Spring 5-7-2021

Dietary Change Among Canis Familiaris During the Late Ceramic Period on the Maine-Maritime Peninsula: A Case Study From the Holmes Point West Site (ME 62-8), Machias Bay, Maine

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DIETARY CHANGE AMONG *CANIS FAMILIARIS* DURING THE LATE CERAMIC PERIOD ON THE MAINE-MARITIME PENINSULA: A CASE STUDY FROM THE HOLMES POINT WEST SITE (ME 62-8), MACHIAS BAY, MAINE

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A THESIS

Submitted in Partial Fulfillment of the

Requirements for the Degree of

Master of Science

(in Quaternary and Climate Studies)

The Graduate School

The University of Maine

May 2021

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An Abstract of the Thesis Presented
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Archaeological study of Indigenous pasts has been characterized by a focus on objects over people. This study attempts to humanize the past by illuminating human agency in the human-dog relationship through a case study of dog health and diet during the Late Ceramic period (ca. 950 – 450 BP) in the Maine-Maritime Peninsula region. To circumvent the cycle of western knowledge building and marginalization of Indigenous communities, past Wabanaki people and their relationships with dogs are positioned at the center of research questions presented here.

Few studies in the Northeast have analyzed dog remains from the Ceramic period (ca. 3050 – 450 BP) and none from the Late Ceramic period for subsistence trends. This thesis addresses that gap and evaluates dog diet and human and canine relationships through an analysis of canine faunal collections at the Holmes Point West site (ME 62-8) in Machias Bay, Maine. Special emphasis is placed on legacy canine collections representing the remains of two dog burials excavated in 1973.

A minimum of four canine individuals are the subject of analyses undertaken here. Individuals are contextualized through investigation of available health and pathology information, existing site records, relevant historical and ethnographic accounts, regional ceramic chronologies, and new and established radiocarbon dates. These traditional lines of evidence are complemented by a study of bone collagen stable isotopic values of $\delta^{13}C$ and $\delta^{15}N$ derived from canine individuals for information about

past diet. Dietary evidence from dogs is used as an analogy for human diet, following the Canine Surrogacy Approach (CSA), which is based on established understandings of social and food-sharing practices at the heart of the human-dog relationship. This method has been used by researchers to infer human diet when human remains are unavailable or not preferable for study.

Findings suggest that canine individuals at the Holmes Point West site may have fulfilled diverse roles, based on the varying ages of individuals present and wide-range of depositional contexts. Stable isotope analysis suggests that canines consumed an increasingly terrestrially-oriented diet ca. 600 BP, a change from the overwhelmingly marine-oriented diets of canines during the earlier Ceramic period. Overall, results suggest major subsistence changes for dogs and potentially Wabanaki people at the Holmes Point West site during the Late Ceramic period, a period of intermittent contact between Europeans and Indigenous people. This case study offers a new approach for understanding subsistence changes in the region and provides a framework to examine human agency through the remains of dogs.

This research addresses several gaps in regional archaeological datasets. Dog remains from an understudied time period are examined, addressing calls by previous researchers in the region for more contextualized case studies to further our understanding of human and dog dietary relationships. This research also helps to address gaps that exist between the ethnographic and archaeological records for the Late Ceramic and Protohistoric periods. Lastly and most importantly, this case study underscores the importance of the human-dog relationship within a hunting, fishing, and gathering community in the Maine-Maritime Peninsula region.

DEDICATION

This work is dedicated to Moose and Ki, who challenge and inspire me to be more than human.

ACKNOWLEDGEMENTS

Many different groups and people made this research possible. Funds to support my research came from the Maine Academic Prominence Initiative grant and a research grant from the College of Liberal Arts and Sciences at the University of Maine. Support from the Department of Anthropology and Climate Change Institute allowed me to present my research on many occasions to a variety of audiences. My two-year assistantship with TRIO Student Support Services is the only reason I was able to live in Orono during the whole process, and I am indebted to their generous support. The Penobscot Chapter of the American Association of University Women provided scholarship funds which have allowed me more time to write this research and prepare for publication.

Thanks go to my advisor, Bonnie Newsom, for all her patience and guidance, as well as the other members of my thesis committee, Eric Guiry and Daniel Sandweiss for their time and support. Dr. Mark Hanks provided invaluable help examining the canine remains and Dr. Marcella Sorg assisted with identification. Matthew James and my husband Brendan Hall helped teach me how to do photography. Arthur Spiess, Donald Soctomah, Sky Heller, Gabriel Hrynick, Arthur Anderson, and Kendra Bird have all provided insight along the way. Emily Blackwood provided moral support.

This project would not be possible without the cooperation of the Passamaquoddy Tribe, Maine Coast Heritage Trust, and the Brack Family. Thanks, and kci woliwon!

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CHAPTER 1

INTRODUCTION AND OVERVIEW

Introduction

The study of human and dog relationships in the archaeological record has benefited from considerable attention by past and current researchers. The study of past dogs has the potential to provide insight into the first human and domesticate relationship, the timing and nature of human migrations and dispersal throughout the world, hunting and work practices among different cultures and communities, as well as the complex roles of animals within human societies. Most importantly, the study of dogs offers unique insight into human nature, due to the time-tested and unique social and food-sharing relationship that exists between the two species (Miklosi 2004:48-50).

The goal of this research is two-fold: first, it aims to humanize the past by illuminating agency in the human-dog relationship. Second, this research confronts archaeological practices that have historically excluded descendant communities from the archaeological research process. These goals are rooted in an Indigenous archaeologies approach to research. Atalay (2008) proposes that in order to address archaeology's nationalist, colonialist, and imperialist roots we must do more than create room for multiple voices at the table (Atalay 2008:38). In her view, a more comprehensive and multivocal approach affects archaeology at every stage of the project, from the planning phases to the presentation and uses of research. In an effort to circumvent the cycle of knowledge building solely through Westernized archaeology and science, this type of multivocality attempts to combine Western and Indigenous theoretical and methodological concepts (Atalay 2008:34). Examining the past through the lens of communities offers a bridge between empirical archaeological practice and community-oriented archaeologies.

The research presented here builds on the scholarly body of work by examining social interaction between humans and canines, understood through its material manifestation within zooarchaeological remains. This study is unique in that it frames interactions between dogs and humans through agency theory, which has historically been applied to understand the relationship between humans and material culture through social reproductions. Here, agency theory is used to explore the material manifestation of human agency in the human-canine relationship, through a study of dog health and in particular dietary trends.

How to Humanize People in the Past through Archaeological Inquiry

Research Questions

Human-canine interactions in the Maine-Maritime Peninsula region during the Ceramic period (ca. 3050 – 250 BP) are not well understood archaeologically. Previous archaeological studies of dogs in the Northeast have focused heavily on remains dating to the Late Archaic period (Bourque 1995; Guiry 2012; Guiry and Grimes 2013; Spiess and Lewis 2001; Tuck 1970). The remains of dogs and dog burials dating to the Ceramic period have been recovered throughout the region and discussed briefly in the literature (Abbe Museum 1994; Allitt 2011; Deal 1986; Ingraham 2011) but have not received the same level of archaeological scrutiny as those dating earlier than approximately 3,050 BP (Mann 2020:23). This project examines the zooarchaeological remains of dogs and their archaeological context at the Holmes Point West site (ME 62-8) in Machias Bay, Maine in order to better illuminate human-canine interactions in the Maine-Maritime Peninsula region during the Late Ceramic period (ca. 950 – 250 BP).

This research addressed two questions. First, a review of past investigations by archaeologists shows that their work frequently emphasizes the value of objects over people, and I attempt to address this issue through my research question. This case study incorporates agency theory as a tool to aid in humanizing archaeological inquiry and highlighting the individual and collective decisions made by people in the past, based on cultural and/or historical contexts. Agency is defined here as "…the intentional choices made by men and women as they take action to realize their goals" (Brumfiel 2000:250). As already mentioned, many archaeological questions linked to agency theory and its methodologies are specifically concerned with identifying how human choice has shaped past material culture (Chilton 1996; Dobres 1995; Dobres and Hoffman 1994; Newsom 2017; Spector 1993). This case study proposes that these ideas are also relevant when considering the zooarchaeological remains of dogs. Compelling evidence from the archaeological record and ethnohistorical research support that past peoples made choices which inevitably affected dogs cohabitating in their communities (Butler and Hadlock 1994), determining their roles (Kerber 1997a), the way they ate, worked, moved or were traded, and ultimately how they were deposited into the archaeological record after their death (Perri 2017; Tourigny et al. 2016).

Second, this case study also suggests that there are physical and measurable effects of human agency in the archaeological remains of dogs. This is demonstrated through a case study of the remains of at least four canine individuals at the Holmes Point West site (ME site 62-8), a Ceramic period shell-midden site located on Machias Bay in the Eastern portion of the current-day State of Maine. Radiocarbon dates, Indigenous ceramics, and European components at the site have indicated a period of use spanning the entire Ceramic period (ca. 3,050 – 250 BP), following Petersen and Sanger's (1991) regional ceramic chronology.

Research Objectives

Four research objectives were established to help guide answering the research question posed above:

1) To better understand the human-canine relationship at a specific case study site in the Maine-Maritime Peninsula region;
2) Humanize the past by exploring human agency in the archaeological record, illuminating choices made by people;
3) Contribute to the archaeological data set for the Northeast specifically and North America more broadly, using faunal remains from the Holmes Point West site as a case study;

4) Add to the cultural heritage of Wabanaki people in Maine, supporting outreach and publication about cultural heritage management.

Contribution to Archaeological Research

This case study makes several important contributions to archaeological research in the region. This project examines the archaeological remains of dogs from an understudied time period and region, namely the Late Ceramic period (ca. 950 – 450 BP) of the Maine-Maritime Peninsula, and so addresses a gap in the regional dataset for dogs, as well as dog dietary data. Previous researchers in the region have called for more contextualized case studies on dogs to further our understanding of human and dog dietary relationships (Guiry and Grimes 2013:743-744). This research, while comprising a small case study at one site, attempts to provide such a dataset.

Findings from this research indicate the possibility that dogs were affected by major subsistence changes in Wabanaki communities beginning approximately 700 years ago, though the reason for this change is still unclear. Other researchers in eastern Maine and the adjacent Maritimes have also noted substantial changes to seasonal transhumance patterns and overall subsistence trends during the Late Ceramic period, perhaps as a result of economic pressures from Europeans seeking furs (Hrynick et al. 2017). Though Wabanaki people at the Holmes Point West site during the Late Ceramic period may not have been in direct contact with Europeans, it stands to reason that their traditions of subsistence and trade would be transformed by large socio-economic changes in the overall region. This research helps to address gaps that exist between the ethnographic and archaeological records for the Late Ceramic and Protohistoric periods (Hrynick et al. 2017:102).

Perhaps most importantly, this case study underscores the importance of the human-dog relationship within a hunting, fishing, and gathering community in the Maine-Maritime Peninsula Region. An assessment of dental pathology indicates that at least one dog at the study site was elderly and likely suffered from advanced periodontal disease, indicating that it was still considered to be an important part of the human community late into its life. This individual was placed adjacent to another dog in what is assumed to be a double inhumation within the site's shell midden. Yet at least two other dogs at the site were discovered within very different archaeological contexts: one within the vicinity of a hearth feature and one in a discarded state. The research presented here offers insight into the potential roles of these identified canine individuals and the possible explanations for their indicated health, diet, and archaeological context.

Finally, this research has attempted to circumvent established exclusionary practices in archaeological inquiry by engaging with Wabanaki people and communities throughout the research process. Future engagement and publication to highlight the importance of this research are ongoing and is part of the scaffolding for sustained Wabanaki engagement in archaeological inquiry, which is currently underway in Maine. Engaging with communities in and around cultural heritage management and resources does not always translate easily to traditional academic accomplishments. As archaeological researchers, efforts in this regard contribute to the systemic changes needed to ensure a more equitable archaeological practice.

Engaging Communities in Archaeology at the Holmes Point West Site

Research at the Holmes Point West site, directed by Dr. Brian Robinson from 2008 through 2014 and most recently by Dr. Bonnie Newsom, both of the University of Maine, exemplifies collaborative efforts between researchers, descendant communities, and additional stakeholders. Indigenous communities and local stakeholders are often excluded from archaeological investigations, attributable to long standing exclusionary practices in academic research and control over archaeology by academic institutions. The concept of multivocality makes the practice of Indigenous archaeologies different from that of other archaeologies (Atalay 2008:29). Indigenous archaeologies are still evolving in their definition, however they have several defining characteristics: collaboration with local communities, development of research questions and agendas with and for Indigenous people, respect for local traditions, incorporation of traditional practices, combining of western and Indigenous approaches, and respect for Indigenous peoples' connection to the past (Atalay 2008:29-30). "While focus and specifics may vary, one common thread among Indigenous archaeologies…is an incorporation of, and respect for, the experiences and epistemologies of Indigenous groups globally" (Atalay 2008:29).

Previous archaeological research in the Machias Bay region has incorporated various communities and organizations with vested interests in the management of cultural heritage sites. The Passamaquoddy Tribe and the Tribal Historic Preservation Officer, Donald Soctomah, have been tireless collaborators with researchers at the University of Maine in their work at Machias Bay sites. Work at the site is facilitated by the local land trust organization, Maine Coast Heritage Trust, which manages the Holmes Point West and Long Point sites and their access. The landowners of Holmes Point West work in conjunction with the land trust and university to ensure access for archaeological work.

This project has endeavored to stay true to the tradition of community engagement at the study site through various steps taken throughout the research process. Developing a project with an emphasis on human aspects of archaeological inquiry helped to place people and not objects at the center of the research, hopefully making any findings more accessible and relevant to Indigenous communities and other stakeholders. Prior to carrying out any analyses on canine faunal remains, permission to work with the legacy materials was requested of and granted by the Passamaquoddy Tribal Historic Preservation Officer. Finally, giving back to the wider Wabanaki community and other stakeholders through publication and outreach about findings from this work is planned for the future. By incorporating Indigenous peoples and their values into our research, we make our projects more inclusive and ensure that communities who are invested in the preservation and management of the past are included throughout the research process (Atalay 2008).

Conventions Used

This section is provided as an overview of the archaeological conventions used throughout the text. Archaeological site numbers are presented following first mention of the site and where otherwise appropriate, such as in captions. The study site's locale is generally referred to as the "eastern region of Maine." The broader geographic region is termed the "Maine-Maritime Peninsula," which is often discussed as a cohesive cultural region within the archaeological and ethnohistoric research community.

Radiocarbon dates other than those generated through the present study are presented as originally reported along with available standard errors, calibration curve, and source material. New radiocarbon dates presented by the author are reported following updated guidance by Millard (2014), accounting for calibration curve, software used, and any pre-treatments applied to the sample. All new radiocarbon dates were calibrated using the most recent terrestrial and marine calibration curves, IntCal20 and Marine20, and OxCal 4.4.2 software.

The term "assemblage" is used to refer to all collections of a particular faunal material from the case study site at all discrete times in the past, and the term "collection" is used to refer to specific times, such as the 1973 field season faunal collection. The way that the term "element" is used is inclusive of whole and non-whole specimens which are identifiable to element, and the term "specimen" is used interchangeably with "element." The term "canid" is used when specimens may include the remains of non-domesticated individuals, and the term "canine" is used more generally to refer to any faunal remains attributable to dogs, domesticated or not.

Thesis Organization

Six chapters are included in this thesis and are outlined here to better orient the reader. Chapter 1 introduces the reader to the research question and objectives for this case study, which are outlined in four components. Next, the community engagement aspect of this research is explored, highlighting the stakeholders involved in ongoing research at the Holmes Point West site who make archaeological inquiry possible there. A review of the conventions used throughout this document is presented followed by an overview of the organization of the overall thesis document.

Chapter 2 begins with a brief presentation of the agency theory framework used to understand human and canine relationships at the Holmes Point West site, accomplished by examining the material manifestation of human agency in canine health and diet. This section is followed by a select review of relevant information on dogs in the archaeological record. Earliest known interactions between humans and dogs during the Pleistocene Ice Age in Europe are considered, then the focus turns to evidence from early human migrations into North America and finally the Northeast. Lastly, available ethnographic and historical accounts detailing interactions between Indigenous people, dogs, and European colonists in the region is considered for contextualized insight into the human-canine relationship.

The case study is presented in Chapter 3, beginning with an overview of the study site, including the environment and ecology, surficial geology, tidal subsidence, paleoclimates, and resulting human adaption. Following this, a review of culture history of the Far Northeast is provided, specifically focused on people and traditions of the Eastern portion of Maine and the adjacent Canadian Maritime region, including the present-day provinces of New Brunswick and Nova Scotia. Finally, a history of archaeological inquiry in the region is provided, starting with work completed in the 18th, 19th, and early 20th centuries during the field of archaeology's nascency and moving into the mid to late 20th century when the majority of excavations occurred.

Methodologies and methods used to address the research question and objectives outlined in Chapter 1 are presented in Chapter 4. The Canine Surrogacy Approach (CSA), which suggests that dogs may be used to help infer human dietary patterns, is the methodological approach used in this case study and a short review of previous applications is presented for the reader. The categorical framework as outlined in Guiry (2012) is presented and later used in Chapter 6 to evaluate the results of stable isotope analyses. Methods are presented in four stages. Stage 1 outlines the steps taken in zooarchaeological sampling of canine remains during the 1973 excavations at the Holmes Point West site and presents some considerations taken by the author in working with legacy archaeological collections. Stage 2 outlines steps taken in completing comparative faunal analyses, including NISP and MNI calculations, health and pathology examinations, and the resulting inventory and photographic catalog. Stage 3 reviews available data collected from the 1973 field season, including field notes, maps, and photographs, to help contextualize the canine remains sampled in this study. Considerations are also provided to the reader regarding the original data recovery, including excavation techniques and datum differences between units. Finally, a ceramics chronology was completed utilizing the chronological framework established by Petersen and Sanger (1991) to help indicate relative ages of faunal material sampled for radiocarbon dating and stable isotope analyses. Stage 4 outlines steps taken for sampling canine zooarchaeological remains for radiocarbon dating and stable isotope analyses. Sample preparation and treatment standards are presented, as well as a review of stable isotope theory as it applies to archaeological inquiry in this case study. Lastly, biological considerations in sampling from canine remains are reviewed and reasons for including an environmental baseline sample are presented.

Chapter 5 presents the results of analyses completed in the course of this case study. A review is presented of results from each of the four stages outlined in Chapter 4. Finally, data pertinent to each of the four canine individuals sampled in this case study are presented to aid the reader in understanding details about their archaeological context, health, and diet.

Chapter 6 begins with an evaluation of the degree to which dog diet at the Holmes Point West site is reflective of human diet, following the categorical framework outlined by Guiry (2012). Next, an interpretation of this study's results is presented within the context of the Late Ceramic period of the Maine-Maritime Peninsula region. Next steps and future directions for this research are outlined, calling for additional stable isotope analyses, sampling of ancient DNA from canine individuals at the study site and other sites in the region during the Late Ceramic period, greater involvement of the Wabanaki community in research, and future outreach and publication to communicate the results of this research with invested stakeholders. Lastly, conclusions are drawn based on interpretations made, specifically that evidence of human agency is evident in the archaeological remains of dogs from the Holmes Point West site.

CHAPTER 2

THEORETICAL FRAMEWORK AND LITERATURE REVIEW

Introduction

Archaeologists are challenged with humanizing their research, a task complicated by the often-arcane nature of our work. It is difficult to interpret meaning when the remains of the past are fragmentary or unclear, let alone distill out aspects of the human element. One approach offered to archaeologists seeking to humanize archaeological inquiry is through applications of agency theory. Archaeological investigators have used the lens of agency when examining material culture to humanize the archaeological record (Dobres 1995; Dobres and Hoffman 1994; Newsom 2017; Spector 1993), though using agency theory to understand human-animal and interspecies relationships is also possible and a growing area of exploration (Spzak et al. 2014). This chapter provides a brief review of agency theory as it applies to this case study and presents it as a framework for understanding human and canine relationships at the Holmes Point West site. Following this, a history of dogs in the archaeological record of the region is presented, from important early Pleistocene finds to evidence from early human migrations into North America and finally the Far Northeast. After this, available ethnographic and historical accounts are reviewed for contextualized insight into the human-canine relationship in the region.

Seeking Agency in the Human-Dog Relationship

According to Dornan (2002), the use of agency theory has become more commonplace in archaeology and the social sciences since the 1970s (Dornan 2002:303). Agency theory utilizes seminal agent/structure frameworks developed by Pierre Bourdieu (1977) and Anthony Giddens (1979), which build upon the work of earlier theorists, including Karl Marx and Émile Durkheim (Dornan 2002:302-303). Elizabeth Brumfiel (2000:250) observed that scholars of agency tend to agree that "…agency refers to the intentional choices made by men and women as they take action to realize their goals. All would agree that these actors are socially constituted beings who are embedded in sociocultural and ecological surroundings that both define their goals and constrain their actions." Many archaeological questions linked to agency theory and its methodologies are specifically concerned with identifying how individual choices shaped material culture from the past (Chilton 1996; Dobres 1995; Dobres and Hoffman 1994; Newsom 2017; Spector 1993). For example, Dobres (1995) presents a conceptual framework and methodology for understanding the social agency of bone and antler technological production strategies during the Magdelenian Ice Age in the French Midi-Pyrénées region, utilizing a *chaîne opértoire* analysis to counter conventional typological emphases. Following Dobres, similar "operational sequence" approaches were utilized by Chilton (1996) and Newsom (2017) to understand technological choices made by Indigenous potters in the Northeast. Spector (1993) explores the life of a Wahpeton woman through a biography of a personalized awl and its owner, offering both a feminist archaeology perspective and that of an Indigenous woman in the 19th century.

These ideas are also relevant when considering zooarchaeological remains, specifically those of dogs. Early ethnographic and historical accounts, despite their obvious limitations, offer us compelling evidence that the roles of dogs in the past were varied and transmutable (Kerber 1997a). Archaeological literature concerning agency in the human and animal relationship is lacking. Recent research in the fields of zooarchaeology and stable isotope applications include examples of studies which at least attempt to illuminate human and animal relationships by investigating variation in their lives through diet (Guiry and Grimes 2013; Spzak et al. 2014).

Dobres and Robb (2005:161) suggest that through material culture we can understand ancient social reproduction and that most archaeologists, regardless of which paradigm they are using, see material culture as "…instrumental to how people create, experience, give meaning to, negotiate, and transform their world" (Dobres and Robb 2005:161). Dobres and Robb (2005:161) propose that the relationship between material culture and people is "…complicated, context-specific, and dialectical" and that as a result, methodologies to study this relationship "…cannot be understood transparently."

Applying these frameworks to research on human-dog interactions might feel like fitting a square peg in a round hole. What tools can an agency theory framework normally applied to people and their material culture offer researchers examining human and animal relationships? If Dobres and Robb are suggesting that the only way to understand agency in the past is to examine the materiality of social reproduction, then we are seeking the ways in which agency manifests in the physical or measurable aspects of the human and dog relationship.

The human-dog relationship is one that has a deeper history than any other domesticated animal. Dogs are the first domesticate and humans have cohabitated and evolved socially with them for at least 16,000 years, and likely much longer (Perri 2019). Dogs are important for more than just their relationship with humans; dog remains are interesting in and of themselves because they can offer insights into domestication, migration, dog trade, spirituality, and more (Guiry 2012:369). The Holmes Point West canine remains offer us a glimpse into the deep social connection that exists between Indigenous peoples and dogs in the region. To explore agency in the human and dog relationship, I apply methods and methodologies designed to illuminate choice through dog diet, care, and burial practices at the Holmes Point West site in Machias Bay, Maine. This study adds to a growing body of research on dogs in the archaeological record, which is briefly reviewed in the following sections.

Dogs in the Archaeological Record

Introduction

Archaeological research on domestic dogs has a long history, likely due to the time-tested and unique social relationship that exists between canines and their human companions (Kerber 1997a; Morey 2006). Dog burials have been recorded on every major continent with the exception of Antarctica (Morey and Wiant 2006), often accompanying human burials. Canine remains recovered from archaeological contexts can include species which are domestic (*Canis familiaris* or *Canis lupus familiaris*), domesticate (wild wolves or coyotes of the genus *Canis* that have been tamed), and wild (wolves [*Canis lupus* and ancient ancestors] or coyotes [*Canis latrans*]) (Gentry et al. 2004; Kerber 1997a:82), but all of whom served a role within past human societies. It should be noted that the Holmes Point West site would not yield zooarchaeological remains of coyotes, as their historic range did not include the Northeast region (Hody and Kays 2018).

Initial Domestication and Presence in North America

Based on substantial archaeological and genetic evidence (Perri 2016:1), the commonly accepted date for the initial domestication of dogs is approximately 16,000 BP (Clutton-Brock 1995; Morey and Wiant 1992). That being said, recently described remains of several Pleistocene dogs recovered from sites in Europe and southern Siberia suggest a much earlier initial domestication (Perri 2016). These remains, tentatively identified as early dogs, suggest a date range for putative incipient domestication of dogs ranging from 17,000 – 36,500 BP (Perri 2016). Lacking comprehensive data describing the variation of Pleistocene wolf populations, it is impossible to determine if any of these remains represent those of domesticated dogs dating prior to the late Upper Paleolithic (Perri 2016). The earliest generally accepted remains of a domestic dog burial in the world are those of the Magdalenian Bonn-Oberkassel dog, recovered from present-day Bonn, Germany, whose remains date to the 14,223 +/- 58 years cal BP and are interred with the remains of two adult humans and associated grave goods (Janssens et al. 2018).

Evidence of early dogs in North America is sparse but suggests that domesticated dogs accompanied Paleoindian period populations from the Old World to the New World (Fiedel 2005), whether this journey was across the Bering land bridge, via boat to South America, or yet another potential route has yet to be identified by archaeologists. Fiedel (2005) suggests that domesticated dog populations likely played a key role in the rapid expansion of late Pleistocene human populations from

East Asia into North America. In a scenario where people traversed the "ice-free corridor," human groups would have faced extremely long journeys across snow and ice and a myriad of predators. Dogs may have provided the necessary support in hunting and sled transport to facilitate expansion into North America, as well as potentially expediting the extinction of megafauna populations on the continent (Fiedel 2005).

Evidence of dogs in North America has been discovered in the context of burials, both with humans and as separate inhumations, but is also frequently discovered with subsistence remains and displaying evidence of butchering. The oldest evidence of domestic dogs in North America is represented by the remains of three individual dog burials from the Illinois River Valley, originally dated to approximately 8,500 years BP (uncalibrated) from associated charcoal (Morey and Wiant 1992:225). Recently revisited by Perri and colleagues (2019), canine remains from the Koster site and one individual from the nearby Stillwell site yielded dates between 10,190 and 9,630 cal BP (2-sigma). These canine burials represent the earliest confirmed evidence of domestic dogs in the Americas and are the oldest securely dated individual dog burials anywhere in the world (Perri et al. 2019:70). Prior to the direct dating of the individuals from Koster and Stillwell by Perri and colleagues (2019), the oldest evidence of domesticated dogs in the Americas was tentatively suggested to be remains excavated from Danger Cave in Idaho, relatively dated to between 10,000 - 9,000 BP based on associated features (Grayson 1988), however, no direct dating of these remains has occurred.

Domestic dog remains have also been recovered from human palaeofaeces at Hinds Cave in present-day southwest Texas yielded an AMS date of 9,260 ± 170 cal BP (Tito et al. 2011:653). The researchers completed genetic sequencing on DNA from the identified bone, an occipital condyle of a domestic dog, and characterized it with dog clades rooted in Eurasian wolves (Tito et al. 2011). The evidence from Hinds Cave not only demonstrates the presence of early domestic dogs in the southern interior of the North American continent but also that they were consumed by Paleoindian peoples.

Whether the consumption of dogs occurred only in emergencies or was a more systematic practice is unclear (Tito et al. 2011:656).

Dog Burials in the Archaeological Record

The ways that dogs are deposited by humans into the archaeological record is linked to their social positions (Perri 2017:1). While many canines are recovered with subsistence remains, others are often recovered from burial contexts. Dog burials in the archaeological record provide an opportunity to examine the complex nature of human-canine relationships, not just their interment. While impossible to fully explain the cultural significance and reasoning behind the depositional variation of dog remains within archaeological contexts, it is likely that each canine individual could have fulfilled multiple roles within one lifetime, including but not limited to spiritual significance, economic and cultural status, hunting assistance, companionship, and sustenance (Kerber 1997a; Perri 2017). Differences in archaeological deposition may be related to the wide-ranging roles dogs played in past human societies (Kerber 1997; Perri 2017), which change in response to community needs and choices. Differences in the context of deposition may also be explained by other factors, including human behavior, cultural differences, temporal changes, taphonomic processes, and post-depositional disturbance, such as by archaeological excavations. In an Eastern Siberia study, Losey and colleagues (2013) noted that dogs were only buried at times when human burials were prevalent, suggesting a relationship between dog and human burial contexts. The authors indicated that only foraging groups buried canines while pastoralist burial sites lack dog remains; however, animals who were sacrificed did not fit this pattern. The researchers also noted that dog burials in the Cis-Baikal region of eastern Siberia during the Neolithic (ca. 7,000 - 8,000 BP) occurred only in locations where human diets were rich in aquatic resources, including riverine, lake, and Baikal Sea fish as opposed to terrestrial sources (Losey et al. 2013).

Though it is not clear at what point humans began to bury their canine companions, the burial of a Pleistocene wolf from the Pavlov I site in the present-day Czech Republic suggests an extremely early date for the human-dog bond (Sazelová et al. 2018). Sazelová and colleagues (2018) completed osteological analyses on the burial remains of a late Pleistocene wolf from Pavlov I, a large campsite used by Gravettian mammoth hunters', with cultural layers dated between 30,495−29,564 cal BP (Beta 359288, 2-sigma) and 33,561−32,524 cal BP (Beta 359286, 2-sigma). Analysis of the *C. lupus* remains discovered from the Pavlov I burial indicates that the individual suffered from a suite of inner-ear pathologies which would have been fatal without intervening treatments, not to mention likely predation by other individuals in a wild canid pack setting (Sazelová et al. 2018:11-12). In addition, the skeleton was discovered with an accumulation of shells and red ochre, elements present within human and canine mortuary environments world-wide. Based on this evidence and a lack of butchering or skinning marks on the individual, the researchers conclude that the wolf was likely intentionally buried by humans, that humans were aware of its illness and potentially intervened, and that this instance represents an early interaction and potential relationship between human and wolf populations (Sazelová et al. 2018:12). The Bonn-Oberkassel dog, recently reexamined by Janssens and colleagues (2018), has also been determined to have been terminally ill up until its unknown cause of death. The young dog, a puppy aged about 19 weeks, may have suffered from a morbillivirus infection (canine distemper), however other genetic and bacterial causes are possible. The authors hypothesize that the puppy could have survived only with intensive human care over several weeks, attributable to human compassion or empathy and with no expectation of utilitarian value or benefit of return (Janssens et al. 2018:8-10).

Dog Burials in Northeastern North America

Archaic Period

The earliest domestic dog remains in the Northeast date to the Archaic period (Kerber 1997a), among them the remains of two dogs buried above an adult woman and man at the Maritime Archaic site of Port au Choix in northwestern Newfoundland (Tuck 1970). According to Tuck (1970), the cause of death for one canid could not be determined; evidence suggests that the second individual died from a skull injury, which Tuck attributed to a sacrificial act (Tuck 1976:77). Directly dated human bone from the burial located beneath the two dog burials produced a radiocarbon date of 3930 ± 130 BP (I-4678, uncalibrated) (Tuck 1976:162). In another case, from the Turner Farm site on North Haven Island in Penobscot Bay, five dog burials were also recovered from Occupation 2 (ca. 4500 BP). These remains were accompanied by red ochre and utilitarian and ritual artifacts (Bourque 1975; Bourque 1976; Bourque 1995). At the Nevin Site in Blue Hill, Maine, the remains of 19 human individuals were recovered in 1979 (Shaw 1988), and the mandible of a dog was present in one of the secondary graves along with the remains of a child (Byers 1979), perhaps representing a partial deposition. At least four dog burials were recovered from the site during excavations, and the midden contained fragmentary remains of over 500 specimens identified to the genus *Canis* and one identified as domesticated (as reported in Guiry and Grimes 2013:736).

Ceramic (Woodland) Period

Based on the available archaeological evidence from the Northeast and nearby regions, Kerber (1997:82-83) concluded that dog burials appeared to become more common during the Ceramic period in the Northeast (approximately 3050 BP – 400 BP) (Petersen and Sanger 1991). Reasons for the potential increase in dog burial events during the Ceramic period are not clear and this pattern may be related to heightened visibility of younger sites in the archaeological record due to “chronological shingling” at coastal sites caused by the heightened effects of climate change in the Gulf of Maine region

(Young et al. 1992) or differential preservation between shell midden and non-midden sites as a result of calcium carbonate rich contexts (Dincauze 2004:309).

There are a few instances of canine burials in the archaeological record of the Maine Maritime Peninsula region dating to the Ceramic period. A minimum of five canine individuals and at least two dog burials were excavated from the Ruth Moore site (ME site 31.17) located on Great Gott Island to the southeast of Bass Harbor on Mt. Desert Island, as part of the Abbe Museum field school during the summers of 1991 through 1994 (Abbe Museum 1994). The burial dogs (nicknamed “Ernie” and “Bert”) were recovered from the site’s basal layer just below the midden (Abbe Museum 1994:30). Ernie, the first of the two skeletons excavated, was recovered directly below a layer of undisturbed crushed shell with a large, flat rock placed on its chest (Abbe Museum 1994:30). Ernie’s leg bones were C^{14} dated to 2030 BP +/- 70 (uncalibrated), early in the Middle Ceramic period (Abbe Museum 1994:30). The second skeleton, Bert, was recovered from the subsoil directly below the midden about 2 meters east of Ernie, lying in an east-west orientation (Abbe Museum 1994:30). One artifact was recovered that may have been deposited in association with the burial, a graphite paint stick was discovered near the top of the pit (Abbe Museum 1994:30).

Deal (1986) briefly described the remains of a possible dog burial recovered at the Mud Lake Stream site (BkDw 5) in southwestern New Brunswick. The “Meadowood burial feature” was found “…in association with eight sherds of Vinette 1-like pottery” (Deal 1986:72), suggesting this possible dog burial might date to the beginning of the early Ceramic period, ca. 3050 - 2150 BP. Deal noted that all the material identified during the 1983 field season was assigned to the Late Archaic and Ceramic periods (Deal 1986:69).

At the Lambert Farm Site in Warwick, Rhode Island, Kerber and colleagues (1989) report three formal canine interments, tentatively dated to the Late Woodland (Ceramic) period (950 – 450 BP, Petersen and Sanger 1991) based on C^{14} dates of 870 ± 80 BP (uncalibrated) on quahog shells located directly above the remains. Excluding the three burials, disarticulated remains of the genus *Canis* comprise the second-most abundant vertebrate specimen, perhaps indicating dogs were consumed and then discarded (Kerber et al. 1989). Differences in depositional context may also be explained by other factors, including human behavior, cultural differences, temporal changes, taphonomic processes, and post-depositional disturbance, such as by archaeological excavations.

An early archaeological account of domestic dogs being utilized as a food source in the Northeast comes from Jeffries Wyman (1868), a well-known American naturalist who was the first curator of the Peabody Museum of Archaeology and Ethnology at Harvard University in Massachusetts. Wyman (1868) noted that broken dog bones were found at shell midden sites at Eagle Hill in Ipswich and Cotuit Port in Barnstable, Massachusetts, as well as from several midden sites in and near Mount Desert Island in Maine. Though no butchering marks were evident, he suggested they had been consumed as food based on their provenience and disarticulated nature, followed by justification: "In fact, they have served as food in so many parts of the world, that the use of their flesh anywhere ought not to be considered an improbability" (Wyman 1867:576-577).

The Human and Dog Relationship on the Maine Maritime Peninsula

Ethnographic Insights

In addition to archaeological evidence, ethnohistoric accounts also document the relationship between humans and dogs in the region (Butler and Hadlock 1994; Kerber 1997a; Kerber 1997b; Kerber et al. 1989). For example, Kerber (1997a:92), has noted that socio-cultural insights provided through the examination of contact and historic period ethnographic accounts can inform our interpretation of the socio-cultural context of archaeological dog remains excavated in the Northeast. Historical and ethnographic accounts offer potential insights and explanations to questions posed by archaeologists about past people; however, limitations do exist, and archaeologists should be cautious when relying on ethnohistorical data to support archaeological interpretations (Kerber 1997a:92). Ethnographic and historic accounts must be considered carefully, as each is the reflection of one person's viewpoint in a certain place and time. Colonial accounts are rife with misrepresentations due to Euro-centrist frames being applied to early perceptions of Wabanaki life.

Sources of information on the relationship between people living in the Maine Maritime region and their Indigenous dogs primarily come from the writings of early European explorers, traders, and missionaries in Northeastern North America. Close examination of these early accounts from the region indicate that multiple roles existed for canines, including but not limited to status symbols, hunting aids and companions, and occasionally sustenance.

<u>First Encounters and Physical Appearance</u>

Butler and Hadlock (1994) summarized the writings of many early visitors to the Northeast and noted that many of them were interested in identifying the origin of aboriginal dogs. The authors concluded that many of the early writers agreed on the general appearance of aboriginal dogs. "They were not considered as large dogs when compared with European breeds. They had narrow heads with long noses and large teeth. The colors mentioned were black, white and red or brown" (Butler and Hadlock 1994:4). James Rosier (1906:128), who chronicled the exploratory voyage of George Waymouth from England to the "northern coast of Virginia" (present-day New England) in 1605, reported that he and the ship's crew saw an assemblage of some two hundred and eighty-three Indians, "every one with his bowe [sic] and arrows, with their dogges [sic] and wolves." This encounter probably took place on the Pemaquid Peninsula (Butler and Hadlock 1994:10), in present-day Bristol, Maine.

French explorer Nicholas Denys, whose published accounts detailing his explorations in Acadia (New France) beginning in 1632, describes dogs belonging to Mi'kmaq people of the Canadian Maritimes:

> Then the Indians have their Dogs, which are a kind of Mastiff, but more lightly built. They have the head of a Fox, but do not yelp, having only a howl which is not of great sound. As for their teeth, these are longer and sharper than those of Mastiffs. These Dogs serve for hunting the Moose, as I have related, in the spring, summer, and autumn, and in the winter when the snows will bear them. There is no hunter who has not from seven to eight of them. They cherish them greatly [Ganong 1908:429-430].

More than two centuries later, the late 19th-century naturalist and famed writer Henry David Thoreau interacted with members of the Penobscot Tribe during his travels into the Maine Woods with Joe Polis, making several observations of their dogs (Thoreau 1892). Regarding their possible origins, Thoreau commented "As we walked up to the nearest house, we were met by a sally of a dozen wolfish looking dogs, which may have been lineal descendants from the ancient Indian dogs, which the first voyageurs describe as 'their wolves.' I suppose they were" (Thoreau 1892:8).

Butler and Hadlock describe that many of the early accounts "…testify that the Indians felt the imported breeds of dogs were superior to their own and sought to improve their stock by acquiring dogs from the white men" (Butler and Hadlock 1994:29). This suspicion has been confirmed by recently published research completed by Leathlobhair and colleagues (2018) which sequenced the mitochondrial DNA of 71 samples and the nuclear genomes of 7 samples of ancient Siberian and North American dog remains spanning the past ~9000 years. The authors' analysis confirms that the only surviving genetic legacy from ancestral dogs still present in existing *C. familiaris* populations of North America is a canine transmissible venereal tumor, passed on to current dog populations in North America from a single individual that lived up to 8000 years ago (Leathlobhair et al. 2018). This is one example where the ethnographic and historical record are consistent with archaeological evidence.

Dogs as Food

Butler and Hadlock (1994:15) observe that there are a few ethnographic accounts from the Northeast of people enjoying dog meat as a delicacy. Dogs were usually eaten on a special occasion or during times of famine, the latter of which was not just limited to Indigenous peoples but also affected early English colonists who were ill-adapted to the Northeast and its harsh winters. For example, an account from a colonist named Mary Rowlandson who was captured and fled with the Wampanoag during King Philip's War reported that dogs served as emergency food (Butler and Hadlock 1994:15). This information is in contrast to the customs and behaviors from other regions where dog feasting was more common. The Huron (Wendat), who historically lived at the western extremity of the St. Lawrence River adjacent to the Great Lakes, were reported to have raised dogs especially for food, perhaps due to a dearth of game animals (Butler and Hadlock 1994:15-16). This example in particular highlights the transmutability of dog roles within human society. Dogs may have served a crucial role in helping to hunt big game (moose, deer, and caribou) in the Maine Maritime Peninsula region, where mainly upland resources were exploited in lieu of practicing maize agriculture. Early observations that dogs were not commonly eaten in the Maine Maritime Peninsula help us to confirm or deny patterns in the archaeological record of the Northeast which differ from other regions.

Of the Mi'kmaq, Denys reported that "Their wealth was in proportion to their Dogs, and as a testimony to a friend of the esteem in which they held him, they give him that Dog to eat which they valued the most; [this was] a mark of friendship" (Ganong 1908:430). Accounts of *tabagie*, or dog feasts as they came to be called, are common in early accounts of Algonquian communities (Ganong 1908; Kerber 1997a; Thwaites 1900). Father Biard, one of the earliest Jesuit missionaries in New France, recounts several instances where Algonquian people engaged in the consumption of dogs, including during a Mi'kmaq *tabagie*, a banquet in honor of a dying man (Thwaites 1900). Biard's observations in New France, which occurred beginning in 1608, are likely one of the first written observations from a

European perspective of human-canine interactions among the Indigenous Wabanaki in the Maine Maritime Peninsula region.

Dogs as Hunting Aids

As stated above, Denys noted that dogs served an important role as hunting aids in the pursuit of moose for the Mi'kmaq of the Maritimes (Ganong 1908:429-430). During the mid-19th century, Thoreau asked the Penobscot Indians guiding him through the Maine woods if they ever used dogs to hunt moose, and was told "…that they did so in winter, but never in the summer, for then it was of no use; they would run right off straight and swiftly a hundred miles," or alternatively that the dog would "…hang to their lips [moose], and be carried along till [sic] he is swung against a tree and drops off" (Thoreau 1892:141).

Even into the 20th century, dogs assisted Indigenous peoples in the Penobscot and St. John River Valleys in pursuit of moose and deer (Butler and Hadlock 1994). Denys' 17th century account contains detailed descriptions of the Mi'kmaq of the Maritimes region hunting moose, as well as other game such as lynx, beaver, bear, fowl, and hare with the aid of dogs (Ganong 1908:430-434). The Montagnais (Innu) did not consume dog meat "even when they were starving," perhaps as a result of needing their assistance in hunting upland game. According to Le Jeune, "In the famine which we endured, our Savages would not eat their dogs, because they said that, if the dog was killed to be eaten, a man would be killed by blows from an axe" (Thwaites 1900, Vol. VI:221).

Though dogs have been used for transport with sleds in northern parts of the Maine and Maritimes region, it is likely not a practice used prior to the Historic period. Speck (1925) believed that the use of sled dogs by the Innu and Naskapi was a practice introduced during the Historic period by French Canadian fur trappers (Speck 1925:58). Particularly in the Maine-Maritime Peninsula region where the study site is located, it does not appear that dogs were adapted to pull sleds and no archaeological sledging materials are present. Any transportation aid on the part of dogs was likely just the weight which could be carried alone.

Attitudes Toward and Care of Dogs

The accounts of early voyageurs of New England and Canada provide us with ethnohistoric evidence of dogs as important individuals and even family members, being cared for in their early life as well as during periods of sickness. Le Jeune, a French Jesuit missionary working in New France (Acadia), reported an instance in which the family of a young Huron girl who had been killed requested that she be buried with two dogs that she had cherished in life. When the Jesuits refused to let the relatives bury the dogs with the girl's body in the cemetery, they asked if they could bury them near the cemetery because it was customary to bury the dead with their possessions they loved most in life (Thwaites 1900, Vol. VIII:267).

By some accounts, Indigenous peoples in the region were fearful of English or other dogs belonging to Europeans (Rosier 1906:121); however, there are also indications that some Indigenous people valued European dogs, seeking to breed them with their own (Butler and Hadlock 1994). "Many references are so indefinite that it is impossible to determine whether or not the dogs owned by the Indians in early colonial times were aboriginal dogs or some which they had obtained from the English" (Butler and Hadlock 1994:7).

English attitudes toward Indigenous dogs are reported to have been less kind. "…dogs were ubiquitous and universally disliked by the settlers, who complained about them frequently, and often ordered them put to death" (Butler and Hadlock 1994:7). Butler and Hadlock (1994:7) note that though this dislike is usually attributed to the aggressive behavior that Indigenous dogs displayed toward livestock belonging to colonists, they suspect that the real motive behind the colonists' desire to exterminate local dogs was "…because they usually gave warning to the Indians that their enemies were approaching."

Dogs and Specialized Treatment Practices

It is clear from several primary sources (Ganong 1908; Thwaites 1900) in the historic record that Wabanaki people withheld certain subsistence remains from dogs due to concerns with ritual disposal of hunted animals, including at least those of beaver and seal. According to Butler and Hadlock (1994:23), many of the early accounts detail that bones of various kinds of hunted animals, and specific skeletal elements, were withheld from dogs and disposed of in a customary. Le Jeune (Thwaites 1900) reported of the Montagnais (Innu) that:

> The Savages [sic] do not throw to the dogs the bones of female Beavers and Porcupines,--at least, certain specified bones; in short, they are very careful that the dogs do not eat any bones of birds and of other animals which are taken in the net, otherwise they will take no more except with incomparable difficulties. Yet they make a thousand exceptions to this rule, for it does not matter if the vertebrae or rump of these animals be given to the dogs, but the rest must be thrown into the fire. Yet, as to the Beaver which has been taken in a trap, it is best to throw its bones into a river. It is remarkable how they gather and collect these bones, and preserve them with so much care, that you would say their game would be lost if they violated their superstitions [Thwaites 1900, Vol. VI:211].

Le Jeune (Thwaites 1900) said that he had told the Indians that the beaver did not know what was done with their bones and such precautions were useless. The Indians answered, "Thou doest [sic] not know how to take Beavers, and thou wishest to talk about it" (Thwaites 1900, Vol. VI:211). Le Jeune said, “Before the Beaver was entirely dead, they told me, its soul comes to make the round of the Cabin of him who had killed it, and looks very carefully to see what is done with its bones; if they are given to the dogs, the other Beavers would make themselves hard to capture” (Thwaites 1900, Vol. VI:211).

Denys (1908) described disposal practices in the 1630s used by the Mi'kmaq of the Maritimes, reporting that bones were withheld out of safety as well as superstition. He writes:

> As to the bones, they [dogs] are not given any, for fear of damaging their teeth, not even those of the Beaver. If they should eat of that, it would keep the Indians from killing any, and the same if one were to burn them. For it is well to remark here that the Indians had many superstitions about such things, of which it has been much trouble to disabuse them. If they had roasted an Eel, they also believed that this would prevent them from catching one another time. They had in old times many beliefs of this kind, which they have no more at the present time, and of which we have disabused them [Ganong 1908:430].

On the Gaspé Peninsula of Quebec, Le Clercq (1910) reported in the late 17th century of the Mi'kmaq people that "The bones of the beaver are not given to the dogs, since these would lose, according to the opinion of the Indians, the senses needed for the hunting of the beaver." Le Clercq further described that "fawn of moose" and marten remains were also withheld from dogs, and never burned, lest those animals inform others of their kind that they had been treated ill by the Mi'kmaq (Le Clercq 1910:226).

Ethnographic research completed by Wallis and Wallis (1955) in Mi'kmaq communities of eastern Canada in the early 20th century confirmed that Indigenous people's concern for disposal of certain animal remains had continued to be an important aspect of hunting and tradition. "You should not throw away a bone that has flesh on it, but should leave it there on the ground. It will bring starvation to you even if you pitch the bone to a dog" (Wallis and Wallis 1955:107).

Specialized treatment practices and disposal methods as reported ethnographically leave behind noticeable subsistence patterning in the archaeological record (Ingraham 2011; Ingraham et al. 2016;

Robinson and Heller 2017). Previous zooarchaeological research at the Holmes Point West site provides support for the ritual disposal of certain species and skeletal elements. Ingraham (2011) noted a discrepancy in gray seal (*Halichoerus grypus*) remains from the site, specifically that the left portion of the skull had been retained while the right was noticeably absent throughout the assemblage. Ingraham and colleagues (2016) concluded that Passamaquoddy people at the site likely returned the right portion of the skull to the sea, in accordance with ritual treatment protocols of hunted remains, which is similar to practices of other Algonquian peoples', namely the First Nations Cree and Mistassini. Archaeologically, this practice resulted in differential preservation of the left temporal bone. These ritual practices of retention and disposal at Holmes Point West are explored in greater depth by Robinson and Heller (2017), who also examined faunal patterns in remains of sea mink (*Neovison macrodon*, now extinct), which were represented almost exclusively by cranial elements with almost no post-cranial (non-skull) elements present in the faunal assemblage.

At Turner Farm in Penobscot Bay, Spiess and Lewis (in Bourque 1995:338) report that zooarchaeological remains recovered indicate the presence of "dog yards" in Area 2 of Occupation 2, relatively dated to ca. 4500 BP, based on the low incidence of fish and bird bone, areas of bone concentration, high incidence of freed cervid teeth (from dog chewing behavior on discarded cervid mandibles), and the high proportion of seal bone (especially postcranial elements) (Spiess and Lewis 2001:150). The authors refer to arctic and subarctic cultures who use working dogs, and their practice of keeping them tied up adjacent to human occupation areas. Though the authors do not delve into any discussion about potential specialized treatment protocols, they suggest that a lower human preference for phocid meat over that of cervid would lead to the distribution found in Area 2, and further posited that the finds indicated a human-dog occupation unit at the site (Spiess and Lewis 2001:349).

Summary and Conclusion Final Thoughts: Ethnographic Biases

Chapter 2 has provided an overview of agency framework and offered it as a different way for examining the human and dog relationship. Viewing human-canine interactions through an agency lens can allow researchers to illuminate past human choices through dog diet, care, and burial practices at the Holmes Point West site in Machias Bay, Maine. Dogs have been present in human communities since the Late Pleistocene, perhaps as wolves or early domesticates (Perri 2016) and have been intentionally buried by humans for almost as long. The remains of dogs in the archaeological record offer an opportunity for us to better understand the deep social connection that exists between people and dogs in the Maine-Maritime Peninsula region.

Descriptions of the region and its inhabitants by early European visitors have been considered here as an existing line of evidence to aid interpretations of existing archaeological data, keeping the potential biases of the original authors in mind. Despite inherent biases in European narratives about Indigenous people of the Maine Maritimes region, Indigenous peoples and their dogs were notable enough to Europeans to be worthy of writing about, even if the details may be skewed by colonial agendas. Indigenous people of the Maine-Maritime Peninsula region actively selected for certain dogs and traits, provided specific roles to individuals, cared for dogs that were sick or aging as if they were community or family members, and even engaged in specialized and ritual treatment of hunted animal remains in the presence of dogs. All of these observations support that dogs were affected by active choices made by Indigenous people in response to opportunities and constraints presented to them within their cultural and physical environment.

CHAPTER 3

CASE STUDY

Introduction

Dobres and Robb (2005:161-162) tell us that “The reason good case studies move the discipline forward is not just because they apply some abstract theory to a material pattern, but because they suggest new ways to see and make sense of that pattern. Thus, a case study is theory in its own right.” These words are particularly appropriate in light of the overall goal of this project -- to humanize archaeological research. By looking at archaeological data in different ways, we may make sense of patterns in a way that they have not been understood before. In addition, challenges presented in working with legacy archaeological materials prompted the incorporation of methods and tools that otherwise would not have been necessary.

To address the research objectives outlined in Chapter 1, a case study developed at the Holmes Point West site is presented here. First, a review of the general environment, surficial geology, effects of tidal subsidence, paleoclimates and resulting human adaptation in the region is presented. This chapter also briefly covers the culture history of the region, termed the Far Northeast or Maine-Maritime Peninsula region, and reviews highlights in the history of archaeological practice in the region with an emphasis on archaeological researchers and sites in eastern Maine. These synopses are by no means comprehensive and are limited by time and space, however the author has attempted to address significant cultural and environmental changes, important sites, early practitioners, and current relevant work taking place in the Machias Bay region. Material in this chapter situates the research appropriately within the region and its cultural traditions, underpinnings necessary to contextualize and interpret data collected on human-canine interactions at the Holmes Point West site.

Site Setting and Environmental and Cultural Contexts

Overview

The Holmes Point West site (designated ME 62-8) is situated on the head of the Holmes Point peninsula in northern Machias Bay, Washington County, Maine (Figure 3.1). A cobble stone beach is located below this embankment and adjacent to mud flats near the outlet of the Machias River. The Machias River empties into Machias Bay just north and west of the site location and the drainage is a migratory route for several diadromous fish species, including anadromous Atlantic salmon, alewives, shad, as well as catadromous eels (Bigelow and Schroeder 2002). The extensive tidal mud flats adjacent to the site support a variety of shellfish, including *Mya arenaria* or soft-shell clam, and these bivalves support higher trophic species including herring, sturgeon, striped bass, and pinnipeds (Ingraham

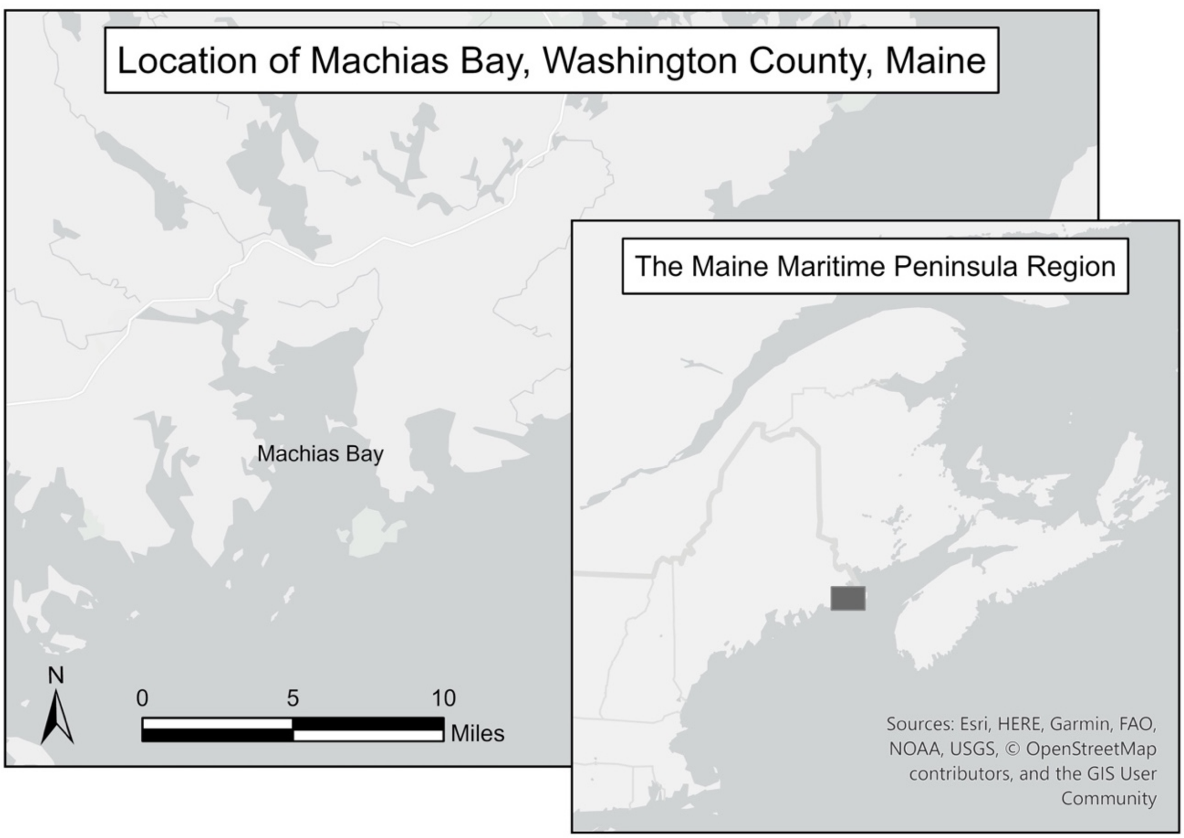


Figure 3.1. Overview of the general location of the Holmes Point West site (ME 62-8) in the eastern region of Maine and its position within the Maine-Maritime Peninsula region.

2011:7). Even today, clam diggers are a regular sight along the tidally influenced shoreline in this northern end of the bay.

The site area at Holmes Point West is composed of midden and non-midden portions. The midden area is located along the western embankment of the peninsula head and is actively eroding (Figure 3.2). The non-midden components of the site are located east of the main concentration of excavation activity. Organic materials located within the site's midden enjoy significantly better preservation. Shell middens offer ideal alkaline preservation conditions for organic archaeological remains due to their high concentration of $CaCO_3$, which mitigates the rapid breakdown that otherwise occurs in low pH spodosols (Dincauze 2004:309).

Modern Day Climate, Environment, and Ecology

The study site is located in the East Coastal biophysical region, a 20 km wide band paralleling the Gulf of Maine from Mount Desert Island and Isle au Haut east to the western side of Passamaquoddy Bay (McMahon 1990:78). The geography of the East Coastal region is characterized by low ridges and poorly drained, relatively flat terrain. This region is strongly moderated by the Gulf of Maine, resulting in cool and wet summers, high annual precipitation, and frequent fog. Vegetation is dominated by two major ecosystem types -- spruce-fir forests and coastal raised peatlands, the former attributable to high year-round moisture availability and dense fog (McMahon 1990:79). Peatlands generally occur within 10 km of the coast along the Bay of Fundy, their southernmost extent on the North American continent.

Surficial Geology

The surficial geology of Machias Bay is dominated by bedrock outcrops with Presumpscot Formation glacio-marine clay deposits above (Borns 1974; Locke 2000). The study site on the Holmes Point Peninsula is located on a southwesterly facing wave-cut terrace, consisting of a gravel bench positioned against a marine clay hillside (Ingraham 2016:5). Bird (2017:17-19) notes that the lack of bedrock outcrops along the southwest bank contributes to erosion of the site's western bank edge through wave action, in comparison to the nearby sites of Holmes Point East and Long Point, both of which have bedrock outcrops buttressing them against tidal action.

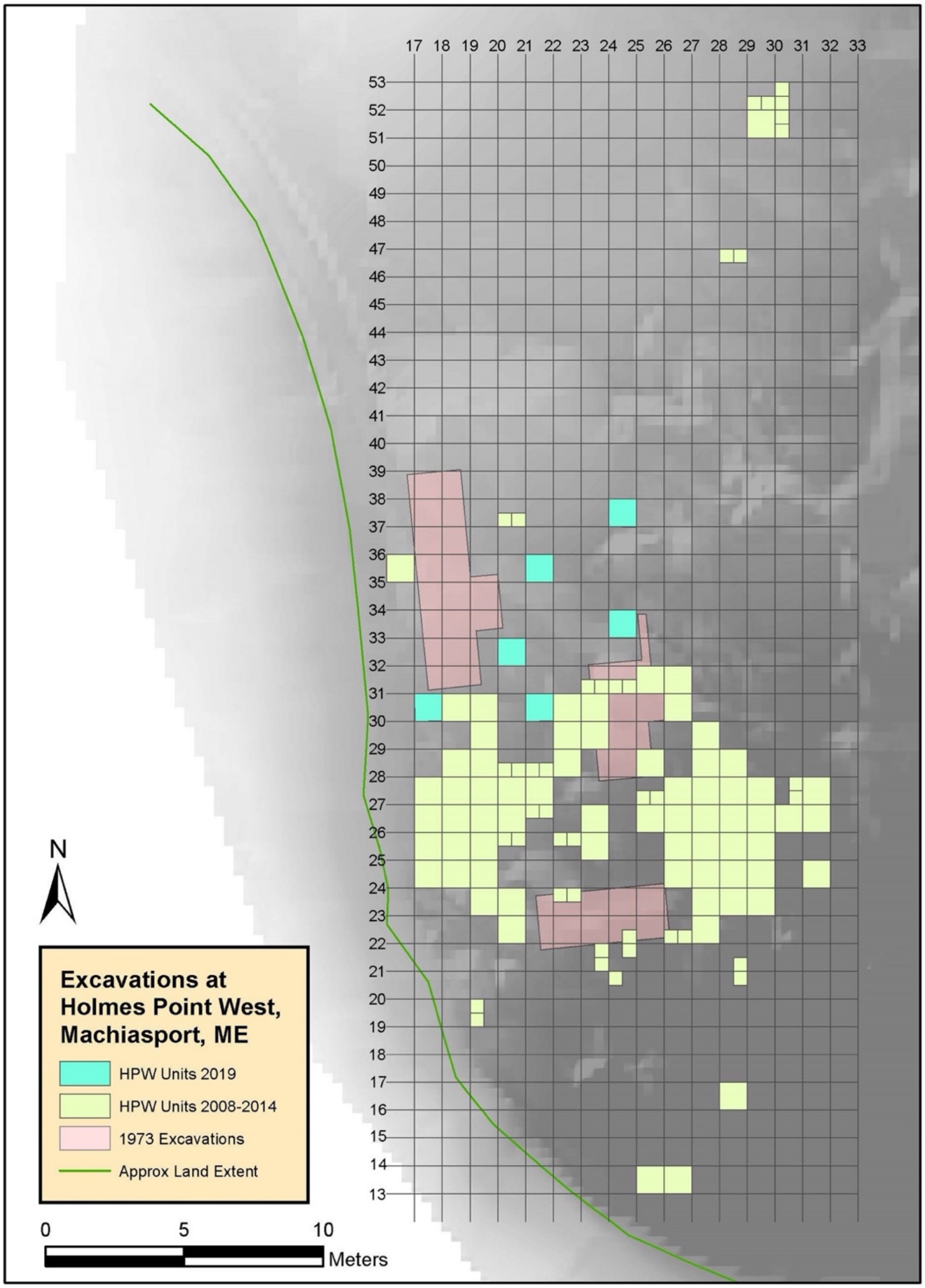


Figure 3.2. Site overview map of excavation units at the Holmes Point West site, years 1973, 2008-2014, and 2019.

Tidal Subsidence

Tidal subsidence in the eastern portion of the Gulf of Maine is quite strong, influenced by its geographic position near the Bay of Fundy, which produces the highest tidal ranges in the world at 15.6 meters or 51.2 feet (Canadian Hydrographic Service 2020). Extreme tides in this region are a result of the near resonance that the Bay of Fundy and Gulf of Maine have with the oceanic semi-diurnal tide, heavily influenced by the basin geometry and bottom friction (Shaw et al. 2010). Sanger and Kellogg modeled the rate of sea level rise for Englishman, Machias, and Passamaquoddy Bays by comparing erosion of archaeological sites against known C^{14} and tree ring dates. Indications exist that Englishman and Machias Bays are eroding rapidly, with rates ranging from 1.71 to 7.92 meters every 100 years (Sanger and Kellogg 1989). Sanger and Kellogg (1989:120) posit that the increased rate of erosion along the eastern coast of Maine may be attributed to some of the metavolcanic bedrock being highly fractured, leading to increased erosion of unconsolidated sediments due to waves and frost action. This characteristic of eastern Maine geology makes coastal archaeological sites in the region particularly vulnerable to coastal erosion.

In the Bay of Fundy – Chignecto Bay region, Amos and Zaitlin (1984) determined that the relative sea-level curve decreased from a high stand of +48 meters at the termination of the Pleistocene (ca. 13,500 BP) to a low stand of -25 meters during the early to middle Holocene, ca. 7,000 BP (Amos and Zaitlin 1984). Earlier models hypothesized that tidal expansion increased most rapidly in the basin between 7,000 and 4,000 BP and at a slower rate during the past 4,000 years (see Gehrels et al. 1995; Scott and Greenberg 1983). This trend has been updated for the eastern-most portion of the Bay of Fundy at Minas Basin by Shaw and colleagues (2010), who have proposed that Minas Basin was separated from the rest of the Bay of Fundy in the early Holocene by a glacially deposited outwash barrier.

Amplified effects of tidal erosion on coastally situated archaeological deposits in the eastern region of Maine were documented by several early investigators (Byers 1959; Kingsbury and Hadlock 1951; Matthew 1888). The Maine-Maritime Peninsula Region is not unique in the challenges posed by climate change; coastal erosion due to climate change poses a significant threat to archaeological sites along all coastlines and is of increasing concern for archaeologists and Indigenous peoples working to preserve cultural heritage located at coastal sites (Alvarez et al. 2011; Carmichael et al. 2018; Dawson et al. 2020; Rick and Sandweiss 2020). Bird (2017) highlights the rapid coastal erosion at Machias Bay archaeological sites due to the effects of sea level rise accelerated by climate change. Anecdotally, landowners at the Holmes Point West site report a loss of roughly 30 feet along the property's shoreline since the 1970's (Bonnie Newsom, personal communication 2019).

Paleoclimates and Human Adaptation

Past peoples living in the study region experienced a changing climate numerous times after deglaciation circa 12,000 BP, responding to consequent shifts in resource availability. Local and regional climate changes present both constraints and opportunities for human communities, who make adaptive choices with regard to site location, resource exploitation, and group interactions (Bourque 1995; Sanger 1979; Spiess and Lewis 2001). Palynological reconstructions by Almquist-Jacobson and Sanger (1992) indicate that ca. 9200 BP what is now central Maine was an open and boreal environment dominated by spruce and poplar and that the landscape was subject to frequent burning. This period was followed by dominant pine forests (ca. 9000 – 7400 BP), though by ca. 8400 BP many hardwood species had begun to replace more boreal taxa (Almquist-Jacobson and Sanger 1995:216). Palynological data from Maine's eastern coast support other paleoclimatic indications that the Gulf of Maine region experienced long-term climatic cooling between approximately 5000 and 6000 BP (Schauffler and Jacobson 2002:246). Schauffler and Jacobson (2002:246) suggest that the presence of coastal spruce refugia in these eastern and coastal locations during the Late Archaic (ca. 5000 - 6000 BP) indicates cooler and moister conditions along the eastern coast. Spruce refugia played a role in influencing later expansion of species stands at the much later date of ca. 1000 BP.

Climatic cooling during the Late Archaic resulted in an increase of upland and wetland resources associated with beech-dominated hardwood forest stands ca. 4700 BP (Almquist-Jacobson and Sanger 1995:217). Almquist-Jacobson and Sanger (1995) propose that this climatic and ecological shift correlates with an increase in the number of people in the region, stemming from a greater availability of resources. The authors note that the appearance of increased resource utilization may also be due to increased archaeological visibility of cultural deposits during the Late Archaic (Almquist-Jacobson and Sanger 1995:221).

A synthesis of paleoclimatic proxies in the Northeastern US by Marlon and colleagues (2016) indicates a subtle overall cooling trend during the past 3000 years, consistent with a continuation in cooling from the early Holocene and climatic events such as the Little Ice Age (Marlon et al. 2016:1367-1368). Overall, the late Holocene was also much wetter in the Northeast, with the exception of the Medieval Climate Anomaly (Marlon et al. 2016:1372). Recent and rapid warming is indicated during the past two centuries following preindustrial cooling (Marlon et al. 2016:1372), a result of greater fossil fuel use during the industrial era through the modern day.

Culture History of the Far Northeast

The term "Far Northeast" has been coined to refer to the region extending from the southern coast of Maine to the coasts of Newfoundland and Labrador. Archaeologists recognize that past people inhabiting this region shared culture tradition, adaptations, and linguistic ties (Renouf and Sanger 2006). Though the debate between various interpretations of culture-history traditions defined in the Far Northeast will inevitably continue (see Sanger 2006 for a review), enough similarities exist for researchers to discuss this region in a more-or-less cohesive way.

Paleoindian Period and Early Human Occupation (ca. 13,000 – 9,500 BP)

In attempting to reconstruct what past lives of Indigenous people might have looked like living in the Maine-Maritime Peninsula region, many gaps exist in our knowledge about the choices and behaviors of individuals living so long ago. Therefore, it is important that we consider multiple lines of evidence available to us, including but not limited to archaeological evidence, ethnographic insights, as well as Indigenous oral traditions.

The landscape of Maine and the Maritimes was affected by the last stage of ice advance to occur during the Pleistocene, known as the Wisconsin Glaciation, beginning at approximately 150,000 BP and culminating around 20,000 BP (Schnitker et al. 2001). The Late Wisconsinan Laurentide Ice Sheet covered the study region until approximately between 14.5 ka and 11 ka ^{14}C years ago, and the retreating ice margin fluctuated along the entire coastal zone (Hughes et al. 1985). Borns and colleagues (2004:14) note that large discrepancies still exist between ^{14}C dates in coastal southwestern Maine and the timing of ice retreat indicated by varves from coring in the region. This discrepancy may relate to uncertainty in reservoir corrections applied to dated marine organics. The authors also noted that glacial ice lingered from the Mahoosuc range to Quebec until 12.0 to 11.5 ka BP, long after recession to the Penobscot valley marine limit, and that retreating ice may have remained in the Oxbow region of Maine until a much later date (Borns et al. 2004:15)

Some of the earliest archaeological evidence supporting Indigenous peoples living on the Maine-Maritime Peninsula's coast comes from two sites located on either extremity of the Gulf of Maine; the Debert site in Nova Scotia, located near present-day Truro and east of Minas Basin and the Bullbrook complex in Ipswich, Massachusetts. The earliest available radiocarbon date for site occupation at Debert is 12,575 ± 113 cal BP (1-sigma) (MacDonald 1968:56). Though located somewhat south of the Maritime Peninsula, the Bullbrook complex has also produced early evidence for peopling and is the only site of its antiquity located along the southern seacoast. The earliest radiocarbon dates from Bullbrook place

Paleoindian period peoples in the southern end of the Gulf of Maine by approximately 12,338 ± 180 cal BP (1-sigma), though radiocarbon dating at the site has proved to be problematic (see Robinson 2009:425). Even earlier occupation is suggested to the northwest of the Maine-Maritime Peninsula region at the Vail site, located along an ancient channel of the Magalloway River, with an earliest radiocarbon date of 12,697 ± 46 cal BP (1-sigma) (Gramly 2009).

Oldale (1985) suggested two theories to explain the presence (or absence) of Paleoindian sites along the coastal plain and eastern lowlands dating to this early period; sites may either be restricted within the region between the marine limit and the postglacial low sea-level stand or may be absent altogether (Oldale 1985:149). Recent reviews by Lothrop and colleagues (2011; 2016) discuss these scenarios in great detail and would seem to uphold the first of the two scenarios as proposed by Oldale; Paleoindian peoples likely utilized the near coastal zone of Maine and the Maritimes after glacial retreat, however late Pleistocene and early Holocene coastlines have been subsequently submerged.

Archaic Period of the Far Northeast (ca. 9,500 BP – 3,050 BP)

The Archaic period in Maine is believed to begin by roughly 9500 BP, and no sites of this period are identified in the Maritime Provinces (Sanger 2006:226). Termination of the Archaic period in the Maine-Maritime Peninsula region is agreed to be upon introduction of Indigenous ceramics, or roughly 3000 BP, with varying divisions and classifications between early, middle, and late sub-classifications (Sanger 2006:226). Important to briefly discuss within this cultural period of the Far Northeast are two traditions, called the Moorehead Burial Tradition and the Susquehanna Tradition, which are covered briefly in the following section.

The work of Warren K. Moorehead, associated with Phillips Academy at Andover, was an important early contribution to the archaeology of Maine and the Far Northeast, and he was responsible for excavation of a large number of cemetery sites containing red ochre deposits and finely made, ground-stone artifacts (Sanger 2006:227). He termed the creators of these features the "Red Paint

People" and hypothesized that they represented an older and differing culture from that of present-day Wabanaki people in the region (Moorehead 1922). Significant attention was given by Moorehead, as well as other researchers, to what are now termed Moorehead Phase sites, and key specimens curated through early excavations have continued to guide current interpretations (Sanger 2006:227).

More modern work by researchers on this cultural period in Maine and the Maritimes have refined Moorehead's interpretations. Work by Sanger (1973) at the Cow Point site in New Brunswick showed similarities between mortuary traditions dating to the Moorehead Phase from Port au Choix in Newfoundland to sites in Maine, Sanger (2006) did not assume that these stemmed from a single cultural tradition. Work by Robinson (1992; 1996; 2001; 2006) scrutinized red ocher cemeteries in the region and demonstrated the antiquity of the mortuary tradition in the Northeast extending from at least 8500 BP to 3700 BP, or approximately the onset of the Susquehanna tradition ca. 3800 BP (Robinson 2006).

Introduction of the Susquehanna tradition into Maine is marked by major changes in technology, settlement and subsistence patterns, and mortuary practices (Sanger 2006:241). Discussions of the Susquehanna tradition and its cultural implications are on-going. The general sentiment among archaeologists in the region is that a migration of people from the mid-Atlantic region occurred, bringing with it ensuing cultural traditions and adaptations to a hardwood forest environment (Sanger 2006:243). Climatic changes affecting the range of swordfish in the Gulf of Maine have been implicated by some researchers as a possible reason for population movement and new cultural pressures in the region (Sanger 1975). At present, the specifics of introduction of the Susquehanna Tradition to the Maine-Maritime Peninsula region are still unknown.

While some sporadic evidence exists of maritime-focused communities inhabiting the Eastern part of the Maine-Maritime region during the late Archaic (Bourque 1995; Byers 1979; Sanger 1975; Rowe 1940; Sanger 1986:147), environmental factors may have made the Downeast region less hospitable to people prior to the late Holocene (Sanger and Kellogg 1989:109; Sanger 2006:235). Late-glacial relative highstand models suggest that shorelines would have been in a rapid state of fluctuation, restricting development of biologically productive near-shore environments such as salt marshes or tidal flats (Oldale 1985:148-149). Additionally, Sanger has pointed out that the lack of visibility of older sites may be related to preservation due to varying rates of coastal erosion, with significantly greater erosion rates in Passamaquoddy, Machias, and Englishman Bays than elsewhere in the region (Sanger and Kellogg 1989:109).

In the late 1940s, Kingsbury and Hadlock excavated at a site on Moose Island located near the present-day Passamaquoddy Reservation of Pleasant Point (Sipayik) in Eastport, Maine. An occupation layer located directly on top of the marine clay at the edge of a talus slope produced evidence of firepits and large to medium-sized stemmed points and large scrapers, all located in a non-midden context (Kingsbury and Hadlock 1951). The site's occupation layer lacked remains of shell, bone, and ceramic, yet contained large projectile points. The authors drew similarities between the points found at this site with another Moorehead phase site at Taft's Point, an unpublished site report from the Union River, and the "Red Paint" burials as described by Willoughby in his 1935 work *Antiquities of the New England Indians* (Kingsbury and Hadlock 1951:24).

Oral traditions from descendent Indigenous communities are an important line of evidence to consider and are often understated in archaeological interpretations of the past. It is unfortunate that much of the work completed by archaeologists has rarely considered Indigenous oral histories. Studies which have included oral traditions as an additional source of information have produced unique and sometimes surprising conclusions, which help to confirm facts that have been presented through the lens of science. Geologic events occurring in the Late Archaic period have potentially been memorialized in the oral traditions of the Wabanaki (Beck 1972; Shaw 2010), regardless of whether or not they are believed to have cultural affiliation with pre-Susquehanna Tradition populations and offer an additional line of evidence to be considered.

Utilizing new models combined with high-resolution paleotopographic sonar survey data, Shaw and colleagues (2010:1088) hypothesized that Minas Basin was separated from the rest of the Bay of Fundy in the early Holocene by a glacially deposited outwash barrier which restricted the tidal range. The authors theorize that tidal amplification was delayed by the existing barrier until approximately 3,400 BP, when it was catastrophically broken down during a relatively short period of several hundred years (Shaw et al. 2010:1080). The authors argue that Wabanaki memory of the destruction of the theorized barrier across Minas Passage is preserved in legends of Glooscap (Shaw et al. 2010:1090), the magical and benevolent culture hero featured in the folklore of Wabanaki peoples (Rand 1894). Multiple legends describe the creation and eventual destruction of a great beaver dam at Minas Passage, which is said to be responsible for the current high tides (Beck 1972; Rand 1894). Beck (1972) suggests that these legends also attest to human memory of the Pleistocene giant beaver *Castoroides ohioensis*. Oral traditions like this serve to strengthen the cultural connection between descendent Wabanaki communities living today and communities of Indigenous people inhabiting the region during the Archaic period.

Ceramic (Woodland) Period and Quoddy Tradition (ca. 3,050 BP – 550 BP)

There is strong archaeological evidence for the presence of Indigenous people in eastern Maine beginning in the early Ceramic period (ca. 3,000 years ago). As discussed in the previous section, environmental factors may have prevented Indigenous peoples from occupying eastern Maine, perhaps precluding intensive use of the region until the late Holocene (Oldale 1985:148-149; Sanger 2006:235). Amplified coastal erosion in the eastern coastal region of Maine may also affect our understanding of early human habitation in this region by erasing evidence of earlier sites (Sanger and Kellogg 1989:109).

The Maine-Maritime Peninsula region, from an archaeological perspective, is often discussed as a cohesive cultural region due to similarities in the Algonquian dialects of the Wabanaki and hunter-gatherer subsistence patterns east of the Kennebec River. Sanger (2008) points out that a recognition of regionalism and macro cultural tradition inhibits our understanding of distinct adaptations to certain environments. The “Quoddy Tradition” (Sanger 1987:6) of Eastern Maine and adjacent coastal and interior southwestern New Brunswick may represent an example of this scenario. This archaeological construct arose from a series of papers detailing the environmental systems of the Passamaquoddy Bay region (Thomas 1983). Though not a tested hypothesis, Sanger (1986) notes that the Chiputneticook Lakes form a historically significant travel route between the St. John and Penobscot River watersheds, between historic Maliseet (Wolastoqiyik) and Penobscot (Panawahpskek) territory. The St. Croix River, situated between the West Grand chain and Chiputneticook system, has produced little archaeological evidence of sustained use by Indigenous peoples. According to Sanger (1986:154), this section of the river is difficult to canoe upstream in low water and being a north-flowing river would make southbound travel quite difficult. Therefore, the St. Croix River may have acted as a geographic boundary between the ancestors of the coastally situated Passamaquoddy and interior bands of Wabanaki peoples (Sanger 1986:154).

The Quoddy Tradition (Sanger 1987) refers to approximately the last 1,500 years of Indigenous lifeways in the Passamaquoddy Bay region of the Maine-Maritime Peninsula. Technological and subsistence strategies in this environment focused heavily on marine resources, evidenced by the large number of shell middens dating to this period and material and subsistence remains representative of a marine-oriented lifestyle (Sanger 1986:148). Quoddy Tradition sites are typically located on flat to gently sloping terrain situated near fresh water sources and clam flats, with dwellings placed toward the rear of the encampment and refuse heaps along the shore-facing side (Sanger 1986:148-149). The Carson site (BgDr-5), a Late Ceramic period occupation located on the New Brunswick side of Passamaquoddy Bay on Digdeguash Harbor, exemplifies many of the characteristics found at Quoddy Tradition sites throughout the region (Sanger 1987). Recent studies provide compelling evidence that seal contributed significantly to Quoddy Tradition diet at some sites in the Eastern region of the Maine-Maritime Peninsula (Ingraham 2011; Ingraham et al. 2016), in addition to the shellfish and wetland-dwelling terrestrial species such as beaver and moose which are almost ubiquitous at coastal sites all over the region.

Dwellings, dwelling floors, and functional spaces at Quoddy tradition sites have been the subject of recent intense research by Hrynick and colleagues (Hrynick and Robinson 2012; Hrynick et al. 2012; Hrynick et al. 2017) and were examined previously by Sanger (Sanger 1987). Archaeological evidence in combination with ethnohistoric accounts provide support for the continuity of dwelling architecture as a technology in eastern Wabanaki society, with continued use in parts of the Maine-Maritime Peninsula from the Middle Ceramic period into the nineteenth century (Hrynick et al. 2017:100). Research on dwellings at several archaeological sites on Port Joli Harbour along the southern shore of Nova Scotia (Hrynick and Betts 2017) has suggested a general regional consistency in architectural form across the Maritime Peninsula Region. Research at Port Joli Harbour has also highlighted the role that architecture and domestic spaces play in hunting, fishing, and gathering communities, supporting "… gendered dwelling-scale negotiations with the broad Wabanaki cosmology" (Hrynick and Betts 2017:2).

Within the vicinity of the study site's locale of Machias Bay are a suite of archaeological sites dating to the Ceramic period as well as the largest concentration of petroglyphs (rock art) along the eastern coast of North America (Bird 2017:30). The largest of these petroglyph groupings is located at the Birch Point site (ME 62-1), while smaller groupings of petroglyphs occur along the western shore adjacent to the Holmes Point East and West sites (62-8 and 62-6) in the eastern portion of the bay. Archaeological interpretations of the Holmes Point West site suggest a ritually charged place of feasting and gathering (Bird 2017; Ingraham 2015) or a spiritual locale frequented by shamans. Summarizing three decades of research on petroglyphs in the Machias Bay region, Hedden (2004) theorized that the petroglyphs are linked to an Algonquian “vision quest” tradition. “In form, subject, and context, the prehistoric petroglyphs are consistent with the work of visionary shamans” (Hedden 2004:343). Hedden developed a chronological sequence for the petroglyphs by correlating stylistic periods with relative radiocarbon dated peat and salt marsh deposits in the region. Utilizing this method, Hedden estimates that the oldest carvings date to approximately 3,000 years ago and that the youngest and final carving, depicting a European ship with sails, dates to the historic period (Hedden 2004).

Hedden’s research represents the only anthropological investigation of its kind into the petroglyphs located in Machias Bay. Robinson and Heller (2017:90), in their research on faunal remains and ritual symbolism in the Machias and Frenchman Bay regions, observe that petroglyphs might be classified as symbolic, but their uses may have been practical. It is also possible that the carvings were created by visitors to the area during gathering and feasting events, the occurrence of which might be supported by large faunal deposit features identified by archaeologists working at the Holmes Point West site (Bird 2017:130). While it is entirely natural for researchers to seek an explanation for the unique carvings, the only people who truly know their meaning and purpose are those who created them (Donald Soctomah, personal communication 2019).

<u>Protohistoric and Historic: Wabanaki and European Exchanges (ca. 550 BP – Present Day)</u>

Our understanding of Indigenous peoples who lived in eastern Maine and the adjacent Maritimes during the Protohistoric period is aided by available historic accounts, in addition to archaeological remains, ethnohistoric work, and Indigenous oral traditions. Overlapping the end of the Ceramic period and onset of the Historic is the Protohistoric period (ca. 550–350 BP or AD 1400 – 1600), understood to mark a time of intermittent contact between Indigenous Wabanaki and Europeans in the Maine-Maritime Peninsula region; the extent of contact at this time is largely unknown, and researchers are unsure if contact was more than indirect (Bourque and Whitehead 1985; Fitzgerald et al. 1993;

Hrynick et al. 2017). In this section, I highlight some of the important historic accounts which mention the area and its Wabanaki peoples, as well as identify sites where Protohistoric components have been identified in the archaeological record. By all accounts, it is clear that by the late sixteenth century, contact between Indigenous people and Europeans was well under way, as well as ensuing changes for Wabanaki culture and communities (Hrynick 2017; Fitzgerald et al. 1993).

A prime example of a Protohistoric site in the region is Devil's Head in Calais, Maine (97.10 ME), a late Maritime Woodland (i.e., Late Ceramic) and Protohistoric period occupation with an earliest radiocarbon date of 1183 - 1275 cal AD (AA-106617, 2-sigma) and latest of 1432 - 1635 cal AD (AA-106097, 2-sigma) (Hrynick et al. 2017). Sites containing protohistoric components are difficult to identify in the Maine-Maritime Peninsula and as a result are uncommon in the archaeological record(Hrynick et al. 2017:85). According to Hrynick and colleagues (2017), the Devil's Head site provides zooarchaeological evidence that patterns of seasonal transhumance were changing toward the summer coastal/winter interior pattern and away from a winter-to-spring coastal occupation pattern indicated by archaeological data (Bourque 1973), a shift that has been described in the ethnographic literature and attributed to the introduction of the fur trade (Snow 1976). While it is clear that Indigenous peoples during the Protohistoric were adapting to the arrival of Europeans by shifting patterns of seasonality, subsistence economy, and stone tool technologies, substantial continuities exist in technologies such as dwelling architecture and ceramic production (Hrynick et al. 2017:86). The work of Hrynick and colleagues (2017) demonstrates the resilience of Wabanaki people during a time of rapid change and upheaval, adapting as necessary yet maintaining many of their established traditions.

Sanger (1982, 1996a, 1996b) proposed that seasonal transhumance as it manifested during the Protohistoric and Historic periods was a product of the socio-economic changes resulting from the presence of Europeans in the region, particularly along the coast. The Protohistoric and Historic periods in northeast North America are marked by extreme social change. Based on anecdotal evidence, it is commonly accepted that Europeans and Indigenous people had begun to interact and trade by the late sixteenth century, prior to well-known accounts such as those produced by the French Jesuits in New France or Acadia (Thwaites 1896-1901). Early colonial explorers recounting their interactions with Indigenous people in the Northeast for the first time noted that they were already familiar trading with Europeans (Rosier 1906:128). European trade goods such as Basque copper kettles excavated from Wabanaki burials and accounts of the early European fishing stations which dotted the coastlines of the Maritimes region (Fitzgerald et al. 1993) are sufficient evidence that socio-economic models in the Maine-Maritime Peninsula region were in the process of shifting and adapting for decades if not longer prior to these written accounts.

Seal hunting is likely a characteristic of the Quoddy Tradition in eastern Maine and extends into the Protohistoric period. Evidence of a subsistence focus on *Phocidae* species exists in ethnohistoric sources from the region. Correspondence in the 1930's between Lewis Mitchell (Passamaquoddy) and author/historian Fannie Hardy Eckstorm mentions that the Roque's Bluffs region (located just to the west of Machias Bay) was frequented by Wabanaki peoples historically as a seal hunting locale (Prins and McBride:342). The importance of seal hunting to Passamaquoddy people, prior to the banning of hunting sea mammals in 1972, is documented in interviews conducted by Donald Soctomah, the Passamaquoddy Tribal Historic Preservation Officer, in collaboration with investigators from the University of Maine (Soctomah and Robinson 2010). Interviews with seal hunting elders and their families revealed the importance of seal hunting to Passamaquoddy ways of life and documented seal use, however, no specific practices of disposal or specialized treatment were noted (Soctomah and Robinson 2010). Subsequent faunal analyses completed by Ingraham (2011) provide supporting archaeological evidence that the Machias Bay region played an important role in Passamaquoddy seal hunting in the Pre-colonial past, highlighting substantial cultural continuity in Passamaquoddy hunting traditions through the modern period and their community's consistent use of the landscape and marine environment.

Archaeological Significance of the Holmes Point West site and Machias Bay Region

Oral and written records recounted by Drisko (1904) from the descendants of early European colonists' living in Machias describe large gatherings of Wabanaki peoples in Machias Bay:

> The late Charles Gates, of Machiasport, who died an octogenarian many years ago, once said to the author,: – [sic] "I have heard my mother say that when a girl, 1785 '90, I counted over one hundred birch canoes drawn up on the beach and shore opposite Machiasport, while the Indians were in Camp Fires, phullabaloos and dances, in the forest growth and wood-lands on the East side and towards Holmes' Bay" [Drisko 1904:7].

According to an unnamed historian's account as retold by Drisko (1904), Wabanaki people would travel to Holmes Point from as far west as the Penobscot watershed and east from St. John, New Brunswick, traditional home of the Maliseet "…to associate in war dances and campfires" (Drisko 1904:7). In corroboration of this account, Drisko asks the reader to consider shell middens dotting the region's coastline and the Indigenous artifacts found in them, especially "…the greatest heap of all, the head of Western inlet of Holmes' Bay only two miles from the East shore of Machiasport" (Drisko 1904:7). Drisko (1904) is one of the first historians to mention the importance of the Holmes Point peninsula to the region's Indigenous people during the historic period. This location is likely the same locale as multiple archaeological sites identified by University of Maine researchers. They compose the entirety of the peninsula's head and include Holmes Point West (62-8), Holmes Point East (62-6), two Long Point sites (62-53 and 62-54), and a plowed and heavily eroded site northwest of Holmes Point West (62-55). A full description of archaeological sites located in Machias Bay is provided by Bird (2017).

Detailed faunal analyses completed by Ingraham (2011) on the Holmes Point West assemblage also support the interpretation of the site as a place of ritual significance, as Hedden has proposed through his analysis of the significance of petroglyphs located in Machias Bay (2004). During analyses, Ingraham noted a discrepancy in gray seal (*Halichoerus grypus*) remains from the site, specifically that the left portion of the skull had been retained while the right was noticeably absent throughout the assemblage (Ingraham 2011). Ingraham and colleagues (2016) concluded that ancestors of Passamaquoddy people at the site had practiced returning the right portion of the skull to the sea, in accordance with ritual treatment protocols of hunted animal remains, consistent with those of other Algonquian peoples', namely the First Nations Cree and Mistassini. Archaeologically, this practice resulted in differential preservation of the left temporal bone of *H. grypus*. These ritual practices of retention and disposal at the Holmes Point West site are explored in greater depth by Robinson and Heller (2017), who also examined patterning in faunal remains of now extinct sea mink (*Neovision macrodon*). The authors observed that *N. macrodon* remains were represented almost exclusively by cranial elements and almost no post-cranial (non-skull) elements were present in the assemblage. Other possible explanations that exist which could explain the differential patterning found in faunal remains at the site include taphonomic biases, sampling biases or errors, and even cultural behaviors, such as food sharing. Two dog burials originally excavated in 1973 from Holmes Point West are also considered to represent ritualistic or symbolic behavior and were inventoried as part of Ingraham's thesis in 2011.

Archaeological History

The Maine-Maritime Peninsula attracted the attention of many early researchers interested in the cultural and environmental history of the region. High-profile figures such as Jeffries Wyman, first curator of the Peabody Museum of Archaeology and Ethnology at Harvard, and the Portland-born Edward Sylvester Morse, a former student of the celebrated naturalist Louis Agassiz and President of Peabody Academy of Science (now the Peabody Essex Museum) focused much of this early attention on shell-bearing sites along the southern coast of Maine (see Loomis and Young 1912; Morse 1925; Wyman 1868), as well as the areas surrounding Mount Desert Island (see Hadlock 1939; Hadlock 1941; Loomis and Young 1912; Wyman 1868). Very few sites beyond the eastern boundary of Frenchman's Bay were explored in great detail prior to the mid twentieth century.

Northeast Shell Midden Research

Research on shell middens has a long history in the Northeast and the site locale of the Holmes Point West site is characteristic of other shell-bearing sites in the region. For decades, Northeast naturalists and archaeologists have observed several natural and geographic factors corresponding with shell midden sites, including mud flats productive in shellfish, nearby sources of fresh water, and south-facing flat or gently sloping topography (Hadlock 1939; Matthews 1884; Sanger 1986). New England naturalist Edward Sylvester Morse (1925:433) observed that shell heaps along the eastern coast of New England shared similar spatial traits, noting that "The Indians who made these deposits always established their camps in close proximity to mud-flats in which clams abounded, and usually where springs of water were found" (Morse 1925:433). Morse, a naturalist who primarily specialized in univalves and bivalves, was interested in the composition and change of floras and faunas (Martin 1995). He made enduring contributions to early shell-midden archaeology and our understanding of change in prior environments in the Maine and Maritimes region (Bennett and Hamilton 2010:9).

Spencer Fullerton Baird, an American naturalist based at the Smithsonian Institution in Washington D.C. for most of his career (Black 2009), also noted the predictability of shell midden site location. Reporting on the nature and composition of shell middens in New Brunswick and New England between 1869 and 1873, he said "Thus, whenever on the sea-coast [sic] the shore sloped gently to the south, with fresh water in the neighborhood, shell mounds or beds could always be inferred, especially if in the vicinity of flats where clams could be obtained" (Baird 1881:292).

The activities of nineteenth century Danish archaeologists played a large role in directing and informing early shell-midden archaeology in North America, and modern archaeological practices more generally. In 1836, Christian Thomsen of the National Museum of Denmark introduced the three-age classification system (Stone, Bronze, and Iron), leading antiquarians and institutions of the time to the realization that through careful documentation of artifacts and their context it was possible to establish a world-wide cultural-historical framework (Hayden 1984: 81). Thomsen's work was followed by Jens Jacob Asmussen Worsaae and Johann Japetus Steenstrup, who each pioneered work on *kjokkenmœddings* (literally "kitchen-middens") one of the few Danish words universally adopted (Klindt-Jensen 1975:72-3). Their work had a particularly long-lasting impact with future researchers along the east coast of the United States and the Canadian Maritimes. Early scientific methods used in the examination of *kjokkenmœddings*, such as the regular practice of stratigraphic representations and the inclusion of investigators with a variety of training in physical and natural sciences, resounds in the writing of G. F. Matthew (1884). Steenstrup's work is cited as a direct influence on Edward Sylvester Morse in his work in New England with Jeffries Wyman and Fred W. Putnam (Morse 1925). The discovery of the importance of environmental remains and artifacts in Denmark helped to usher in a wider adoption of archaeological science, noticeable in the work of Morse and other Northeast archaeologists.

Early Archaeological Work in Eastern Maine

The first archaeological work in the eastern region of Maine is attributed to Judge Robert Pagan, a British loyalist, who completed excavations at the site of St. Croix Island along with the surveyor Thomas Wright in 1797 (Sanger 1986:139; Sanger 1987:4-5). St. Croix Island was the site of a failed settlement established by the Sieur de Monts and Samuel de Champlain in 1604 (Biggar 1936) and the 1783 Treaty of Paris stated that the St. Croix River was to be the border between the newly formed United States and British-controlled Canada (Sanger 1986:140). When there was confusion about which river was the St. Croix, Pagan organized the expedition to explore the island for the original settlement and verify the validity that St. Andrews was on the British (formerly French) side of the border. Pagan's work proved a success and supported the boundaries outlined in the Treaty of Paris but is often overlooked when accounting for the earliest archaeological work in North America (Sanger 1986:139).

Approximately 100 years passed before the next recorded excavations occurred in the eastern region of Maine and adjacent Maritimes. Investigators during the late nineteenth century typically provided reports on the general characteristics of shell mounds and types of artifacts distributed within them (Bailey 1887; Baird 1881), but mostly lacking the level of detail or analysis expected from a modern site report. Black (2009) states that Bailey's 1887 descriptive report on Indigenous artifacts from New Brunswick, while lacking a comparative framework, set the groundwork for future researchers in New Brunswick to contextualize their finds with those from other regions. In his paper, Bailey (1887) also presented findings mainly from the New Brunswick interior and in doing so established a precedent for Northeast archaeologists to consider coastal and interior collections separately, a practice which continues to persist among researchers (Black 2009:2). Spencer Fullerton Baird of the Smithsonian Institution conducted excavations during his vacations to the southwestern coast of New Brunswick (Black 2008:2). He documented brief descriptions of each site he visited and noted information about the locale and interesting artifacts found there. He also produced a vertical diagram of the shell midden deposit at Oak Bay, New Brunswick (Baird 1881).

Notable for its accuracy and early use of scientific field methods was the work of G. F. Matthew at the Bocabec Village site in New Brunswick in 1883 (Matthew 1884). The field techniques employed by Matthew and fellow researchers at Bocabec were accurate enough to reconstruct past diet, make observations about seasonality, identify locally exploited lithic sources, and identify gendered areas within the site's dwellings (Sanger 1986:140). Archaeologists over a century later have lauded Matthew for this early work, which went mostly unnoticed at the time (Sanger 1986:140). Matthew (1884) was likely the first researcher to detail observations of oval-shaped, gravel-lined house floors that have been detailed by Hrynick and colleagues (Hrynick and Robinson 2012; Hrynick et al. 2012; Hrynick et al. 2017) and Sanger (1987) before that, though Wyman (1868:564) also noted cultural features possibly attributable to dwellings. Gravel floors and conical shaped dwelling footprints are frequently found at Ceramic period sites distinctive of the Quoddy Tradition. Matthew also documented manufacture of pottery and decoration, including inclusion of a fir needle, a ceramic production technique which was recently observed in the ceramics collection of the Holmes Point West site (Newsom and James 2019). Matthew (1884:12) also identified tidal erosion in action at the site, noting a partial house floor.

Following this work, little in the way of archaeological investigations occurred in eastern Maine and the adjacent Maritimes region for three decades. At this time, much of the focus continued to be along the southern and mid-coastal regions of Maine. Of noten are investigations presented by Smith and Wintemberg on a suite of sites in and around Merigomish Harbor along the Strait of Northumberland, identified as cultural materials deposited by MicMac [sic] people who had lived there in the past (Smith and Wintemberg 1929).

Warren K. Moorehead's treatise *A Report on the Archaeology of Maine* in 1922 has little mention of excavations or artifacts from the Eastern Coastal region. In fact, Moorehead calls for future research in the Machias region, stating that no thorough exploration was completed there (Moorehead 1922:127 and 207). In a short section titled "East Machias," Moorehead (1922:238) describes excavating pieces of decorated Indigenous pottery at a camp site with evidence of "wigwam impressions." He determined the sherds to be of both "archaic" and "late types" of Algonquian pottery and notes a lack of shell-tempering, the presence of certain decoration, and rim and base forms. Moorehead also describes non-provenienced artifacts and a burial dating to the historic period, all in the possession of local collectors (Moorehead 1922:236).

Regional Archaeological Work since the Mid 20th Century

In the years following the second World War, then Director of the Robert S. Peabody Institute Douglas Byers dispatched researchers to conduct a "Downeast Survey" in the Far Northeast, including the eastern Maine and southwestern New Brunswick region. Researchers under the direction of Robert H. Dyson, Jr. completed exploratory field surveys beginning in the summer of 1948 and conducted fieldwork beginning in the summer of 1952 (Arthur Anderson, personal communication 2020). Of note are excavations at the Holt's Point Site, a shell-midden site located along the New Brunswick side of Passamaquoddy Bay and another example of coastal adaptation in the eastern region of Maine. Work completed by Hammon (1984) demonstrated that Holt's Point was a Ceramic period site by classifying projectile point forms and ceramic decoration recovered from the oldest cultural layer, placing the site ca. 2800 BP at its earliest. Further and more detailed research of the site could potentially add to our knowledge of Wabanaki people in the region during the Ceramic period, people who potentially visited Holmes Point.

During the early Downeast Survey years, a maritime-oriented occupation site was identified on Moose Island in Eastport during the summers of 1948 and 1949 (Kingsbury and Hadlock 1951). This site is one of the few in eastern Maine which can potentially be attributed to the Late Archaic period, based on diagnostic artifacts. As mentioned earlier, very little archaeological evidence exists to support sustained use of Maine's eastern region prior to the Ceramic period other than those early finds from the Debert site in Nova Scotia (MacDonald 1966) and some sporadic evidence of maritime-focused settlements dating to the late Archaic (Sanger 1986:147), making the mid-twentieth century excavations on Moose Island significant within the region.

During the second half of the twentieth century, two institutions have primarily conducted archaeological excavations in the eastern region of Maine: The University of Maine, under the direction of David Sanger and colleagues, and the University of New Brunswick, under the direction of David Black and colleagues. Recent work in the Machias Bay region was spearheaded by the University of Maine beginning in the late 1960s and supervised by research associate Robert MacKay. Six sites were originally identified and surveyed as part of the University of Maine’s 1973 Downeast Survey: Birch Point (62-1), Holmes Point East (62-6), Holmes Point West (62-8), The Rim (62-9), and sites 62-10 and 62-11 (no names are mentioned) (Bird 2017:15). Holmes Point West, and several other sites identified during the 1970’s survey, were revisited by the late Dr. Brian Robinson in 2008, becoming the focus of future field schools from 2008-2014. This work has been continued by Dr. Bonnie Newsom beginning with the 2019 field season, and future excavations are in the works.

CHAPTER 4

METHODS

Introduction

Methods that could best address the objectives outlined in Chapter 1 were selected for inclusion in this case study. To reiterate, these goals were to provide insight into the lives of past dogs and humans and their interactions together, highlight variation in dog remains that may reflect human choice, and provide a new archaeological dataset for the region. The methods used in this case study are intended to highlight human agency by revealing choices Indigenous peoples made in the care and feeding of their dogs, providing new ways for looking at archaeological questions related to agency in the human and dog relationship. The choice of methods selected was also influenced by the lack of contextual or archaeological information available on the nature of the dog burials as they were originally excavated in 1973.

Dogs and dog burials at Late Archaic period sites in the Maine-Maritime Peninsula have received the most focus (ca. 5000 – 3050 BP) (see Bourque 1995; Guiry 2012; Guiry and Grimes 2013; Spiess and Lewis 2001; Tuck 1970), with far less study of dog remains dating to the Ceramic period ca. 3050 – 250 BP (see Abbe Museum 1994; Allitt 2011; Deal 1986; Ingraham 2011). This research builds on these earlier studies by providing a detailed analysis of several canine individuals originating from the Holmes Point West site and contextualizing the dog remains spatially and temporally within the broader Maine-Maritime Peninsula region. This study applies the Canine Surrogacy Approach (Guiry 2013) to access information about human agency in the human-dog relationship through an analysis of past canine diet.

In the following sections, I provide an overview of the overarching methodology as well as the methods used in this case study. Dobres and Robb (2005:160) tell us that methodologies and methods differ -- specifically, methodologies are theoretically informed and usually dictate the "…'kit' of analytic research methods" used to address archaeological questions at hand. Discussing methodology in the context of “doing” agency theory, Dobres and Robb remind us that “…in archaeology there is also no useful distinction between theory and methodology” (Dobres and Robb 2005:160). Alternatively, methods are the “bread and butter” of archaeology, providing the empirical approaches used to address archaeological questions (Dobres and Robb 2005:160). This chapter will discuss the methods in a series of four stages, organized based on similarities and order of application.

Methodologies

The methodology applied here is Canine Surrogacy Approach (CSA), which suggests that the diet from dogs in archaeological deposits is similar to that of humans and can thus be used as an analogy for general human consumption patterns, utilizing stable isotopes measurements of $\delta^{13}C$ and $\delta^{15}N$ derived from archaeological bone and teeth remains (Guiry 2013). The CSA is based on established social and food-sharing practices that are at the heart of the human-dog relationship (Miklosi 2004:48-50) and this study suggests that human agency is integral to the dietary make-up of dogs. In this case study, the CSA assists in connecting a legacy canine dataset that has lost much of its original provenience information to questions about human choice, agency, and the human-dog relationship. A background of CSA applications in archaeology and an overview of the framework are summarized below.

Background to the Canine Surrogacy Approach

Use of dogs as a proxy for human dietary patterns occurred as a result of an accidental discovery made during a collaborative project aimed at dating the remains of domestic dogs from archaeological sites in Peru (Burleigh and Brothwell 1978). Burleigh noted that the range of $^{13}C/^{12}C$ ratios indicated a large contribution of C_4 plants to the diet of the dogs, as well as indirect evidence that communities were practicing maize agriculture. Other researchers followed suit, observing that $\delta^{13}C$ measurements from canid remains could be used to indicate maize inputs to diet (Katzenberg 1989; Murray and Schoeninger 1988).

In the earliest example of canines being utilized as a proxy for human dietary changes, Noe-Nygaard (1988) made two important observations. First, that the $\delta^{13}C$ values of dogs and humans recovered from coastally situated archaeological sites in Denmark dating from the Mesolithic-Neolithic boundary were isotopically similar, specifically that samples had less depleted ^{13}C, suggesting a diet high in marine resources. Second, temporally comparative samples from dogs and humans from archaeological sites situated inland had more depleted ^{13}C, indicating that they primarily ate non-marine food sources. Comparison by Noe-Nygaard between Mesolithic and Neolithic isotopic values demonstrated a difference of –6 ‰, indicating dietary changes consistent with a shift from hunter-gatherer subsistence patterns to more sedentary and agrarian patterns. This evidence not only suggested that canines could provide a surrogate for human diet but also that the changes were consistent over time, demonstrating profound shifts in food sources as a result of cultural change (Noe-Nygaard 1988). This evidence has subsequently been corroborated by research in Europe, Asia, and North America (Cannon et al. 1999; Clutton-Brock and Noe-Nygaard 1990; Guiry and Grimes 2013; Losey et al. 2013).

Building on this original study, Clutton-Brock and Noe-Nygaard (1990) compared stable isotope values of carbon and nitrogen from a dog at the inland site of Kongemose in Sjælland, Denmark to evidence from coastal sites at Star Carr and Seamer Carr sites in Yorkshire, England and identified seasonal habitation and resource exploitation of humans. Their research demonstrated that canines discovered from inland Kongemose subsisted mainly on a marine-based diet, suggesting that the dogs discovered at Kongemose died while on hunting trips inland with humans. Clutton-Brock and Noe-Nygaard (1990) interpreted these findings as evidence the dogs analyzed in the study had lived a majority of their lives along the coast, evidenced by their incongruent stable isotope values.

A frequently cited and early utilization of the CSA was conducted by Cannon and colleagues at the site of Namu, located along the central coast of British Columbia (Cannon et al. 1999). To confirm subsistence trends suggested through zooarchaeological analyses at Namu, previous researchers also sampled human remains available from burials for isotopic data but were limited to the period between 4500 – 2880 BP (uncalibrated) (Cannon et al. 1999:399). Lacking human specimens from all occupation periods at the site (spanning 6060 – 1405 BP, over 4,500 years), the researchers sampled the remains of 15 dogs recovered from contexts representing a broad temporal span at the site. δ^{13}C values from sampled dogs indicated that the protein intake was almost exactly the same as that of human remains tested from the site (Cannon et al. 1999:402). While there was also relatively close correspondence between δ^{15}N values of humans and dogs, reflecting the trophic level of an individual's diet, the trend was not as consistent as that of the δ^{13}C values. The researchers note that this may be due to real differences in consumption patterns between the two at the site, or metabolic differences between species (Cannon et al. 1999:404).

In an early example of utilizing dogs as a proxy for human diets in the context of NAGPRA, Chilton and colleagues (2001) conducted an initial study that combines δ^{13}C and δ15N values from the molars of dog remains spanning the Woodland to contact period in the Northeast (Chilton et al. 2001). They used isotope values to address questions of relative importance of maize agriculture to pre-contact communities in the Northeast. Results from this initial study indicate that δ^{13}C and δ^{15}N values derived from tooth collagen and enamel apatite could indicate the relative importance of maize to the canine individual's diet, as well as the importance of marine resources (Chilton et al. 2001).

Accessing Dietary Data from Archaeological Dog Remains

When working to establish pre-contact reconstructions of diet and subsistence practices it has historically been easiest to work directly with human remains. Faunal and plant remains may be used for reconstructing diet and subsistence practices, however, there are issues related to differential preservation, recovery, and variation in the method of quantification which can complicate analysis (Cannon et al. 1999). While direct study of human remains is ideal for addressing these topics, there are times when human skeletal remains or their immediate context are unavailable (see Cannon et al. 1999 and Chisolm et al. 1982 for specific examples) and ethical considerations of cultural affinity and human rights must also be taken into account. The Native American Graves Repatriation Act of 1990 (NAGPRA) mandates the repatriation of Native American human remains, as well as associated funerary items and objects of cultural patrimony (United States National Park Service 1990). The adherence to federal regulations associated with NAGPRA and consideration of the rights of Indigenous peoples demand that researchers consider the ethics of working with human remains and objects of Indigenous cultural patrimony, whether procured from legacy collections or new excavations.

In some cases where human remains are inaccessible for study, researchers have been successful in utilizing information about canine diet as a proxy for human subsistence and nutrition (Burleigh and Brothwell 1978; Cannon et al. 1999; Guiry 2012; Guiry 2013; Guiry and Grimes 2013; Noe-Nygaard 1988). This is accomplished by utilizing stable of carbon and nitrogen isotope compositions of collagen or bioapatite from preserved bones and teeth (Katzenberg 2008:416), dependent on the application used and questions asked. The measured ratios of carbon and nitrogen stable isotopes (reported as δ^{13}C and δ^{15}N) are used in concert to identify the general dietary trends of sampled individuals. One of the primary applications of δ^{13}C measurements in archaeology and paleodietary studies is in identifying consumers of maize; in those individuals who primarily consumed maize, the δ^{13}C signature is less depleted than in non-maize consumers (Katzenberg et al. 1995; van der mewe and Vogel 1977; Vogel and van der mewe 1978). Research has also demonstrated that the δ^{13}C signature from consumers of non-marine-based food sources is significantly depleted compared with those individuals consuming marine-based sources, and therefore may also be used to differentiate between marine and terrestrial focused diets (Chisholm et al. 1982). Measured ratios of stable isotopes of nitrogen generally show a stepwise increase of between 3‰ and 5‰ (measured in parts per mil) with each ascending trophic level (Bocherens and Drucker 2003; Minigawa and Wada 1984), and can consequently be used to differentiate between herbivorous, omnivorous, and carnivorous diets (DeNiro and Epstein 1981; Schoeninger and DeNiro 1984). Assuming that canine diets were similar to those of the human populations with which they cohabitated and shared resources, information about canine diet can be considered as analogous to humans (Guiry 2012; Guiry 2013; Guiry and Grimes 2013; Noe-Nygaard 1988).

<u>A Categorical Framework for Evaluating the Canine Surrogacy Approach</u>

Studies incorporating CSA applications are analogical inferences which can be separated into two distinctive categories, namely those which are based on direct analogies between the “source” and “subject” (dogs and humans, respectively) and those which are based on an indirect analogy between the two (Guiry 2012:360, see Cannon et al. 1999 for an early example of direct analogy). This case study is an example of the latter and emulates similar research where dog remains have been used as a substitute for human remains when they are unavailable for study (see Allitt 2011; Cannon et al. 1999; Chilton et al. 2001; Noe-Nygaard 1988). Studies incorporating mixing models to estimate dietary contributions to prehistoric dog diets continue to demonstrate support for the theoretical grounding of Canine Surrogacy Approach (see Hillis et al. 2020).

Guiry (2012:362) tells us that “CSA applications make two foundational a priori assumptions that specify the ways in which dogs should share similar dietary stable isotope signatures with humans: (a) that dogs had access to human foods through scavenging, handouts, and cacaeotrophy…and (b) “that

Foundational *a priori* assumptions of CSA (as outlined in Guiry 2012)	
a	that dogs had access to human foods through scavenging, handouts, and cacaeotrophy
b	that dogs and humans metabolize and incorporate their food intake in a similar manner such that rates of isotopic fractionation and incorporation into respective tissues are comparable for both

Table 4.1. Foundational *a priori* assumptions of CSA (Guiry 2012:362).

dogs and humans metabolize and incorporate their food intake in a similar manner such that rates of isotopic fractionation and incorporation into respective tissues are comparable for both" (Table 4.1).

If these assumptions are accepted, three factors might influence the degree to which dog diet reflects human diet (Guiry 2012:362):

1. Inherent biological or behavioral differences existing between humans and dogs that could alter the expression of dietary isotopic signatures in their respective tissues;
2. Cultural factors affecting human−dog relationships, thereby contributing to dogs eating or being fed foods with isotopic signatures disproportionate to those of the bulk food constituent of their human keepers' diet;
3. Environmental stimuli affecting how humans fed and/or cared for their dogs.

The above stated comparative factors, which are considered to have a positive, negative, or neutral influence on the similarity between dog and human diet, can help to better support CSA inferences which are based on direct analogies, making them "…more transparent and less susceptible to criticism" (Guiry 2012: 362). Though this case study presents an example of indirect analogy, the above-stated factors and the degree to which they influence dog diet at Holmes Point West will still be considered. Following the analysis of stable isotope data from canine remains at Holmes Point West, the results will be evaluated within the terms of this categorical framework.

Methods

Introduction

At the time of their discovery in 1973, the position and nature of the dog burials were not noticed or understood to be intentional inhumations. Therefore, little specific information exists as to artifact associations within the context of the burials and even stratigraphic relationships are somewhat unclear. To make matters more difficult, much of the original faunal material from the same excavation units as the burials has dwindled due to its use as part of a teaching collection (Ingraham 2011b:12-13), likely resulting in the loss of skeletal material originating from the two identified canine individuals located in the burial.

Several methods were used in the course of this case study to analyze archaeological data from the original excavations completed in 1973 and the later faunal analyses completed by Ingraham (2011). Stage 1 involved sampling of zooarchaeological canine remains using legacy collections from the Holmes Point West site; Stage 2 incorporates a comparative faunal analysis and an assessment of available health data from the canine remains; Stage 3 contextualizes the sampled canine faunal material within available information from the original excavations; and Stage 4 examines available radiocarbon data from carbon and stable isotope data from carbon and nitrogen, both extracted from archaeological canine bone collagen.

Stage 1: Sample Selection

This project incorporates legacy collections from the Holmes Point West site, originally excavated in 1973 by student researchers at the University of Maine's field school. Legacy collections have the potential to provide a source of archaeological data that has previously been overlooked, both in regard to paleoclimate or baseline reconstructions and in support of newly excavated archaeological data (St. Amand et al. 2020). Archaeological data, especially from coastal sites affected by climate change, are a dwindling resource. Incorporating legacy collections can provide information about sites which have been destroyed. St. Amand (2020) and colleagues have called on the archaeological community to address the long-term management of these legacy collections and the important data they hold, which are oftentimes inaccessible to those researchers who could use them due to shortfalls in curation or record keeping issues (St. Amand et al. 2020:8290).

<u>Working with Legacy Archaeological Collections at the Holmes Point West Site</u>

The zooarchaeological samples selected for analyses within this case study were first analyzed as part of Ingraham's (2011) master's thesis research. Ingraham (2011) attributed the 1973 canine faunal collection (n=109) to the context of a dog burial and analyzed the total additional canid material recovered during field seasons 2008 – 2010 (n=162). Field records from the 1973 excavations presented some challenges in reconstructing the contexts of the dog remains. Significant discrepancies exist between the number of faunal specimens originally reported from the 1973 excavation area that included the dog burials and what remains in the collection. Ingraham (2011) indicates that a significant portion of the original skeletal material recovered from the context of the dog burials is missing from the Holmes Point West legacy collections. He notes:

> …the use of the 1973 fauna as a teaching collection may have been a source of significant loss. Field counts of bone from N24 W20 indicate that between collection and the present assemblage, some 271 specimens have been lost. How many of these specimens were related to the dog burial is unknown [Ingraham 2011b:12-13].

This information is corroborated by former lab manager Steven Bicknell, who observed in his post-excavation notes that portions of the 62-8 faunal assemblage were combined with those from the Grindle site (ME 42-10) in the fall of 1978 to create a teaching collection (62-8 1973 notes).

Zooarchaeological Sample Areas

Zooarchaeological samples considered in this case study include the remains of canine individuals at the site and a sampling of all available taxa from the site with a similar spatial and temporal context. Great care was taken to avoid resampling of individuals so as to yield the greatest number of individual results for analysis. Permission to work with the dog burial remains was received from the Passamaquoddy Tribal Historic Preservation Officer, in accordance with the collaborative and Indigenous archaeologies approach used in the course of this research.

Two criteria were necessary for selection of canine and supporting zooarchaeological samples:

1. Contextually, all samples are from locations within the site that included both canine and a representative sampling of other zooarchaeological materials. Identifying areas of the site with representative dog remains as well as other faunal material ensured relatively consistent measure of spatial and temporal comparison across the site.
2. Canine specimens sampled include elements with sufficient bone collagen for stable isotope analyses. Radiocarbon dating samples required a minimum overall weight of 1,000 mg and environmental baseline samples required 300 mg or more. For the latter less material was used in several cases. Teeth were excluded from this analysis because different teeth are formed at different ages in an individual's life and therefore the bone carbonate present is not reflective of dietary averaging in the same way as bone collagen.

Three sample areas were defined for guidance: Sample Area A, the dog burial context; Sample Area B, the context of a hearth unit; Sample Area C, disarticulated context; and Sample Area D, additional disarticulated context (Figure 4.1).

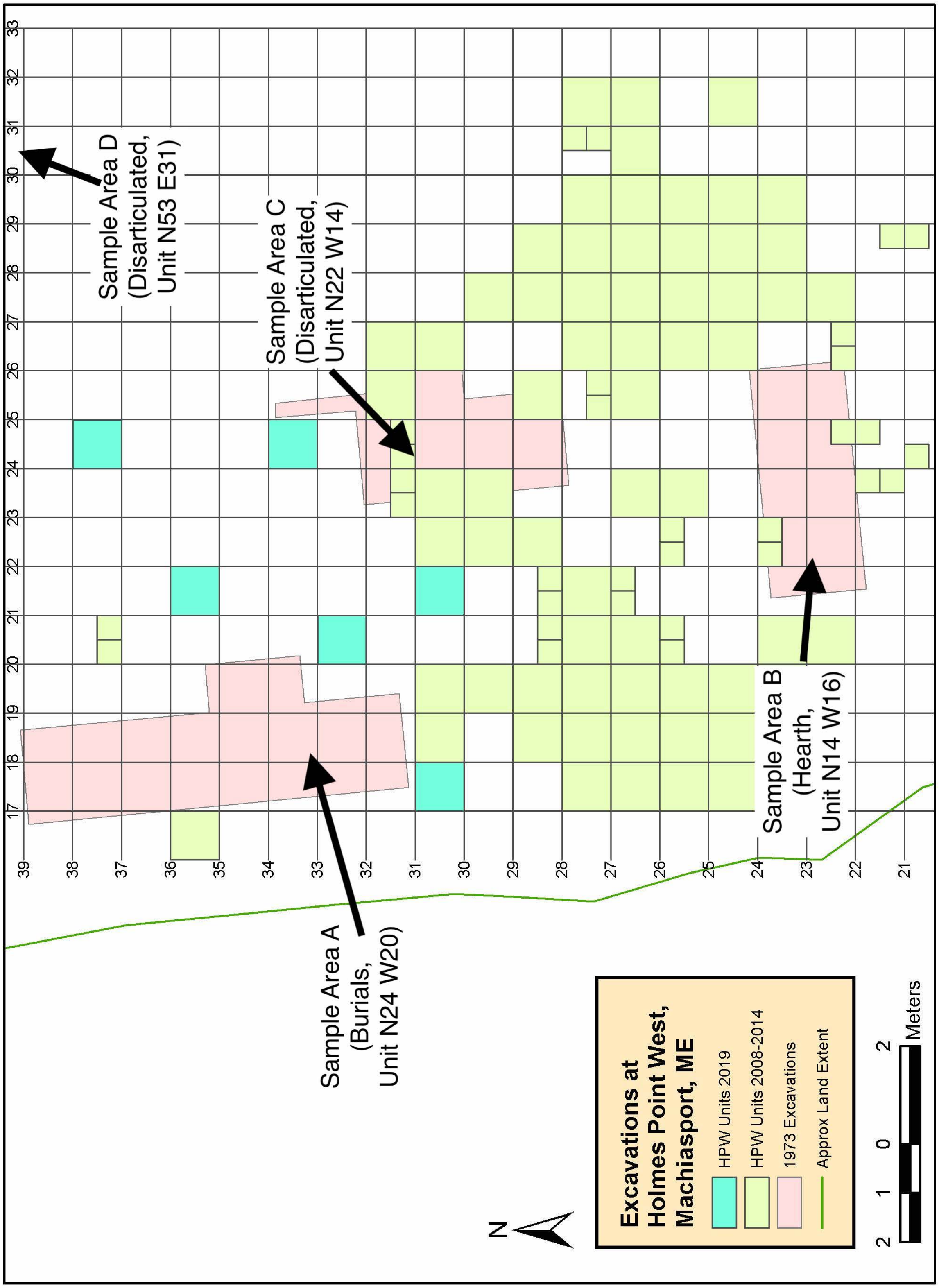


Figure 4.1. Grid of the Holmes Point West site (ME 62-8), including all excavation years 1973, 2008 – 2014, and 2019. Zooarchaeological Sampling Areas are identified, with corresponding units.

Stage 2: Comparative Faunal Analysis and Health Data

Utilizing available comparative collections housed at the University of Maine's Zooarchaeology Laboratory and online comparative databases, a comparative analysis was completed for the canine faunal materials in the assemblage. Use of comparative collections was aided using drawings and morphological descriptions from Gilbert (1990). Specimens were identified through analysis of size and diagnostic features. Where possible, sex, age, and any obvious morphologies were identified with the assistance of Doctor of Veterinarian Medicine Mark Hanks. The available collection of canine zooarchaeological material from the Holmes Point West assemblage is quite fragmented, so many of the specimens did not yield any health or pathological information. Canine remains analyzed in this study were recovered during the field seasons of 1973, 2008, 2009, 2010, and 2012. Analysis of faunal materials from the most recent 2019 excavations is on-going, and they are not considered in these analyses.

<u>Number of Individual Specimens (NISP) and Minimum Number of Individuals (MNI) Calculations</u>

Two analytical values frequently employed in the calculation of relative frequencies of species or taxa within an archaeological assemblage include NISP (Number of Individual Specimens) and MNI (Minimum Number of Individuals). NISP values include the total number of identifiable specimens within a given assemblage; however, this count is often used to estimate the relative frequency of taxa or skeletal elements (Reitz and Wing 2008:202). Utilizing NISP to develop estimates of species abundance is problematic because it is dependent on a number of factors such as the number of identifiable elements deriving from each animal, site-formation processes, recovery techniques, and laboratory procedures employed (Reitz and Wing 2008:203). NISP counts are particularly sensitive to issues stemming from differential preservation (Grayson 1984:21).

The MNI is a count of the smallest number of individuals necessary to account for all the skeletal elements of a particular species from a particular site (Shotwell 1955:330). MNI is also dependent of the same factors described for NISP calculations, however (unlike NISP) MNI is solely an analytical product and is interpreted as such. MNI should never be used to estimate the actual number of individuals as more may be present in the assemblage (Reitz and Wing 2008:206). For the archaeological questions posed in this case study, NISP and MNI are deemed appropriate analytical measures and are used to aid in determining sampling for radiocarbon dating and the isotopic environmental baseline, discussed in greater detail below.

This study attempted to complete these analyses utilizing an MNI count so as to avoid resampling of the same individuals. Great care was taken determining which canine elements would yield the most conservative and careful MNI count, thereby eliminating the possibility that results of the analyses would be redundant. This is not to say that intra-individual analyses should not be carried out on these remains in the future, however such work was outside the scope of this particular project.

Quantifications of NISP and MNI were originally calculated for *Canis* sp. in the assemblage by Ingraham (2011), with a total NISP of 155 overall for the entire canid assemblage. The two identified burials excavated in 1973 were represented by 109 elements and a minimum of 4 individuals from the entire site assemblage (Ingraham 2011:89). Ingraham (2011) selected single elements per taxon and MNI calculations were done on the assemblage instead of breaking out excavation blocks assuming spatial and temporal continuity, due to variable excavation techniques used in the initial excavation and site disturbance (Ingraham 2011:30-31).

Canis sp. Skeletal Element Frequency

Skeletal element frequency was calculated for all the *Canis* sp. identified from the site assemblage. Elements are accounted for individually with the exception of several elements which were grouped into skeletal portions, including:

1. **Vertebra** (inclusive of vertebra unidentifiable to region of the spine, individual spinous processes, vertebra centrum, and 3 lumbar vertebrae);

2. **Head** (inclusive of the maxilla, sphenoid, temporal, zygoma, palatine, and palate), and
3. **Teeth** (including all teeth listed).

Health and Pathology

Health and pathology of the canine individuals at the site was investigated with the assistance of Doctor of Veterinarian Medicine Mark Hanks and medical and forensic anthropologist Dr. Marcella Sorg. While identifying the health and possible diseases afflicting the individuals were complicated by the fragmentary nature of the canine assemblage, with the assistance of the two experts involved it was possible to identify general ages and some dental pathologies using the available mandible and teeth.

Morphometrics have not been used in this case study due to the highly fragmentary nature of the canid remains from the site. In addition, morphometrics are a hotly disputed area of study currently, due to the significant subjectivity involved and overlapping measurements as a result of the ranging morphology of different domestic breeds as a result of human selective pressures. Using traditional morphometrics as classification criteria for archaeological canid remains has been scrutinized recently by researchers, and most previous measurements have been determined to be mostly non-diagnostic (Drake et al. 2015; Janssens et al. 2019; Welker et al. 2021). Some canine individuals examined in earlier studies which were identified as domesticated have been revisited with more advanced methods and are now reclassified as wolves (Drake et al. 2020). These realties are complicated by the fact that domesticated dogs present significant morphological variation as a result of selective pressures from human breeding, and it is certainly possible that identified “dogs” in the archaeological record could have represented partially or entirely wild canid specimens (Gentry et al. 2004:645-646).

Inventory and Photographic Catalog

An inventory of the canine faunal assemblage from the Holmes Point West site was completed. Each specimen was verified to ensure it was labeled and bagged correctly within the assemblage and the existing Excel sheet database was reviewed for consistency. Following inventory, a comprehensive photographic catalog was created of the skeletal assemblage to digitally archive the remains, ensuring that if methods of destructive analysis are needed at any later stages of research, a complete record exists of each element. Photographs were taken with a Nikon DSC camera. Adobe Lightroom and Apple Photos software programs were used to edit the photographs and a digital archive was created in Google Drive for sharing and collaboration with colleagues on this project.

Stage 3: Contextualizing Selected Samples from the Holmes Point West Site

Data from the Holmes Point West site are contextualized using various datasets available that provide details on the site and how it has been excavated. A review of available sources of contextual data is presented below.

Review of 1973 Field Notes, Maps, and Photographs

Records of the 1973 field season and the ensuing fieldwork at the Holmes Point West site are archived at the University of Maine's Northeast Archaeology Laboratory. Field notes, maps, and photographs of excavators completing field work were taken at the site during the field school in 1973. Corresponding photo inventories for these 1973 excavations could not be located, making it difficult to correlate photos to excavation units, a prime example of one of the challenges encountered when working with legacy archaeological collections. This unfortunate reality limits how useful photos are in understanding the original excavation. Despite this limitation, a general idea of the site and excavations from almost 50 years ago is possible by looking at the photographs (Figure 4.2). Available field notes, level sheets, and stratigraphic drawings provide a granular view of the excavation and its techniques.

Figure 4.2. Student excavators at the 1973 field school at Holmes Point West. Photo on file with the University of Maine Anthropology Department.

Notes on Data Recovery at the Holmes Point West Site

Initial field excavations at the Holmes Point West site were conducted by students at the University of Maine's 1973 field school under the direction of University of Maine Research Associate Robert MacKay, focusing on the shell-rich portions of the site along the western bank, an area of approximately 41.2 m^2 (Ingraham 2011:9). Excavation strategies at the site have evolved over time. MacKay and his students approached excavations using a trench-based methodology, excavating minimum unit sizes of 2x2x1 meters with levels depths ranging from 10 to 30 cm in some cases; they did not screen the soil removed from units. While this strategy was beneficial for revealing large stratigraphic blocks, it was not conducive for reconstructing detail on the spatial relationships of site materials. Recent field seasons occurring between 2008 and 2019 have utilized standard excavation unit sizes of 1x1 meter, levels of 5 cm, and employed the use of ¼ inch screens for processing soil, greatly increasing the overall understanding of the site's components and their associations.

Notes from the field journals indicate that two different datums were used and as a result the depths for the burials were recorded as different levels, but adjacent to one another (62-8 1973 notes) supporting the interpretation that levels 3 and 4 represent (more or less) the same context and provenience. Therefore, canine zooarchaeological specimens from Level 4 of N24 W20 and Level 3 of N26 W20 were likely interred at the same time in the past. In addition, because the 1973 excavation crew did not employ the use of screens, only recognizable or diagnostic artifacts were recorded in situ. Disarticulated canid remains, mainly domesticated, were excavated from four other units during the 1973 field season (N28 W20, N22 W14, N20 W14, N22 W12, and N14 W16), and while it is possible that they could have also represented burials, they were not identified as such by the crew (Ingraham 2011:37).

Ceramics Chronology and Relative Temporal Assignments

To guide the sampling strategy and gain an initial understanding of the potential temporal assignment to the dog burials, a preliminary sequencing of Indigenous ceramics recovered in rough association with the dog burials at the Holmes Point West site was completed by the author under the guidance of Dr. Bonnie Newsom. Diagnostic assignments were made using comparative collections at the University of Maine at Orono and following the regional ceramic chronology established by Petersen and Sanger (1991). Petersen and Sanger's chronology classifies Indigenous ceramics temporally based on changes in ceramic attributes through time and is supported by 164 radiocarbon dates taken from 76 archaeological sites in Maine, the Maritimes, and other nearby regions (Petersen and Sanger 1991:122). A modified version of the chronology is borrowed here from Newsom (2017), shown in Table 4.2 with corresponding diagnostic characteristics.

Ceramic Period (CP) Temporal Assignment (^{14}C years B.P.)	Cultural Period	Diagnostic Characteristics
Ceramic Period 1: ca. 3,050 - 2,150	early Ceramic (Woodland)	Fabric-impressed interior/exterior surfaces; grit temper; conoidal bases and simple rims; commonly referred to as "Vinette 1."
Ceramic Period 2: ca. 2,150 - 1,650	early Middle Ceramic (Woodland)	Exterior decoration features dentate, pseudo-scallop shell, or linear designs; stamped and/or rocked design techniques; incision; non-standardized punctates; grit temper; appearance of castellated rims.
Ceramic Period 3: ca. 1,650 - 1,350	middle Middle Ceramic (Woodland)	Exterior decoration features dentate designs with an increase in dentate tooth size; linear and circular punctates; disappearance of pseudo-scallop shell; grit temper; thicker vessel lot walls; thickened rims or low collars.
Ceramic Period 4: ca. 1,350 – 950	late Middle Ceramic (Woodland)	Exterior decoration features cord-wrapped stick and cylindrical punctate designs often restricted to the upper portion of the vessel lot; conoidal vessel lots; simple to slightly excurvate rim forms; first appearance of shell/organic temper.
Ceramic Period 5: ca. 950 – 650	early Late Ceramic (Woodland)	Exterior decoration features simple vertical cordwrapped stick and circular punctate designs; decrease in cordage and punctate diameter; straight to excurvate simple rims; dominant use of shell/organic temper.
Ceramic Period 6: ca. 650 – 450	late Late Ceramic (Woodland)	Exterior decoration features cord-wrapped stick and linear punctates; appearance of fabric paddling; decrease in vessel lot wall thickness; globular vessel lots; collared rims with chevron or geometric motifs; undecorated bodies; shell/organic or grit temper.
Ceramic Period 7: ca. 450 – 250	Contact Period (Early Historic)	Exterior decoration features incision and fabric paddling techniques; very thin vessel lot walls; collared rims; predominant use of grit temper.

Table 4.2. Timeline of the Ceramic (Woodland) Periods in Maine with diagnostic characteristics, adapted from Newsom 2017 (sourced from Petersen and Sanger 1991).

All available ceramic artifacts were analyzed from both excavation units in which the dog burial remains had been recovered during 1973 (N24 W20 and N26 W20). This was to achieve a relative temporal assignment, taking into account any effects of prior looting at the site or record-keeping issues introduced through original recovery methods.

Stage 4: Radiocarbon Dating and Stable Isotope Analyses

Radiocarbon dating and stable isotope analyses were completed to add temporal context and dietary data to the canine remains from the site. A review of steps taken to complete both analyses is reviewed below, as well as a review of biological considerations when sampling canine remains for stable isotopes. Reasoning for including environmental baseline samples to assess dietary variability is explained and is followed by a review of standards and pretreatments applied to all stable isotope analysis samples.

<u>Radiocarbon Dating</u>

Zooarchaeological samples selected in Stage 1 were sent for radiocarbon dating in order to add temporal context to the dataset. All radiocarbon dates were completed at the labs of Beta Analytic in Miami, Florida using an Accelerator Mass Spectrometer (AMS). Pretreatments and standards for radiocarbon samples run at the labs of Beta Analytic are as follows: before radiocarbon dating, the sample is first gently crushed then dispersed in deionized water. It is then washed with hot HCl acid to eliminate carbonates followed by an alkali wash (NaOH) to remove secondary organic acids. The alkali wash is followed by a final acid rinse to neutralize the solution before drying. Chemical concentrations, temperatures, exposure times, and number of repetitions depend on the sample submitted. Each chemical solution is neutralized prior to application of the next. During serial rinses, mechanical contaminants such as associated sediments and rootlets are eliminated.

Conventional radiocarbon ages and sigmas are rounded to the nearest 10 years per the conventions of the 1977 International Radiocarbon Conference, and when counting statistics produced sigmas lower than +/- 30 years, a conservative +/- 30 BP is cited for the result. In sampling for radiocarbon dating, a minimum overall weight of 1,000 mg or 1 gram was necessary to extract the needed collagen for analysis. All samples were cut using a Dremel rotary tool and Dremel 545 diamond wheel.

Originally, two duplicate samples were taken each from three dogs identified here as Dogs 1, 2, and 3 as determined in Stage 1 (six samples total). This method ensured that all of the same individuals identified through the faunal analysis and radiocarbon dated were matched to the canine stable isotope samples run by Dr. Guiry at the Water Quality Centre at Trent University. It also ensured that the full treatment parameters and standards used for the canine samples were known. Following the original duplicate sampling of Dogs 1, 2, and 3, the initial ulna sample did not yield enough preserved collagen for the radiocarbon dating at Beta Analytic. A new sample from the calcaneus of what is believed to represent the same canine individual was sent to Beta Analytic; however, no corresponding duplicate stable isotope sample was run at Trent University for stable isotope analysis. Additionally, a new canine individual, Dog 4, was added to the research process later on and therefore was not subject to a duplicate stable isotope analysis.

New radiocarbon determinations completed during the course of this research are reported in this document following updated guidance as outlined by Millard (2014), accounting for calibration curve and software used and any pre-treatments applied to the sample.

Stable Isotope Analysis

Stable Isotope Theory

Interpreting stable carbon and nitrogen isotope values is based on an established understandings of stable isotope ecology, supported through a large body of literature stemming from the fields of paleodietary, biogeochemical, and archaeological studies. Stable carbon isotope ratios ($\delta^{13}C$) mainly reflect relative proportions of plants with distinctive C_3 and C_4 photosynthetic pathways (O'Leary 1981; O'Leary 1993) (Figure 4.3) contributing to dietary intake either through direct consumption of plant materials or indirectly through animal consumption (Schwarcz and Schoneninger 1991). This technique is often used to distinguish the contribution of maize to consumer diet, which is an indication of the arrival of agricultural practices in the Northeast (van der mewe and Vogel 1977; Vogel and van der mewe 1978). Stable nitrogen isotope ratios generally show a stepwise increase of between 3‰ and 5‰ with each ascending trophic level (Bocherens and Drucker 2003; Minigawa and Wada 1984), and can therefore be used to differentiate between herbivorous, omnivorous, and carnivorous diets. Additionally, due to the much longer food chains that exist in marine ecosystems, predominantly marine-derived diets can also be differentiated from terrestrial focused diets based on $\delta^{15}N$ values (Minigawa and Wada 1984). Used together, the measured ratios of carbon and nitrogen stable isotopes can be used to identify the general dietary trends of sampled individuals (Figure 4.4). Isotopic data are most commonly plotted as *x, y,* points within bivariate space because the relationships between isotopic data are qualitatively meaningful when illustrated in this way (Szpak et al. 2014:115).

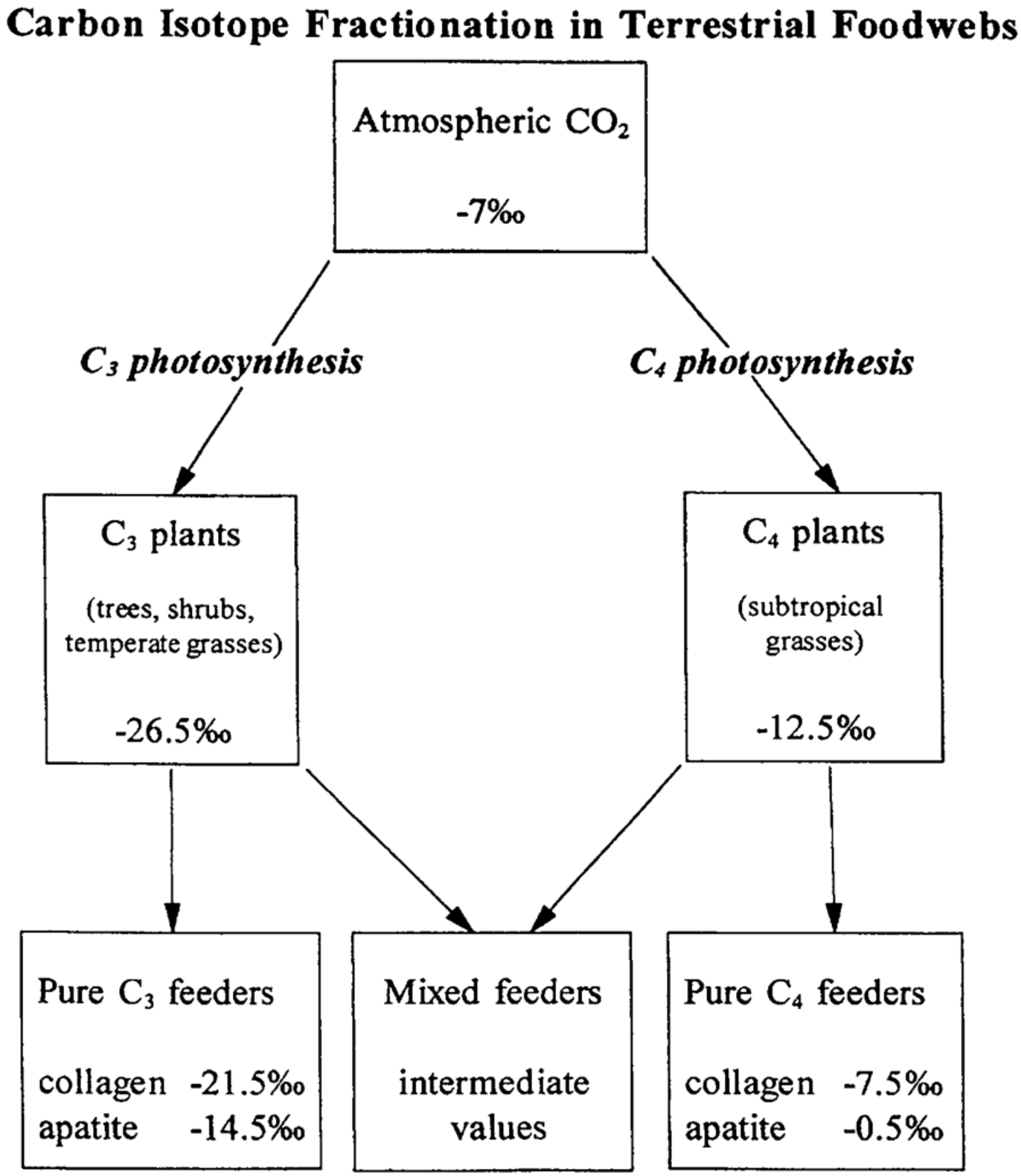


Figure 4.3. Carbon isotope fractionation in terrestrial foodwebs (Tykot 2004).

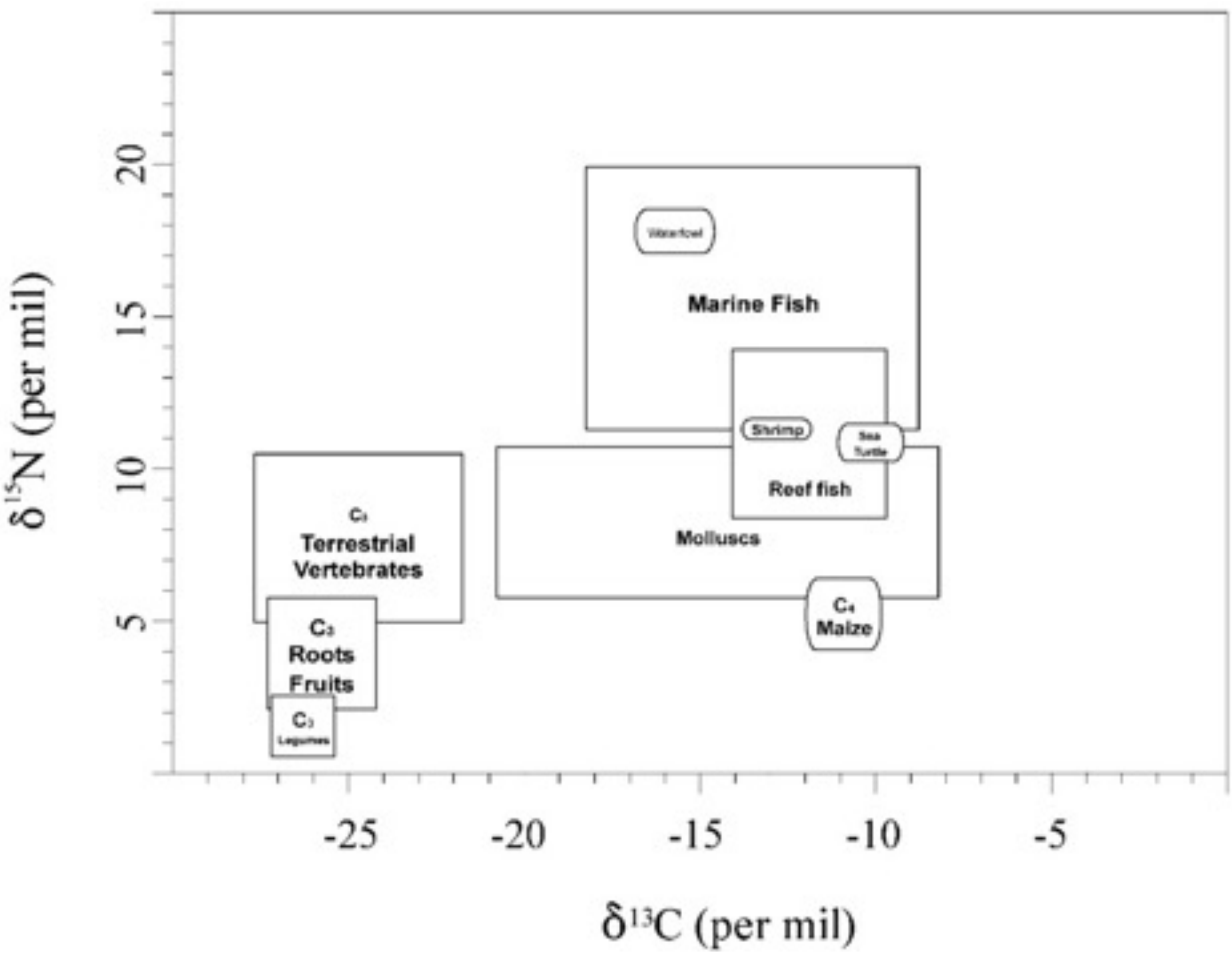


Figure 4.4. Carbon vs. nitrogen isotope ratios in common New World food groups, displayed in bivariate chart (Tykot 2004).

Biological Considerations When Sampling Stable Isotopes from Canine Remains

Important differences exist in sampling of canine hard tissue remains for stable isotopes in contrast to those of human remains. Human bone remodels quite slowly and sampling of isotopic signatures from bone collagen can reflect diet on average of more than 20 years (Hedges et al. 2007). In contrast, dogs bone tissue remodels much more rapidly as a result of a shorter life span (Noe-Nygaard 1988:2), therefore sampling from bone collagen may produce isotopic signatures which are influenced by short-term dietary fluctuations (Guiry 2012:363). The sampling of canid species other than domesticated dog is another potential source of isotopic difference. It is important to consider whether the zooarchaeological material sampled can be confirmed as domesticated dog either through contextual evidence or the presence of diagnostic faunal material. Sampling of ancient DNA from canid specimens can also prevent the misidentification of wild canids as domestic individuals. Finally, a well-known behavior in dogs known as caeceotrophy, or the consumption of feces (Katzenberg 1989:326), could potentially alter dog isotopic signatures. While previous research has demonstrated that urine is depleted in δ^{15}N compared to diet (Minigawa and Wada 1984), it is not clear what the effect of consuming human feces might be on dogs.

Environmental Baseline

In order to assess dietary variability at the study site, this case study also generated a faunal isotopic baseline, which is spatially and temporally comparable to the dogs. It is crucial to understand any environmental or cultural factors which may impact the isotopic values derived from archaeological bone. By analyzing the δ^{13}C and δ^{15}N signatures from animals and plants local to the site area, an isotopic baseline is available which provides a comparison for understanding values derived from dog bones in that region and time.

Sampling Procedure

Sampling for the environmental baseline reconstruction included a total of 41 samples, representing all available taxa from units and contexts associated with the four dog individuals sampled. Baseline samples were taken when available from the same level as the canine samples and always within the same 1x1 meter provenience unit; however, if no sample for the given species was available in the same level but was present in either the adjacent level above or below, those species were selected as a “second-best” choice. Baseline samples were never taken from levels either above or below the adjacent level to the dated canine material or outside of the same 1x1 meter provenience unit in order to best preserve temporal control over the dataset. To avoid resampling of the same individuals, an MNI count was used when possible. Ideally, samples taken for the environmental baseline weighed at least 300 mg, however in some cases this was not possible, and less material was sampled. All samples were cut using a Dremel rotary tool and Dremel 545 diamond wheel.

Isotopic Analyses Pretreatments and Standards

For all samples excluding fish, collagen was extracted from faunal bone samples following a Longin (1971) method modified as follows: samples were soaked in 0.5 M HCl until the mineral phase had dissolved. Samples were then neutralized in Type 1 water (resistivity = 18MΩ cm) and treated with 0.1 M NaOH in an ultrasonic bath (solution refreshed every 15 min until solution remained clear) to remove base-soluble contaminants. Samples were then neutralized again in Type 1 water and refluxed in 0.01 M HCl (~pH3) for 36 h. Samples were then centrifuged, and the soluble fraction was pipetted into a new vial, frozen, and lyophilized. Quality controls for collagen isotope composition followed well-established parameters for detecting degradation and/or contaminants, including carbon-to-nitrogen ratios ($C:N_{atomic}$ acceptable between 2.9 and 3.6) and percent carbon and percent nitrogen (acceptable above 13.0% and 4.8%, respectively; Ambrose 1990).

For samples of fish, the following procedures were used: bone collagen was extracted from the specimens following a Longin (1971) method modified as follows. Bone samples were treated with a 2:1 chloroform–methanol solution in an ultrasonic bath (solution refreshed every 15 min until it remained clear) to remove residual bone lipids (Folch et al. 1957; Guiry et al. 2016). Samples were then demineralized in 0.5 M HCl at room temperature. Demineralized samples were then neutralized in Type 1 water before being treated with 0.1 M NaOH in an ultrasonic bath (solution refreshed every 15 min until it remained clear) to remove base-soluble contaminants (e.g., humic acids). Samples were again neutralized in Type 1 water and then solubilized in a 10^{-3} HCl solution (~pH 3) in an oven at 70 °C for 48 hours. Sample solutions were then centrifuged, after which the solubilized fraction was transferred to a new vial, which was frozen and lyophilized.

Radiocarbon samples run at the labs of Beta Analytic were accompanied with corresponding δ13C and δ15N signatures for each sample, following pretreatment as already outlined for radiocarbon date samples. The reported δ13C was measured separately in an isotope ratio mass spectrometer (IRMS) and is not the AMS δ13C which would include fractionation effects from natural, chemistry and AMS induced sources.

Data Calibration for Isotopic Analyses

Carbon and nitrogen elemental and isotopic compositions were measured on 0.5 mg subsamples of the extracted collagen using an Elemental Analyzer 300 (Eurovector, Pavia, Italy) coupled via continuous flow to a Horizon Isotope Ratio Mass Spectrometer (Nu Instruments, Wrexham, UK) at the Water Quality Research Centre at Trent University (Peterborough, ON, Canada). Replicate analyses were performed on 20% of samples. Stable carbon and nitrogen isotope compositions were calibrated relative to VPDB and AIR, respectively, using a two-point calibration anchored to USGS40 and USGS41a (Qi et al. 2003; Qi et al. 2016). Analytical accuracy was monitored using three internal check standards. Calculated for carbon and nitrogen isotopic compositions, respectively: random errors (uR(w)) were

±0.138‰ and ±0.323‰; systematic errors (u(bias)) were ±0.122‰ and ±0.158‰; standard uncertainty was ±0.184‰ and ±0.360‰ (Szpak et al. 2017). Collagen quality was assessed using established criteria for ancient collagen (Ambrose 1990; DeNiro 1985; van Klinken 1999). Isotopic compositions from archaeological bone collagen are deemed acceptable if they are accompanied by elemental concentrations of >13% and 4.8% carbon and nitrogen, respectively, collagen yields >1%, and a C:N atomic ratio between 2.9 and 3.6.

Quality assurance on reference standards at Beta Analytic are as follows: known-value reference materials were analyzed quasi-simultaneously with the unknowns. Results are reported as expected values vs. measured values. Reported values are calculated relative to NIST SRM-4990B and corrected for isotopic fractionation. Results are reported using the direct analytical measure percent modern carbon (pMC) with one relative standard deviation. Agreement between expected and measured values is taken as being within 2 sigma agreement (error x 2) to account for total laboratory error.

CHAPTER 5

RESULTS AND ANALYSIS

Introduction

The results and analysis of this case study are presented here in five sections outlining the results of the analyses completed. This chapter is presented in the following order:

1. A review of relevant data collected from archaeological and archival materials originating from the 1973 field season, in order to better contextualize the results of the overall analysis;
2. a review of faunal analysis results, including NISP and MNI calculations, skeletal frequencies, and any identified health and pathology patterns;
3. results of radiocarbon dating;
4. results of stable isotope analyses, including the baseline environmental samples taken in order to assess dietary variability as well as the four canine individuals sampled; and
5. presentation of information on each canine individual sampled.

Data Collected from 1973 Field Season

A review of available information from the 1973 field season was completed, including field notes, maps, photographs, and associated artifacts. Post-excavation notes indicate that the two dog burials were located within units N22-24 W18-20 and N24-26 W18-20 (Figure 5.1), both excavated as 2x2x1 meter units, along the western edge of the site adjacent to the eroding embankment. While excavating Unit N22-24 W18-20, one student noted in her field journal what appeared to be a “bone cluster” within Level 4 (62-8 1973 field journals, Book 3:21). Records from this unit indicate that 272 bone specimens were recovered, as well as 33 teeth. Records also indicate that “part of the backbone was in position” (62-8 1973 notes). Though the nature of the “bone cluster” escaped notice of the field crew during excavations, a student field sketch shows a dog skeleton oriented in a curled, half-circle

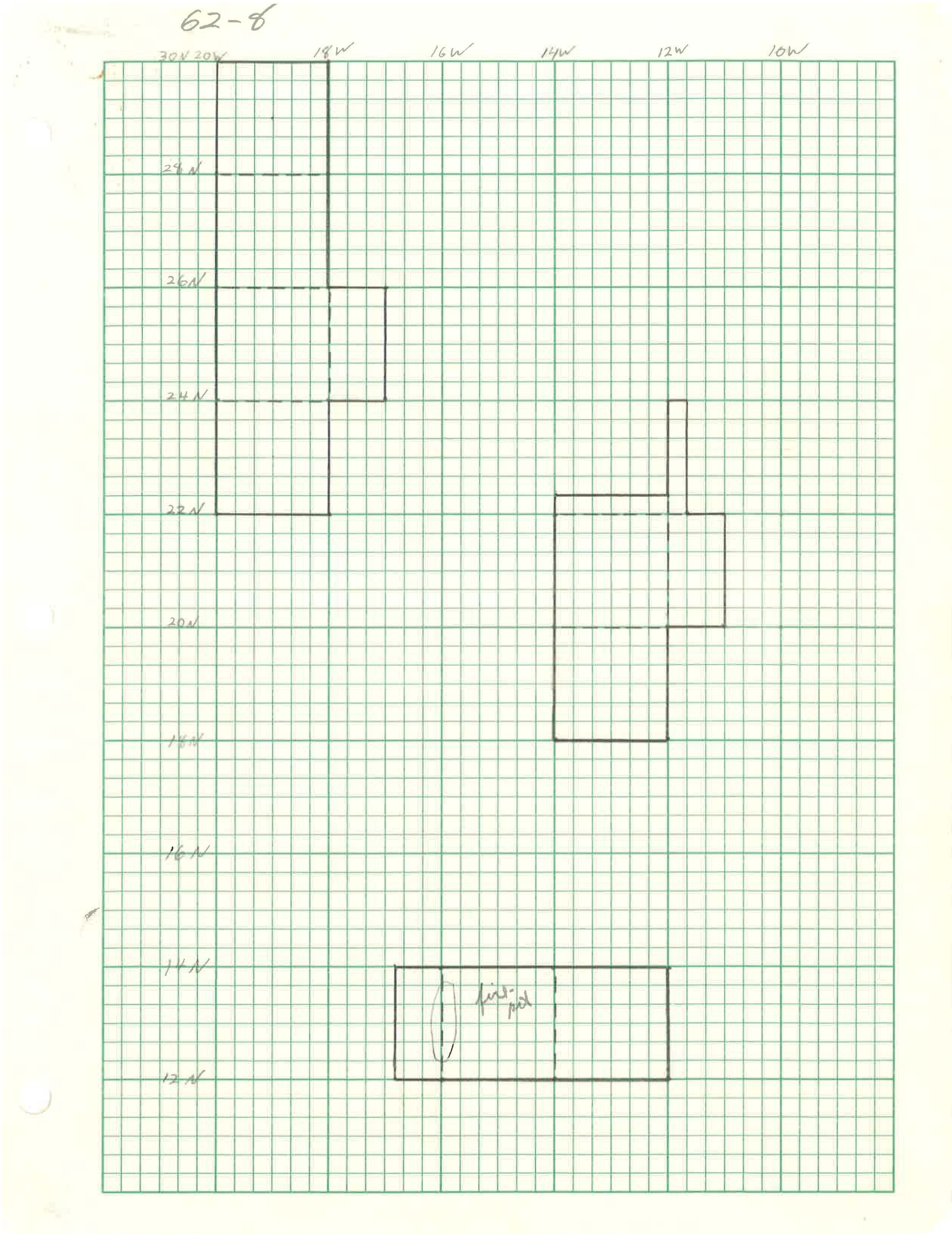


Figure 5.1. 1973 grid of Holmes Point West site excavations (ME 62-8).

shape (62-8 1973 field journals, Book 3:22). The skeleton was oriented in a north-south direction, head south and tail north, with the head facing toward the shoreline, or the west (Figure 5.2). The second dog burial, located in Level 3 of Unit N25 W20, was described by the excavators as a "bone patch" containing 177 bone specimens (62-8 1973 excavation paperwork, N26 W20).

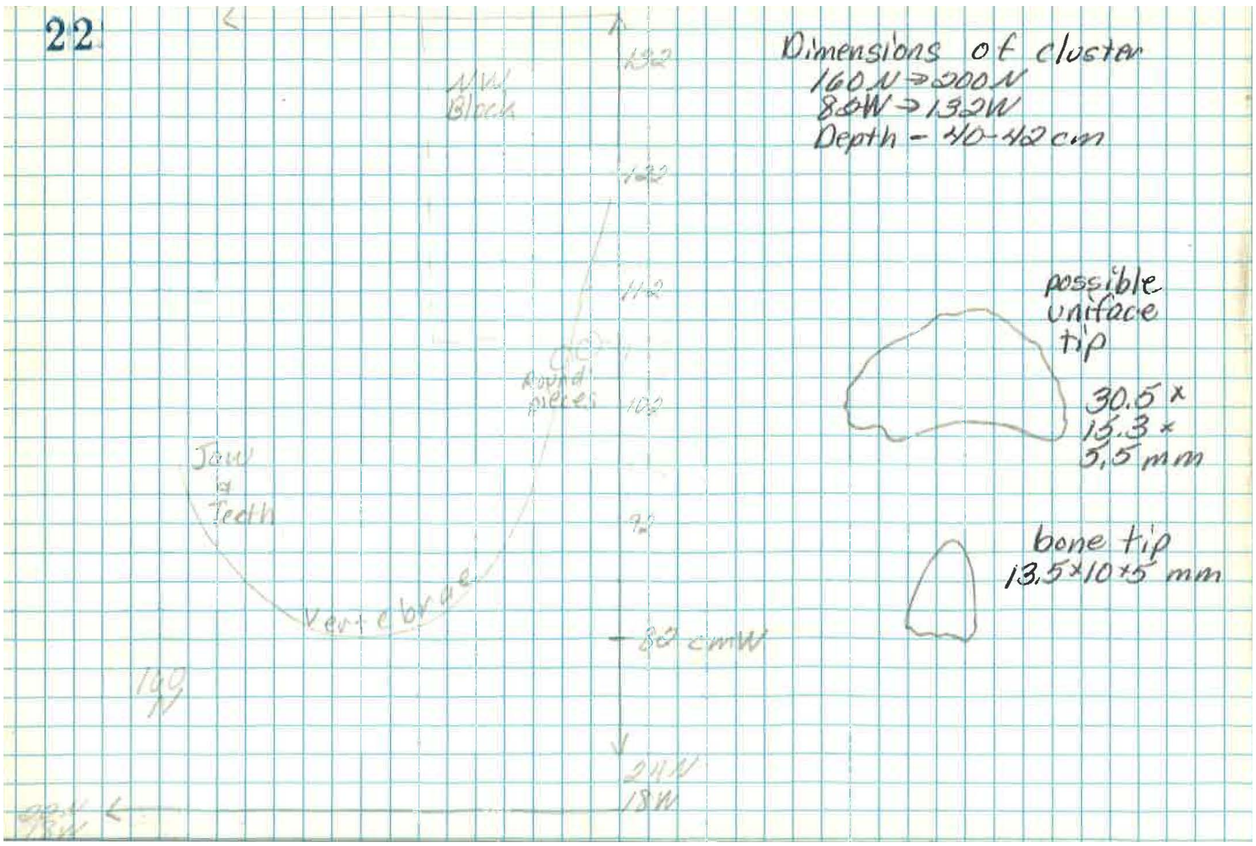


Figure 5.2. Sketch of dog burial located in unit N22-24 W18-20. Copied from 62-8 1973 field journals, Book 3, page 22.

Based on the reconstructed level sheets and field notes, the two burials were located less than one meter apart, adjacent to each another and in mirror image (Ingraham 2011:37). Burial of whole and unmodified organisms is indicative of non-subsistence behavior (Ingraham 2011:82), suggesting these two dogs served a cultural role beyond subsistence (Kerber 1997; Perri 2017). Level records indicate that a few artifacts (lithic debitage, unifacially and bifacially-worked tools, and a core) occurred in Level 4 of

Unit N22-24 W18-20, although it is not clear by the documentation if they were in direct association with the burials (62-8 1973 excavation paperwork, N24 W20 and N26 W20). While other canine faunal specimens were recovered from the site during the 1973 field season, none have been (as yet) identified as part of an interment (Ingraham 2011:37). Ingraham (2011) indicates that the disarticulated, non-burial remains may have actually been in burial context but were not recognized as such by the 1973 field crew. Additionally, the site has been looted for years and several units reflect looter's activities (Bird 2017; Ingraham 2011). The number of elements identified as non-burial remains may have also been affected by the nature of excavations, where screening techniques were not practiced, and only diagnostic items were recorded *in situ*. Later excavations, between 2008 and 2014, produced additional canine bones; however, none appear to be associated with burials.

Ceramics Chronology

Based on the chronological framework established by Petersen and Sanger (1991), the dog burials are tentatively assigned to the early middle to late Middle Ceramic period, or CP 2 – CP 5 (2150 BP – 950 BP). Figure 5.3 shows that chronological variation exists among the Indigenous ceramics recovered from both units. The ceramics recovered from Level 4 of Unit N26 W20 and Level 3 of N24 W20 span the entire Middle Ceramic period. Of note are Artifacts 48 and 17 recovered from Level 4 of N26 W20, both of which were classified as CP 5 (950 – 650 BP). The presence of these two CP 5 sherds with other CP 3 – 4 sherds may be due to stratigraphic mixing from intrusional dog burial activities within the shell midden. The dog burials were hypothesized to represent younger cultural features than the surrounding midden deposit.

Diagnostic Ceramic Analysis, Units N24 W20 & N26 W20 (Dog Burial Context)		
Artifacts by Unit	**CP Assignment**	**Time Period**
<u>N24W20</u>		
Level 3 <u>(30 – 40 cmbs)</u>		
• Artifact 37	CP 2	2850 – 1650 BP
<u>N26W20</u>		
Level 1 (0 – 10 cmbs)		
• Artifact 39 (v1)	CP 3	1650 – 1350 BP
• Artifact 39 (v2)	CP 3	1650 – 1350 BP
Level 2 (10 – 20 cmbs)		
• Artifact 40	CP 2	2850 – 1650 BP
Levels 1, 3, and 4 (Mixed Levels)		
• Artifact 16	CP 4 – CP 5	1350 – 650 BP
• Artifact 16 (v2 – 3 pieces)	CP 4 – CP 5	1350 – 650 BP
• Artifact 41 (8 pieces)	CP 4 – CP 5	1350 – 650 BP
Level 4 (40 – 50 cmbs)		
• Artifact 7	CP 4 – CP 5	1350 – 650 BP
• Artifact 48	CP 5	950 – 650 BP
• Artifact 17	CP 5	950 – 650 BP
• Artifact 42 (v1)	CP 3	1650 – 1350 BP
• Artifact 42 (v2)	CP 4 – CP 5	1350 – 650 BP
Level 5 <u>(40 – 50 cmbs)</u>		
• Artifact 43	CP 2	2850 – 1650 BP

Figure 5.3. Summary of diagnostic ceramic analysis for Units N24 W20 and N26 W20, the location of the two dog burials at site 62-8.

Faunal Analyses

Introduction

For this study, individual specimens previously identified as *Canis* elements within the Holmes Point West faunal assemblage were checked and re-identified to at least the genus and in most cases to species. The overall canid assemblage represents a minimum of four individuals. Canine specimens recovered from the site and still preserved in the collection are predominantly teeth (n=26), rib,(n=28) and vertebral (n=30) elements. Two specimens previously identified as *C. familiaris* (PNs 803.70 and 1402) were reclassified as *Lontra canadensis* and *Castor canadensis.* One new canid specimen was added to the assemblage, PN 1406, identified as a left 2nd premolar representing a *Canis* sp. Following removal of PNs 803.70 and 1402 and the addition of 1406, NISP was recalculated and resulted in 160 total *Canis* elements (see Tables A.4-6 in the Appendix for a complete table of all elements in the canid assemblage).

NISP and MNI Calculations

NISP and MNI for all *Canis* sp*.* elements from the assemblage were recalculated and 160 elements were identified. An MNI count was calculated by taking into account sidedness as well as proximal and distal portions. As Ingraham (2011) had identified before, a minimum of four (4) individuals was identified from the overall faunal assemblage, based on a count of paired upper and lower canines. An MNI of three was also derived from left ulnae, and ultimately left ulnae were the major basis for individuals chosen for sampling in stable isotope analyses and radiocarbon dating.

Canis sp. Skeletal Frequencies

Axial elements (consisting of bones from the skull, spinal column, and rib cage) are the most common in the canid assemblage (Figure 5.4). Because most recovered elements were categorized as axial, it made sense to sort the assemblage based on skeletal portions in order to provide more detailed comparison. Based on the skeletal portions used in this faunal analysis, vertebral, rib, and teeth elements are all represented in frequencies greater than 15.0%. Head elements (which exclude the mandible and teeth in this analysis) account for 11.25% of the elements, and phalanges account for 8.13%.

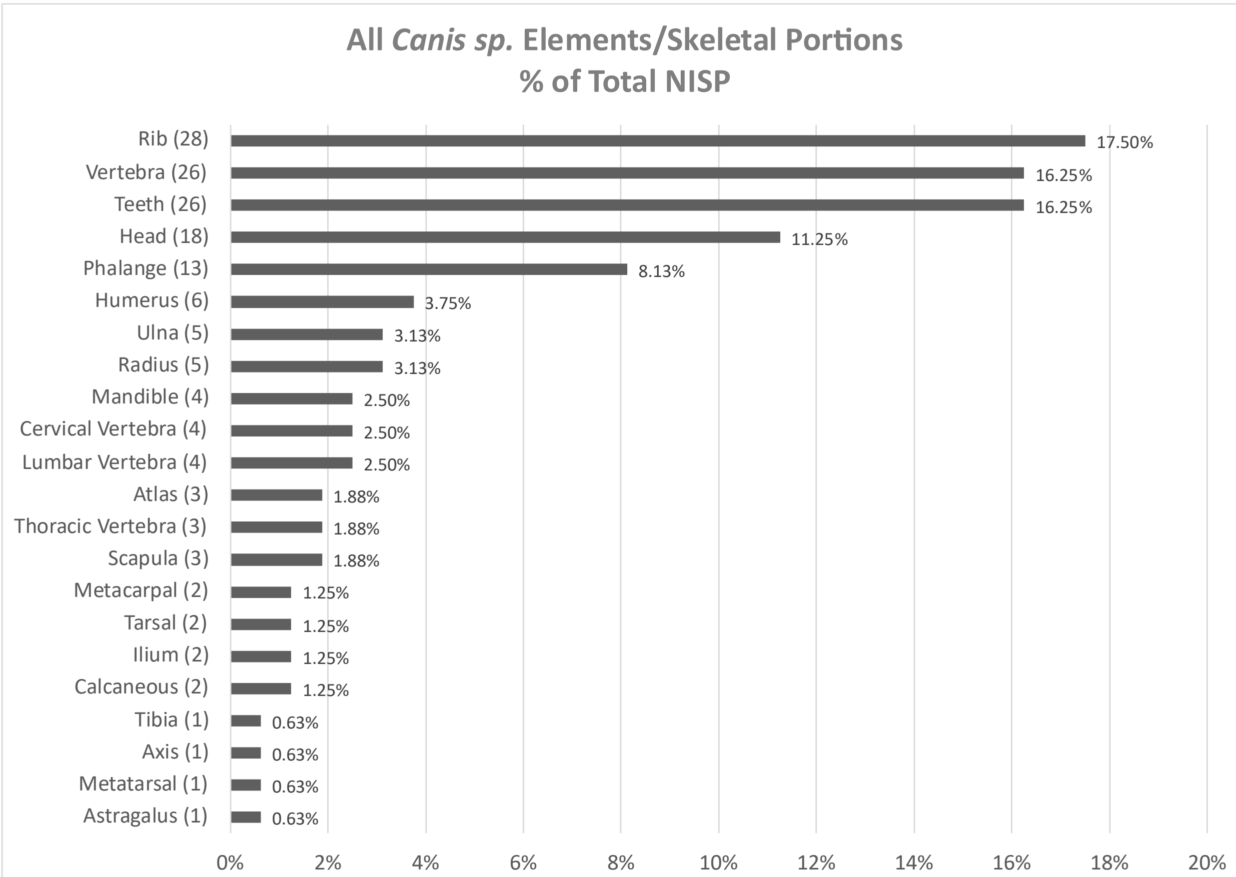


Figure 5.4. Overall counts and percentages of total NISP for each type of *Canis* sp. element and grouped skeletal portions.

<u>*Canis* sp. Burial vs. Non-Burial Elements</u>

Past researchers have pointed out that burial of whole and unmodified organisms is indicative of non-subsistence behavior (Ingraham 2011: 82) and can increase the survival of elements in the archaeological record. The act of burying dogs changes many aspects of their appearance in the archaeological record, including their articulation and positioning, location, and the types of inclusions present (Perri 2017). Comparison of burial and non-burial contexts could be useful for understanding the spatial distribution of canine remains and also potential ritual and behavioral patterns at the Holmes Point West site, however site disturbance and excavation are also important considerations within the context of this particular site.

The frequency of burial versus non-burial elements/skeletal portions and their overall percentage of the overall NISP for *Canis* sp. are displayed in Figure 5.6. A noticeable difference between burial context and non-burial context elements is reflected by the total number of recovered specimens; 73.91% of all *Canis* sp. remains were recovered from burial context and just 25.47% from non-burial contexts, so recovered at a proportion of roughly 3:1 respectively. Frequencies of canine elements which were excavated from burial contexts were calculated and compared with skeletal frequencies of those elements excavated from non-burial contexts (Table 5.1 and Figure 5.5). The results of the skeletal frequency analysis demonstrate that those elements recovered from burial contexts are represented by predominantly axial remains, in this case skeletal elements including ribs, vertebrae, head portions, and teeth. When combined, these elements account for 87.5% of the total burial elements (Table A2, found in the Appendix). Frequencies for elements excavated from non-burial contexts are represented predominantly by teeth and phalanges. When combined, these two categories of elements account for 47.5% of the total non-burial elements (Table A3, found in the Appendix). As has been noted previously, substantial loss of the original faunal collection greatly impacts our understanding of contextual relationships at the site and means that the ratio of burial to non-burial elements is likely even greater. Frequencies calculated here should be utilized with caution.

Elements/Skeletal Portions	Combined NISP	% of Total NISP
Astragalus (1)	1	0.63%
Metatarsal (1)	1	0.63%
Axis (1)	1	0.63%
Tibia (1)	1	0.63%
Calcaneous (2)	2	1.25%
Ilium (2)	2	1.25%
Tarsal (2)	2	1.25%
Metacarpal (2)	2	1.25%
Scapula (3)	3	1.88%
Thoracic Vertebra (3)	3	1.88%
Atlas (3)	3	1.88%
Lumbar Vertebra	4	2.50%
Cervical Vertebra (4)	4	2.50%
Mandible (4)	4	2.50%
Radius (5)	5	3.13%
Ulna (5)	5	3.13%
Humerus (6)	6	3.75%
Phalange (13)	13	8.13%
Head (18)	18	11.25%
Teeth (26)	26	16.25%
Rib (28)	28	17.50%
Vertebra (26)	26	16.25%
TOTAL	**160**	**100.00%**

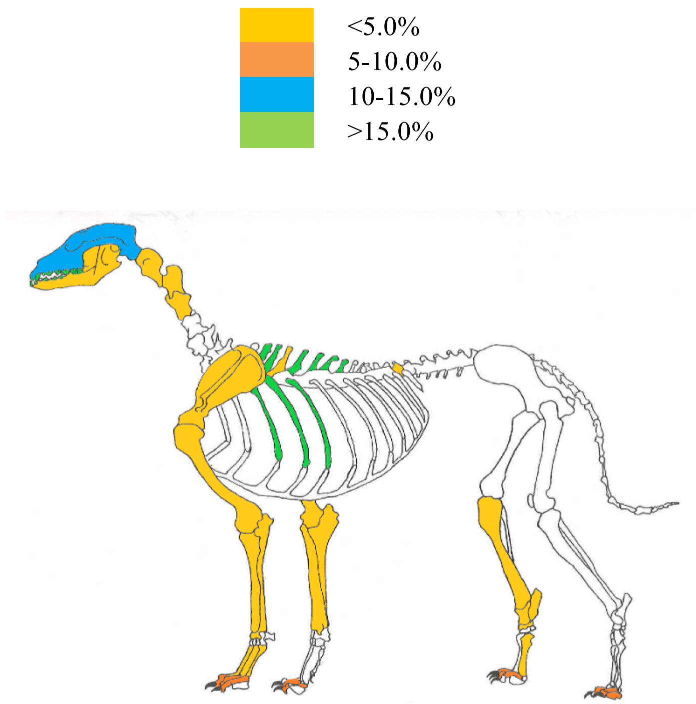


Table 5.1 (Left). *Canis* sp. elements and skeletal portions with combined NISP and % of total NISP calculated. Figure 5.5 (Right). Generalized body map depicting the skeletal elements and portions present for *Canis* sp. Body map should not be considered representative of the sample and is for visual aid only. Diagram adapted from Gilbert (1990).

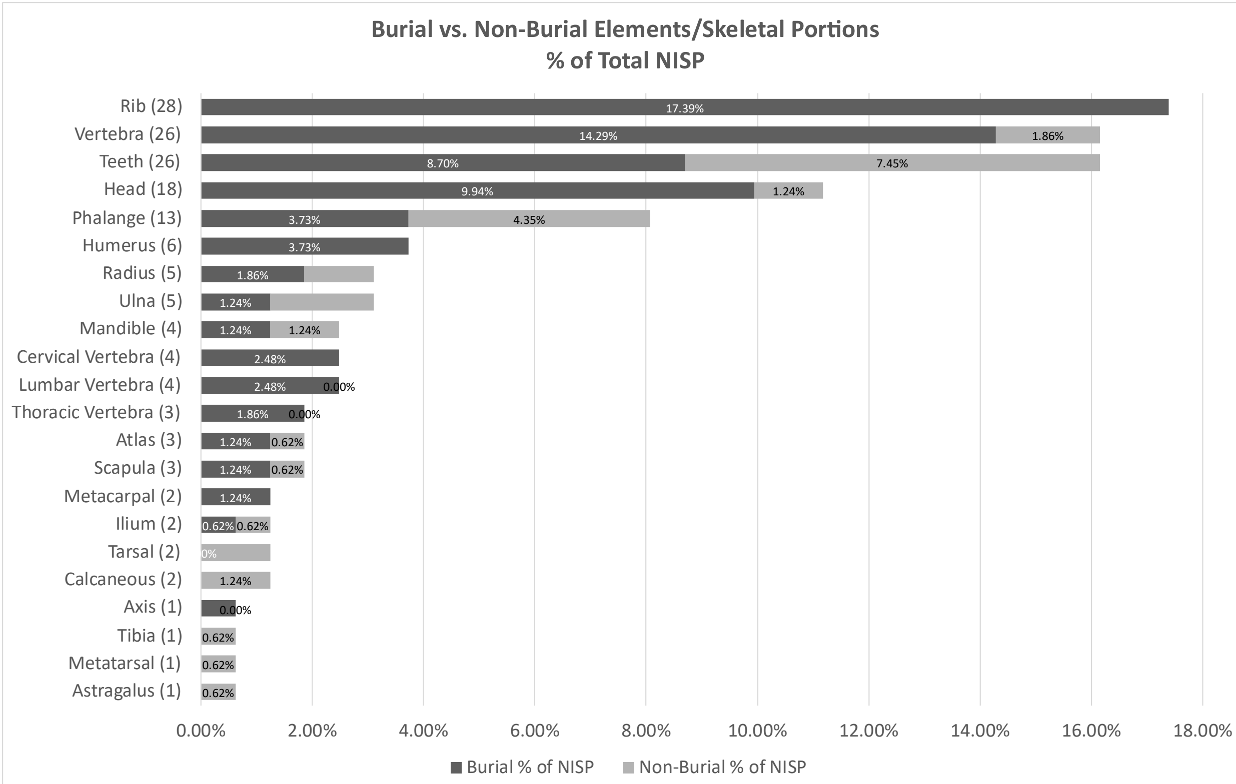


Figure 5.6. Combined *Canis* sp. elements excavated from non-burial context with combined NISP and % of total NISP calculated. (dark bars) Combined *Canis* sp. elements excavated from burial context with combined NISP and % of total NISP calculated. (light bars)

Health and Pathology

Available mandibles and teeth were investigated for dental health and pathology with the assistance of Dr. Mark Hanks and Dr. Marcella Sorg. The remains of the two burial individuals yielded the most skeletal material during faunal analyses, including two more-or-less complete mandibles with several refit premolars as well as refit 1st and 2nd molars in both specimens. It is not known which of these two mandibles belongs to Dog 1, represented by the left ulna specimen (PN 30.72) sampled for stable isotope analyses and radiocarbon dating. An additional mostly complete mandible was available from Unit N22 W14, assumed to be associated with the left ulna specimen (PN 66.87) representing Dog 3. A fragmentary mandible from Unit N53 W31 was also examined, along with a refit 1st molar, the same madiblen element sampled representing Dog 4 (PN 315.70). At this time, no health or pathology was noted on the calcaneus specimen representing Dog 2 (PN 38.99), and no other diagnostic elements with noticablee health or pathology details were recovered from within the same context.

Prior to completion of the health and pathology work, it was unknown if the two mandibles from the burial context in Unit N24 W20 represented the remains of two different dogs. These mandibles were examined by Dr. Hanks and are hypothesized to represent two separate individuals, based on differences in present dental pathologies, however a more thorough examination is necessary to confirm this hypothesis. The left sided mandible (Figure 5.7, panel A) has evidence of advanced periodontal disease along the gum line, indicated by the recessed bone and pitting caused by bacteria on the periodontal structures, while there is little to no indication of this condition in the right-sided mandible (Figure 5.7, panel B). Based on this information, the age of the two dogs is tentatively assigned as at least 7-8 years for PN 28.79 individual and to be adult-aged for the PN 28.80 individual (Hanks personal comment. 2021).

Two different types of wear were considered when examining the canine remains: attrition, which is wear that comes from chewing behavior, and breakages. Tooth wear and/or breakage was noted on all dog individuals with the exception of PN 315.72, which most likely represented a young adult and was only identifiable by a mandible fragment and a single M1.

Figure 5.7. *C. familiaris* left sided mandible PN 28.79 (Panel A) and *C. familiaris* right sided mandible PN 28.80 (Panel B). Both were excavated from a burial in 1973 at site 62-8. It is believed that one of these mandible specimens is associated with Dog

A right-sided mandible specimen, PN 39.125, was also recovered in 1973 from Unit N14 W16, associated with a hearth feature (Figure 5.8). Dental pathologies were determined based on tooth wear and this individual is classified as an adult, likely younger than the individual identified from the burial unit (PN 28.79).

Another right-sided mandible specimen and refit 1st molar, PNs 315.70 and 315.72 (Figure 5.9), were examined from a test unit located on the far northeastern corner of the site, N53 E31. Though fragmentary, the refit molar allowed us to observe that this individual appears to be significantly younger than the others represented at the site. Little wear on the tooth likely indicates that this dog was juvenile or young adult (Mark Hanks, personal communication 2021).

Figure 5.8. *C. familiaris* right sided mandible (PN 39.125). Excavated from a hearth feature in 1973 at site 62-8.

Figure 5.9. *C. familiaris* right sided mandible (PN 315.70) and refit 1st molar (PN 315.72). Excavated from test unit N53 E31.

At least one of the burial individuals also exhibited significant wear on the rear surface of their lower canines, represented by PN 28.88, a paired set (Figure 5.10). This type of wear is common in modern-day domestic dogs and according to Hanks (personal communication 2021) typically comes from repetitive chewing on the bars of cages or wooden sticks. The wear seen in the specimen from the burial may derive from chewing activity, perhaps on the remains of *Phocidae sp.*, a feature noted on substantial amounts of faunal material from other archaeological collections at Turner Farm on North Haven Island (Spiess and Lewis 2001: 4,55) but which has only been observed on a few specimens within the Holmes Point West faunal assemblage (Ingraham 2011).

Figure 5.10. *C. familiaris* worn paired lower canines (PN 28.88). Recovered from one of the burial dogs in Unit N24 W20.

Radiocarbon Dating

Radiocarbon dating analyses for samples of Dogs 1 – 4 were completed at Beta Analytic. These results are reported following updated guidance as outlined in Millard 2014 (Table 5.2), with 1 and 2-sigma ranges reported and median probability, all in calibrated years BP. A complete list of radiocarbon samples, notes, and pretreatment details are included in Table A.1 in the Appendix.

Dog #	RC Sample Number	Original PN #	Unit #	Sample Material	Element	Conventional AMS RC Age and Std. Dev.	1-sigma	2-sigma	Median Probability	Culture Phase
1	Beta-544315	30.72	N24 W20	*C. familiaris*	Ulna	990 +/- 30 BP	931 – 904 cal BP (32.1%) 867 – 825 cal BP (32.8%) 809 – 804 cal BP (3.3%)	958 – 897 cal BP (44.6%) 874 – 794 cal BP (50.8%)	869 cal BP	Late Ceramic/ Woodland
2	Beta-544314	66.87	N14 W16	*C. familiaris*	Ulna	650 +/- 30 BP	655 – 634 cal BP (28.2%) 590 – 562 cal BP (40.1%)	669 – 622 cal BP (44.7%) 605 – 555 cal BP (50.8%)	599 cal BP	Late Ceramic/ Woodland
3	Beta-546919	38.99	N22 W14	*C. familiaris*	Calcaneus	610 +/- 30 BP	645 – 621 cal BP (25.5%) 615 – 586 cal BP (29.9%) 566 – 554 cal BP (12.8%)	651 – 546 cal BP (95.4%)	603 cal BP	Late Ceramic/ Woodland
4	Beta-558633	315.70	N53 E31	*C. familiaris*	Mandible	450 +/- 30 BP	520 – 494 cal BP (68.3%)	537 – 470 cal BP (95.4%)	506 cal BP	Proto-historic

Table 5.2. New reported ^{14}C Dates from Holmes Point West (ME 62-8). Dates calibrated with IntCal20 and Marine20 where appropriate utilizing OxCal 4.4.2 software (abbreviated version, please see Table A.1 in the Appendix for full details on pretreatments and cultural context).

The oldest conventional radiocarbon date is associated with PN 30.72, one of the burial dogs, and returned a median probability for calibrated date of 869 cal BP (2-sigma). This date is consistent with the temporal assignment based on the ceramic analysis outlined previously in this chapter, which indicates that the general time period of association for the dog burial units was between CP2 and CP5 (2150 – 650 BP, Petersen and Sanger 1991). The other canine individuals from the site are dated to after this time period, all between CP 5 and CP 6 (650 – 450 BP, Petersen and Sanger 1991). While ceramics were not identified from any of the other sampling areas, these dates are well-supported by other archaeological materials previously identified from the site (see Bird 2017).

__**Testing for Potential Marine Reservoir Effect**__

During the process of receiving and interpreting radiocarbon dates from Beta Analytic for the canine samples, it became evident that the potential existed for a marine calibration curve to be more appropriate for samples that had indicated a marine-based diet based on the stable isotope analysis. Due to the difference in atmospheric and oceanic carbon sources, individuals consuming ^{14}C from primarily marine sources can appear to be older than they actually are (Heaton et al. 2020). Based on the preparation and sample type information provided to Beta Analytic prior to the collagen extraction process, the lab delivered dates calibrated with what was the most recent standard terrestrial curve at the time, IntCal13 (Reimer et al. 2013). In order to test whether or not the most recently developed world-wide, non-polar marine curve, Marine20 (Heaton et al. 2020), would be a more appropriate calibration for dogs at the site with a heavily marine-based diet, a comparative analysis was completed. Radiocarbon dates provided by Beta Analytic were recalibrated using the Marine20 curve to test whether a significant discrepancy existed in the reported dates. Radiocarbon dates from all dated canine individuals were also run with the most up-to-date terrestrial calibration curve, IntCal20, to ensure that a more refined date was not available (Reimer et al. 2020).

Utilizing the free OxCal v. 4.4.2 software suite developed by Bronk Ramsey (2009), Dogs 1, 2, and 3 (which had indicated through the stable isotope analysis either a primarily or at least partially marine-based diet) were remodeled with the most recent marine calibration curve, Marine20. Differences in calibrated radiocarbon dates for Dog 1-3 using the marine calibration curve vs. the terrestrial curve are negligible and therefore marine reservoir effect is not considered to have a significant impact on the interpretation of radiocarbon date results (Figure 5.11). Dog 4, the only individual who returned isotopic values indicating a terrestrial diet, was remodeled using the most recent terrestrial curve, IntCal20. Calibration Figures B.1-3 for Dogs 2 - 4 are located in Appendix A.

Stable Isotope Analysis

Stable isotope analysis included a total of 43 samples, 41 of which were completed as part of the environmental baseline and are displayed in Table 5.3 below. Stable isotopes of $\delta^{13}C$ and $\delta^{15}N$ derived from an additional two samples of *Canis familiaris* completed at Beta Analytic were included in the overall analysis. A complete list of stable isotope analysis samples and their results are included in Table A.4 in the Appendix.

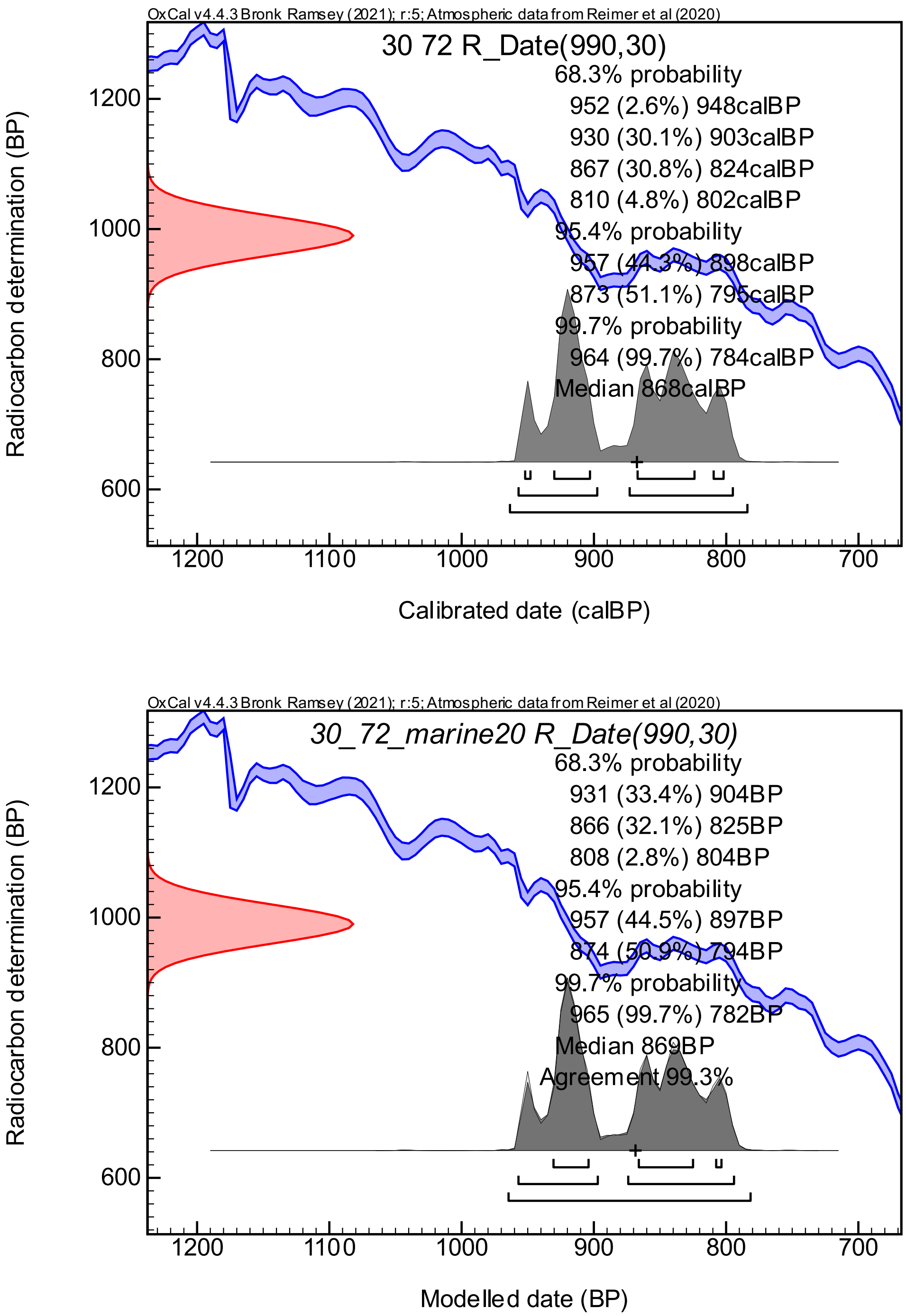


Figure 5.11. Comparison of original calibrated date using IntCal20 and recalibrated radiocarbon date using Marine20 for Dog 1 (PN 30.72). PN 30.72 is the only canine sample which indicated a predominantly marine-oriented diet.

TEAL No.	δ13C	δ15N	%C	%N	C:N	PN	Cat. No	Class	Element	Species	Unit and Context
9218	-12.2	18.9	43.7	15.2	3.36	20	80A	Mammal	Temporal	Phoca vitulina	Burial Context (Unit N24 W20)
9219	-10.3	14.6	49.0	17.8	3.20	20	95	Fish	Hyomandibular	Gadus morhua	
9220	-13.0	17.3	44.2	15.7	3.28	20	99	Bird	Coracoid	Alca torda	
9221	-12.0	19.5	44.3	15.6	3.31	21	74	Mammal	Temporal	Phoca vitulina	
9222	-13.6	17.2	38.9	13.0	3.48	21	77	Mammal	Vertebra, thoracic	Phocoena phocoena	
9223	-23.0	3.9	43.7	15.6	3.27	27	79	Mammal	Humerus	Erethizon dorsatum	
9224	-23.2	2.1	43.0	15.4	3.25	28	90	Mammal	Phalange	Alces alces	
9225	-19.7	3.8	43.9	15.9	3.21	28	94	Mammal	Metatarsals	Ursus americanus	
9226	-13.0	18.5	43.4	15.7	3.23	28	95	Mammal	Temporal	Halichoerus grypus	
9227	-9.5	15.5	43.7	15.8	3.24	28	99	Mammal	Mandible	Mustela macrodon	
9228	-11.3	13.2	43.2	15.7	3.22	28	104	Fish	Scute	Acipenser sp.	
9229	-22.4	2.1	43.5	15.6	3.26	28	106	Mammal	Frontal	Castor canadensis	
9230	-16.5	10.5	44.0	15.7	3.26	28	107	Bird	Coracoid	Aythia marila	
9231	-24.9	11.7	43.1	15.4	3.26	28	111	Reptile	Plastron	Chelydra serpentina	
9232	-10.5	16.3	43.7	15.9	3.20	30	72	Mammal	Ulna	Canis familiaris	
9233	-23.0	1.5	43.2	15.4	3.26	38	70	Mammal	Astragalus	Alces alces	Disarticulated Context (Unit N22 W14)
9234	-12.0	16.5	42.0	15.2	3.23	38	96	Mammal	Femur	Phoca vitulina	
9235	-13.0	17.8	43.3	15.5	3.26	38	97	Mammal	Cuboid	Halichoerus grypus	
9236	-16.7	10.0	43.3	15.5	3.25	38	98	Mammal	Ulna	Canis familiaris	
9237	-11.6	15.5	42.2	15.4	3.19	38	109	Fish	Articular	Gadus morhua	
9238	-11.6	12.1	42.8	15.3	3.26	38	112	Fish	Scute	Acipenser sp.	
9239	-11.1	11.9	43.2	15.4	3.27	38	115	Bird	Humerus	Somateria mollissima	
9240	-15.1	14.8	43.8	15.5	3.31	38	117	Bird	Ulna	Alca torda	
9241	-22.7	1.8	43.5	15.7	3.23	39	73	Mammal	Astragalus	Alces alces	
9242	-23.3	3.1	43.2	15.3	3.29	39	130	Mammal	Mandible	Castor canadensis	
9243	-10.0	14.9	42.9	15.5	3.22	39	146	Fish	Scute	Acipenser sp.	
9244	-11.3	12.1	42.6	15.6	3.17	39	150	Fish	Premaxilla	Pomatomus saltatrix	
9245	-14.4	15.2	43.7	15.6	3.27	39	154	Bird	Ulna	Alca torda	
9246	-20.2	3.0	42.7	15.0	3.31	39	108B	Mammal	Metatarsal	Ursus americanus	
9247	-12.5	16.5	41.7	14.8	3.30	39	121C	Mammal	Vertebra, thoracic	Phocoena phocoena	
9248	-9.7	14.4	42.5	15.2	3.26	65	95	Fish	Scute	Acipenser sp.	Hearth Context (N14 W16)
9249	-23.0	1.5	43.1	15.6	3.23	66	75	Mammal	Femur	Alces alces	
9250	-10.6	16.9	42.9	15.4	3.25	66	78	Mammal	Tibia	Halichoerus grypus	
9251	-12.7	15.7	41.6	14.9	3.24	66	81	Mammal	Mandible	Phoca vitulina	
9252	-14.9	12.2	43.5	15.8	3.21	66	87	Mammal	Ulna	Canis familiaris	
9253	-24.4	11.5	43.4	15.6	3.24	66	90	Mammal	Radius	Lutra canadensis	
9254	-21.8	3.2	43.1	15.2	3.31	66	91	Mammal	Temporal	Castor canadensis	
9255	-24.0	11.5	42.8	15.3	3.25	66	100	Reptile	Scapula	Chelydra serpentina	
9256	-12.6	17.4	42.6	15.1	3.29	66	101	Bird	Humerus	Alca torda	
9257	-10.3	14.4	42.6	15.4	3.22	66	103	Fish	Scute	Acipenser sp.	
9258	-22.8	5.6	41.4	14.5	3.34	74	79	Mammal	Femur	Ondatra zibethicus	

Table 5.3. Summary table of stable isotope analysis samples. Please refer to the Appendix for a complete list of stable isotope analysis samples and their results.

Faunal Stable Isotope Baseline

To assess dietary variability within the ecological baseline of species at the study site, 43 samples were used to reconstruct the environmental baseline. Taxa sampled included all available taxa from units and contexts associated with the four dog individuals sampled. Mammals comprised the majority of the total with 63%, followed by fish with 18%, aves with 14%, and finally reptiles represented just 5%.

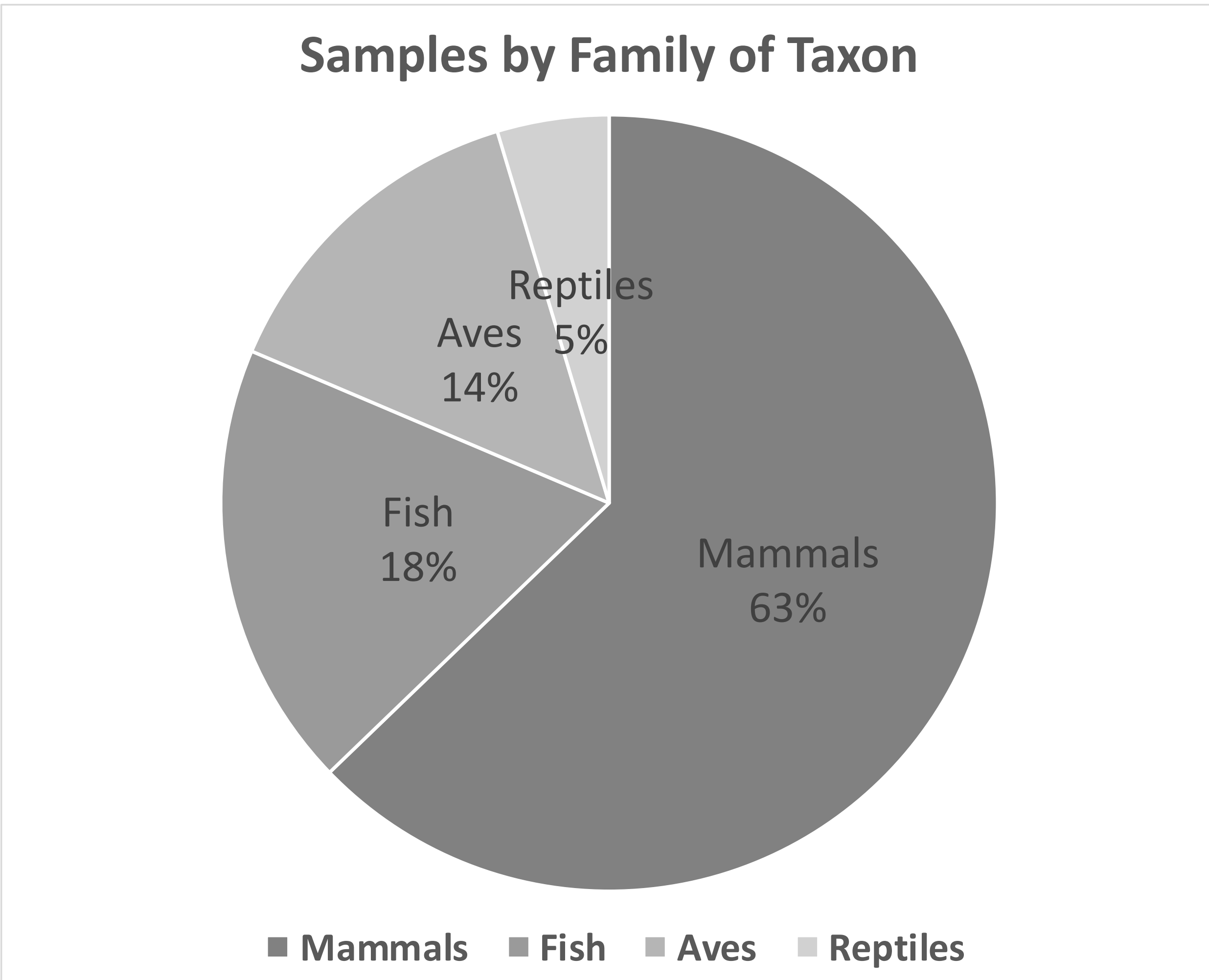


Figure 5.12. Distribution of samples used to reconstruct the environmental baseline at the Holmes Point West site (62-8), organized by family of taxon.

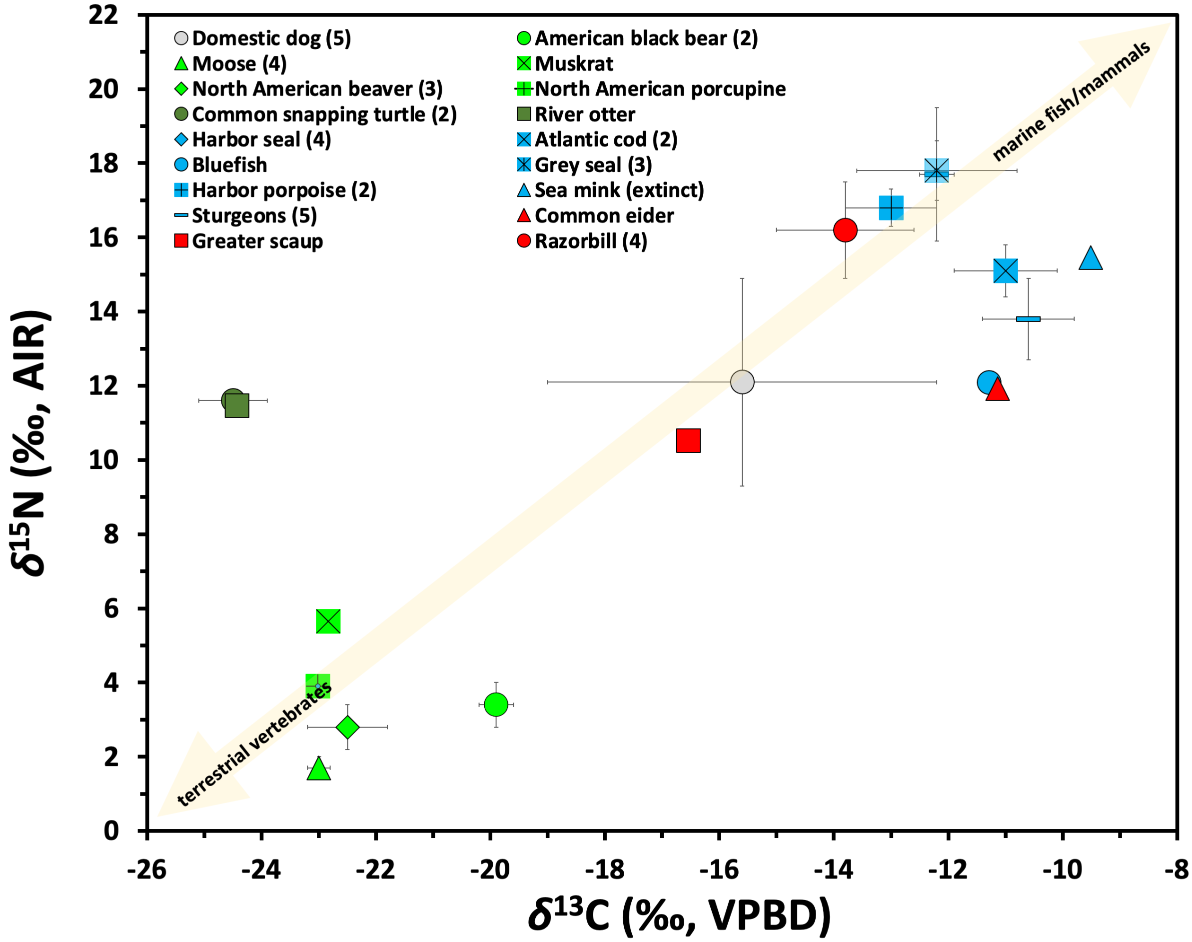


Figure 5.13. Results of stable isotope analysis to establish an environmental baseline for the Holmes Point West site (62-8), Machias Bay, ME.

Taxa are displayed here in bivariate space with δ^{13}C along the x-axis and δ^{15}N along the y-axis (Figure 5.13). Terrestrial mammals are represented by green, marine fish and mammals are represented by blue, avian species are represented by red, species with a likely riverine-influenced diet are colored dark green. This last category includes snapping turtle and river otter, and their riverine influence is assumed because both species exhibit a more enriched nitrogen signature over terrestrial species; however, they exhibit a more depleted carbon signature than the marine-oriented mammals and aves.

The results of the environmental baseline demonstrate that taxa at the Holmes Point West site (excluding *C. familiaris*) had relatively stable dietary stable isotope values. Notably within this ecological baseline, species which indicate a predominantly marine diet demonstrate the most variability other than canines. Alternatively, the standard deviation for δ^{13}C and δ^{15}N for *C. familiaris* samples is significant, at 3.4 and 2.8 respectively, indicated by the much greater standard deviation than all other taxa sampled (Table 5.4).

Canine Diet and Regional Comparative Analysis

The faunal isotopic baseline developed to assess dietary variability at the site yielded a continuum of δ^{13}C and δ^{15}N values consistent with the spectrum of marine-to-terrestrial taxa analyzed for the case study site. Little dietary variability exists within the samples presented in Table 5.4, with the exception of canine samples, as discussed above. While the canine individual identified from the burial unit appears to have a diet with mainly marine inputs, two other individuals appear to have a mixed diet and one a mostly terrestrially oriented diet. When the results of stable isotope analyses are displayed in conjunction with radiocarbon dates from each individual, those individuals consuming increasingly terrestrially-based diets are identified as being deposited at the site at the onset of the Protohistoric period (550 – 350 BP or AD 1400-1600) (Figure 5.14).

Species	Common Name and sample n>1	δ13C (avg for n>1)	δ15N (avg for n>1)	Std. Dev. (δ13C)	Std. Dev. (δ15N)	Total
Ursus americanus	American black bear (2)	-19.9	3.4	0.3	0.6	2
Gadhus morhua	Atlantic cod (2)	-11.0	15.1	0.9	0.7	2
Pomatomus saltatrix	Bluefish	-11.3	12.1	0.0	0.0	1
Somateria mollissima	Common eider	-11.1	11.9	0.0	0.0	1
Chelydra serpentina	Common snapping turtle (2)	-24.5	11.6	0.6	0.1	2
Canis familiaris	Domestic dog (5)	-15.6	12.1	3.4	2.8	5
Aythia marila	Greater scaup	-16.5	10.5	0.0	0.0	1
Halichoerus grypus	Grey seal (3)	-12.2	17.8	1.4	0.8	3
Phocoena phocoena	Harbor porpoise (2)	-13.0	16.8	0.8	0.5	2
Phoca vitulina	Harbor seal (4)	-12.2	17.7	0.3	1.8	4
Alces alces	Moose (4)	-23.0	1.7	0.2	0.3	4
Ondatra zibethicus	Muskrat	-22.8	5.6	0.0	0.0	1
Castor canadensis	North American beaver (3)	-22.5	2.8	0.7	0.6	3
Erethizon dorsatum	North American porcupine	-23.0	3.9	0.0	0.0	1
Alca torda	Razorbill (4)	-13.8	16.2	1.2	1.3	4
Lontra canadensis	River otter	-24.4	11.5	0.0	0.0	1
Neovison macrodon	Sea mink (extinct)	-9.5	15.5	0.0	0.0	1
Acipenser sp.	Sturgeons (5)	-10.6	13.8	0.8	1.1	5
Sample Total						**43**

Table 5.4. Standard deviations for environmental baseline samples from the Holmes Point West site (62-8), Machias Bay, ME.

As noted in Chapter 4, the initial sample of Dog 3 sent to Beta Analytic, a sample of fragmentary proximal ulna (PN 38.98), did not yield enough collagen during the extraction process to complete analysis of ^{14}C. The fragment of ulna had suffered significant post-depositional breakdown as a result of root action, due to its position near the top of Level 1 in the excavation unit N22 W14 (1973). In lieu of this first sample, a second sample taken from the calcaneus (PN 38.99) was used as a replacement. While the depth of these two samples falls within the same provenience unit (Level 1), the depth of this level extends from just below sod to a depth of between 25 and 35 centimeters, making the spatial and temporal context of zooarchaeological materials somewhat open to interpretation. As has been

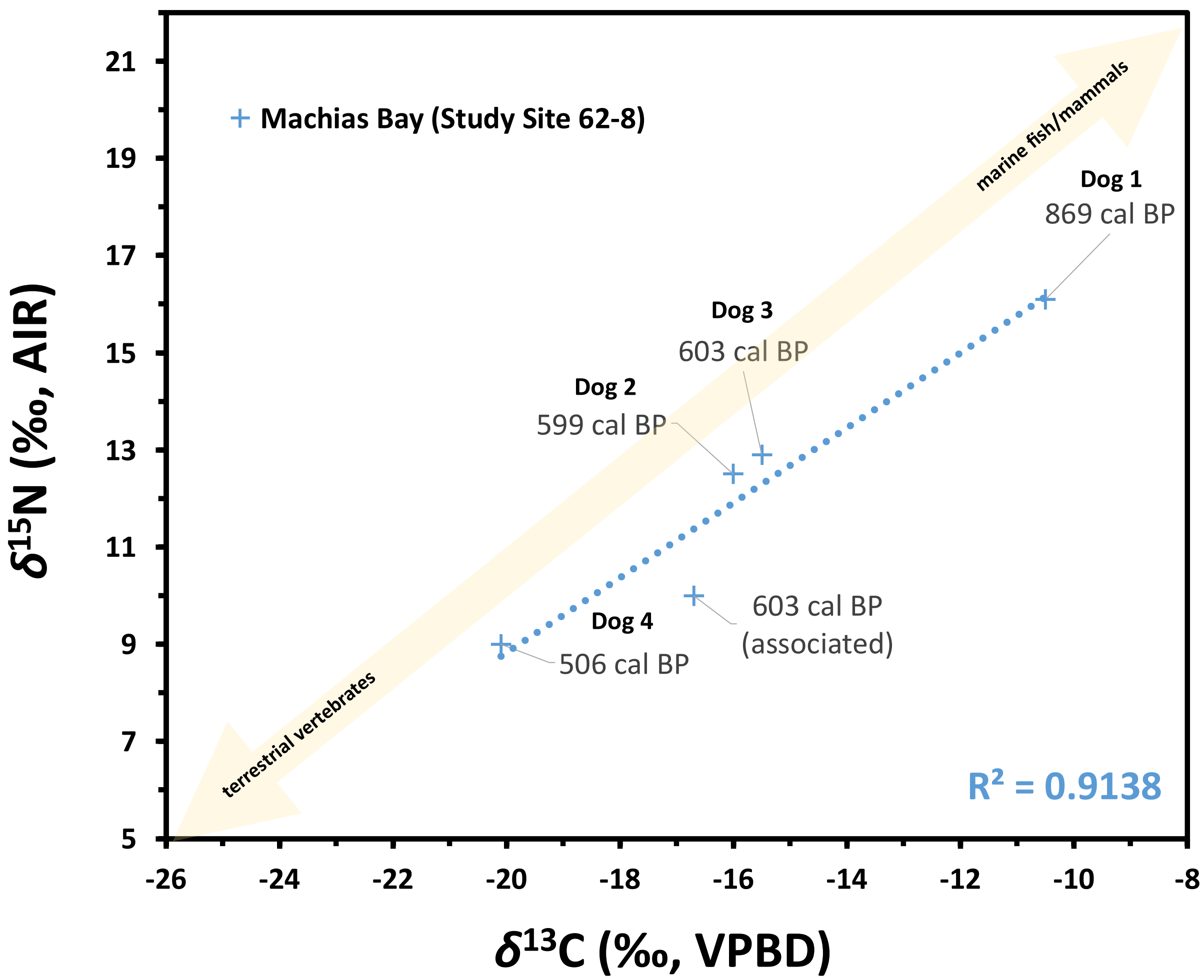


Figure 5.14. Results of stable isotope analysis of C. familiaris only from the Holmes Point West site (62-8), Machias Bay, ME, with trendline and R^2 value shown. All dates were calibrated using OxCal 4.4.2 software and a marine calibration curve was applied to Dog 1 only.

discussed elsewhere, this unit contains backfill material due to looting activity in the adjacent unit and therefore, the archaeological context has been compromised. While in theory the same radiocarbon date retrieved from the second sample could be extended to the first failed sample (which still yielded enough collagen for stable isotope analysis), thereby adding a fifth individual to the dataset, it should be taken as a very loosely attributed temporal assignment. These two samples yielded fairly different δ^{13}C and δ^{15}N signatures, an indication that they could potentially be two different individuals or that there is significant inter-individual variability in one dog.

To assess dietary choice indicated in the canine sample from the Holmes Point West site, results of the stable isotope analysis were compared with a regional dataset of any known Ceramic period canine isotopic values (Table 5.5 and Figure 5.15). Included in the comparative dataset are previously published results by Allitt (2011) of several dogs from Maine sites dated either directly to the Ceramic period or indirectly associated with dated materials. Published data from Allitt (2011) represent dogs recovered from both intentional burial contexts and subsistence remains. All of these dogs were recovered from sites located within Frenchmen's Bay, located to the west of Machias Bay, and are temporally comparable with the canine dataset recovered from the Holmes Point West site.

Stable Isotope Analysis Sample Number	Site Number	Sample Material	Element	Site Name	Location	d13C	d15N	%C	%N	C:N	Yield %	Source/Reference
-	14.168	C .familiaris	Mandible	Broad Cove	Cumberland, Maine	-13.1	15.6	41.41	14.55	3.3		A. Spiess upublished 2019
DB10	31.17	C .familiaris	Metatarsal	Ruth Moore/Great Gott	Blue Hill Bay, Maine	-10.4	17.0			2.98		Allitt 2011, dissertation (republished from Cox and Lawless 1994)
DB13	44.13	C .familiaris	Mandible	Jones Cove		-9.7	16.5			3.09		Allitt 2011, dissertation
DB16	31.17	C .familiaris	Femur	Ruth Moore/Great Gott	Blue Hill Bay, Maine	-13.3	14.5			3.07		Allitt 2011, dissertation (republished from Cox and Lawless 1994)
DB17	44.12	C .familiaris	Humerus	Tranquility Farm		-9.5	16.8			3.03		Allitt 2011, dissertation
DB18	44.7	C .familiaris	Femur	Waterside		-12.8	18.1			3.09		Allitt 2011, dissertation
DB20	31.17	C .familiaris	Femur	Ruth Moore/Great Gott	Blue Hill Bay, Maine	-11.1	15.9			3.05		Allitt 2011, dissertation (republished from Cox and Lawless 1994)
DB22	44.13	C .familiaris	Mandible	Jones Cove		-12.3	15.4			3.00		Allitt 2011, dissertation
DB26	44.7	C .familiaris	Femur	Waterside		-12.3	16.3			3.01		Allitt 2011, dissertation
DB28	44.06	C .familiaris	Mandible	Taft Site		-10.2	15.7			3.01		Allitt 2011, dissertation
DB29	31.17	C .familiaris	Femur	Ruth Moore/Great Gott	Blue Hill Bay, Maine	-11.9	17.0			3.03		Allitt 2011, dissertation (republished from Cox and Lawless 1994)

Table 5.5. Summary table of regional comparative *C. familiaris* data used to assess the dietary variability in canine individuals at the Holmes Point West site.

An additional unpublished sample from southern Maine was included from datasets held by the Maine State Historic Preservation Office and is considered to be generally temporally comparable with the rest of the data presented. All dates that were not sampled by the author were recalibrated using OxCal 4.4.2 software and a marine calibration curve was applied to all samples based on the results of stable isotope analyses originally completed (Allitt 2011; Spiess unpublished 2019). Recalibrated dates are provided in Table A.5 and calibration charts for each comparative date used can be found in Figures B.4-7 in the Appendix.

When the canine data from the Holmes Point West site are plotted against the available data of comparable temporal and geographic scale, it is clear that differences exist. While the oldest radiocarbon dated material from the Holmes Point West site is similar to stable isotopes indicated in the comparative dataset, the canine remains dated to the Late Ceramic period and Protohistoric period appear to have a more terrestrially focused diet. R values provided indicate that the dogs at the Holmes Point West site demonstrate a strong linear correlation compared with the comparative samples.

As a caveat, new radiocarbon dates from canine individuals at Holmes Point West are likely significantly younger than the majority of other individuals sampled by Allitt (2011), and the individual sampled by Spiess was recovered much further south than the rest of the samples, along Casco Bay.

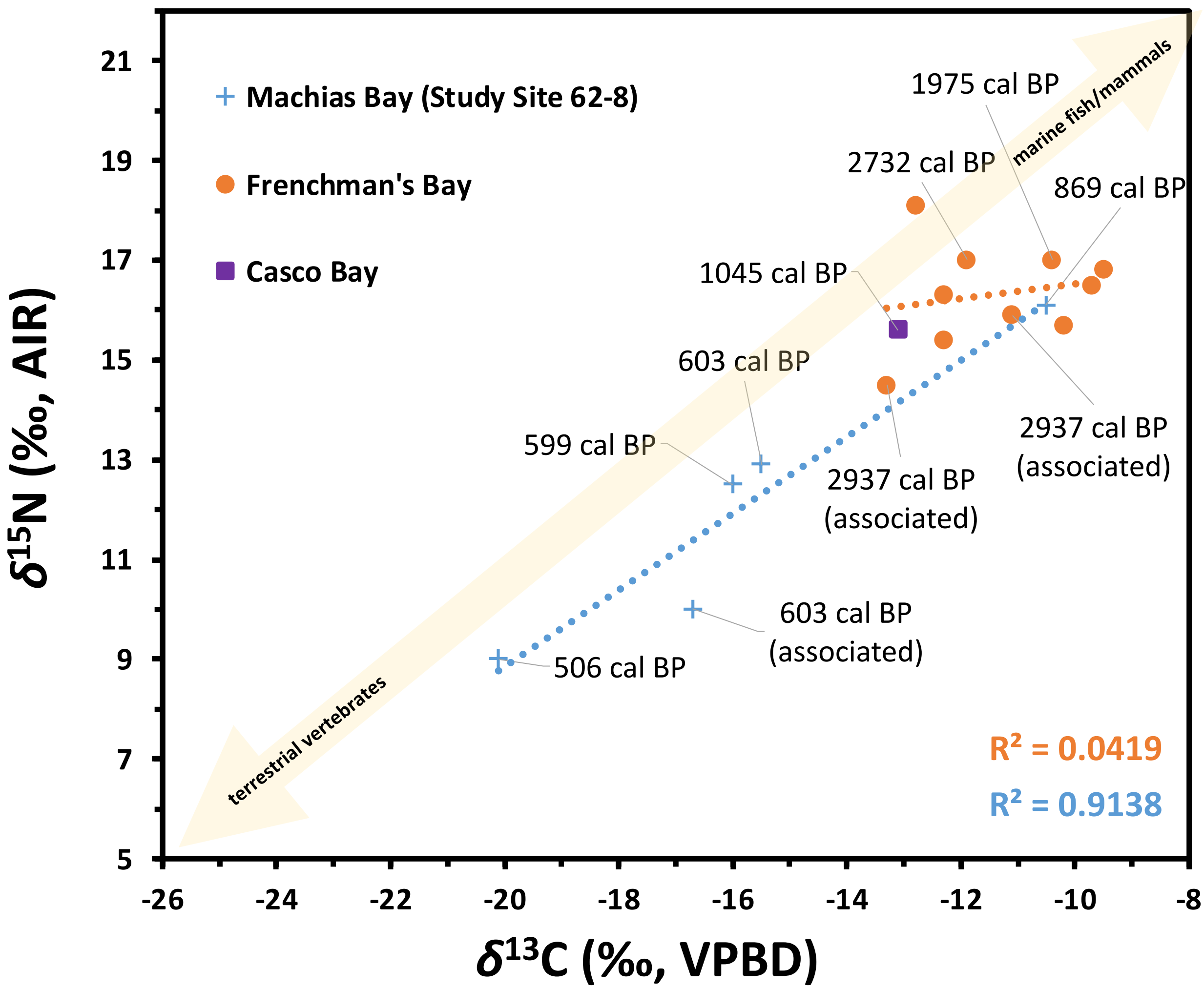


Figure 5.15. Results of stable isotope analysis of *C. familiaris* from the Holmes Point West site compared with regional canine data considered to be roughly temporally comparable with the study site, with linear trendlines and R2 values provided. Data from Allitt (2011) and Spiess unpublished (2019).

Review of Canine Individuals Sampled

Introduction

In this section, I summarize data on canine individuals. Notably, some cautionary remarks preface this discussion. With regard to MNI calculations, it is important to note that these affect our understanding of individual animals deposited in the archaeological record. While each specimen is referred to as a specific dog individual, this extends only to the specific element sampled. Any extension to the other remains within the same context should be done carefully, since the possibility always exists that these could represent the remains of additional animals. Where health and pathology information has been included, there is always the caveat that the patterns identified may not correspond to the dog element selected for radiocarbon dating and stable isotope analyses. For example, Dog 1 was recovered from Unit N24 W20 where an MNI count for all canine remains within the unit yields a count of two individuals. Two mandibles recovered have been identified and hypothesized to represent different dogs based on present pathologies. However, it is unknown which mandible corresponds to the ulna sampled for radiocarbon dating and stable isotope analysis.

Dog 1 (PN 30.72)

Context

Dog 1 is sampled from the left ulna of one of two canine individuals from the context of a burial feature at the junction of 1973 Units N24 W20 and N26 W20. This area of the site has the greatest concentration of canid remains likely due to the remains being intentionally interred. The canid remains from these two units comprised 119 individual skeletal remains representing 74.38% of 160 total specimens (see Table A2 in the Appendix for a full list). The majority of the canine remains recovered from within the burial feature were excavated from Levels 3 and 4 in N24 W20 (30 – 50 cm below surface), while slightly less than half of the remains were excavated from within Level 3 (30 – 40 cm below surface) of N26 W20, approximately 10 cm higher than the remains in N24 W20. As discussed in

Chapter 4, the use of two datums led previous researchers to interpret these as two different burials, however reconstruction of the notes and level sheets has confirmed that the two dogs were buried at approximately the same depth, and therefore likely the same time in the past. Radiocarbon dating indicates the age of the dog burials to be 869 cal BP (Beta-544315, 2-sigma).

Health

The left-sided mandible of one of the burial dogs (PN 28.79) indicates advanced periodontal disease along the gum line, but there is little to no indication of this condition in the right-sided mandible (PN 28.80). The presence of periodontal disease could be related to many factors, such as age, diet, and environmental stressors, and will affect each individual in a different way. Based on this information, the age of the two dogs has tentatively been assigned as at least 7-8 years for the PN 28.79 individual and to be adult aged for the PN 28.80 individual (Mark Hanks, personal communication 2021). Potential fractures were noted on the third premolar and the back end of the second premolar.

Diet

The individual sampled appears to have had a predominantly marine-focused diet, as indicated in the stable isotope analysis. This individual is the only dog at Holmes Point West to demonstrate a diet of mainly marine origin.

Dog 2 (PN 66.87)

Context

Dog 2 is sampled from the left ulna of an individual recovered from the general area of a hearth feature which is noted in 1973 field notes, including the remains of an ulna, ilium, and radius (Refer to Table 5.2 for a full list). This area, subsequently named feature 73-1 by Dr. Brian Robinson, includes part of unit N14 W14, most of unit N14 W16, and all of N14 W16.8 (a partial unit opened to finish excavating was believed to be a continuation of the hearth feature in the other two units) from the 1973 field school (62-8 1973 field journals, 8, 9, and 4). Within unit N14 W16, two of the existing canine faunal elements are catalogued as being recovered from Level 3, at a depth of 20-30 cm below surface. The third canine element in this unit was recovered from Level 2, at a depth of 10-20 cm below surface. Radiocarbon dating indicates the age of this individual to be 599 cal BP (Beta-544314, 2-sigma).

Health

No specific health information was determined for any remains identified from this context.

Diet

The individual sampled appears to have had a diet with both marine and terrestrial inputs, as indicated in the stable isotope analysis. This individual is one of two dogs at the Holmes Point West site to demonstrate a mixed diet, both dated to late Ceramic period/early Protohistoric period.

Dog 3 (PN 38.99)

Context

Dog 3 is sampled from the right calcaneus of an individual recovered within the vicinity of a pit feature in Unit N22 W14 excavated in 1973. Twelve individual remains were recovered, including the fragmentary remains of an ulna, astragalus, and whole calcaneus. Please refer to Table 5.2 for a full list of canine elements recovered from this unit. The unit is directly adjacent to a location where a large disturbance was caused by looting activity at the site during the historic period (Bird 2017; Ingraham 2011). The 1973 field crew specifically avoided the "looter's pit" to the north of the unit, later designated feature 73-3 by Dr. Brian Robinson, resulting in the irregular shape of the excavation blocks around it (Bird 2017:27). Ingraham (2011) observed that a higher proportion of certain archaeological artifacts occurred in the upper levels of this section of the excavation (originally called Block B). Bird (2017) observed that large amount of faunal remains within the section of Block B containing Unit N22 W14 likely derived from the "…salvaged portions of a pit feature (designated Feature 73-3) that was covered with a lens of shell and contained dense faunal material, likely from a single episode, with a stemmed projectile point at the very bottom" (Bird 2017:27).

Looters often seek out cultural materials, such as lithic tools, Indigenous ceramics, or carved or otherwise modified materials, and Ingraham (2011) surmised that the concentration of faunal materials was likely as a result of looters dumping back dirt there (Ingraham 2011) Twelve canine faunal remains were recovered from N22 W14 and these specimens were distributed throughout all four levels of the unit (please refer to the Appendix for a complete list of remains). Radiocarbon dating indicates the age of this individual to be 603 cal BP (Beta-546919, 2-sigma).

Health

The right-sided mandible of a dog (PN 39.125) was recovered from this unit. No major dental pathologies were determined based on tooth wear and this individual is classified as an adult, likely younger than the individual represented by the mandible with advanced periodontal disease, PN 28.79 (Mark Hanks, personal communication 2021). The root of the third premolar exhibited some exposure, the second premolar exhibited a fracture, likely from chewing behavior, located on the backside of the tooth.

Diet

The individual sampled appears to have had a diet with both marine and terrestrial inputs, as indicated in the stable isotope analysis. Both the individual in this unit and the one in N14 W16 demonstrate a mixed diet, and both are dated to late Ceramic period/early Protohistoric period.

Dog 4 (PN 315.70)

Context

Dog 4 is sampled from the right-sided mandible of an individual recovered from N53 E31 (2008 field season), a 50x100 centimeter test unit located on the far northeastern corner of the excavation. While the test units in the northeast portion of the site did not yield a significant amount of cultural material (and were therefore not explored further by student researchers) there are notably several diagnostic elements of domestic dog originating from two of the test units. These include a right mandible fragment with refit 1st molar (see Figure 5.3), two phalanges, one upper canine, and one lower canine (see Table 5.3 for full details). The mandible is marked in the field notes as being excavated from Level 1 of the northwest quadrant of the unit and the depth of this level ranges up to 15 centimeters below surface in this section of the test unit. Two 19th century nails and a variety of Indigenous artifacts were found in context with these canine remains, including other faunal material, a polished biface, lithic flakes, and crushed shell. Radiocarbon dating indicates the age of this individual to be 506 cal BP (Beta-558633, 2-sigma).

Health

The right-sided mandible (PN 315.70) recovered from this unit was inspected by Dr. Mark Hanks and the researcher. No major dental pathologies were determined based on tooth wear and this individual is tentatively classified as a young adult (Mark Hanks, personal communication 2021).

Diet

The individual sampled has a predominantly terrestrial-focused diet, as indicated in the stable isotope analysis, and is the only dog not impacted by marine reservoir effect. This dog is the only individual sampled at the site which returned a radiocarbon date well within the Protohistoric period, or the very beginning of the Contact period.

Summary

Results of the analyses discussed here have helped to further contextualize canine remains at the Holmes Point West site. Field notes and maps collected during the 1973 field season reveal a granular level of information about the location of the dog burials, however no photographs were taken and specifics about their provenience are lacking. The ceramics chronology developed for the two units containing the dog burials supports use of the site during the early middle to late Middle Ceramic period, or CP 2 – CP 5 (2150 BP – 950 BP), but younger sherds classified as CP 5 (950 – 650 BP) within the same level as the dog burial hint at an intrusional burial.

Faunal analyses included NISP calculations and a calculation of skeletal frequency, the last highlighting that almost three times more canine faunal material has been recovered within the burial context than in non-burial contexts at the site, and that the remains preserved within burials are more representation of the entire skeleton. Non-burial remains are represented by a large proportion of teeth and phalanges, almost half of overall non-burial remains or 47.5%. A review of present health and pathology information identified that one of the canine individuals was elderly and presented evidence of what is likely advanced periodontal disease. All canine individuals displayed evidence of breakage and wear on teeth present, with the exception of the youngest individual, likely a young adult.

Radiocarbon dating indicates that all canine individuals are dated to the Late Ceramic and Protohistoric periods, and the oldest individuals are represented by the dog burials, which date to after the beginning of the Late Ceramic period, or 869 cal BP (Beta-544315, 2-sigma). This date supports earlier suppositions based on the presence of CP5 ceramics sherds within the context of the dog burials that the burials are intrusional features.

Stable isotope analysis of 18 different species of fauna at the Holmes Point West site reveals that all species except for canines demonstrated relatively stable dietary indications throughout time, with the exception of several marine mammals, fish, and one species of bird, all of which indicated marine-oriented diets. Canine dietary variability at the site was much greater than the rest of species sampled, with standard deviations of 3.4 and 2.8 for δ^{13}C and δ^{15}N respectively. When stable isotope data for just dogs are displayed in conjunction with new radiocarbon dates, a potential trend toward more terrestrially oriented diet is indicated through the end of the Late Ceramic and beginning of the Protohistoric periods. Comparison of canine stable isotope data with available regional stable isotope data for dogs during the Ceramic period in Maine reveals that this trend toward more terrestrially focused diets is unique to the Holmes Point West site.

All results will be interpreted in the following Chapter 6, taking into consideration the cultural context of the study region and time period previously reviewed in Chapter 3.

CHAPTER 6

DISCUSSION, CONCLUSIONS, AND FUTURE WORK

Introduction

In this case study, I presented new ways for exploring archaeological questions related to agency in the human and dog relationship. The overarching methodology of CSA and the methods used to complete this research answer questions of human agency by illuminating choices made by past Indigenous peoples about the care and feeding of their dogs. In making decisions about how to incorporate dogs into their communities and how they were cared for and fed, past Wabanaki people were presented with both opportunities and constraints posed by their physical and cultural setting. By situating this study within an agency framework, I highlight the intentional choices made by people in the past in order to humanize the archaeological record by focusing on relationships over objects.

This chapter begins by evaluating the results of analyses within the categorical framework laid out for CSA applications (Guiry 2012) in order to identify biological, cultural, or environmental factors that might have influenced the degree to which dog diet is reflective of human diet. This exercise is important because it forces us to consider the material ways in which human agency manifests in the human-dog relationship. I then consider what patterns of health and diet in dogs at the site can tell us about people's choices at this place and particular time(s) in the past, and deliberate how my findings fit within our understanding of the Holmes Point West site and its significance within the region. Finally, I will reflect on the future directions of this research and potential avenues for further illuminating the human-dog relationship both at the Holmes Point West site and the wider Maine-Maritime Peninsula region.

Evaluating Dietary Results with the Categorical Framework for CSA

Under the *a priori* assumptions used when applying the CSA method, the degree to which dog diet reflects human diet could be related to the variety of factors already mentioned; biological or behavioral, cultural, and environmental stimuli may all be at play (Guiry 2012). The comparative framework used here to evaluate these potential influences on similarities between human and dog diets is especially important to consider in cases where direct analogies are examined (Guiry 2012: 362). Though this case study presents an example of indirect analogy, the categorical framework is still applied to better understand the degree to which these stimuli have a positive, negative, or neutral influence on the similarity between dog and human diet at the Holmes Point West site.

Biological and Behavioral Factors

In thinking about how similar dog diet is to that of past human communities at the Holmes Point West site, it is important to consider how biological or behavioral aspects of dogs might have influenced their diet. Inherent biological and behavioral differences that exist between humans and dogs mean that isotopically similar foods consumed by each species may be expressed differently in sampled zooarchaeological tissues (Guiry 2012:362). Several biological and behavioral effects are considered in Chapter 4, including difference in bone remodeling rates between dogs and humans, cecotrophy, weaning effect, and dietary differences between wild and domestic canid specimens.

As discussed previously, human and dog bone tissue remodel at very different rates and it is possible that short-term fluctuations in dog diet would be captured through stable isotope values. Since stable isotope values derived from bone collagen reflect an average of dietary protein intake, values from dogs could potentially be altered by recent changes to diet, in contrast to those values derived from human samples. While the shorter averaging period in canine individuals may weaken dietary inferences developed through use of the CSA, they can also offer insight into inter-annual dietary variability that cannot be gleaned from human samples. Of particular concern to this issue is Dog 4, which produced stable isotope values of $\delta^{13}C$ and $\delta^{15}N$ of -20.1‰ and 9.0‰ respectively, indicating a terrestrially oriented diet. If it is assumed that this sample represents a young adult canine individual (as hypothesized through the health and pathology analysis), then stable isotope values are likely reflective of the beginning of this dog's life. It is possible that the individual's age had some impact on the types of food it consumed.

Cecotrophy, or the consumption of feces, could also potentially alter dog isotopic signatures. While previous research has demonstrated that urine is depleted in δ^{15}N compared to diet (Minigawa and Wada 1984), it is not clear what the effect of consuming human feces might be on dogs. The effect of breastfeeding on young pups is a final behavioral consideration, however none of the specimens sampled for this study were derived from very young dogs and none of the δ^{15}N values indicated enriched levels consistent with this situation, therefore weaning effect is not considered to have any impact on stable isotope values.

A final biological or behavioral consideration is the potential difference between wild and domesticated canines. As has been reviewed in Chapter 3 of this document, previous research has demonstrated that, in general, domesticated canine dietary information recovered from archaeological settings is more or less reflective of human diet. Accidentally sampling from wild canid specimens, whether they are hybridized or fully wild, would provide incorrect inferences for human diet. Though great care was taken in this study only to sample from zooarchaeological remains that had been positively identified to species as well as genus, the possibility exists that these remains could represent those of wild or domesticate varieties (Gentry et al. 2004) rather than fully domesticated individuals. The wide variety of dietary inputs indicated in the four dog individuals sampled at Holmes Point West could either represent variability as a result of human-induced choices or alternatively represent the accidental introduction of wild specimens. Researchers have demonstrated that wild wolf populations in boreal Canada have significant inter-individual dietary regimes (Urton and Hobson 2005), and it is possible that domesticated individuals at Holmes Point West could also present a wide range of subsistence patterns, influenced by various stimuli. Ancient DNA analysis is necessary to confirm that the canines in this study are fully domesticated individuals.

Cultural Factors

In making choices about which foods to allow dogs to access, people and communities alter the degree to which dog diet is directly reflective of human diet. As discussed in Chapters 2 and 3, previous researchers at the Holmes Point West Site have identified specialized taphonomies in *Phocidae* species remains and the remains of the extinct sea mink, *Neovison macrodon* (Ingraham 2011; Ingraham et al. 2016; Robinson and Heller 2017*).* When compared with other coastal sites in the region (Spiess and Lewis 2001), these disposal patterns in combination with the extremely low incidence of chewing behavior on *Phocidae* remains from the site provide additional support for the withholding of certain food remains from dogs (Ingraham 2011). Since special disposal and treatment practices have been observed archaeologically at the site, this cultural factor should be a primary consideration how dog diet is influenced by humans.

Another factor to consider is whether or not dogs who were ritually sacrificed or used for ceremonial purposes may have been fed differently than dogs bred for other purposes, such as hunting or protection. Though no evidence of butchery or processing has been observed on any of the canine remains at the site, the possibility exists that any one of the individuals identified in this study could have served a ceremonial purpose, including as sustenance in feasting activities. Accounts of *tabagie* or dog feasts exist in the early historic record for this region (Ganong 1908; Kerber 1997a; Thwaites 1897). In particular, Dog 2 was recovered from the vicinity of a hearth feature in N14 W16, so we must consider if a ritual or ceremonial role could have influenced this individual's diet in any way. Dog 2 produced stable isotope values of $\delta^{13}C$ and $\delta^{15}N$ of -16.0‰ and 12.5‰ respectively, indicating that the individual consumed a mix of marine and terrestrial resources. Including zooarchaeological samples from the hearth feature forces us to consider if the remains are there because they were consumed or placed in the hearth for reasons other than disposal. No health or pathology information was noted for Dog 2 during analyses. Based only on dietary trends indicated through stable isotope analysis, it is not clear if a relationship exists between this individual's context within the hearth and its diet. It is also possible that these dog remains are not subsistence remains but were affected by post-depositional disturbances such as looting or taphonomic processes, both issues that have been noted by prior researchers at the site (Ingraham 2011; Bird 2017).

Yet another cultural consideration is how different breeds of dogs may have been treated and fed. While morphologically it is difficult to make any major distinctions among the canine faunal remains from the site, it is possible that any of the dogs identified during the course of this work could have been bred for specific tasks and as a result were fed a special diet. In the ethnographic and historic record, large dogs specially bred for moose hunting on ice and snow in the Maine and Maritimes region are referenced (Butler and Hadlock 1994; Smith 1917; Thoreau 1892) and were considered vital assets, although no specific dietary regime is mentioned. Protection was also an important role for dogs in this region, at least during the Protohistoric and Historic periods (Butler and Hadlock 1994), perhaps as a result of conflicts between colonists, traders, and Indigenous people (Rosier 1906; Thwaites 1897), and it is likely they played protective roles prior to European contact as well. It is possible that dogs needed for important tasks such as hunting and protection were fed and cared for differently, perhaps even prioritized over other individuals due to their important place in hunting, fishing, and gathering societies.

Results of radiocarbon dating and stable isotope analyses from Dog 4 raise the possibility that this individual may be a dog of European origin. Ethnohistoric accounts provide evidence that Indigenous people in the Maine-Maritime Peninsula region valued European dog breeds for their size (Butler and Hadlock 1994), and potentially for other reasons not specifically mentioned in the written record, such as status symbols or important trading goods. Research has shown that major selective pressures existed during the Historic period against Indigenous dogs, so much so that almost no pre-Contact genetic material is present in current-day North American domestic dog populations

(Leathlobhair et al. 2018). Further research using ancient DNA or additional stable isotopes methods are required in order to identify the potential origins of this terrestrially oriented individual.

Environmental Factors

Several geographic and environmental factors are important to consider when interpreting the canine dataset from the Holmes Point West site. Once again, the demand for dogs as hunting aids and transport in the far Northeast may have afforded them special treatment and feeding over canine individuals with other roles. The importance of dogs as hunting aids has already been discussed above and may have been a driving factor in why the consumption of dogs by hunting, fishing, and gathering bands in the Northeast seems to have been a limited practice. The role of dogs for transport in southern regions of the Northeast prior to contact is disputed and may have been a practice introduced further north to the Innu and Naskapi through contact with early French and Canadian fur trappers (Speck 1925:58). In addition, the geographic distribution of Wabanaki bands was likely a factor influencing the roles of dogs in Indigenous communities. Unlike larger and more sedentary communities practicing agriculture in present-day southern New England and New York, the Wabanaki of the far Northeast were comprised of small bands, likely familial, that followed a hunting, fishing, and gathering subsistence model.

The role of dogs in these communities would have likely been dynamic, and the isolation of bands from one another during long stretches may have limited the number of dogs in each family band and dog trading between bands. It is significant that Dog 1, identified from the burial containing two canine individuals, suffered from what appears to be advanced periodontal disease and was of advanced age, hypothesized to be 7-8 years at the minimum (Mark Hanks, personal communication 2021). That a small community would choose to continue to feed and care for this individual who was likely nearing or past their “working” age demonstrates very deliberate choices on the part of people. Past people made choices based on the cultural and historical context within which they operated, and, within Wabanaki culture, a notion existed of acting responsibly toward other species (Bonnie Newsom, personal comment 2021). While Dog 1 may have still provided utilitarian benefits to the people caring for them, it is probably a safe assumption that the individual had additional roles in the community and that great care was given for this animal to live such a long life.

The potential exists that the dietary patterning seen in the canine individuals at the Holmes Point West site is influenced by factors spurred by climate changes, though identifying this influence is complex. While it is safe to assume that human communities in the Machias Bay region during the study period responded to climate changes, the ensuing cultural responses can be difficult to separate out from those having little to no relationship to environmental change. Choices made by people within the context of constraints and opportunities presented by their environment could be confounded with those stemming from human agency and cultural changes in response to trade, movement, and diffusion. These responses, while perhaps influenced to a certain degree by environment or climate, are secondary and cultural in nature. In order to determine whether environmental factors were an influence on canine diet, further archaeological research is needed. Studies highlighting seasonality have the potential to guide research questions related to climate proxies and climate change at Holmes Point West (see Blackwood 2019 and Pontbriand 2018 for examples). Blackwood (2019:68) cautions that reconstruction of climate using archaeological proxies requires a deep knowledge and understanding of the species analyzed, methods used, and environmental inputs that might exist and which would alter our understanding of the regional baseline (Blackwood 2019:68).

Interpreting the Results of the Analyses

Overview: Dog Diet and Human Agency at the Holmes Point West Site

The $\delta^{13}C$ and $\delta^{15}N$ signatures from the stable isotope analysis for five domestic dogs at the Holmes Point West site suggest a diet which ranged from one primarily focused on marine inputs to one which was primarily terrestrial. Dog 1, the oldest individual dated to 869 cal BP (Beta-544315, 2-sigma), produced stable isotope signatures which indicate a marine-oriented diet. These results are consistent with data from other regionally and temporally comparative sites (Allitt 2011; Spiess unpublished) as well as previous faunal analyses indicating a focus on hunting *Phocidae* species at the site (Ingraham 2011). Dogs 2 and 3, 599 cal BP (Beta-544314, 2-sigma) and 603 cal BP (Beta-546919, 2-sigma) respectively, indicate a diet with a mix of both marine and terrestrial resources, falling roughly between Dog 1 and Dog 4 in the bivariate comparison of δ^{13}C and δ^{15}N signatures. Dog 4, dated to 506 cal BP (Beta-558633, 2-sigma), demonstrated a diet which was predominantly terrestrial, differing notably from the other three dogs. Finally, stable isotope data derived by Beta Analytic is available for a fifth sample of domestic dog, PN# 38.98, recovered from the same unit as Dog 3 (N22 W14); however, it is unknown if this dog represents a separate individual or the same. Stable isotope values of δ^{13}C from this sample are slightly more depleted compared to Dog 3 (-16.7 vs. -15.5) and are less enriched in δ^{15}N (10.0 vs. 12.9). The dietary indications based on stable isotope values from these two samples are quite different, however without further research it is impossible to state whether they are indeed the remains of separate individuals or if these differences are attributable to intra-individual variation stemming from the type of skeletal element sampled (ulna vs. calcaneus respectively).

The results of the environmental baseline provide support for relative dietary stability in all species other than *C. familiaris* at the site during the study period (ca. 950 – 450). Standard deviations demonstrated little dietary variability for multiple individuals of the same species at the site throughout the study time period. Greater standard deviations in the average δ^{13}C and δ^{15}N from domestic dogs (3.4 and 2.8 respectively) compared with all other species lend support to the idea that the diets of canine individuals at the site were highly variable. By utilizing CSA framework to understand the relationship between human and canine diet, an assumption is made that human choice played a significant role in the ways dogs were cared for and fed. Available resources in the Machias Bay region during the study period certainly may have shifted over time due to climatic changes in the region; the trend toward terrestrial diet in canines at the site presents a new avenue for study. All published stable isotope analysis results for Ceramic period domestic dogs in this region suggest a consistently marine-oriented diet, as discussed in Chapter 4. All known regionally comparable canine data derive from dogs recovered from coastally situated archaeological sites, so therefore do not represent dogs which may have resided in more inland terrestrial environments with corresponding terrestrial dietary inputs.

Taking into account that the long-term average dog diet reflected in hard tissue would not likely reflect these short-term fluctuations (at least in adult individuals), we are left to wonder to what extent dog diet at Holmes Point West may or may not have been similar to both dog and human diet elsewhere. Based on previous interpretations that the site was used intermittently (Bird 2017; Ingraham et al. 2016), the indicated trend from stable isotope analyses is likely reflective of overall subsistence patterns in dogs as well as humans, since neither were likely present at the site year-round.

Comments on Sample Size

Results of the analyses from this study represent at a minimum four canine individuals and at most five individuals, if the sample taken from PN# 33.98 is considered to be from a separate dog than Dog 3 based on differing stable isotope values alone. Small sample size is a limitation often encountered by archaeological investigators, but that should not stop us from attempting to integrate new data into what is already known. Interpretations and conclusions drawn solely on the small sample analyzed in this case study would be speculative at best; however, by integrating them within the context of a larger regional dataset, they offer a detailed glimpse of diet and health at fine-grained timescale with a supporting environmental baseline. In identifying different canine individuals to sample within discrete cultural areas of the site, it may also be possible to identify any inter-individual differences that exist in canine diets and how these might reflect human diets, as well as particular choices made by humans that could have influenced canine diet.

Specialized Treatment and Disposal Practices at the Holmes Point West Site

Other coastal sites in the region have presented faunal assemblages with significant evidence of mastication from dogs. The Holmes Point West site assemblage is unique in that it does not. Based on the faunal studies completed by Ingraham (2011), which do not include the most recent University of Maine field schools completed after 2010, just 0.7% of the mammalian assemblage exhibits evidence of chewing behavior, in comparison to the Turner Farm site where many of seal remains featured ragged epiphyseal ends, a classic mark of dog chewing (Bourque 1995:349). At the Turner Farm site, Spiess and Lewis (in Bourque 1995:338) identified the presence of what they believed to be "dog yards" based on a low incidence of fish and bird bone, spatial patterning indicated by a high incidence of freed cervid teeth (from dog chewing behavior on discarded cervid mandibles), and a high proportion of seal bone (especially post-cranial elements). Considering that the Turner Farm site represents one of the longest consistently utilized habitation sites on the coast of Maine, it stands to reason that different influences would impact subsistence remains compared to the Holmes Point West site, which may represent a type of gathering place or specialized processing site.

Dogs at the Holmes Point West site may have been prevented from accessing faunal remains out of concerns for appropriate cultural protocols, another material manifestation of human choice that may influence dietary signatures derived in archaeological remains of dogs. Patterns of specialized treatment and disposal practices Holmes Point West site based on faunal studies by previous researchers (Ingraham 2011; Ingraham et al. 2016; Robinson and Heller 2017) are also corroborated by historic and ethnographic accounts of superstitions surrounding disposal and retention around dogs by people from other Algonquian-speaking communities (Butler and Hadlock 1994; Ganong 1908; Le Clercq 1910; Tanner 1979; Wallis and Wallis 1955). Historical accounts from Le Jeune (Thwaites 1897, Vol. VI:211) of the Montagnais (Innu) of Canada indicate that they feared a poor hunt or future misfortunes when certain remains were taken by dogs. Le Clercq reported that the Mi'kmaq of the Gaspé Peninsula region of Quebec had similar concerns about the treatment of hunted animals, specifically that the remains of young moose, beaver, and marten were never burned or given to dogs (Le Clercq 1910:226). Ethnographic research by Wallis and Wallis (1955) confirmed that the Mi'kmaq of eastern Canada retained special treatment protocols at the beginning of the 20th century (Wallis and Wallis 1955:107). The role of the Holmes Point West site as a focused processing site for certain species could potentially have impacted how and why dogs were fed certain foods while residing there. If we assume that the historical and ethnographic accounts outlined above are reflective of pre-colonial practices, we might expect groups of people using the site who were concerned about the outcome of hunting seals and other species would be expected to withhold their remains. We are left to consider what resources dogs were allowed to consume and how that is reflected in their variable dietary signatures over the course of the Late Ceramic period at the site.

The Site Itself: How Was Holmes Point West Used?

It is not clear what purpose the Holmes Point West site might have had for past Wabanaki people. It has been proposed that the site could have been a gathering place (Bird 2017; Hedden 2004), based on its lack of habitation features and the presence of petroglyphs, dog burials, and other ritualized features and practices (Ingraham 2011; Ingraham et al. 2016; Robinson and Heller 2017). A dwelling floor, indicated by a gravel lens, was excavated at the nearby site of Holmes Point East (ME 62-6), located approximately 300 meters to the east of the Holmes Point West site, and reported on by Hrynick and Robinson (2012). While dwelling features may exist, they are likely difficult to see because the site sits atop a Pleistocene beach where gravel is abundant (Hrynick and Robinson 2012:30). This matter is complicated by the intense coastal erosion experienced along the Holmes Point peninsula head, which has certainly impacted our view of cultural features at the Holmes Point West site in particular. It seems possible that the study site could represent a component that is contiguous or overlapping with cultural features at Holmes Point East. Future cross-comparative analysis between the two closely located sites could reveal if they represent the same complex or are discrete areas of use.

As others (Bird 2017; Hedden 2004) have indicated, the Holmes Point West site may have served as a gathering place, but additional research is necessary to determine the temporal span of such use. Perhaps instead, the site represents a specialized processing site focused on pinnipeds. Faunal analyses completed by Ingraham (2011) determined that focused processing of *Phocidae* species occurred at the site, comprising 60.6% of the mammalian faunal assemblage and the single largest MNI of any group (MNI = 40). Other species present include small furbearers such as beaver (MNI = 4) and extinct sea mink (MNI = 3), as well as moose (MNI = 4), all species that would have been easily accessible along with an abundance of soft-shell clam from the adjacent mud flat. Aves also compose a large number of MNI at the site, including sea birds (MNI = 8) as well as four different species of ducks and loons (MNI = 9).

Accounts of large gatherings of Indigenous people at the beach along the site's western edge during the late 18th century (Drisko 1904:7) could be an extension of pre-colonial practices or they may represent a biproduct of European contact. The presence of European visitors along the Maine-Maritime Peninsula's coastline during the summer months to trade for furs could have made the site an ideal meeting place. Due to its location at the mouth of the Machias River, the site would have provided an opportune place for gathering, with its abundant resources and beach accessibility. This potential increase in use would make the Holmes Point West site important within the context of seasonal transhumance at the boundary of the Late Ceramic and early Protohistoric period (ca. 550 BP). Use of the site during the Late Ceramic period is supported by previously published radiocarbon dates sourced from features identified at the site (Bird 2017:121) as well as radiocarbon dates associated with canine individuals produced in this study.

Additionally, the presence of both early French and English artifacts at the site (Bird 2017) and accounts of a short-lived French tradition post at Clark's Point (Drisko 1904:1) near the Birch Point petroglyph site located across the bay further underscore the site's possible importance to early Wabanaki and European interactions. Regardless of whether canine individuals at the site were directly in contact with Europeans, they would certainly have been affected by changes to Wabanaki subsistence and transhumance patterns.

Early European Influences on Wabanaki Life

Brian Fagan, in his work titled "The Little Ice Age" (2000), proposed that the economic pressure stemming from demand for *Gadhus morhua (*Atlantic cod) in Europe was the force that pushed European fishing vessels to the continental shelf off of North America (Fagan 2000:71). As Gulf Stream thermoclimes shifted south, cod stocks plummeted first in the waters surrounding Norway and Iceland and shifted toward Greenland and eventually further south and west to the Grand Banks. Basque and later English fishing vessels made their way to the shores of Labrador, Newfoundland, and Nova Scotia during the summer months, filling their vessels full of dried cod for sale in Europe (Fagan 2000:69-78). More important for Wabanaki people inhabiting the Maine and Maritimes region, it is known anecdotally that Basque fishing fleets were early visitors to North American shores (Bourque and Whitehead 1985; Fitzgerald et al. 1993).

Beginning in the late 15th century, clear economic connections existed between European ports and Wabanaki communities, evident in the demand for Basque copper kettles in northeast North American Indigenous communities (Fitzgerald et al. 1993) and growing demand for furs in Europe. Kettles produced in France were loaded onto fishing boats headed for the coastline of the Maritimes for summer fishing to be traded for furs. By the 16th century, summer stations had been established by Basque fishing and whaling crews on the Strait of Belle Isle near the northern tip of Newfoundland and at the mouth of the Saguenay River in the Gulf of St. Lawrence (Fitzgerald et al. 1993).

If interpreted under the assumptions taken when applying the Canine Surrogacy Approach, dog diet is a reflection of human choices in subsistence, so long as the aforementioned biological or behavioral, cultural, or environmental factors are taken into consideration. As already discussed, most Ceramic period dog stable isotope analysis data demonstrate a distinctly marine dietary trend (Allitt 2011; Spiess unpublished data) and thus the results of stable isotope analyses from the Holmes Point West site pose a question, why would the diet of dogs change in the Late Ceramic period? Stable isotope values of carbon and nitrogen at the study site are likely a reflection of human responses and ensuing adaptation to the presence of Europeans and pressure for New World trade items, such as furs (Fitzgerald et al. 1993; Hrynick et al. 2017). Human agency in this context, or the intentional choices made by Wabanaki people as they responded to constraints and opportunities presented to them (Brumfiel 2000:250), is deeply specific to the sociocultural and ecological context of the Late Ceramic and Protohistoric period of the Maine-Maritime Peninsula.

Seasonal Transhumance and Wabanaki Adaptation

Though many possible explanations exist to explain a change in the subsistence base of dog individuals sampled from the Holmes Point West site (and potentially people), these changes should be considered within the context of these larger changes to Wabanaki seasonal transhumance in the region occurring during the Late Ceramic. Early interactions between European visitors and Wabanaki people are important to understanding changes in subsistence economy and people's choices at the Holmes Point West site and the wider region. By incorporating what scholars know of Wabanaki seasonal transhumance and how it was influenced by early contact with Europeans during the Protohistoric period, we can attempt to illuminate some of the choices made by Indigenous people in response to the early presence of Basque fishing and whaling crews and the impending fur trade in the later part of the 16^{th} century.

As I discussed in Chapter 3, past people in this region practiced hunting, fishing, and gathering, with a clear marine-focused subsistence strategy at many sites in the region during the Ceramic period, supplemented by exploitation of small fur bearers, moose, and available aves (Ingraham 2011).

Focus on marine resources is consistent with faunal remains not only from the Holmes Point West site but from many other Ceramic period coastal sites in the region (for examples, see Belcher 1989; Sanger 1987). At the Carson Site (BgDr-5) on the New Brunswick side of Passamaquoddy Bay, Sanger proposed a season of occupation of fall through spring, based on the presence of wintering bird species and absence of immature individuals. Sanger speculated that the interpretation of a coastal to interior seasonal transhumance might be inaccurate for the Ceramic period (Sanger 1987:68). In other work, Sanger (1982, 1996a, 1996b) has proposed that seasonal transhumance documented during the Protohistoric and Historic periods was a product of the socio-economic changes resulting from the presence of Europeans in the region, particularly along the coast. Research at the Devil's Head site in

Figure 6.1. Nineteenth century painting of Mi'kmaq hunting from boats with dogs (Unknown artist, 1820).

Calais, Maine (97.10 ME), by Hrynick and colleagues (2017) has demonstrated that significant changes in subsistence strategies and seasonal transhumance after the late Maritime Woodland (Ceramic) period and at the onset of Protohistoric period. The authors suggest that changes in subsistence and seasonal site occupation seen during the Protohistoric is the European desire for furs and fish and its impact on Wabanaki communities (Hrynick et al. 2017:101). When results of the stable isotope and radiocarbon analyses from this case study are considered within the context of other regional Ceramic period dog stable isotope data and available radiocarbon dates, a trend away from a marine-based diet is suggested during the Late Ceramic period, beginning by 600 BP, or approximately during the past 700 years.

Integrating additional archaeological and ethnohistoric data is necessary to further understand these findings and confirm interpretations presented. If dogs are assumed to infer human dietary choices based on the CSA framework, then major changes to subsistence and seasonal transhumance at the Holmes Point West site are suggested by this dataset. Wabanaki people at the site made specific choices which resulted in these changes, as a result of opportunities and constraints presented to them within the sociocultural context of their lives.

Future Work and Recommendations

Findings from this study reveal several lines of inquiry that warrant further study. The following list, while certainly not inclusive, provides recommendations for future work to better contextualize the interpretations and conclusions drawn from this research, as well as next steps for giving back to both the research community and the Wabanaki community.

Genetics

Sequencing the DNA of the canine individuals sampled in this study would address some of the important questions raised as a result of this research. Ancient DNA sampled from dogs at the Holmes Point West site could determine whether they were local residents or visitors to the area at the time of their death. While all pre-contact Indigenous dogs in North America share a common ancestor and are grouped in the same clade (Leathlobhair et al. 2018), sequencing ancient DNA on individuals at the study site could confirm if all individuals were Indigenous or whether any of them were dogs of European origin. Dog 4, radiocarbon dated to 506 cal BP (Beta-558633, 2-sigma) and indicating a terrestrial-oriented diet, could potentially represent a European dog that had made its way to the North American continent with human companions or even through trade. Details from ancient DNA could, in conjunction with the dietary and health findings from this case study, help to better contextualize seasonal transhumance and population models for the far Northeast region during the Late Ceramic period.

Strontium/Oxygen Isotopes for Residence and Mobility

Including stable strontium and oxygen isotopes could aid in the identification of region of birth for dogs at the site. Strontium isotopes are present in groundwater and are recorded at the time of birth in the inorganic components of animal remains. Sampling $\delta^{86}S$ provides an indicator of local geology at the time of birth, regardless of where the individual has moved during their lifetime. Stable oxygen isotopes can also help to indicate region of birth, since $\delta^{18}O$ preserved in human hard tissue is reflective of fluctuations that are generally specific both geographically and temporally. That being said, many issues exist in using stable oxygen isotopes to a specify region of birth (Lightfoot and O'Connell 2016) and further investigation is warranted before utilizing this approach with the Holmes Point West dataset. Strontium and oxygen isotope signatures derived from bone apatite in teeth from each dog sampled in this study could help identify if they potentially traveled with different groups of Indigenous peoples or were traded from other regions. In conjunction with genetic work, strontium and oxygen stable isotopes also have the potential to address if Dog 4 is of European origin or not.

Sulfur Isotopes as a Third Dietary Measure

Including stable sulfur isotopes as third measure of dietary variability has the potential to aid in understanding dietary inputs. Stable isotope ratios of sulfur ($\delta^{34}S$) can be used to distinguish between freshwater and terrestrial ecosystems, aiding in identification of potential freshwater inputs to canine diet at the study site (Chilton et al. 2001), especially when measured together with carbon and nitrogen isotope ratios. Studies incorporating $\delta^{34}S$ values have been used in conjunction with carbon and nitrogen values to identify human migration and movement where little other supporting archaeological evidence existed (Cheung et al. 2017). $\delta^{34}S$ values have the potential to further elucidate the origins and potential migration patterns of dogs and humans between the Holmes Point West site and other areas of the Maine-Maritime Peninsula region.

Sampling Additional Ceramic Period Dogs from Interior Sites

Published radiocarbon dates, contextual information, and stable isotope data for Ceramic period dogs exists exclusively for individuals discovered at coastal archaeological sites, usually with exceptional preservation owing to the calcium carbonate rich context of shell middens. While the remains of interred canines are rare from interior sites in the far Northeast due to endemic acidic spodosols, fragmentary remains are present in many legacy collections. Sampling from the remains of dogs recovered from interior sites may provide a more complete picture of dietary trends and potential variability between individuals. Though past and present research continues to support CSA inferences in general, sampling from more and better contextualized dog remains in the Maine-Maritime Peninsula region could provide insight into variability that is not yet available with such a limited dataset.

Community Input on Ethnohistoric and Traditional Knowledge

Until fairly recently, archaeologists have often neglected the integration of descendent communities during the research process. Past collaborations between archaeologists and descendent Wabanaki communities who consider past peoples at the Holmes Point West site to be direct ancestors have created a reciprocal relationship between the University of Maine and Indigenous stakeholders, giving Wabanaki voices a more prominent role in archaeological inquiry and decision-making about their cultural heritage management. A prime example of this type of partnership is a series of interviews about traditional seal hunting practices completed together with Passamaquoddy Tribal Historic Preservation Officer Donald Soctomah (Soctomah and Robinson 2010). Researchers from the University of Maine interviewed elders from the Passamaquoddy Tribe and their families to understand the importance of seal hunting as a traditional method of subsistence, as well as a tradition that played an important role in Passamaquoddy life. Such projects can be completed in tandem with supporting archaeological investigations and together can identify cultural connection and continuity to place. In this example, subsequent to the interviews, faunal analyses were completed at the Holmes Point West site and provided confirmation of past Passamaquoddy seal hunting traditions (Ingraham 2011; Ingraham et al. 2016).

Future collaborations at the Holmes Point West site could potentially identify modern cultural connections surrounding dogs in the lives of the Passamaquoddy, or other Wabanaki people. This information might provide insights into past interactions between past Wabanaki people and their dogs and could even help to strengthen cultural connection and continuity to place at the study site.

Publication and Giving Back to the Community

An early goal of this research was to create a new dataset which could contribute to Northeast archaeology specifically and to North American archaeology more broadly, using the Holmes Point West site as a case study. Health, pathology, and stable isotope data analyzed in this project will be published to add to the body of knowledge on human and animal relationships in the past.

A second goal at the outset of this project was to enhance stakeholder connections to the Holmes Point West site and the Indigenous peoples living there formerly through the development of educational materials designed to make this study accessible to the people whose cultural heritage is represented at the site. This research was made possible through the generosity of the Wabanaki community, the landowners of the Holmes Point West site, as well as Maine Coast Heritage Trust, all of whom collaborated to allow for archaeological inquiry to take place. Continued work with the Wabanaki community will prioritize their needs in regard to resources and support through cultural resource management. This research has attempted to circumvent established exclusionary practices in archaeological inquiry by engaging with Wabanaki people and communities throughout the research process. By incorporating communities and giving them a voice in the way research is conducted, researchers can contribute to the systemic changes needed to ensure a more equitable archaeological practice.

Conclusions and Impact

This research has raised more questions than it has answered about the human and dog relationship, however, some important findings are clear. This study has suggested that human agency plays a key role in the dietary make-up of dogs through the choices made by people in response to the opportunities and constraints provided to them in their socio-cultural and physical setting. The Canine Surrogacy Approach is used to connect a legacy canine dataset lacking much of its original provenience information to questions about human choice, agency, and the human-dog relationship.

This case study and similar work from the Machias Bay region (Ingraham 2011; Ingraham et al. 2016; Robinson and Heller 2017) are an example of how zooarchaeological materials from legacy collections might still answer important research questions, even with challenges surrounding their original provenience and contextual information. Using existing archaeological materials which would otherwise be gathering dust in storage is an avenue of research which can help to reconstruct baselines, support data recovered in the course of new excavations, and address archaeological questions at coastal sites where new findings threatened by human and climate-change related factors (St. Amand et al. 2020).

It seems likely that human choices about the health and diet of canines in the region would be materially affected by ensuing cultural changes during the past 700 years. Based on interpretations of the data presented in this thesis, the opportunities and constraints presented to Wabanaki people as their contact with Europeans progressed likely influenced previously established patterns of seasonal transhumance and site occupation. Dogs that may have demonstrated only marine dietary inputs before the onset of these changes ca. 950 BP (Dog 1) begin to indicate a mix of dietary inputs from terrestrial sources just prior to the onset of the Protohistoric period ca. 600 BP (Dogs 2 and 3), perhaps as a result of residing further inland to meet the demand for fur trapping in winter. Finally, at the boundary of the Protohistoric and Historic periods ca. 550 BP, dog diets may have been influenced by decades or potentially a century or more of intermittent trade with European visitors, as well as selective pressures as a result of the introduction of European breeds of dogs (Dog 4).

This research has addressed a call by previous researchers in the region for more contextualized case studies to further our understanding of human and dog dietary relationships (Guiry and Grimes 2013:743-744). Here, I provide an example of a carefully completed case study with the potential to provide high-resolution data specific to canine individuals during the Late Ceramic period on the Maine-Maritime Peninsula. This small body of research will serve other researchers exploring the human-canine relationship through studies of health and diet.

Additionally, this study has potentially helped to address an issue raised by Hrynick and colleagues (2017) in the study of the Protohistoric period of Maine and the Maritimes. Interpretations of this period are generally driven by events which occurred after the 15th century and are almost exclusively from the perspective of European explorers and colonizers. “Apparent disjunctures are magnified or even created by gaps in and difficulties bridging the ethnographic and archaeological records” (Hrynick et al. 2017:102). By offering a high-resolution dataset of several canine individuals living during this transitionary period in the history of northeastern North America, this study helps to untangle cultural changes occurring during the prolonged period of contact within the context of the Protohistoric period (Hrynick et al. 2017:102).

Perhaps most importantly, this case study underscores the importance of the human-dog relationship within a hunting, fishing, and gathering community in the Far Northeast. The research presented here highlights the long-established connection that exists between dogs and humans and how human choice plays a significant role in the day-to-day lives of dogs. While the specifics of this relationship in the past may not be clear, it is clear that the human-canine connection still ever-present in many of our lives also existed in ancient Indigenous communities migrating to North America, as well as the Wabanaki communities who visited the Holmes Point West site.

BIBLIOGRAPHY

Abbe Museum

1994 *The Indian Shell Heap: Archaeology of the Ruth Moore Site.* Blackberry Books, Nobleboro, Maine.

Allitt, Sharon

2011 Stable isotopic insights into the subsistence patterns of prehistoric dogs (*Canis familiaris*) and their human counterparts in northeastern North America. PhD dissertation, Department of Anthropology, Temple University, Philadelphia.

Almquist-Jacobson, Heather and David. Sanger

1995 Holocene climate and vegetation in the Milford drainage basin, Maine, U.S.A., and their implications for human history. *Vegetation History and Archaeobotany* 4:211-222.

Álvarez, Myrian, Ivan Briz Godino, Andrea Balbo, and Marco Madella

2011 Shell middens as archives of past environments, human dispersal and specialized resource management. *Quaternary International* 239 (1–2): 1–7. DOI:10.1016/j.quaint.2010.10.025.

Ambrose, Stanley H.

1990 Preparation and characterization of bone and tooth collagen for isotopic analysis. *Journal of Archaeological Science* 17(4):431–451. DOI:10.1016/0305-4403(90)90007-R.

Amos, C.L., Zaitlin, B.A.

1984 The effect of changes in tidal range on a sublittoral macrotidal sequence, Bay of Fundy, Canada. Geo-Marine Letters 4, 161–169 (1984). https://doi.org/10.1007/BF02281699

Anderson, Arthur and Gabriel Hrynick

2019 A Reported Hafted Biface from Pennamaquan Lake, Washington County, Maine. *Maine Archaeological Society Bulletin* 59(2): 1-8.

Atalay, Sonya

2008 Multivocality and Indigenous Archaeologies. In *Evaluating Multiple Narratives: Beyond Nationalist, Colonialist, Imperialist Archaeologies*: pp. 29–44. Eds. J. Habu, C. Fawcett, and J.M. Matsunaga. DOI:10.1007/978-0-387-71825-5_3.

Bailey, L.W.

1887 On the relics of the Stone Age in New Brunswick. *Bulletin of the Natural History Society of New Brunswick* 6:1–16.

Baird, S. F.

1881 Notes on Certain Aboriginal Shell Mounds on the Coast of New Brunswick and of New England. In *Proceedings of the United States National Museum*. Science 9(231):776–779. DOI:10.1126/science.9.231.776.

Bennett, Thomas C. and Nathan D. Hamilton
2010 An 1868 Lecture on the Shell Midden on Goose Island, Casco Bay, Maine. *The Maine Archaeological Society Bulletin* 50(1): 9-22.

Black, David W
2008 Pioneers of New Brunswick Archaeology I: Spencer Fullerton Baird: 1–6.

2009 Pioneers of New Brunswick Archaeology III: Loring Woart Bailey: 1–5.

Bigelow, Andrew Frank and William C. Schroeder
2002 *Bigelow and Schroeder's Fishes of the Gulf of Maine*. 3rd ed., eds. Bruce B. Collette and Grace Klein-MacPhee. Smithsonian Institution, Washington, DC. Press.

1970 Chippewa Customs. Reprinted. Ross and Haines, Minneapolis. Originally published 1929, Bulletin No. 86, Bureau of American Ethnology, Smithsonian Institution, Washington, DC.

Bird, Kendra
2017 Spatial Organization and Erosion at the Holmes Point West Archaeological Site, Machiasport, Maine. Master's thesis, Department of Anthropology, University of Maine, Orono.

Bishop, Jennifer C. and David W. Black
1988 The Lands Edge Also: Culture History and Seasonality at the Partridge Island Shell Midden. *Canadian Journal of Archaeology* 12: 17-37.

Biggar, Henry P. (editor)
1936 *The Works of Samuel de Champlain*, Vol. III. Champlain Society, Toronto.

Bocherens H. and D. Drucker
2003 Trophic Level Isotopic Enrichment of Carbon and Nitrogen in Bone Collagen: Case Studies from Recent and Ancient Terrestrial Ecosystems. *International Journal of Osteoarchaeology* 13: 46–53.

Borns, Harold W.
1974 Reconnaissance surficial geology of the Machias Bay 7.5' quadrangle, Maine. Maine Geological Survey. Open-File Map 74-5.

Borns, Harold W. Jr., Lisa A. Doner, Christopher C. Dorion, George L. Jacobson Jr., Michael R. Kaplan, Karl J. Kreutz, Thomas V. Lowell, Woodrow B. Thompson, and Thomas K. Weddle
2004 The Deglaciation of Maine, USA. *Earth Science Faculty Scholarship*, 276.

Bourque, Bruce J.
1973 Aboriginal Settlement and Subsistence on the Maine Coast. *Man in the Northeast* 6:3–20.

1975 Comments on the Late Archaic Populations of Central Maine: The View from the Turner Farm. *Arctic Anthropology* 12(2): 35-45.

1976 The Turner Farm Site: A Preliminary Report. *Man in the Northeast* 11: 21-30.

1995 *Diversity and Complexity in Prehistoric Maritime Societies: A Gulf of Maine Perspective.* New York and London: Plenum Press.

Bourque, Bruce J. and Ruth Holmes Whitehead
1985 Tarrentines and the Introduction of European Trade Goods in the Gulf of Maine. Ethnohistory 32(4): 327-341.

Butler, Eva and Wendell S. Hadlock
1974 *Use of birch-bark in the Northeast*. Reprinted. Maine Coast Printers, Rockland, Maine. Originally published 1957, Bulletin No. 7, The Robert Abbe Museum, Bar Harbor, ME.

1994 *Dogs of the Northeastern Woodland Indians.* Reprinted. Robert Abbe Museum, Bar Harbor, Bulletin No. 8. Originally published 1949, Bulletin 10:17-35, Massachusetts Archaeological Society.

Cannon, Debbi Yee
1987 *Marine Fish Osteology: A Manual for Archaeologists*. Publication no. 18, Archaeology Press, Department of Anthropology, Simon Fraser University. Burnaby, British Columbia.

Cannon, Aubrey, Henry P. Schwarcz and Martin Knyf
1999 Marine-based Subsistence Trends and the Stable Isotope Analysis of Dog Bones from Namu, British Columbia. *Journal of Archaeological Science* 26:399-407.

Carmichael, B., G. Wilson, I. Namarnyilk, S. Nadji, S. Brockwell, B. Webb, F. Hunter, and Deanne Bird
2018 Local and Indigenous management of climate change risks to archaeological sites. *Mitigation and Adaptation Strategies for Global Change* 23 (2):231–255. DOI:10.1007/s11027-016-9734-8.

Cheung, Christina, Zhichun Jing, Jigen Tang, Darlene A. Weston, and Michael P. Richards
2017 Diets, social roles, and geographical origins of sacrificial victims at the royal cemetery at Yinxu, Shang China: New evidence from stable carbon, nitrogen, and sulfur isotope analysis. *Journal of Anthropological Archaeology* 48:28–45. DOI:10.1016/j.jaa.2017.05.006.

Chilton, Elizabeth S., Nikolaas J. van der Merwe, Ninian Stein, and Kimberly Oakberg Allegreto.
2001 Canine Proxies for Native American Diets. Paper presented at the 66th Annual Meeting of the Society for American Archaeology, New Orleans, Louisiana.

Chisholm, Brian S., D. Erle Nelson and Henry P. Schwarcz
1982 Stable-Carbon Isotope Ratios as a Measure of Marine versus Terrestrial Protein in Ancient Diets. *Science* 216 (4550):1131-1132.

Clutton-Brock, Juliet and Nanna Noe-Nygaard
1990 New Osteological and C-Isotope Evidence on Mesolithic Dogs: Companions to Hunters and Fishers at Star Carr, Seamer Carr and Kongemose. *Journal of Archaeological Science* 17:643-653.

Dawson, Tom, J. Hambly, A. Kelley, W. Lees, and S. Miller
2020 Coastal heritage, global climate change, public engagement, and citizen science. *Proceedings of the National Academy of Sciences* 117 (15):8280 LP – 8286. DOI:10.1073/pnas.1912246117.

De Niro, Michael J. and Samuel Epstein
1979 Influence of diet on the distribution of carbon isotopes in animals. *Geochimica et Cosmochimica Acta* 42: 495-506.

1981 Influence of diet on the distribution of nitrogen isotopes in animals. *Geochimica et Cosmochimica Acta* 45: 341-351.

De Niro, Michael J.
1985 Postmortem preservation and alteration of in vivo bone collagen isotope ratios in relation to palaeodietary reconstruction. *Nature* 317:806–809.

Deal, Michael
1986 Late Archaic and Ceramic Period Utilization of The Mud Lake Stream Site, Southwestern New Brunswick. *Man in the Northeast* 32: 67-94.

Dincauze, Dena F.
2004 *Environmental Archaeology: Principles and Practice*. New York, Cambridge University Press.

Drisko, G.W.
1904 Narrative of the Town of Machias: The Old and the New, the Early and the Late. Press of the Republican, Machias, ME.

Denys, Nicholas
1908 *The Description and Natural History of the Coasts of North America (Acadia)*. Originally published 1672. Translated and edited by W. F. Ganong. The Champlain Society, Toronto.

Folch, Jordi, Lees, M., Sloane Stanley, G.H.,
1957 A simple method for the isolation and purification of total lipids from animal tissues. Journal of Biological Chemistry 226 (1):497–509.

Fitzgerald, William R., Laurier Turgeon, Ruth Holmes Whitehead, and James W. Bradley
1993 Late sixteenth-century Basque banded copper kettles. *Historical Archaeology* 27(1):44–57. DOI:10.1007/bf03373558.

Gentry, Anthea, Juliet Clutton-Brock, and Colin P. Groves
2004 The naming of wild animal species and their domestic derivatives. *Journal of Archaeological Science* 31:645-651

Gilbert, Miles B.
1990 *Mammalian Osteology*. Missouri Archaeological Society, Columbia, Missouri.

Guiry, Eric J.
2012 Dogs as Analogs in Stable Isotope-Based Human Paleodietary Reconstructions: A Review and Considerations for Future Use. *Journal of Archaeological Method and Theory* 19:351-376

2013 A canine surrogacy approach to human paleodietary bone chemistry: past development and future directions. *Archaeological and Anthropological Sciences* 5:275-286.

Guiry, Eric J., Paul Szpak, and Michael P. Richards
2016 Effects of lipid extraction and ultrafiltration on stable carbon and nitrogen isotopic compositions of fish bone collagen. *Rapid Communications in Mass Spectrometry* 30(13):1591–1600. DOI:10.1002/rcm.7590.

Guiry, Eric J. and Vaughan Grimes
2013 Domestic dog (*Canis familiaris*) diets among coastal Late Archaic groups of northeastern North America: A case study for the canine surrogacy approach. *Journal of Anthropological Archaeology* 32:732-745.

Gramly, Richard M.
2009 *Paleoamericans and Paleoenvironment at the Vail Site, Maine*. North Andover, MA: Persimmon Press.

Grayson, Donald K.
1988 Danger Cave, Last Supper Cave, and Hanging Rock Shelter: The Faunas. *Anthropological Papers of the American Museum of Natural History* 66(1):1–130.

Hadlock, Wendell S.
1939 *The Taft's Point Shell Mound at West Gouldsboro, Maine.* Bulletin 5, Robert Abbe Museum. Bar Harbor.

1941 *Three Shell Heaps on Frenchman's Bay*. Bulletin 6, Robert Abbe Museum. Bar Harbor.

Hedden, Mark
2004 Passamaquoddy Shamanism and Rock-Art in Machias Bay, Maine. In *The Rock-Art of Eastern North America: Capturing Images and Insight,* eds. Carol Diaz-Granados and James R. Duncan*:* 319–343. Tuscaloosa: University of Alabama Press.

Hody, James W. and Roland Kays
2018 Mapping the expansion of coyotes (Canis latrans) across North and central America. *ZooKeys* 759:81–97. DOI:10.3897/ZOOKEYS.759.15149.

Hrynick, Gabriel M., Matthew W. Betts, and David W. Black
2012 A Late Maritime Woodland Period Dwelling Feature from Nova Scotia's South Shore: Evidence for Patterned Use of Domestic Space. *Archaeology of Eastern North America* 40: 1-25.

Hrynick, M. Gabriel and Brian S. Robinson
2012 Quantifying Gravel from a Ceramic Period Living Surface in Downeast Maine. *The Maine Archaeological Society Bulletin* 52(2):27–43.

Hrynick, M. Gabriel, W. Jesse Webb, Christopher E. Shaw, and Taylor C. Testa
2017 Late Maritime Woodland to Protohistoric Culture Change and Continuity at the Devil's Head Site, Calais, Maine. *Archaeology of Eastern North America*: 85–108.

Ingraham, Robert C.
2010 Mapping and Distribution Analysis of the 1973 University of Maine Excavations at Site 62-8, Holmes Point West, Machias Bay, Maine. Unpublished report.

2011 Specialized Taphonomies in an Eastern Maine Shell Midden: Faunal Analysis of Site 62-8, Holmes Point West, Machias, Maine. Master's thesis, Department of Anthropology/Climate Change Institute, University of Maine, Orono.

Ingraham, Robert C., Brian S. Robinson, Kristin D. Sobolik, & A. Sky Heller
2015 "Left for the Tide to Take Back": Specialized Processing of Seals on Machias Bay, Maine. *The Journal of Island and Coastal Archaeology.* 11:1, 89-106. DOI: 10.1080/15564894.2015.1096868.

Janssens, Luc, Liane Giemsch, Ralf Schmitz, Martin Street, Stefan Van Dongen, and Philippe Crombé
2018 A new look at an old dog: Bonn-Oberkassel reconsidered. *Journal of Archaeological Science* 92:126–138. DOI:10.1016/j.jas.2018.01.004.

Janssens, Luc, Angela Perri, Philippe Crombé, Stefan Van Dongen, and Dennis Lawler
2019 An evaluation of classical morphologic and morphometric parameters reported to distinguish wolves and dogs. *Journal of Archaeological Science: Reports* 23:501–533. DOI:10.1016/j.jasrep.2018.10.012.

Kerber, Jordan T., Alan D. Leveillee, and Ruth L. Greenspan
1989 An unusual dog burial feature at the Lambert Farm Site, Warwick, Rhode Island: Preliminary observations. *Archaeology of Eastern North America* 17:165-174.

Kerber, Jordan T.
1997a Native American treatment of dogs in northeastern North America: archaeological and ethnohistorical perspectives. *Archaeology of Eastern North America* 25:81-95.

1997b *Lambert Farm: Public Archaeology and Canine Burials Along Narragansett Bay.* Harcourt Brace, New York.

Kingsbury, Isaac W, and Wendell S Hadlock
1951 An Early Occupation Site, Eastport, Maine. *Massachusetts Archaeological Society Bulletin.*

Le Clercq, Chrestien
1910 *New Relation of Gaspesia: With the Customs and Religion of The Gaspesian Indians, Volumes 1-3.* Translated and edited by W. F. Ganong. The Champlain Society, Toronto.

Lescarbot, Marc
1914 *The History of New France, Volumes 1-3*. Translated with notes and appendices by W. L. Grant and an introduction by H.P. Biggar. The Champlain Society, Toronto.

Locke, Daniel B.
2000 Surficial Materials, Machias Bay 7.5' Quadrangle. Maine Geological Survey. Open-File Map No. 00-123.

Longin, Robert
1971 New Method of Collagen Extraction for Radiocarbon Dating. *Nature* 230:241–242.

Loomis, F. B. and D. B. Young
1912 On the Shell Heaps of Maine. *American Journal of Science.* Vol. XXXIV, No. 199.

Lore, Robert J.
2004 Ceramic Period Adaptations in the Gulf of Maine: Maritime, Terrestrial, and Horticultural Inputs Faunal Analysis of an Armouchiquois Indian Village. Master's thesis, Department of Anthropology/Climate Change Institute, University of Maine, Orono.

Losey, Robert J., S. Garvie-Lok, J. A. Leonard, M. A. Katzenberg, M. Germonpre, T. Nomokonova, M. V. Sablin, O. I. Goriunova, N. E. Berdnikova, N. A. Savel'ev
2013 Burying Dogs in Ancient Cis-Baikal, Siberia: Temporal Trends and Relationships with Human Diet and Subsistence Practices. *PLoS ONE* 8(5): e63740. doi:10.1371/journal.pone.0063740.

Losey, Robert J., Erin Jessup, Tatiana Nomokonova, Mikhail Sablin
2014 Craniomandibular Trauma and Tooth Loss in Northern Dogs and Wolves: Implications for the Archaeological Study of Dog Husbandry and Domestication. *PLoS ONE* 9(6): e99746. doi:10.1371/journal.pone.0099746.

MacDonald, George F.
1968 *Debert: A Paleoindian Site in Central Nova Scotia.* Anthropology Papers No. 16. Ottawa: National Museums of Canada.

Maine Coast Heritage Trust
2020 Long Point, Machiasport. Electronic document, https://www.mcht.org/preserve/long-point/, accessed December 18, 2020.

Mann, Abby
2020 Human-Canine Interactions in The Maine Maritime Peninsula Region: A Case Study of Dog Burials from The Holmes Point West Site (ME 62-8). *The Maine Archaeological Society Bulletin* 60(1): 23-36.

Martin, Scott M.
1995 Edward Sylvester Morse. *Maine Naturalist* 3(1): 15 – 17.

Matthew, George F.
1884 *Discoveries of a Village of the Stone Age at Bocabec.* Bulletin of the Natural History Society of New Brunswick 3:6-29.

Miklósi, Ádám
2007 *Dog Behavior, Evolution, and Cognition*. Oxford University Press, New York, NY.

Millard, Andrew R
2014 Conventions for Reporting Radiocarbon Determinations. *Radiocarbon* 56(2):555–559. DOI:10.2458/56.17455.

Minigawa, Masao and Eitaro Wada
1984 Stepwise enrichment of ^{15}N along food chains: Further evidence and the relation between δ15N and animal age. *Geochimica et Cosmochimica Acta* 48: 1135-1140.

Moorehead, Warren K.
1922 *A Report on the Archaeology of Maine*. Andover Press, Andover, MA.

Morey, Darcy F. and Michael D. Wiant
1992 Early Holocene Domestic Dog Burials from the North American Midwest. *Current Anthropology* 33:224-229

Morse, Edward S.
1925 Shell-Mounds and Changes in the Shells Composing Them. *Scientific Monthly* 21(4):429-44.

Morey, Darcy F.
2006 Burying key evidence: the social bond between dogs and people. *Journal of Archaeological Science* 33:158-175.

Newsom, Bonnie D.
2017 Potters on The Penobscot: An Archaeological Case Study Exploring Human Agency, Identity, And Technological Choice. PhD dissertation, Department of Anthropology, University of Massachusetts, Amherst.

Newsom, Bonnie D. and Matthew James.
2019 Beyond Grit and Shell: Evidence of Conifer Needle Temper in Archaeological Ceramics from Maine. *Archaeology of Eastern North America* 47:135-155.

Noe-Nygaard, Nanna
1988 ∂^{13}c-values of dog bones reveal the nature of changes in man's food resources at the Mesolithic-Neolithic transition, Denmark. *Chemical Geology (Isotope Geoscience Section)* 13:87-96.

O'Leary, Marion H.
1993 Biochemical Basis of Carbon Isotope Fractionation. *Stable Isotopes and Plant Carbon-water Relations*:19–28. DOI:10.1016/b978-0-08-091801-3.50009-x.

O'Leary, Marion H.
1981 Carbon isotope fractionation in plants. *Phytochemistry* 20(4): 553-567.

Oldale, Robert N.
1985 Rapid Postglacial Shoreline Changes in the Western Gulf of Maine and the Paleo-Indian Environment. *American Antiquity* 50: 145-150.

Petersen, James B. and David Sanger
1991 An Aboriginal Ceramic Sequence for Maine and the Maritime Provinces. In *Prehistoric Archaeology in the Maritime Provinces: Past and Present Research,* edited by Michael Deal, pp. 121–178. The Council of Maritime Premiers, Reports in Archaeology.

Perri, Angela
2016 A wolf in dog's clothing: Initial dog domestication and Pleistocene wolf variation. *Journal of Archaeological Science* 68:1-4.

2017 A typology of dog deposition in archaeological contexts. In *Economic zooarchaeology: studies in hunting, herding and early agriculture*, edited by Peter Rowley-Conwy, Dale Serjeantson and Paul Halstead, pp. 176-193. Oxbow Books, Limited, Oxford.

Perri, Angela, Chris Widga, Dennis Lawler, Terrance Martin, Thomas Loebel, Kenneth Farnsworth, Luci Kohn, and Brent Buenger
2019 New Evidence of The Earliest Domestic Dogs in the Americas. *American Antiquity* 84(1): 68–87.

Prins, Harald E., and Bunny McBride
2007 *Asticou's Island Domain: Wabanaki Peoples at Mount Desert Island 1500-2000*. Northeast Region Ethnography Program, National Park Service, Boston, MA.

Qi, H., Coplen, T.B., Geilmann, H., Brand, W.A., Böhlke, J.,
2003 Two new organic reference materials for δ^{13}C and δ^{15}N measurements and a new value for the δ^{13}C of NBS 22 oil. *Rapid Communications in Mass Spectrometry* 17 (22), 2483–2487.

Qi, H., Coplen, T.B., Mroczkowski, S.J., Brand, W.A., Brandes, L., Geilmann, H., Schimmelmann, A.,
2016 A new organic reference material, l-glutamic acid, USGS41a, for δ^{13}C and δ^{15}N measurements – a replacement for USGS41. *Rapid Communications in Mass Spectrometry* 30 (7), 859–866.

Rand, Silas T.
1894 *Legends of the Micmacs*. Wellesley Philological Publications, New York and London.

Reitz, Elizabeth J. and Elizabeth S. Wing
2008 *Zooarchaeology*. 2nd ed., Cambridge Manuals in Archaeology. Cambridge University Press, Cambridge. doi:10.1017/CBO9780511841354.

Rick, Torben C. and Daniel H. Sandweiss
2020 Archaeology, climate, and global change in the Age of Humans. *Proceedings of the National Academy of Sciences* 117 (15): 8250-8253. DOI:10.1073/pnas.2003612117.

Robinson, Brian, Jennifer C. Ort, William C. Eldridge, Adrian L. Burke, Bertrand G. Pelletier
2009 Paleoindian Aggregation and Social Context at Bull Brook. *American Antiquity* 74(3):423-447.

Sanger, David
1979 *Discovering Maine's Archaeological Heritage.* Maine Historic Preservation Commission. Augusta, Maine.

1982 Changing Views of Aboriginal Seasonality and Settlement in the Gulf of Maine. *Canadian Journal of Anthropology* 2(2): 195-203.

1986 An introduction to the prehistory of the Passamaquoddy bay region. *American Review of Canadian Studies* 16(2): 139-159.

1987 *The Carson Site and the Late Ceramic Period in Passamaquoddy Bay, New Brunswick*. Mercury Series, Archaeological Survey of Canada, Paper No. 135.

1996a Gilman Falls Site: Implications for The Early and Middle Archaic of The Maritime Peninsula. *Canadian Journal of Archaeology* 20: 7-28.

1996b Testing the models: hunter- gatherer use of space in the Gulf of Maine, USA. World Archaeology 27(3): 512-526.

2005 Pre-European Dawnland: Archaeology of the Maritime Peninsula. New England and the Maritime Provinces: Connections and Comparisons:15–31.

2006 An Introduction to the Archaic of the Maritime Peninsula: The View from Central Maine. In *The Archaic of the Far Northeast*, eds. David Sanger and M. A. P. Renouf. The University of Maine Press, Orono.

2008 Discerning Regional Variation: The Terminal Archaic Period in the Quoddy Region of the Maritime Peninsula. *Canadian Journal of Archaeology.* 32(1): 1-42.

Sanger, David and Douglas C. Kellogg
1989 Prehistoric Archaeology and Evidence of Coastal Subsidence of the Coast of Maine. In *Neotectonics of Maine*, eds. W. A. Anderson and H.W. Borns. Maine Geological Survey, Augusta, Maine.

Sazelová, Sandra, Dennis Lawler, Šárka Hladilová, Soňa Boriová, Soňa Šáliová, Tomáš Janoušek, Angela Perri, Jean-Jacques Hublin, Jiří Svoboda
2020 A wolf from Gravettian site Pavlov I, Czech Republic: approach to skull pathology. *International Journal of Paleopathology* 31:7–13.

Schauffler, Molly and George L. Jacobson
2002 Persistence of coastal spruce refugia during the Holocene in northern New England, USA, detected by stand-scale pollen stratigraphies. *Journal of Ecology* 90:235-250.

Schoeninger, Margaret J., Michael J. DeNiro and Henrik Tauberet
1983 Stable Nitrogen Isotope Ratios of Bone Collagen Reflect Marine and Terrestrial Components of Prehistoric Human Diet. *Science* 220(4604):1381-1383.

Schoeninger, Margaret J. and Michael J. DeNiro
1984 Nitrogen and carbon isotopic composition of bone collagen from marine and terrestrial animals. *Geochimica et Cosmochimica Acta* 48: 625-639.

Schwarcz, Henry P. and Margaret J. Schoneninger
1991 Stable isotope analysis in human nutritional ecology. *Yearbook of Physical Anthropology* 34(13): 283–321.

Shaw, John, Carl L. Amos, David A. Greenberg, Charles T. O'Reilly, D. Russell Parrott, and Eric Patton
2010 Catastrophic tidal expansion in the Bay of Fundy, Canada. *Canadian Journal of Earth Sciences* 47(8):1079–1091. DOI:10.1139/E10-046.

Shotwell, J. A.
1955 An approach to the paleoecology of mammals. *Ecology* 36(2):327–37.

Smith, H.A.P
1917 The Moose Dog. *Forest and Stream* 87. Forest and Stream Publishing Company, New York, N.Y.

Smith, H. I., and W. J. Wintemberg.
1929 *Some shellheaps in Nova Scotia*. National Museum of Canada, Ottawa, ON, Canada.

Snow, Dean R.
1976 Abenaki Fur Trade in the Sixteenth Century. *The Western Canadian Journal of Anthropology* 6(1):3–11.

Soctomah, D. and Brian Robinson.
2010 Student interviews: Passamaquoddy seal hunting oral tradition project. Application for approval of research with human subjects. Orono: University of Maine.

Speck, Frank G.
1925 Dogs of the Labrador Indians. *Natural History* 25: 58-64.

Spiess, Arthur E. and Robert A. Lewis
2001 *The Turner Farm Fauna: 5000 Years of Hunting and Fishing in Penobscot Bay, Maine.* Maine State Museum, The Maine Historic Preservation Commission, and the Maine Archaeological Society. Augusta, Maine

St. Amand, Frankie, S. Terry Childs, Elizabeth J. Reitz, Sky Heller, Bonnie Newsom, Torben C. Rick, Daniel H. Sandweiss, and Ryan Wheeler
2020 Leveraging legacy archaeological collections as proxies for climate and environmental research. *Proceedings of the National Academy of Sciences of the United States of America* 117(15):8287–8294. DOI:10.1073/pnas.1914154117.

Szpak, Paul, Jean-François Millaire, Christine D. White, and Fred J. Longstaffe
2014 Small scale camelid husbandry on the north coast of Peru (Virú Valley): Insight from stable isotope analysis. *Journal of Anthropological Archaeology* 36:110–129.

Szpak, Paul, K. Krippner, and Michael P. Richards
2017 Effects of Sodium Hydroxide Treatment and Ultrafiltration on the Removal of Humic Contaminants from Archaeological Bone. *International Journal of Osteoarchaeology* 27(6):1070–1077. DOI:10.1002/oa.2630.

Tanner, A.
1979 *Bringing Home Animals: Religious Ideology and Mode of Production of the Mistassini Cree Hunters.* St. Martin's Press, New York, NY.

Thomas, Martin. L. H.
1983 *Marine and Coastal Systems of the Quoddy Region, New Brunswick.* Ed. M.L.H. Thomas, Department of Fisheries and Oceans, Ottawa. Canadian Special Publication of Fisheries and Aquatic Sciences, Vol. 64. Department of Fisheries and Oceans, Ottawa.

Thoreau, Henry David
1892 *The Maine Woods*. Houghton, Mifflin and company, Boston and New York. https://lccn.loc.gov/01008883.

Thwaites, Reuben Gold (editor)
1896–1901 *The Jesuit Relations and Allied Documents: Travels and Exploits of the Jesuit Missionaries in New France 1610 – 1791*. 73 volumes. Burrows Brothers Company, Cleveland, Ohio.

Tito, Raul Y. et al.
2011 Brief Communication: DNA From Early Holocene American Dog. *American Journal of Physical Anthropology* 145:653–657.

Tourigny, E., R. Thomas, E. Guiry, R. Earp, A. Allen, J. L. Rothenburger, D. Lawler And M. Nussbaumer
2016 An Osteobiography of a 19th-Century Dog from Toronto, Canada. *International Journal of Osteoarchaeology* 26: 818–829.

Tuck, James A.
1970 An Archaic Indian Cemetery in Newfoundland. *Scientific American* 6:112-121.

1976 *Ancient People of Port au Choix*. Institute of Social and Economic Research, Memorial University of Newfoundland.

Tykot, R.H.
2004 Stable isotopes and diet: You are what you eat. *Proceedings of the International School of Physics "Enrico Fermi",* Course CLIV, eds. M. Martini, M. Milazzo and M. Piacentini, 433-444.

United States National Park Service
1990 Native American Graves Protection and Repatriation Act. Electronic document, https://www.nps.gov/nagpra/mandates/25usc3001etseq.htm, Accessed Feb. 11, 2019.

Urton, Erin J.M., and Keith A. Hobson
2005 Intrapopulation variation in gray wolf isotope (δ15N and δ13C) profiles: Implications for the ecology of individuals. *Oecologia* 145(2):317–326. DOI:10.1007/s00442-005-0124-2.

van Klinken, G.J.
1999 Bone collagen quality indicators for palaeodietary and radiocarbon measurements. *Journal of Archaeological Science* 26 (6):687–695.

Wallis, W.D. and Wallis, R.S.
1955 *The Micmac Indians of Eastern Canada*. University of Minnesota Press, Minneapolis, MN.

Welker, Martin H., David A. Byers, and Sarah B. McClure
2021 "I wanna be your dog": Evaluating the efficacy of univariate and multivariate methods for differentiating domestic and wild canids in North America. *International Journal of Osteoarchaeology*:1–11. DOI:10.1002/oa.2939.

Wyman, Jeffries
1868 An Account of Some Kjœkkenmœddings, or Shell-heaps, in Maine and Massachusetts. *The American Naturalist* 1:561-583.

APPENDIX A: SUPPORTING TABLES

	Dog #1	Dog #2	Dog #3	Dog #4
RC Sample Number	Beta-544315	Beta-544314	Beta-546919	Beta-558633
Original PN #	30.72	66.87	38.99	315.7
Unit #	N24 W20	N14 W16	N22 W14	N53 E31
Sample Material	*C. familiaris*	*C. familiaris*	*C. familiaris*	*C. familiaris*
Element	Ulna	Ulna	Calcaneus	Mandible
Conventional AMS RC Age and Std. Dev.	990 +/- 30 BP	650 +/- 30 BP	610 +/- 30 BP	450 +/- 30 BP
1-sigma	931 – 904 cal BP (32.1%) 867 – 825 cal BP (32.8%) 809 – 804 cal BP (3.3%)	655 – 634 cal BP (28.2%) 590 – 562 cal BP (40.1%)	645 – 621 cal BP (25.5%) 615 – 586 cal BP (29.9%) 566 – 554 cal BP (12.8%)	520 – 494 cal BP (68.3%)
2-sigma	958 – 897 cal BP (44.6%) 874 – 794 cal BP (50.8%)	669 – 622 cal BP (44.7%) 605 – 555 cal BP (50.8%)	651 – 546 cal BP (95.4%)	537 – 470 cal BP (95.4%)
Median Probability	869 cal BP	599 cal BP	603 cal BP	506 cal BP
Calibration Applied and Software Used	Marine20, OxCal 4.4.2	IntCal20/Marine20, OxCal 4.4.2	IntCal20/Marine20, OxCal 4.4.2	IntCal20/OxCal 4.4.2
Culture Phase	Late Ceramic/Woodland	Late Ceramic/Woodland	Late Ceramic/Woodland	Proto-historic
Notes/Pretreatments	Fragmentary, proximal and diaphysis portions, left side, excavated from unit N24 W20 (1973) burial context with second canine individual adjacent	Fragmentary, two pieces that articulate, proximal and distal end of semilunar notch with small diaphysis portion, left side, excavated from unit N14 W16 (1973) hearth context	Whole element, right side, excavated from unit N22 W14 (1973)	Fragmentary, refit M1, right side, age likely juvenile based on tooth wear, excavated from test unit N53 E31 (2008), two 19th nails and indigenous artifacts found with faunal remains

Table A.1. New Reported ^{14}C Dates from the Holmes Point West site (ME 62-8).

Summary Table of Burial Context Canid Elements from Holmes Point West (62-8)

PN	Cat. No	N/S	Co.	E/W	Co.	Quad	Exc. Year	Species	Element	Count	Side	% TOTAL NISP
28	71	N	24	W	20	None	73	Canis familiaris	Axis	1		0.63%
27	78	N	24	W	20	None	73	Canis familiaris	Atlas	1		0.63%
28	70	N	24	W	20	None	73	Canis familiaris	Atlas	1		0.63%
26	84	N	24	W	20	None	73	Canis familiaris	Canine	1	L	0.63%
28	87	N	24	W	20	None	73	Canis familiaris	Canine	2	P	1.25%
28	88	N	24	W	20	None	73	Canis familiaris	Canine	2	P	1.25%
28	72	N	24	W	20	None	73	Canis familiaris	Cervical vertebra	4		2.50%
27	71	N	24	W	20	None	73	Canis familiaris	Frontal	1	R	0.63%
28	74	N	24	W	20	None	73	Canis familiaris	Humerus	1	L	0.63%
28	75	N	24	W	20	None	73	Canis familiaris	Humerus	1	R	0.63%
30	73	N	24	W	20	None	73	Canis familiaris	Humerus	1	L	0.63%
30	74	N	24	W	20	None	73	Canis familiaris	Humerus	1	R	0.63%
30	76	N	24	W	20	None	73	Canis familiaris	Humerus	1	L	0.63%
30	77	N	24	W	20	None	73	Canis familiaris	Humerus	1	R	0.63%
28	89	N	24	W	20	None	73	Canis familiaris	Incisor	6		3.75%
28	79	N	24	W	20	None	73	Canis familiaris	Mandible	1	R	0.63%
28	80	N	24	W	20	None	73	Canis familiaris	Mandible	1	L	0.63%
27	80	N	24	W	20	None	73	Canis familiaris	Maxilla	1	L	0.63%
28	82	N	24	W	20	None	73	Canis familiaris	Maxilla	2	R	1.25%
28	83	N	24	W	20	None	73	Canis familiaris	Maxilla	1	L	0.63%
28	78	N	24	W	20	None	73	Canis familiaris	Metacarpal	1		0.63%
30	75	N	24	W	20	None	73	Canis familiaris	Metacarpal	1		0.63%
26	81A	N	24	W	20	None	73	Canis familiaris	Palantine	1		0.63%
28	85	N	24	W	20	None	73	Canis familiaris	Palate	1	R	0.63%
27	81	N	24	W	20	None	73	Canis familiaris	Phalange	1		0.63%
29	72	N	24	W	20	None	73	Canis familiaris	Phalange	3		1.88%
30	80	N	24	W	20	None	73	Canis familiaris	Phalange	2		1.25%
28	81	N	24	W	20	None	73	Canis familiaris	Premaxilla	1	P	0.63%
30	70	N	24	W	20	None	73	Canis familiaris	Radius	2	R	1.25%
30	71	N	24	W	20	None	73	Canis familiaris	Radius	1	L	0.63%
26	85	N	24	W	20	None	73	Canis familiaris	Rib	1		0.63%
26	79	N	24	W	20	None	73	Canis familiaris	Scapula	1	R	0.63%
28	77	N	24	W	20	None	73	Canis familiaris	Scapula	1	L	0.63%
28	84	N	24	W	20	None	73	Canis familiaris	Sphenoid	1		0.63%
27	82	N	24	W	20	None	73	Canis familiaris	Temporal	1	L	0.63%
27	83	N	24	W	20	None	73	Canis familiaris	Temporal	1	R	0.63%
28	86	N	24	W	20	None	73	Canis familiaris	Temporal	1	R	0.63%
29	71	N	24	W	20	None	73	Canis familiaris	Temporal	1	R	0.63%
30	72	N	24	W	20	None	73	Canis familiaris	Ulna	1	L	0.63%
28	73	N	24	W	20	None	73	Canis familiaris	Vertebra centrum	7		4.38%
28	76	N	24	W	20	None	73	Canis familiaris	Vertebra Spinous Process	10		6.25%
19	80	N	26	W	20	None	73	Canis familiaris	Canine	1	L	0.63%
20	79	N	26	W	20	None	73	Canis familiaris	Canine	1	R	0.63%
22	80	N	26	W	20	None	73	Canis familiaris	Canine	1	L	0.63%
19	76	N	26	W	20	None	73	Canis familiaris	Frontal	1	L	0.63%
21	82	N	26	W	20	None	73	Canis familiaris	Ilium	1	R	0.63%
21	81	N	26	W	20	None	73	Canis familiaris	Lumbar Vertebra	4		2.50%
22	79	N	26	W	20	None	73	Canis familiaris	Maxilla	1	R	0.63%
21	85	N	26	W	20	None	73	Canis familiaris	Rib	25		15.63%
22	81	N	26	W	20	None	73	Canis familiaris	Rib	2		1.25%
21	80	N	26	W	20	None	73	Canis familiaris	Thoracic Vertebra	3		1.88%
22	78	N	26	W	20	None	73	Canis familiaris	Ulna	1	R	0.63%
21	83	N	26	W	20	None	73	Canis familiaris	Vertebra	2		1.25%
21	84	N	26	W	20	None	73	Canis familiaris	Vertebra Spinous Process	4		2.50%
19	81	N	26	W	20	None	73	Canis sp.	Zygoma	1	L	0.63%
									TOTAL	**119**		**74.38%**

Table A.2. Table of all *Canis* sp. elements recovered from the two burial units, N24 W20 and N26 W20.

Summary Table of Non-Burial Context Canid Elements from Holmes Point West (62-8)

PN	Cat. No	N/S	Co.	E/W	Co.	Quad	Exc. Year	Species	Element	Count	Side	% TOTAL NISP
38	100	N	22	W	14	None	73	Canis familiaris	Astragalus	1	R	0.63%
254	73	N	27	E	20	NW	2008	Canis familiaris	Atlas	1		0.63%
38	99	N	22	W	14	None	73	Canis familiaris	Calcaneous	1	R	0.63%
624	70	N	28	E	27	NW	2009	Canis familiaris	Calcaneous	1	R	0.63%
52	71	N	22	W	12	None	73	Canis familiaris	Canine	1	L	0.63%
39	126	N	22	W	14	None	73	Canis familiaris	Canine	1	R	0.63%
315	71	N	53	E	31	NW	2008	Canis familiairis	Canine	1	R	0.63%
318	70	N	53	E	31	SW	2008	Canis sp.	Canine	1	L	0.63%
217	71	N	29	E	22	SE	2008	Canis sp.	Carnassial	1	R	0.63%
65	81	N	14	W	16	None	73	Canis familiaris	Ilium	1	L	0.63%
39	125	N	22	W	14	None	73	Canis familiaris	Mandible	1	R	0.63%
315	70	N	53	E	31	NW	2008	Canis familiairis	Mandible	1	R	0.63%
47	83	N	20	W	14	None	73	Canis familiaris	Maxilla	1	L	0.63%
9	76	N	28	W	20	None	73	Canis familiaris	Maxilla	1	L	0.63%
626	70	N	28	E	27	SW	2009	Canid sp.	Metatarsal	1		0.63%
39	127	N	22	W	14	None	73	Canis familiaris	Molar	1	L	0.63%
39	128	N	22	W	14	None	73	Canis familiaris	Molar	1	L	0.63%
324	70	N	52	E	31	SW	2008	Canis sp.	Molar	1		0.63%
315	72	N	53	E	31	NW	2008	Canis familiairis	Molar	3	R	1.88%
42	79	N	22	W	14	None	73	Canis familiaris	Phalange	1		0.63%
661	70	N	27	E	28	SE	2009	Canis familiaris	Phalange	1		0.63%
630	70	N	28	E	27	SW	2009	Canis familiaris	Phalange	1		0.63%
2345	70	N	52	E	30	NE	2012	Canis familiaris	Phalange	2		1.25%
315	74	N	53	E	31	NW	2008	Canis familiairis	Phalange	1		0.63%
318	71	N	53	E	31	SW	2008	Canis sp.	Phalange	1		0.63%
1406		N	36	E	17	SW	2010	Canid sp.	Premolar	1	L	0.63%
66	88	N	14	W	16	None	73	Canis familiaris	Radius	1	L	0.63%
9	77	N	28	W	20	None	73	Canis familiaris	Radius	1	R	0.63%
40	93	N	22	W	14	None	73	Canis familiaris	Scapula	1	R	0.63%
38	101	N	22	W	14	None	73	Canis familiaris	Tarsal	2	R	1.25%
11	72	N	28	W	20	None	73	Canis familiaris	Tibia	1	R	0.63%
66	87	N	14	W	16	None	73	Canis familiaris	Ulna	2	L	1.25%
38	98	N	22	W	14	None	73	Canis familiaris	Ulna	1	L	0.63%
39	129	N	22	W	14	None	73	Canis familiaris	Vertebra Spinous Process	1		0.63%
115	77	N	26	E	23	NE	2008	Canis sp.	Vertebra Spinous Process	1		0.63%
626	70	N	28	E	27	SW	2009	Canis familiaris	Vertebra spinous process	1		0.63%
									TOTAL	**41**		**25.63%**

Table A3. Table of all *Canis* sp. elements recovered from the non-burial units.

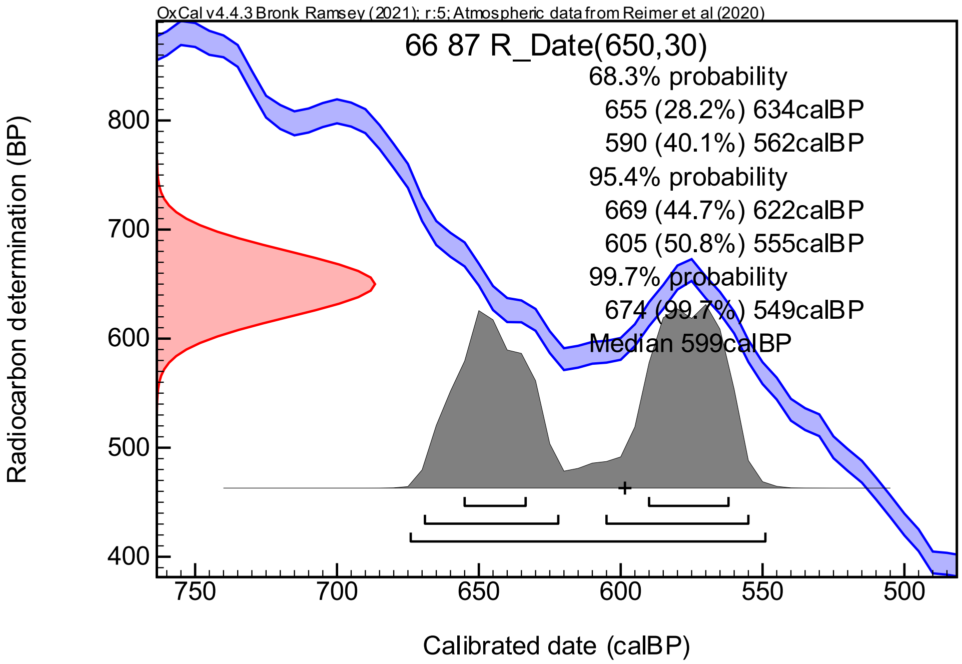
TEAL No.	Replicates	δ13C	δ15N	%C	%N	C:N	PN	Cat. No	N/S	Co.	E/W	Co.	Quad	Exc. Year	top	bot	Exc. Lev.	Class	Weight	Element	Species	Unit and Context
9218	ab	-12.2	18.9	43.7	15.2	3.36	20	80A	N	26	W	20	None	73	10	20	2	Mammal	4.63	Temporal	Phoca vitulina	Burial Context (Unit N24 W20)
9219	a	-10.3	14.6	49.0	17.8	3.20	20	95	N	26	W	20	None	73	10	20	2	Fish	1.26	Hyomandibular	Gadus morhua	
9220	a	-13.0	17.3	44.2	15.7	3.28	20	99	N	26	W	20	None	73	10	20	2	Bird	0.36	Coracoid	Alca torda	
9221	a	-12.0	19.5	44.3	15.6	3.31	21	74	N	26	W	20	None	73	20	30	3	Mammal	8.95	Temporal	Phoca vitulina	
9222	a	-13.6	17.2	38.9	13.0	3.48	21	77	N	26	W	20	None	73	20	30	3	Mammal	1.85	Vertebra, thoracic	Phocoena phocoena	
9223	a	-23.0	3.9	43.7	15.6	3.27	27	79	N	24	W	20	None	73	30	40	3	Mammal	0.99	Humerus	Erethizon dorsatum	
9224	ab	-23.2	2.1	43.0	15.4	3.25	28	90	N	24	W	20	None	73	40	50	4	Mammal	25.34	Phalange	Alces alces	
9225	ab	-19.7	3.8	43.9	15.9	3.21	28	94	N	24	W	20	None	73	40	50	4	Mammal	8.11	Metatarsals	Ursus americanus	
9226	a	-13.0	18.5	43.4	15.7	3.23	28	95	N	24	W	20	None	73	40	50	4	Mammal	18.92	Temporal	Halichoerus grypus	
9227	a	-9.5	15.5	43.7	15.8	3.24	28	99	N	24	W	20	None	73	40	50	4	Mammal	2.3	Mandible	Mustela macrodon	
9228	ab	-11.3	13.2	43.2	15.7	3.22	28	104	N	24	W	20	None	73	40	50	4	Fish	5.59	Scute	Acipenser sp.	
9229	ab	-22.4	2.1	43.5	15.6	3.26	28	106	N	24	W	20	None	73	40	50	4	Mammal	3.3	Frontal	Castor canadensis	
9230	a	-16.5	10.5	44.0	15.7	3.26	28	107	N	24	W	20	None	73	40	50	4	Bird	0.4	Coracoid	Aythia marila	
9231	a	-24.9	11.7	43.1	15.4	3.26	28	111	N	24	W	20	None	73	40	50	4	Reptile	2.3	Plastron	Chelydra serpentina	
9232	ab	-10.5	16.3	43.7	15.9	3.20	30	72	N	24	W	20	None	73	?	?	"?"	Mammal	6.77	Ulna	Canis familiaris	
9233	a	-23.0	1.5	43.2	15.4	3.26	38	70	N	22	W	14	None	73	0	25/35	1	Mammal	59.16	Astragalus	Alces alces	Disarticulated Context (Unit N22 W14)
9234	a	-12.0	16.5	42.0	15.2	3.23	38	96	N	22	W	14	None	73	0	25/35	1	Mammal	11.12	Femur	Phoca vitulina	
9235	a	-13.0	17.8	43.3	15.5	3.26	38	97	N	22	W	14	None	73	0	25/35	1	Mammal	5.65	Cuboid	Halichoerus grypus	
9236	ab	-16.7	10.0	43.3	15.5	3.25	38	98	N	22	W	14	None	73	0	25/35	1	Mammal	2.15	Ulna	Canis familiaris	
9237	a	-11.6	15.5	42.2	15.4	3.19	38	109	N	22	W	14	None	73	0	25/35	1	Fish	2.13	Articular	Gadus morhua	
9238	a	-11.6	12.1	42.8	15.3	3.26	38	112	N	22	W	14	None	73	0	25/35	1	Fish	0.87	Scute	Acipenser sp.	
9239	a	-11.1	11.9	43.2	15.4	3.27	38	115	N	22	W	14	None	73	0	25/35	1	Bird	1.27	Humerus	Somateria mollissima	
9240	a	-15.1	14.8	43.8	15.5	3.31	38	117	N	22	W	14	None	73	0	25/35	1	Bird	0.34	Ulna	Alca torda	
9241	a	-22.7	1.8	43.5	15.7	3.23	39	73	N	22	W	14	None	73	25/35	40	2	Mammal	79.27	Astragalus	Alces alces	
9242	a	-23.3	3.1	43.2	15.3	3.29	39	130	N	22	W	14	None	73	25/35	40	2	Mammal	3.84	Mandible	Castor canadensis	
9243	a	-10.0	14.9	42.9	15.5	3.22	39	146	N	22	W	14	None	73	25/35	40	2	Fish	15.55	Scute	Acipenser sp.	
9244	a	-11.3	12.1	42.6	15.6	3.17	39	150	N	22	W	14	None	73	25/35	40	2	Fish	1.52	Premaxilla	Pomatomus saltatrix	
9245	a	-14.4	15.2	43.7	15.6	3.27	39	154	N	22	W	14	None	73	25/35	40	2	Bird	0.4	Ulna	Alca torda	
9246	a	-20.2	3.0	42.7	15.0	3.31	39	108B	N	22	W	14	None	73	25/35	40	2	Mammal	2.1	Metatarsal	Ursus americanus	
9247	a	-12.5	16.5	41.7	14.8	3.30	39	121C	N	22	W	14	None	73	25/35	40	2	Mammal	1.3	Vertebra, thoracic	Phocoena phocoena	
9248	a	-9.7	14.4	42.5	15.2	3.26	65	95	N	14	W	16	None	73	10	20	2	Fish	1.91	Scute	Acipenser sp.	Hearth Context (N14 W16)
9249	a	-23.0	1.5	43.1	15.6	3.23	66	75	N	14	W	16	None	73	20	30	3	Mammal	5.2	Femur	Alces alces	
9250	a	-10.6	16.9	42.9	15.4	3.25	66	78	N	14	W	16	None	73	20	30	3	Mammal	15.76	Tibia	Halichoerus grypus	
9251	a	-12.7	15.7	41.6	14.9	3.24	66	81	N	14	W	16	None	73	20	30	3	Mammal	4.03	Mandible	Phoca vitulina	
9252	ab	-14.9	12.2	43.5	15.8	3.21	66	87	N	14	W	16	None	73	20	30	3	Mammal	3.06	Ulna	Canis familiaris	
9253	a	-24.4	11.5	43.4	15.6	3.24	66	90	N	14	W	16	None	73	20	30	3	Mammal	1.11	Radius	Lutra canadensis	
9254	a	-21.8	3.2	43.1	15.2	3.31	66	91	N	14	W	16	None	73	20	30	3	Mammal	0.66	Temporal	Castor canadensis	
9255	a	-24.0	11.5	42.8	15.3	3.25	66	100	N	14	W	16	None	73	20	30	3	Reptile	15.61	Scapula	Chelydra serpentina	
9256	a	-12.6	17.4	42.6	15.1	3.29	66	101	N	14	W	16	None	73	20	30	3	Bird	1.21	Humerus	Alca torda	
9257	a	-10.3	14.4	42.6	15.4	3.22	66	103	N	14	W	16	None	73	20	30	3	Fish	0.2	Scute	Acipenser sp.	
9258	a	-22.8	5.6	41.4	14.5	3.34	74	79	N	14	W	16.8	None	73	40	50	2	Mammal	0.61	Femur	Ondatra zibethicus	

Table A.4. Table of all baseline faunal samples used in this study.

RC Sample Number	Stable Isotope Analysis #	Sample Material	Element	Conventional AMS RC Age and Std. Dev.	1-sigma	2-sigma	Median Probability	Calibration Applied and Software Used	Culture Phase
Beta-63829/CAMS-7860	DB10	*Canis familiaris*	Metatarsal	2,030 +/- 70 BP	2095 - 2089 cal BP (1.7%) 2064 - 1875 cal BP (66.6%)	2293 - 2268 cal BP (1.7%) 2151 - 1816 cal BP (92.0%) 1810 – 1787 cal BP (1.2%) 1766 – 1752 cal BP (06%)	1975 cal BP	Marine20, OxCal 4.4.2	Early Middle Ceramic/Woodland
-	DB16	*Canis familiaris*	Femur	2,815 +/- 85 BP	3055 - 3038 cal BP (3.9%) 3025 - 3015 cal BP (2.4%) 3008 - 2843 cal BP (53.8%) 2822 - 2785 cal BP (8.2%)	3158 - 2760 cal BP (95.4%)	2937 cal BP	Marine20, OxCal 4.4.2	Early Ceramic/Woodland
-	DB20		Femur	2,815 +/- 85 BP	3055 - 3038 cal BP (3.9%) 3025 - 3015 cal BP (2.4%) 3008 - 2843 cal BP (53.8%) 2822 - 2785 cal BP (8.2%)	3158 - 2760 cal BP (95.4%)	2937 cal BP	Marine20, OxCal 4.4.2	Early Ceramic/Woodland
Beta-74609/CAMS-14928	DB29		Femur	2,570 BP (no error given)	2738 - 2727 cal BP (68.3%)	2742 - 2722 cal BP (95.4%)	2732 cal BP	Marine20, OxCal 4.4.2	Early Ceramic/Woodland
Beta-548817	14.168 (sample number)	*Canis familiaris*	Mandible	1,150 +/- 30 BP	1173 - 1166 cal BP (3.7%) 1116 - 1104 cal BP (5.5%) 1074 - 1048 cal BP (18.5%) 1035 - 976 cal BP (40.6%)	1177 - 1161 cal BP (6.5%) 1128 - 963 cal BP (88.9%)	1045 cal BP	Marine20, OxCal 4.4.2	Late Ceramic/Woodland

Table A.5. Recalibrated ^{14}C Dates from Allitt (2011) and Spiess unpublished (2019).

APPENDIX B: SUPPORTING FIGURES



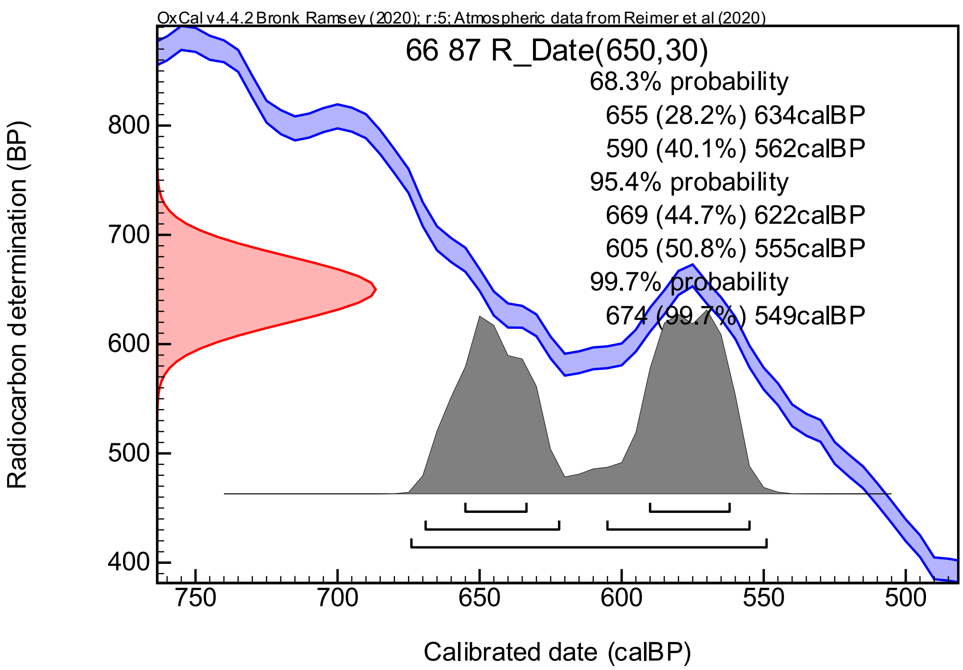


Figure B.1. Comparison of original calibrated date using IntCal20 and recalibrated radiocarbon date using Marine20 for Dog 2 (PN 66.87). Individual indicated a mixed marine and terrestrial diet.

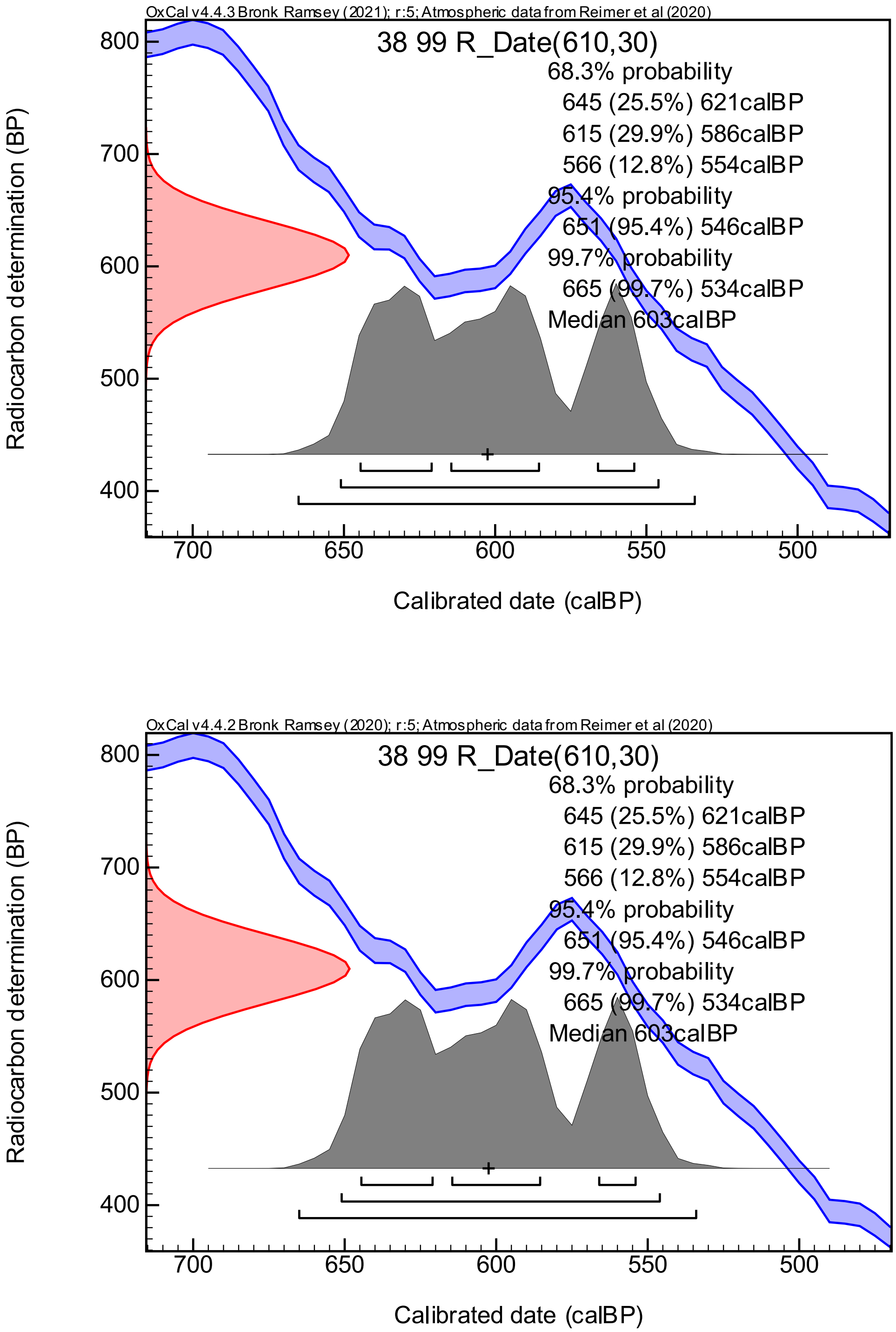


Figure B.2. Comparison of original calibrated date using IntCal20 and recalibrated radiocarbon date using Marine20 for Dog 3 (PN 38.99). Individual indicated a mixed marine and terrestrial diet.

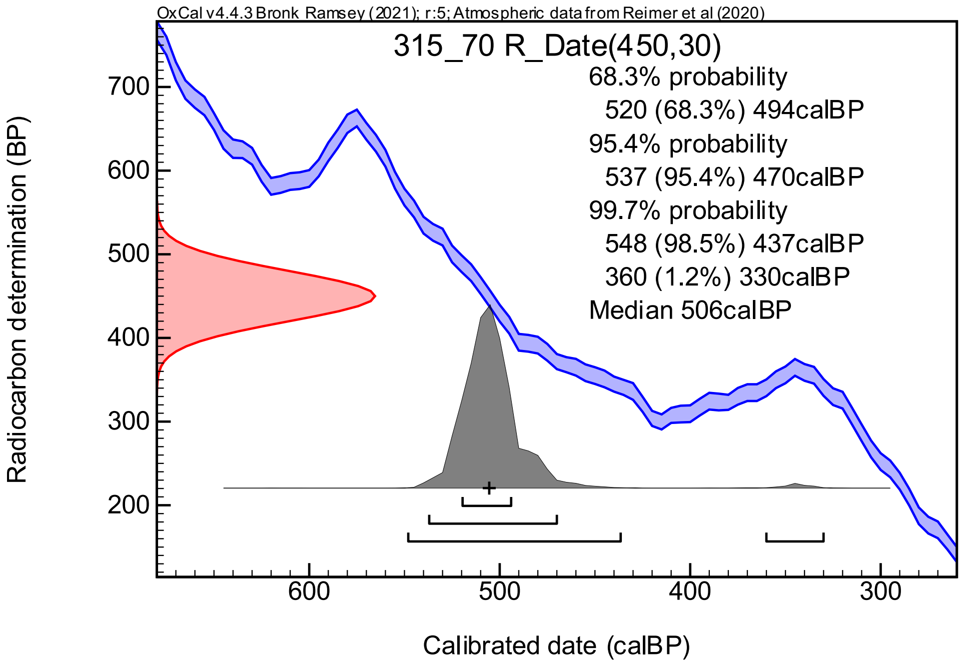
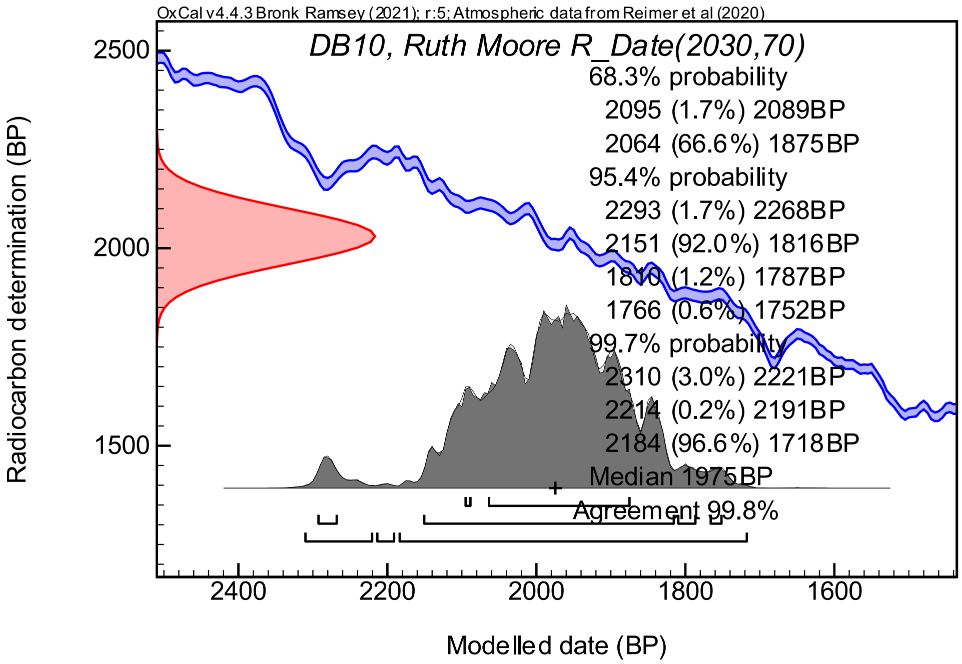


Figure B.3. Calibrated date using IntCal20 for Dog 4 (PN 315.70). Individual indicated a primarily terrestrial diet.



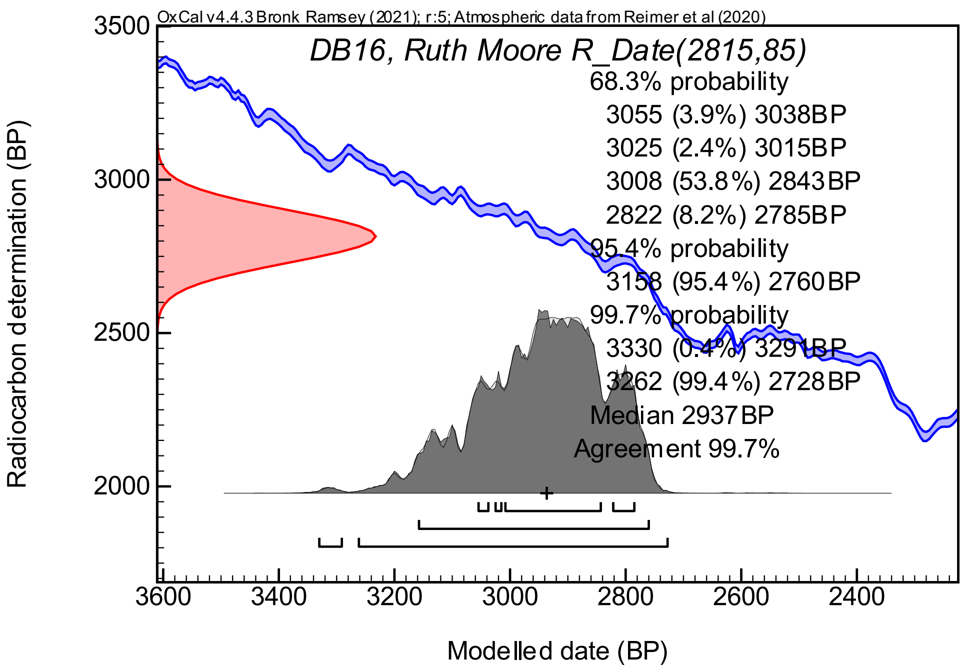
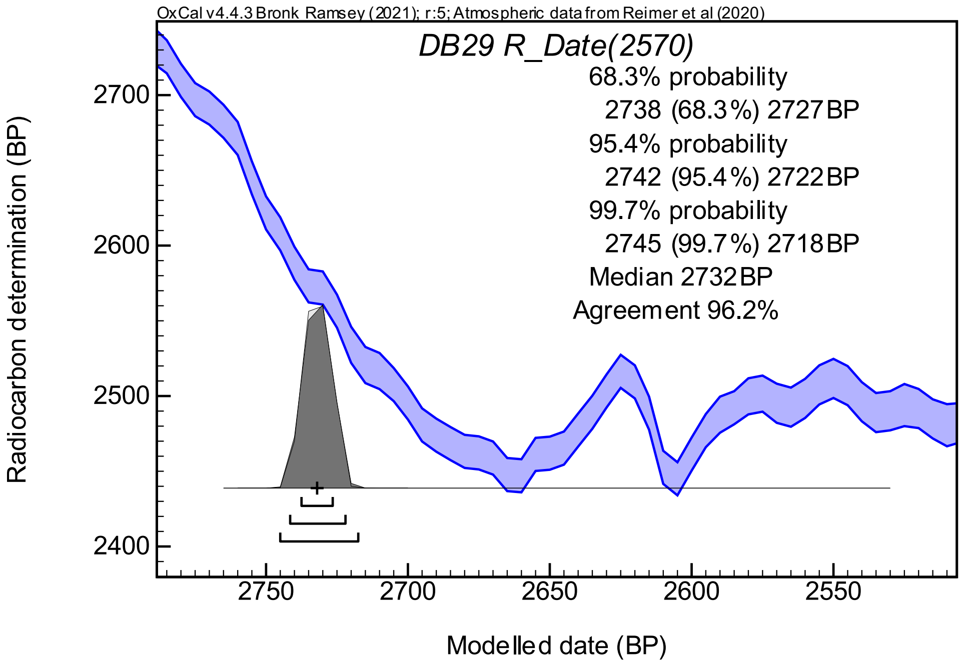


Figure B.4 (Top). Calibrated date for comparative dog DB10 (Allitt 2011). Individual indicated a marine-oriented diet.

Figure B.5 (Bottom). Calibrated date for dogs DB16 and DB20 (same association), both from Allitt (2011). Both individuals indicated a marine-oriented diet.



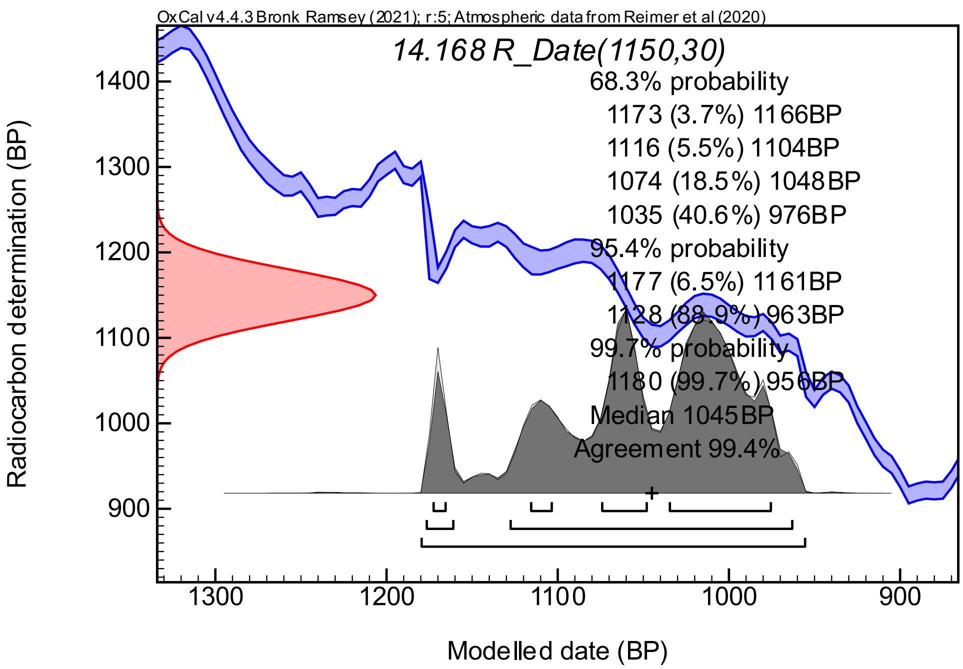


Figure B.6. Calibrated date for comparative dog DB29 (Allitt 2011). Individual indicated a marine-oriented diet.
Figure B.7. Calibrated date for comparative dog 14.168 (Spiess unpublished 2019). Individual indicated a marine-oriented diet.

BIOGRAPHY OF THE AUTHOR

Abby E. Mann was born in Springfield, Massachusetts on November 1, 1990. She was raised in western Massachusetts and was a self-directed homeschooler from the age of 12. Abby's family moved to Saco, Maine in 2007 and she started her university studies in the early aspirations program at the University of Southern Maine in the fall of 2007. She graduated in 2011 with a Bachelor of Arts in Geography and Anthropology and a Certificate in Applied Geographic Information Systems. Following completion of her undergraduate degree, Abby began working with a real estate appraisal company in Portland, Maine, where she assisted licensed real estate appraisers and foresters in research and report writing for appraisals, market studies, and damage reports. In 2016, Abby became self-employed and worked as a consultant on similar assignments, namely several large renewable energy development projects in New England.

After making the decision to return to school and pursue a career in archaeology, Abby entered the Master of Science in Quaternary and Climate Studies graduate program at The University of Maine in the fall of 2018. During her time as a graduate student, she held a two-year assistantship under the Tutor Coordinator at TRIO Student Support Services, as well as additional graduate positions at the Northeast Archaeology Lab and the Hudson Museum, where she helped to oversee ongoing research and collections management, respectively. After receiving her degree, Abby will begin her career in contract archaeology as a field technician with TRC Companies, an international consulting, engineering and construction management firm. Abby is a candidate for the Master of Science degree in Quaternary and Climate Studies from the University of Maine in May 2021.