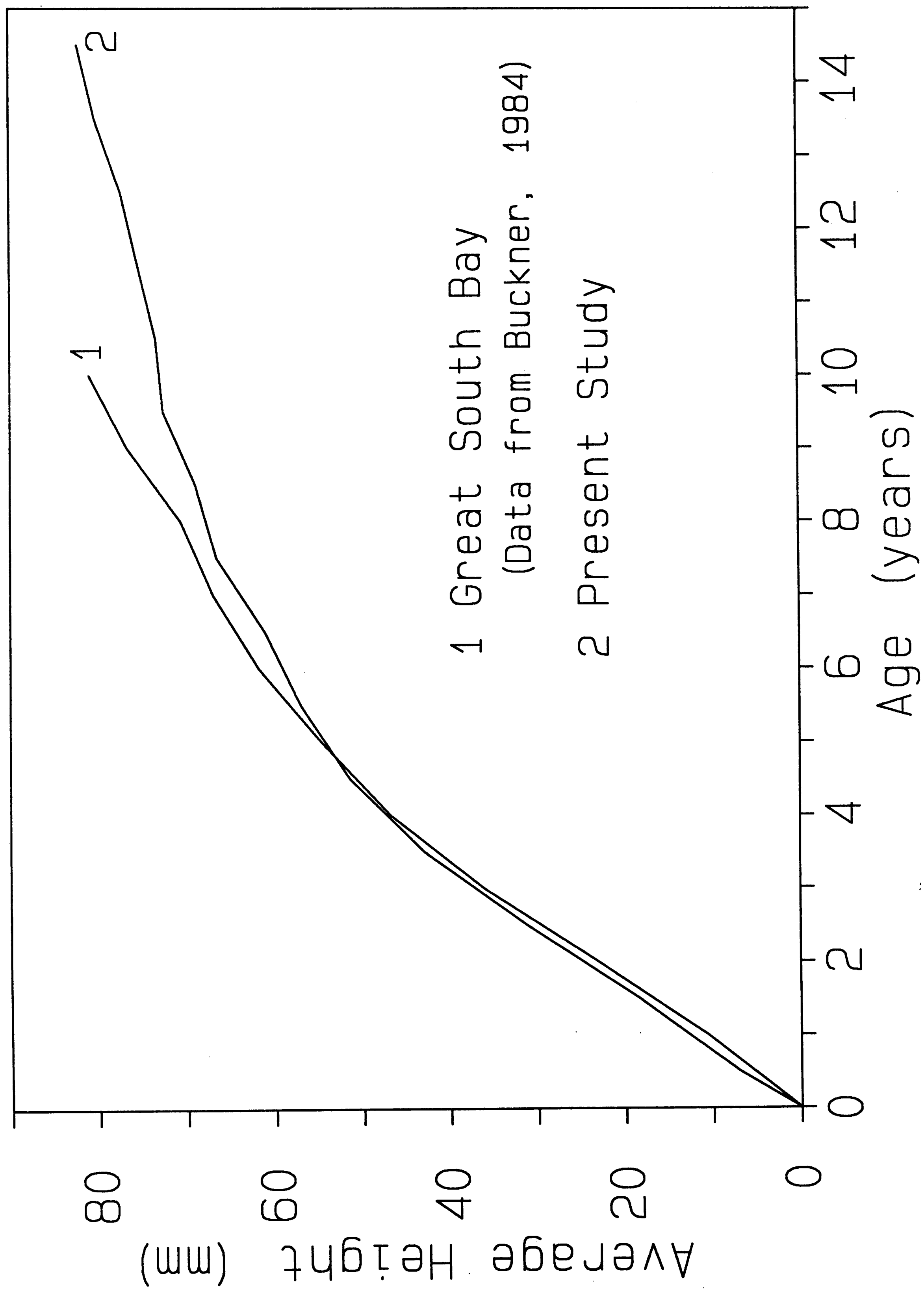

Figure 33. A comparison of overall average shell height vs. age results in the present study to that of a modern hard clam population in Great South Bay. Curve from Great South Bay based on estimates in Buckner (1984).

Cape Cod. It was only north of Cape Cod that maximum annual growth rates appeared to be reduced due to temperature effects.

Based on Ansell's study, it would not be surprising then to find similar growth curves from localities as far apart as Florida and Cape Cod. While this seems discouraging from the perspective of ever being able to reconstruct past environments, it should be noted that this result relates only to variation in annual growth. Other results in Ansell's study indicate that daily and seasonal growth patterns do change markedly with latitude (and presumably with climate).

c. Season of Harvest

Compared to the other results obtained in this study, season of harvesting estimates are the simplest to interpret. Season of death results should reflect only variations in harvesting methods and intensity and should not be sensitive to the effects of differential preservation or any of the other factors discussed earlier. The results for season of harvest are reproduced in Figure 34 and compared to estimates of seasonal hard clam landings for New York State during 1980. The latter were summarized from monthly catch statistics compiled by the New York State Department of Environmental Conservation.

Seasonal harvesting effort in the present day fishery is proportional to the size of the work force (Buckner 1984). In turn, the size of the work force can be related to weather conditions. During the colder months of the year (fall and winter), effort is lowest since only full-time baymen are actively harvesting the resource. Harvests peak during the warmer months (spring and summer) because a number of part-time commercial and recreational clammers enter the fishery.

The pattern of harvesting obtained in the present study is opposite to that in the modern fishery. This pattern shows a distinct seasonal trend that cannot be simply related to the warm and cold months of the year as in the modern fishery. One potential explanation of the results is that the methods used to process the clams after they were collected, rather than harvesting intensity, varied with season. For example, it is possible that during the spring and summer, clams were transported from the area whole or opened by breaking the shell. However, the simplest interpretation of the results is that harvesting intensity varied with season and peaked in the fall and early winter.

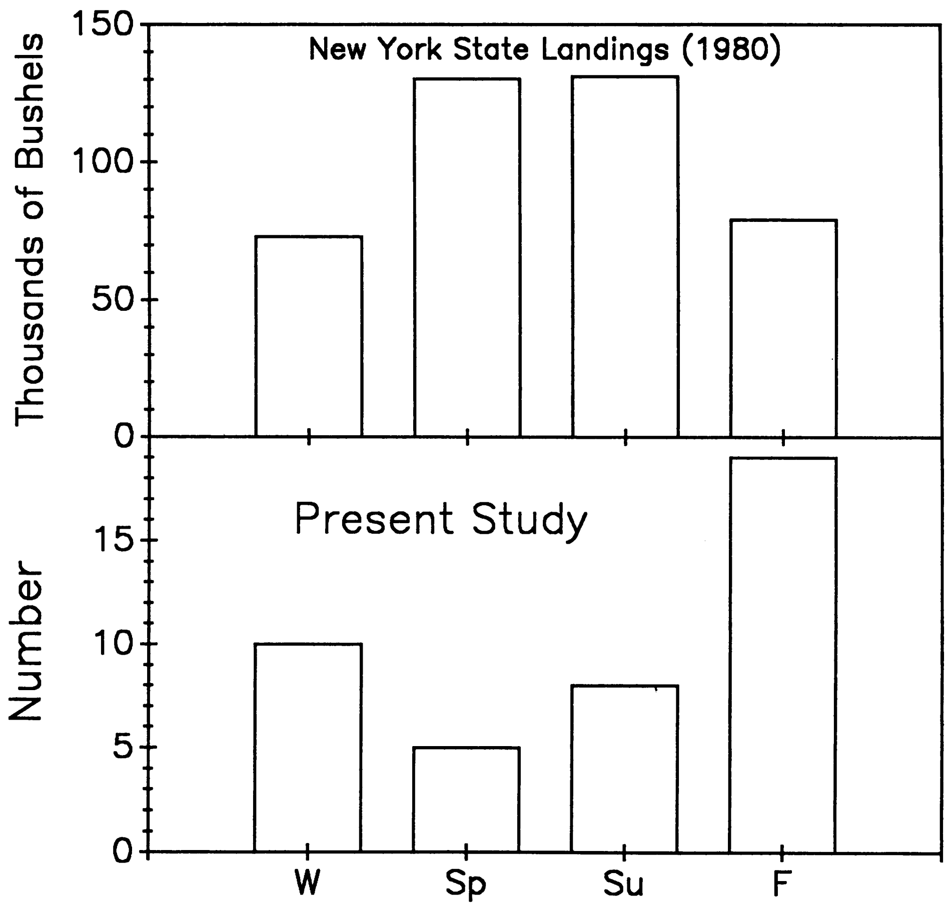

Figure 34. A comparison of season of harvest estimates obtained in the present study to seasonal hard clam landings for New York State in 1980. Data on landings summarized from monthly catch statistics compiled by the New York State Department of Environmental Conservation.

1) The age distribution obtained by pooling all of the sample results is characterized by low relative abundances of young (less than or equal to 30 mm in height and 1-3 years old) and old (greater than or equal to 67 mm in height and greater than or equal to 8 years old) clams. This result differs from the age structure predicted for a natural, unharvested population. Several alternative, but not mutually exclusive, hypotheses were proposed to explain this result:

   a) Small and/or large shells did not preserve as well as whole valves.

   b) Small and/or large clams were rejected as undesirable and/or transported away from the site.

   c) The absence of older individuals is indicative of an intensely harvested resource.

2) The average shell height vs. age relationship was found to be remarkably similar to that of hard clams in present day Great South Bay. This result, however, does not necessarily imply that habitat conditions were on the average similar since annual growth is influenced in a complex way by a variety of environmental factors.

3) The frequency distribution obtained by pooling the season of harvest data is characterized by a relatively high number of specimens collected in fall and early winter. This result is opposite that found in the present day fishery where harvesting effort peaks in spring and summer and can be related to weather conditions. The observed pattern suggests two alternative, but not mutually exclusive, hypotheses:

   a) Harvesting intensity peaked in fall and early winter.

   b) The methods used to process clams after collection varied with season.

Acknowledgements

I would like to thank Heather Wallace, Raoul Castaneda, and Thomas McKibbin for their work in preparing shell cross-sections. This research was supported by a Provost's Grant-In-Aid of Research, State University of New York at Stony Brook.

Data Tablulations By Sample

Sample #= 5S0E Level 3

Specimen #	1	2	3	4	5	6	7
Age (yrs)	Shell Height in mm						
0.5	-	-	-	-	-	-	-
1.5	19.2	-	8.7	12.9	15.8	13.7	17.2
2.5	33.2	24.7	24.9	34.3	-	24.7	26.3
3.5	45.1	41.5	35.6	42.2	41.7	34.3	34.5
4.5	51.4	55.0	46.1	46.4	49.2	45.2	41.7
5.5	53.8		58.3	54.8	54.6		46.4
6.5	58.5				58.0		
7.5	63.8				62.1		
8.5					64.3		
9.5					68.5		
Harvest Season	?	W	Su	F	F	Sp	Sp
Age	7(8?)	4	6	6	10	4	5

Sample #= 5S0E Level 4

Specimen #	1'	2	3	4
Age (yrs)	Shell Height in mm			
0.5	-	-	-	-
1.5	-	13.5	8.8	12.2
2.5	-	22.7	24.7	28.3
3.5	-	29.2	39.8	45.5
4.5	-	35.2	41.3	55.7
5.5	-	40.6	46.4	61.1
6.5	-	47.7	55.5	65.1
7.5			56.3	68.5
8.5			58.5	70.1
Harvest Season	?	W	?	W
Age	?	6	8(?)	8

Sample #= 13S1E Level 4

Specimen #	1
Age (yrs)	Shell Height in mm
0.5	-
1.5	20.8
Harvest Season	F
Age	2

Sample #= 13S1E Level 5

Specimen #	1	2	3	4	5
Age (yrs)	Shell Height in mm				
0.5	-	-	5.3	6.0	-
1.5	-	-	16.2	20.9	18.6
2.5	27.9	22.8	31.1	25.5	27.4
3.5	39.7	41.5	46.6	37.0	
4.5	47.1	52.2	50.1	45.9	
5.5	52.4	58.1			
6.5	57.4	63.2			
7.5	60.2	67.7			
8.5	62.1	69.1			
9.5	64.2	70.2			
10.5	67.6	73.7			
11.5	68.7	74.9			
12.5	70.2	76.1			
13.5	74.6	76.7			
14.5	75.2				
Harvest Season	?	?	Sp	F	F
Age	15(16)	13(14?)	4	5	3

Sample #= 13S1E Level 6

Specimen #	1	2
Age (yrs)	Shell Height in mm	
0.5	-	-
1.5	18.9	22.3
2.5	35.3	32.9
3.5	53.1	41.1
4.5	57.6	51.1
5.5		64.1
6.5		68.2
7.5		75.3
8.5		78.6
9.5		80.1
Harvest Season	W	W
Age	4	9

Sample #= 13S1E Level 7

Specimen #	1	2	3	4	5	6	7	8
Age (yrs)	Shell Height in mm							
0.5	8.5	5.4	-	5.3	-	-	5.5	-
1.5	19.4	20.2	15.9	15.8	-	18.5	19.2	15.5
2.5	33.0	-	32.3	25.8	27.8	34.2	32.3	30.5
3.5	40.3	44.2	43.9		39.9		43.9	43.9
4.5	52.4	51.3	48.6		48.9			50.4
5.5	58.8		57.1		55.5			
6.5	61.4		58.1		60.3			
7.5	65.2		62.9		63.2			
8.5					66.3			
9.5					68.9			
10.5					70.0			
11.5					73.3			
12.5					76.2			
13.5					79.4			
14.5					79.6			
Harvest Season	W	F	F	W	F	F	Su	W
Age	7	5	8	3	15	3	4	5

Sample #= 13S1E Level 8

Specimen #	1	2	3	4	5	6
Age (yrs)	Shell Height in mm					
0.5	-	-	-	-	-	-
1.5	25.2	17.1	16.7		20.5	-
2.5	34.7	34.1	28.1	32.8	34.0	-
3.5	41.9	45.3	37.7	43.6	43.5	-
4.5	46.8	55.3	44.8	52.3		-
5.5	52.8		50.5	60.6		-
6.5	60.0					
Harvest Season	?	F	F	?	?	?
Age	6(7?)	5	6	5(6?)	4(5?)	?

Sample #= 13S1E Level 9

Specimen #	1	2	3	4	5
Age (yrs)	Shell Height in mm				
0.5	-	-	-	-	-
1.5	16.8	19.2	18.0	-	21.9
2.5	30.2	36.2	28.6	28.0	36.4
3.5	41.5	47.2	40.6	36.8	46.5
4.5	52.2		51.4	50.0	60.4
5.5			54.0		
6.5			56.4		
Harvest Season	F	F	F	Su	W
Age	5	4	7	5	4

Sample #= <u>13S1E Level 10</u>

(Specimen #10 - no data)

Specimen #	1	2	3	4	5	6	7	8	9
Age (yrs)									
0.5	-	-	-	-	-	-	-	-	-
1.5	18.0	19.2	18.2	18.8	21.3	17.4	23.2	17.4	18.0
2.5	30.8	31.2	31.4	30.4	29.4	30.7	33.0	29.1	34.0
3.5	43.5	41.3	45.6	42.0	41.0	41.0	42.7	40.8	44.2
4.5	53.3	50.2	53.1	48.8	50.0	51.8	50.2	50.0	51.1
5.5			63.4	56.3			58.6		56.3
6.5				61.8					62.9
Harvest Season	F	Su	W	Sp	Su	Su	F	F	Su
Age	5	5	5	6	5	5	6	5	7

Sample #= <u>14S0E Level 5</u>

Specimen #	1
Age (yrs)	Shell Height in mm
0.5	8.7
1.5	24.1
2.5	39.6
3.5	48.7
4.5	55.8
5.5	62.5
Harvest Season	Su
Age	6

Sample #= 14S0E Level 7

Specimen #	1	2	3
Age (yrs)	Shell Height in mm		
0.5	8.9	-	-
1.5	22.9	15.8	15.1
2.5	33.7	31.2	21.2
3.5	37.6	42.6	31.1
4.5	41.3	55.8	46.9
5.5	44.9		56.9
6.5	47.1		60.5
Harvest Season	F	Sp	F
Age	7	4	7

APPENDIX SIX: ANALYSIS OF THE VERTEBRATE ASSEMBLAGE FROM THE SUNGIC MIDDEN SITE (2N3E 1-0), SHELTER ISLAND, NEW YORK

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The faunal remains described in this report were excavated from the Sungic Midden (2N3E 1-0), a combination shell midden and lithic scatter found north of Sungic Pond on the Mashomack Preserve, Shelter Island. Only one other published report exists for an aboriginal site excavated on Shelter Island (Latham 1957). In this report, Latham provides merely a "laundry list" of the miscellaneous faunal remains from the Smith site. These remains include:

Mammals - dog, muskrat, raccon, beaver, bear, mink, cottontail, woodchuck, whale;

Birds - merganser, sea ducks, wild turkey, night heron, bobwhite, large hawk;

Fish - eel, sting ray, sturgeon, shark, blackfish, porgy, bluefish, sea robin, flounder, codfish, small fish species;

Various crustacea and shellfish

Unfortunately, these faunal remains were not quantified, so that comparisons on a level other than presence/absence with the Sungic Midden assemblage are not possible.

Recovery and Methodology

The Sungic Midden faunal assemblage was recovered by dry screening through .6 cm wire mesh. In addition, flotation samples were taken and screened through two fine meshes (4 x 4 mm and 1.5 x 1 mm). The flotation samples were examined under a 10x compound microscope.

The entire assemblage was identified using comparative skeletal material available at the American Museum of Natural History, the Hunter College Bioarchaeology Facility and the author's private collection. In addition, a number of faunal manuals were used as supplemental references: Gilbert (1980), Gilbert et al. (1981), Olsen (1968).

Identification of faunal remains were made to the genus/species level when possible. In cases where the remains were too fragmentary for identification at this level, they were assigned to class (i.e. mammals, birds, etc.). The class groupings were then further subdivided into relative size categories of small, medium and large animals.

Bone measurements are important in the documentation of a faunal assemblage, if one is to make statements about the size and organization of animal populations. Following von den Driesch (1976) measurements were taken with a dial caliper with a precision of 0.1 mm (at approximately 20 degrees centigrade). These measurements are presented in Table 23.

Quantification

The data presented in this report utilizes the quantitative methods of nominal counts, including: the Total Number of Bones (TNB); the Number of Identified Specimens per Taxon (NISP) and the Total Number of Fragments (TNF). The nominal count methods were chosen due to the relatively small sample size of the assemblage. Tables 24 and 25 present this data.

Other methods of quantification do exist (i.e. Minimum Numbers, Relative Frequency, etc.); however, these methods are more affected by differential preservation of bone, recovery bias and sample size (Amorosi 1984) and were therefore not suitable for the quantification of this assemblage.

Account of the Species

Mammals:

Order: Artiodactyla
Family: Cervidae
Genus/species: *Odocoileus virginianus*
Common name: White-tailed deer

White-tailed deer are medium-sized ungulates which inhabit forest edges, woodlands, swampy and thicket areas adjacent to streams on Long Island. They congregate in groups of at least 25 or more during the winter months and are found singly or in groups of two or three (doe and fawns) in the summer and fall (Burt and Grossenheider 1976). Female white-tailed deer usually breed from October through mid-December and give birth to one or two fawns in late April (Cahalane 1961: 25,28). The fact that Long Island winters are relatively mild and food is fairly accessible, contributes greatly to the proliferation of deer in this area and their relative good health year-round. This results in little or no winter loss (Hamilton 1949) and an abundance for their predator: man.

A total of eight bones from Sungic Midden were assigned to the white-tailed deer. This comprises approximatley 7% of the total faunal assemblage (TNB=112). The following is a list of the represented skeletal elements:

Unit 5S0E - Two pieces of a left astragalus with fused epiphyses, as in an adult (level 3).

Unit 13S1E- One piece of a right mandibular fragment with a permanent second molar (level 5);
- Two pieces of a left mandibular fragment with a permanent first and second molar (level 7);
- Two molar tooth fragments (level 7);
- One piece of a left radial shaft (level 10).

The recovery of the two mandibular fragments with molar teeth facilitates the relative aging of the animal represented. Deer younger than 1.5 years old can be aged on the basis of tooth eruption. However, after this age all deciduous teeth have erupted and aging can only be carried out using a relative tooth wear chart (Hesselton and Hesselton 1983). It is important to remember that this method is a relatively subjective one and that different wear patterns result from different habitats and diets. Therefore, the examples used for comparative purposes should be from a relatively local population.

Through the use of a tooth wear chart available at the New York State Department of Environmental Conservation, an article published by the same organization (N.Y. State Conservation Department, n.d.) and comparative deer mandibles in the author's private collection, it was determined that the mandibular fragments in the assemblage represent an individual of about 3.5 years of age at the time of death. Since deer on Long Island are, for the most part, born in late April, it is likely that this individual was killed in the fall.

Order: Carnivora
Family: Canidae
Genus/species: Canis familiaris
Common name: Domestic dog

Numerous dog burials have been excavated in Long Island Amerind sites. Since the dog remains do not appear to have been butchered or processed as food, their presence may reflect other activities. Strong (1983) suggests that the relationship between the dog and prehistoric man on Long Island is associated with spiritual beliefs. Some dog burials have even been found in direct association with human remains and burial goods.

A total of five bones and bone fragments from Sungic Midden were assigned to the domestic dog. This comprises about 5% of the total assemblage (TNB=112). The following skeletal elements were identified:

Unit 13S1E - One piece of a left mandibular body with deciduous second and third premolars (level 5);
- One left astragalus with unfused epiphyses, appears to be an immature individual (level 5);

Unit 14S0E - One lumbar vertebrae with fused epiphyses (level 5);
- Two fragments of a right scapula (level 7).

A general degree of age can be assessed on the basis of tooth eruption for the deciduous teeth present in the left mandibular body. Deciduous premolars two and three are present, while the first permanent molar is just erupting and the permanent second molar is unerupted. Silver (1963:265) states that the permanent first molar erupts at the age of four to five months, while the permanent second molar erupts at five to six months of age in the dog. On the basis of this evidence, the domestic dog remains recovered from unit 13S1E probably represent an individual that died at the approximate age of five months old. The cause of death is unknown.

Birds:

Order: Anseriformes
Family: Anatidae
Genus/species: Anas platyrhynchos
Common name: Mallard

The mallard belongs to the subfamily Anatinae which is comprised of surface-feeding ducks. They inhabit fresh and salt water marsh areas and are generally found in the vicinity of Long Island during the spring and fall migrations (Robbins et al.: 1966). However, bird banding evidence suggests that the migration patterns are not as standardized as once thought (Wauer 1985:21). Perhaps this is due to the present practice of providing food for waterfowl on a year-round basis.

Only one bone fragment from the entire faunal assemblage has been assigned to the mallard (approximately 1% of the total assemblage). The proximal end and shaft of a humerus were recovered from level 9, below the hearth feature in unit 14S0E. Although the bone does not exhibit signs of butchering, this does not negate its use as a possible food source. Due to their rather delicate nature, it may be that the bones of birds were broken by hand along the joints instead of being butchered with stone tools.

The proximal humeral fragment of the mallard does, however, appear highly carbonized. This is probably the result of the cooking process used in its preparation as food.

Reptiles:

Order: Testudinata
Family: Emydidae
Genus/Species: Terrepene sp.
Common name: Box Turtle

Despite its family affiliation with pond turtles, the box turtle is very terrestrial in habits and often wanders far from water. It is omnivorous but subsists largely on vegetal matter (Smith 1898-1899: 31).

The box turtle most closely resembles the true land tortoise in its ability to completely close itself within a bony shell by means of a plastron (or lower shell) on moveable hinges. With the approach of danger, the limbs and head retract fully into the shell while both lobes of the plastron close tightly against the carapace (upper shell) (Ibid.).

As early as late September, the colder weather triggers the box turtle to seek dry, loose soil and dig a burrow well below the frost line for the winter. It will remain in a state of dormancy for at least six months, emerging in April (Barker 1956:269).

One piece of carapace, probably from the box turtle , was recovered from unit 5S0E, level 3. This comprises approximately 1% of the total faunal assemblage (TNB=112). No evidence of food preparation (i.e. butchering, carbonization, etc) is exhibited on the fragment. However, this does not negate the turtle's possible use as a food source for the aboriginal inhabitants of Sungic Midden. The flesh of the box turtle is very edible (Babcock 1971). In fact, remains of box turtles have been found in other Long Island aboriginal sites (Latham 1957). The shells of the turtle could also have been used as a container for just about anything, from food to water.

Fish:

Order: Acipenseriformes
Family: Aciperseridae
Genus/species: Acipenser sp.
Common name: Sturgeon

Sturgeons are sluggish, clumsy, bottom feeding fish who feed in part by scavenging. They have a prolonged snout, toothless jaw and are the largest fresh water fish, ranging in size from 2.5 to 30 feet in length (Svetovidov 1984:220). The largest species are usually anadromous, primarily inhabiting marine waters and spawning in spring and early summer in fresh water (Jordon 1925:255).

The skeleton of the sturgeon is largely cartilageneous, however, there are five rows of bony scutes or plates on the body. These are sometimes interspersed with smaller plates. In addition, the head is covered with bony shields (Svetovidov 1984:220).

Sturgeons are greatly valued for their use as food, due in part, to their large size. The flesh is coarse and beefy in texture and the eggs of the fish can also be used as food (Jordon 1925:255).

Three tiny fragments of the characteristic bony plates or scutes of the sturgeon have been identified from unit 13S1E, levels 2-7. This comprises approximately 3% of the total faunal assemblage. Usually, all that is found of the sturgeon in an archaeological context is larger fragments of scutes. In this case, however, the fragments recovered in the flotation sample from the midden were so small that they required identification with a 10x compound microscope.

Summary of Faunal Assemblage by Unit

Table 26 summarizes the breakdown of the faunal remains recovered from each unit.

Unit 5S0E. A total of eighteen bones and bone fragments were recovered from this unit in levels 3 through 5. Mammalian species, including deer, medium-sized mammals (i.e. deer size) and unidentified mammal fragments, account for 83% of the faunal assemblage from this unit. Small-sized birds (i.e. song bird size) comprise 11%, while the box turtle carapace fragment comprises the remaining 6% of the assemblage. No fish remains were recovered from unit 5S0E.

Only one carbonized bone, comprising 6% of the assemblage recovered from unit 5S0E, was identified.

Unit 13S1E. A total of seventy-nine bones and bone fragments were recovered from this unit. Of the total remains recovered from unit 13S1E (TNB =77), 97% were recovered from levels 2 through 7, the crushed and trampled shell lense (L1 in figure 22). Mammalian species including deer, dog, medium-size mammals (i.e. deer size) and unidentified mammal fragments account for 61%, while medium-sized birds (i.e. duck size) make up approximately 1%. Thirty-Five percent of the faunal sample is comprised of sturgeon and unidentified fish fragments. No reptile remains were recovered from the unit.

The remaining 3% of the assemblage recovered from this unit was excavated within level 10, the bell shaped pit (F2 - Figure 22). Deer and medium-sized mammals (i.e. deer size) comprise the remains from this level.

No carbonized bone remains were recovered from this unit.

Unit 14S0E. A total of fifteen pieces of bone and bone fragments were recovered. Approximately 86% were recovered from levels 5 through 7, the hearth feature (F1 - Figure 24). Of the total, 60% is comprised of dog, deer, medium-sized mammal (i.e. deer size) and unidentified mammal fragments; 13% is comprised of medium-sized bird (i.e. duck size) and small-sized bird (i.e. song bird size) and the remaining 13% is accounted for by unidentified fish fragments. No reptile remains were recovered from the unit. Approximately, 20% of the bone remains from levels 5 through 7 are carbonized.

The remaining 14% of the total assemblage from unit 14S0E (TNB=15) was excavated from level 9, the pit feature (F2 - Figure 24). The remains included mallard and medium-sized mammal (i.e. deer size) remains. Approximately 7% of the bone remains from this level are carbonized.

Taphonomic Evidence

No clear cut evidence of butchering (i.e. cut marks on bone shafts) was observed in the Sungic Midden faunal assemblage. The majority of the long bone shaft fragments appear to have been split and broken in an effort to facilitate marrow extraction. This may be the result of human activity. As stated previously, the proximal humerus of the mallard may have been broken by hand.

An examination of the remains for other taphonomic alterations reveals that approximately 5% of the total assemblage (TNB=112) appears to have been carbonized, possibly as a result of cooking. Of this 5%, the majority were excavated from unit 14S0E, both within (level 5) and below (level 7) the hearth feature (F1). Only one carbonized bone remain was recovered from unit 5S0E. This data is tabulated in Table 27.

Seasonality

Due to the small sample size it is not suggested that one use the faunal assemblage alone to derive seasonality of occupation at the Sungic Midden site. Although the presence of deer, duck and turtle remains suggests deposition from the spring to the fall, the bone remains could have been deposited at any time of the year. The derivation of seasonality of occupation from such a small sample is prone to error and therefore not suggested.

TABLE 23: MEASUREMENTS OF THE IDENTIFIED VERTEBRATE ELEMENTS

UNIT	LEVEL	SPECIES	ELEMENT	MEASUREMENTS
13S1E	5	Domestic dog	Lt. mandible	19)- 17 mm.
			Lt. astragalus	GL)- 24.96 mm.
14S0E	5	Domestic dog	Lumbar vertebrae	PL)- 18.72 mm. BPacr)- 10.42 mm. BPacd)- 10.45 mm. BFcr)- 10.25 mm. BFcd)- 10.45 mm. HFcr)- 7.27 mm. HFcd)- 7.28 mm.

TABLE 24: THE NUMBER OF IDENTIFIED SPECIMENS PER TAXON (NISP)

TAXON	NISP	% NISP (NISP=18)	% TNB (TNB=112)
Class Mammalia			
Order Artiodactyla			
Family Cervidae			
Odocoileus virginianus (White-tailed deer)	8	44	7
Order Carnivora			
Family Canidae			
Canis familiaris (Domestic dog)	5	28	5
Class Aves			
Order Anseriformes			
Family Anatidae			
Anas platyrhynchos (Mallard)	1	6	1
Class Reptilia			
Order Testudinata			
Family Emydidae			
Terrepene species (Box turtle species)	1	6	1
Class Pisces			
Order Acipenseriformes			
Family Acipenseridae			
Acipenser species (Sturgeon species)	3	16	3
TOTAL NISP	18	100%	17%

Key: NISP = Number of Identified Specimens Per Taxon
TNB = Total Number of Bones

TABLE 25: THE NUMBER OF UNIDENTIFIED BONES AND BONE FRAGMENTS PER CLASS

CLASS	TNF	% TNF (TNF=94)	% TNB (TNB=112)
Mammalia			
Medium-sized mammal (deer size)	21	22	18
Unidentified mammal	41	44	36
Aves			
Small-sized bird (song bird size)	3	3	3
Medium-sized bird (duck size)	2	2	2
Pices			
Unidentified fish	27	29	24
TOTAL TNF	94	100%	83%
TOTAL NISP	18	-	17%
TOTAL TNB	112	-	100%

Key: TNF = Total Number of Fragments
TNB = Total Number of Bones

TABLE 26: BREAKDOWN OF THE MAMMAL, BIRD, REPTILE AND FISH REMAINS IN COUNTS/PERCENTAGES PER UNIT

	5S0E (TNB=18)	13S1E (TNB=79)		14S0E (TNB=15)	
	Levels 3-5	Levels 2-7	Level 10	Levels 5-7	Level 9
MAMMAL	15/83%	48/61%	2/3%	9/60%	1/ 7%
BIRD	2/11%	1/ 1%	-	2/13%	1/ 7%
REPTILE	1/ 6%	-	-	-	-
FISH	-	28/35%	-	2/13%	-
TOTALS	18/100%	77/97%	2/3%	13/86%	2/14%

Key: TNF = Total Number of Fragments
TNB = Total Number of Bones

TABLE 27: TAPHONOMY (CARBONIZATION) BREAKDOWN PER UNIT

UNIT	LEVEL	% OF TOTAL TNB (TNB=112)	% OF TNB PER UNIT
5S0E (TNB=18)	4	1	6
14S0E (TNB=15)	5	3	20
	9	1	7
TOTAL % OF TAPHONOMY		5%	

Key: TNB = Total Number of Bones

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